# INFORMATION TECHNOLOGY
# FOR DEVELOPMENT IN THE ISLAMIC WORLD

# Information Technology for Development in the Islamic World

Proceedings of the Conference on Information Technology for Development in the Islamic World held in Tunis, Tunisia, 20-24 November, 2000

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*Published by*

The Islamic Academy of Sciences
Amman, Jordan

*Publication sponsored by*

Islamic Development Bank
Jeddah, Saudi Arabia

The OPEC Fund for
International Development

*First published in 2002 by*
**The Islamic Academy of Sciences**
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*Type-setting at the Secretariat of the Islamic Academy of Sciences, Amman, Jordan.*
*Printed in Jordan by the Royal Scientific Society Press, Amman.*

Jordan National Library Classification
Deposit Number: 2581/12/2001
Descriptors:/Society/Islamic/Technology

# ISBN 9957-412-03-5

*Price: US$ 30-00*

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# Contents

## PART THREE: SOME SELECTED IT SCENARIOS



## PART FOUR: IT POLICY ISSUES

# Preface

The capability to develop technology and the existence of infrastructure for its application to important economic activities constitute some of the characteristics of a developed economy. In this context, Information Technology (IT) is a factor of obvious importance to the development process. Although other factors such as capital growth, management know-how, and economic self-sufficiency are of much greater importance, no real development can be achieved without effective utilisation of IT.

Increasing economic productivity through IT is considered the key to any national development. In particular, IT contribution to productivity enhancement in service industries is of paramount importance in developing countries, since service industries constitute an important sector in such countries.

IT is important because of its pervasive role in the processes leading to advances in other technologies. All technologies create, process, disseminate, transmit, and use information. Therefore, IT exerts a remarkably profound impact on other technologies and thus contributes to the competitiveness of nations.

Most of the countries of the Organisation of the Islamic Conference are expanding industrially and commercially. The volume of domestic consumption, export and import trade is growing at a considerable rate. This has created and enhanced the demand for the supply and use of information. It is not, therefor, surprising that IT has emerged as an essential element to support the need for regular, timely, and dependable information in business and industry in these countries.

Since its foundation, Islamic Academy of Sciences (IAS) has followed advances in science and technology and has focused especially on developmental issues. This focus is evident in the choice of themes for each of the ten conferences it has organised. The proceedings of these conferences have been distributed worldwide. The high quality of content and the eminence of the participants in IAS activities have attracted the attention of several national institutions and international organisations leading to their sponsorship. The World Bank, UNESCO, Islamic Development Bank, COMSTECH, the OPEC Fund for International Development, and ISESCO are some such collaborators.

This publication, which carries the same title as the conference, has been divided up into six parts with respect to the conceptual aim of the presented material.

**Part One** consists of the statements and messages presented at the opening ceremony of the conference. The present state of the Islamic world in terms of information technologies (IT) and future expectations and implications have been grouped in **Part Two**. Detailed information about the national perspectives on IT was presented at the conference by delegates from several states. Some selected IT scenarios of a number of countries are presented in **Part Three** in an alphabetical order. Some Macro aspects of Information Technology policy issues are given in **Part Four**. This part encompasses themes that were addressed in the various roundtable sessions that formed part of the conference.

**Part Five** contains two presentations that cover important 'theoretical' themes related to IT, namely "Agents Technology," and "Group Theory in relation to applications in IT." Other papers in this part look at IT application in digital imaging, the experience of Maktoob.com, and IT impact on biological sciences as well as IT application in hospital management.

**Part Six** of the book is the appendix that includes the list of participants in the conference, the conference scientific and organising committees, the names of IAS Fellows and Council members as well as various other details about the Islamic Academy of Sciences.

Science leaders in some developing countries suggest that IT adoption and utilisation is the appropriate way to bridge the ever existing development gap that is there between developed and developing countries. They argue that the impact of advanced information technologies on developing countries in years to come cannot be calculated in range or in quantum. They cite numerous examples of how IT can bridge intra-country and inter-country divides. They put forward the example of IT-based distance education as a demonstration of this.

IT-based communications could help in strengthening the ties that hold a nation's people together. The example of large countries where huge distances between cities and regions and the complexity of regional dialects and ethnic considerations come to mind. People would be able to communicate, transact and interact across geographic and political boundaries - think of e-commerce as a case in point.

IT is laying the foundation of a global society and a global economy - an opportunity for developing nations to participate with lesser inhibitions. IT and the associated advanced communications could help in slowing the migration of rural people to urban areas, as they would have access to jobs and sophisticated social services where they already live.

Information Technology could revolutionise education and eliminate differences in quality of education between rural and urban education systems.

Investing in communications infrastructure contributes greatly to a nation’s overall economic development. The new technologies that developing countries could benefit from are becoming more and more cost-effective.

Going through this book will help the reader better understand where this current IT wave will lead to. He/she will be able to get a picture of the potential of IT to jump start a speedy development in under developed economies. Moreover, one will be exposed to a number of varied and interesting facets of IT applications in areas that affect our lives in a very profound way.

**Mehmet Ergin**
**Mustafa Doruk**
**Moneef R Al-Zou’bi**

# Acknowledgements

The Islamic Academy of Sciences is grateful to His Excellency Mr Zine El-Abidine Ben Ali, President of the Republic of Tunisia, for his patronage of the Tenth IAS Conference. The continuous support of the two Academy patrons; His Excellency the President of the Islamic Republic of Pakistan, and His Royal Highness Prince Al-Hassan Ibn Talal of Jordan is gratefully acknowledged.

The IAS extends its appreciation to all the organisations that sponsored the convening of the conference foremost among which are the Islamic Development Bank (IDB), COMSTECH, UNESCO, ISESCO as well as the OPEC Fund for International Development.

Thanks are also due to Dr Sakok Chaabane, Minister of Higher Education (Tunisia), to Dr Ahmed Friaa', Minister of Telecommunications (Tunisia), to Dr Montassar Ouïli, Minister of Informatics (Tunisia), and to Dr Abdelkarim Zbidi, Secretary of State for Scientific Research and Technology (Tunisia), for their support and co-operation.

We also wish to thank all the Tunisian organisations that sponsored and supported the convening of the IAS conference in Tunis.

We are very grateful to all the eminent speakers who participated in the conference and to all the specialists and the various participants who made the effort to take part in the conference.

The preliminary work done by the IAS Council and the efforts volunteered by Dr Ahmed Marrakchi, Dr (Mrs) Zohra Ben Lakhdar, Dr Rafik Boukhris, Dr Farouk Kamoun, Dr Kamel Hamrouni, Mrs Yamina Belkhodja and Ms Imène Ben Salem, Dr M Ergin Mr Moneef R Zou'bi during the meetings of the scientific committee and indeed during the conference itself are gratefully acknowledged.

The IAS Council headed by Dr A S Majali has done a lot too to help realise this activity.

The dedicated staff at IAS Secretariat including Ms Najwa Daghestani, Ms Taghreed Saqr, Ms Lina Jalal, as well as members of staff at the RSS printing unit; Mr George Anz, Ms A Mizher and Mr I Sa'ad have all worked hard to produce this book. To them all we are grateful.

**Mehmet Ergin**
**Mustafa Doruk**
**Moneef R Al-Zou'bi**

# Organisations sponsoring
# the Tenth IAS Conference - 2000

1. Islamic Academy of Sciences (IAS), Amman, Jordan;
2. Secretariat of State for Scientific Research and Technology, Tunis, Tunisia;
3. (OIC) Ministerial Committee on Scientific and Technological Co-operation (COMSTECH), Islamabad, Pakistan;
4. The Islamic Development Bank (IDB), Jeddah, Saudi Arabia;
5. The OPEC Fund for International Development, Vienna, Austria;
6. Arab League Educational Cultural and Scientific Organisation (ALECSO), Tunis, Tunisia;
7. Islamic Educational Scientific and Cultural Organisation (ISESCO), Rabat, Morocco;

# IAS Tunis Declaration
# on
# *Information Technology for Development in the Islamic World*

Adopted in Tunis (Tunisia), on the
27 Sha'aban 1421
24 November 2000

**PREAMBLE**

**WHEREAS** Allah (God) Subhanahu-Wa-Ta'ala has created Man in the best of forms, provided him with the abilities and resources to improve his well-being, endowed him with reason, dignified and honoured him, and granted mankind the inheritance of life and resources of nature;

**WHEREAS** Allah has made the pursuit of knowledge an absolute obligation and its acquisition a source of pride and dignity, and has urged human beings to seek, utilize and disseminate it for the benefit of humanity;

**WHEREAS** the teachings of Islam emphasize the importance of the well-being of man, and underline the fact that Man's relationship to the universe and to his fellow-man must be one of stewardship and complementarity respectively, and never one of mastery;

**WHEREAS** Information and Communication Technologies (ICTs) have now become the prominent features of "globalization," and are continuously reaching new levels in advancement and complexity;

**AND WHEREAS** the majority of OIC and developing countries seem to lack a clear vision in the field of Information Technology (IT), and are thus lagging behind in this area;

**NOW, THEREFORE** the Islamic Academy of Sciences:

(i) **APPRECIATING** the activities being carried out by many governments, academic institutions, and non-governmental organizations in the area of information and communication technology;

(ii) **REALIZING** that some OIC member countries actually face steadily rising child and adult alphabetic and numeric illiteracy, and the prospect of computer illiteracy that is looming large on the horizon;

(iii) **ACKNOWLEDGING** that information technology can represent an area where rapid and meaningful advancement can readily be made by OIC countries;

(iv) **ACKNOWLEDGING** that emphasis on advancement in IT should not be at the expense of investment in basic sciences, which are the backbone of sustainable S&T advancement;

**MOREOVER**

(a) **OBSERVING WITH CONCERN** the lack of a long-term IT policy at the national level in most OIC member countries;

(b) **NOTING WITH CONCERN** the limited number of centres of excellence and the general deficiency of S&T institutions in many OIC member countries;

(c) **NOTING WITH CONCERN** the limited number of enrolled students and quality-graduates, as well as the low level of instruction at science and vocational institutions;

(d) **NOTING WITH CONCERN** the lack of specialized IT-based educational programmes at all levels of education in most OIC countries and the inadequacy of educational institutions;

(e) **NOTING WITH CONCERN** the widening inter-country and trans-country digital divide that is developing as a result of the information technology rush;

(f) **OBSERVING WITH CONCERN** the difficulties faced by some OIC member countries in combating alphabetical adult illiteracy and in promoting computer awareness among the adult population;

(g) **BEING CONCERNED** at the lack of IT standards at the national, as well as regional levels in OIC and developing countries;

(h) **BEING CONCERNED** at the lack of adequate infrastructure available in most OIC countries to sustain the growing IT sector in them;

(i) **NOTING WITH CONCERN** the absence of co-ordination between the various agencies involved in IT education within the educational process;

(j) **NOTING** the apparent slow adoption of advanced educational and IT tools such as personal computers, access to the Internet, etc … and the general inadequacy of educational infrastructure;

(k) **NOTING** the lack of up-to-date IT curricula for all stages of the educational process, as well as the shortage of qualified and motivated teaching staff ;

**THE ISLAMIC ACADEMY OF SCIENCES MEETING AT TUNIS DURING NOVEMBER 2000 CALLS UPON** the international community to:

(i) **EXTEND**, in the spirit of co-operation, all possible help to developing countries in the area of technology transfer, as well as debt relief, to enable them to divert more resources to develop their IT infrastructure ;

(ii) **EXTEND** free-trade agreements with developing countries and open up their IT markets to products, especially software, being developed in the Third World ;

(iii) **CONTINUE** to support research projects of importance in the developing countries;

**AND CALLS UPON** the leaders and decision-makers of Islamic countries to:

(a) **RE-DEFINE** national development objectives in the area of science and technology especially IT, in view of globalization and the information revolution;

(b) **EVALUATE** their IT policies and where possible incorporate them into national S&T policies;

(c) **DIVERT** available resources to science education, with a view to building up a scientific and technological manpower base capable of adapting and developing new -including information and communications - technologies;

(d) **INTRODUCE** IT programmes at the various stages of the educational process;

(e) **PROMOTE** the adoption of PC-clusters at educational institutions to facilitate optimum use of computers at such institutions by students and faculty;

(f) **FACILITATE** the use of Internet to all sectors of society and adopt a subsidized e-rate policy to enable the public to use the Internet at low cost;

(g) **ESTABLISH** training institutions for IT, especially for personnel involved in e-commerce;

(h) **SPEED UP** the introduction of e-systems into national infrastructures including e-government, …;

(i) **INTRODUCE** appropriate legislation, including tax and customs exemptions, to promote the various aspects of the IT industry;

(j) **AIM TO** develop a coherent national IT system with a view to interlink such a system to other systems at the regional level at some point in the future;

(k) **ESTABLISH** linkages and partnerships between OIC member countries in IT to facilitate inter-country co-operation by governments, industry and academia;

(l) **EMPHASIZE** the key role played by contemporary applied mathematics and basic sciences education for gaining mastery in IT;

(m) **MONITOR** the influence of the Internet so as to maximize the benefits of its availability and where necessary enact regulations to minimize any physical, psychological and social damage that could result from introducing this new medium;

**AND FURTHER CALLS UPON** the relevant OIC and other organisations to:

(i) **PROMOTE** the supervised use of the Internet at homes, in schools and universities as well as government and private sector concerns as a means of education and communication;

(ii) **PROMOTE** inter-connectivity of world-wide web sites of OIC countries, institutions, universities, etc …;

(iii) **ESTABLISH** an Islamic portal that encompasses the web sites originating form within OIC member countries;

(iv) **ENCOURAGE** and support OIC-based IT industrial ventures;

(v) **DEVELOP** databases of IT human resources in OIC countries to facilitate appraising national strengths and weaknesses;

(vi) **CONTINUE** to address developments in basic sciences and mathematics, and not to marginalize this backbone of S&T development;

(vii) **ENCOURAGE** and promote the publication of quality research material of OIC scientists on the Internet;

**AND FURTHER PROPOSES**

**THE CREATION OF AN ISLAMIC IT FUND** to help poorer OIC countries to upgrade their IT infrastructures and invest in small to medium-sized IT industrial ventures; and

**THE STRENGTHENING OF THE ISLAMIC BROADCASTING CORPORATION** (IBC) to enable it to project Islamic values, as well as address emerging scientific and technological areas in the twenty first century, and promote distance education in the Muslim world. The IBC must cater for coming generations in the areas of sport, culture, entertainment, information technology, besides combating the blatant propaganda against Islam.

# Tenth Conference
# of the
# Islamic Academy of Sciences

## *Information Technology for Development in the Islamic World*

## 20-24 November 2000
## Tunis, Tunisia

## Conference Report

Under the patronage of His Excellency the President of the Republic of Tunisia Mr Zine El-Abidine Ben Ali, the Islamic Academy of Sciences convened its tenth international conference under the title *Information Technology for Development in the Islamic World*, during 20-24 November 2000.

The conference, which was held at Khamsa Corinthia Hotel, Gammarth, Tunis, was an open activity in which over 120 participants representing over 25 countries participated. It was organised and sponsored by the following organisations:

1. Islamic Academy of Sciences (IAS), Amman, Jordan;
2. Secretariat of State for Scientific Research and Technology, Tunis, Tunisia;
3. (OIC) Ministerial Committee on Scientific and Technological Co-operation (COMSTECH), Islamabad, Pakistan;
4. The Islamic Development Bank (IDB), Jeddah, Saudi Arabia;
5. The OPEC Fund for International Development, Vienna, Austria;
6. Arab League Educational Cultural and Scientific Organisation (ALECSO), Tunis, Tunisia;
7. Islamic Educational Scientific and Cultural Organisation (ISESCO), Rabat, Morocco;

The main objectives of the conference were:

(a) To appraise some contemporary (theoretical and practical) concepts in Information Technology (IT) with the aim of introducing them into national development policies in OIC and developing countries;
(b) To define some areas of importance for possible inclusion in IT policies, and develop innovative proposals for future activities in IT;
(c) To assess the status of IT applications in the Islamic world, with particular reference to countries with extensive or limited experience in this field;
(d) To define a role for governments and NGOs in IT development;
(e) To study the impact of developments in IT on medicine and education; and
(f) To facilitate the free exchange of views among experts on IT policies;

In addition to a number of keynote presentations from Tunisia and Pakistan that reviewed the status of Information Technology (IT) in the Islamic world, an Internet visio-conference was organised in which Dr Vinton G Cerf, the eminent American academic and one of the "founders" of the Internet, presented a keynote paper on the future of the Internet and its applications.

In order to generate academic interaction among the participants, the conference was mostly divided up into roundtable discussions (three in all), in which short communications were followed by lively discussions on a number of important issues. The roundtables addressed the themes of IT Policy Issues; IT and Education and National IT Scenarios.

The "Education" session was particularly appealing to the Fellows of the Islamic Academy of Sciences who are involved in higher education.

In the "Scenarios" session, speakers from Pakistan, Tunisia, Jordan, Indonesia, Turkey, Iran and Malaysia were invited to present highlights of their national experiences in the area of the development of the IT sector. Emphasis was placed on the future courses of action that these countries will take in the field of IT and its applications.

At the conclusion of the conference, the Islamic Academy of Sciences adopted the IAS Tunisia Declaration on Information Technology for Development in the Islamic World.

The declaration noted that the majority of OIC and developing countries seemed to lack a clear vision in the field of IT, and that IT can represent an area where rapid and meaningful advancement can readily be made by these countries. The declaration highlighted some of the problems that face Islamic countries in the area of IT, and re-iterated IAS's long standing view that countries need to upgrade their national science and technology policies and, where appropriate, incorporate IT elements into such policies.

Some specific recommendations concerning adult illiteracy (including the looming computer illiteracy), the growing digital divide that is widening between IT rich and the IT poor countries, and communities, were also made.

The IAS also adopted a Resolution at the conclusion of the conference in which it expressed its deep distress at the developments that were taking place in the occupied Palestinian territories.

As part of the follow-up action, the Academy will circulate the IAS Tunis Declaration to concerned individuals and relevant agencies throughout the world, so that some measures can be taken to implement the recommendations decided upon at the conference.

The Academy will also publish the complete proceedings of the conference in a quality volume that will be distributed internationally. Such a book, like all other published IAS proceedings, will become a valuable reference for experts that draw up IT policies.

Through IAS Fellows, personal contact and correspondence, the IAS will promote the ideas that were developed at the conference among the decision making circles of the Islamic World, and will provide whatever help it can to get the various recommendations implemented.

# Message* of
# His Excellency Mr Muhammad Rafiq Tarar
# President of the Islamic Republic of Pakistan
# Patron of the Islamic Academy of Sciences

I am delighted to know that the Islamic Academy of Sciences is holding its 10th annual conference in Tunisia in the month of November 2000. The theme chosen for the conference viz "Information Technology for Development in the Islamic World" is well timed.

The Islamic Academy of Sciences was formed as a result of the deliberations at the OIC Summit Conference of 1984, to analyse pressing scientific and technological issues of the day and give recommendations for facing such challenges including those posed by information revolution and globalisation.

The rapid growth of information technology continues to alter the cultural, social, economic and scientific landscape of the world. Through its unprecedented scale of penetration in almost every element of human affairs, information technology creates new challenges. To meet these challenges and obtain maximum benefits from this wonderful and potent tool of multi dimensional development, the *Ummah* must devise measures and explore strategies.

I am glad to know that the President of Tunisia has granted his patronage to this conference. While expressing our gratitude to His Excellency Mr Zine El-Abidine Ben Ali for his personal interest in the conference, we thank His Excellency's government for hosting the event and making arrangements for such a distinguished body of Muslim scientists, scholars, intellectuals and thinkers to debate issues of urgent concern to the *Ummah*.

While making information technology an engine of growth and integration of the *Ummah* through Internet, we must remain on guard for preserving and promoting Islamic values and our rich cultural heritage. Dissemination of information through the Internet must not be allowed to become a medium of one-sided flow of information. It must be utilised to spread the authentic knowledge of Islam and its cultural values.

I take this opportunity to congratulate the Islamic Academy of Sciences for holding this important conference and wish them all success in their future endeavours.

* Delivered by Dr M A Mahesar, Executive Secretary, COMSTECH.

# Message* of
# His Royal HighnessPrince Al-Hassan Ibn Talal of Jordan
# Founding Patron of the Islamic Academy of Sciences

بسم الله الرحمن الرحيم

**Your Excellency Dr Sadok Chaabane, Minister of Higher Education**
**Your Excellency Dr Abdul Kareem Zbidi, Secretary of State of Scientific Research and Technology**
**Excellencies, Fellows of the Islamic Academy of Sciences**
**Ladies and Gentlemen**

السلام عليكم و رحمة الله و بركاته

It is a pleasure for me to address a distinguished gathering of scientists on this timely and significant event, to pursue bringing science and technology and, in particular, information technology, to our mainstream of development. I regret my inability of being among you, my dear Fellows of the Islamic Academy of Sciences, but hope to be able to be taking part in your future events.

As you are aware, we have been moving throughout our symposia from one theme to another to deal with science in the Islamic world, and to harness the benefits of its application to our people. We have already covered themes like: food security, science and technology policy, manpower development, health and nutrition, water, science education and technology management. The Academy has published your deliberations under those themes for dissemination to the public at large. These are examples of the progressive work of the scientists of the Academy towards problem-solving of many issues facing our Muslim societies.

**Dear colleagues**

Today's theme, Information Technology, is on the top of the world agenda, and linked directly to brain-intensive human capital. It is directly linked to the application of knowledge through creativity and innovation and capacity building of entrepreneurship. However, if there is no "knowledge," particularly in frontier areas of science, there is nothing to apply; this is why "generation of knowledge and its transfer" through strengthening education at all levels, in terms of quality and relevance is becoming crucial for building the knowledge-based society.

We are living in a competitive world and we have to excel in education and scientific research. Therefore, I call on Islamic countries to target 6% of their GNP to invest in education, to build the competitive human capital for the global competitive economy during this decade. However education alone is not enough, we need to turn the wheels of our research and development (R&D) at our universities and research institutions and invest in science.

Therefore I call on Islamic countries to target a minimum of 1% of GNP to invest in science, by the end of this decade. OECD countries are already investing 6% of GNP in education; and are investing 2.8 – 3.0 % of GNP in science (R&D).

Nowadays, we have to strike a balance between tradition and modernity. The communication revolution is changing our lives. The new information highways will reach

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* Delivered by Prof. Adnan Badran FIAS, President of Philadelphia University, Jordan.

the unreached and include the excluded. In addition, it will invade our privacy. This is a powerful tool to bridge the gap between info-rich and info-poor societies. Knowledge and access to information are going to be the main criteria to govern progress and become dominant in the global market economy. The concept of "interactive multimedia" and "virtual university" will change the whole concept of the university of today. New learning processes, life-long and distance education at various international levels of degrees and diplomas will be carried out at home, from the words, images and sounds of the computer screen, using state-of-the art interactive learning packages, written and designed by Nobel laureates of various disciplines.

With this scientific and information revolution, we still have too many **unacceptables** remaining in our developing world. With the level of illiteracy of 850m throughout the world, mostly in rural areas, 70% of them women – how could we develop a true democratic institution under such **unacceptable** circumstances? How can we empower women who form 50% of the planet's population, when men form 95% of government posts and 90% of parliamentary seats? How can we go on, while the voice of virtually half the planet goes unheard? Civic rights and building justice and democratic institutions towards peace and development cannot be achieved with half the human beings being marginalised.

How can we develop equality while 70% (representing over 2 billion people) in the developing world have no access to electricity, and how could we supply basic energy needs at a time when our present way is far from being sustainable? It is really a shame for today's humanity that they have landed a man on the moon and conquered space and harnessed technology while still 24 people die of hunger every minute, 35 thousand every day, and 13 million die from hunger every year. It is **unacceptable** that villagers go hungry and thirsty from polluted water, and epidemic diseases wipe out their children. Malaria is taking a toll of 2 million deaths per annum and this number will increase to reach 3 million by the end of this decade, mostly in Africa. How could we justify that the combined wealth of 400 people is greater than the total income of the poorest half of the world's population?

**Dear colleagues**

Our world is in a state of rapid transition. We are living in an age of renewal and transformation. When people renew, they usually take stock of past failures and past success stories and compare themselves with others. They heighten ethical values and education and look for a renewed hope, new rigour and vigour to do the impossible and to not take "no" for an answer. Usually when people renew, they go back to the "charisma of the founder" to reinstate it.

I wish you all a very fruitful conference. Thank you for your attention.

# Address* of
# His Excellency Prof. Sadok Chaabane
# Minister of Higher Education
# Republic of Tunisia

**Your Excellency Prof. Abdel Salam Majali, President of the Islamic Academy of Sciences**
**Distinguished Professors, Members of the Academy**
**Dear Speakers**
**Honoured Guests of Tunisia**

It is my great honour and privilege to take part with you in opening this conference of yours, the Tenth Scientific Conference of the Islamic Academy of Sciences.

I am also happy to convey to you the greetings of President Zine El-Abidin Ben Ali who has graciously patronised your present conference and heartily wishes you a happy stay in Tunisia and great success in your deliberations.

**Honoured Guests**

Tunisia is pleased to host you in the land of Islam. The land of Al- Qayrawan and Al-Zaytounah, where we received Islam, the true religion, and maintained its prefect values. It is from this land that we spread Islam far and wide in the Southern Desert and in the Arab Maghreb and then to Al- Andalus (Spain) and Southern Italy.

Tunisia today, my brethren who hail from different Muslim countries, shares with you the challenges of this century as well as the aspirations of all our peoples towards a better future. Knowledge, as you know, is the real weapon of nations. This was true throughout history and still is. There is no sustainable power except that of science and learning. Our Muslim *Ummah* (Nation) used to lead the world during the golden age of Islam because our *Ummah* acquired and borrowed various branches of learning from other peoples, added to them and was careful to be original and creative in handling them. However, when learning declined and an age of darkness spread over our educational institutions and mosques, our civilisation declined, our economy suffered, our culture dwindled and our unity has been disrupted.

Today we are on the threshold of a new awakening at the beginning of this new century. Under such circumstances we have either to proceed guided by the light of authentic Islam without introversion and isolation, firmly facing the challenges and successfully tackling difficulties, or to be overwhelmed and become lost in the mazes of backwardness, bickerings of degradation and reactionary thought, thereby giving the opportunity for demagogy to prevail and, letting reason disappear.

You, venerable scholars, therefore, are the true shields that protect our peoples and rising generations and are the best makers of the hopefully prosperous future waiting for us.

**Ladies and Gentlemen**

Information Technology which today renovates and links together all the older sectors of sciences in an astounding interactive manner has a considerable effect on the growth of the various other sectors of knowledge and eventually spearheads the promising future industries and sorts out the professions which will predominate over the world in the coming decades.

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* A translation of the original speech delivered in Arabic.

To all of us, information technology is simultaneously the problem and the solution, and we have either to take possession of it and thereby accelerate our endeavours to catch up with those who are ahead of us, or we miss this opportunity, and thus make the gap wider, which makes it difficult for us to overtake those who have left us behind. I may recollect what President Zine El-Abidine Ben Ali said a few years ago: “We must make this formidable challenge the biggest opportunity for our peoples.” President Ben Ali, it is true, chose the hard way for Tunisia, but it is the only course to be taken which can open wider horizons before our country. He managed to enable Tunisia to jump over to the new economy that is based on knowledge and made investment in knowledge one of the foremost slogans of the forthcoming phase. In fact, several policies have pivoted around this grand motto.

The President has indeed placed large landmarks before the Tunisians for the year 2004. One of these landmarks is raising the expenditures allocated for scientific research and technological renovation to 1% of the gross national product (GNP), i.e. the size of these expenditures will rise threefold during the current fine years. President Ben Ali has also been careful to broaden the base of educated people to produce outstanding scientists. Now Tunisia, which has attained a 100% rate of school enrolment for the children who are six years old, has started this year its pre-school education and approved the decision that students cannot leave school before the age of 16. It had also been decided that completing the basic schooling successfully must be at a rate of 80%. This so that the state effort is concentrated on the outcome of continuing education, make up classes and combination of theoretical education with practical application alternately between formal schools and practical education institutions.

Another landmark is that higher education enrolment is to rise up to 30% in the year 2004 for young people aged 19-24. Thus Tunisia, by the middle of this decade will come near the mean indicator of the Organisation for Economic Co-operation and Development (OECD) countries. Thanks to the judicious policies of its leadership, Tunisia rose from a rate of 6% enrolment in higher education in 1987 when President Zine El-Abidine Ben Ali came to power to the rate of 22% at present. Furthermore, all university institutions have been linked to the Internet at present and we are keen on expanding the faculty member’s linkage, on installing Internet terminals within university campuses and on opening wider horizons for electronic interconnection amid the tertiary stage students and on creating greater opportunities for students in other educational stages. Meanwhile secondary education institutions are in the process of intensive connection and there are numerous elementary education institutions that have actually embarked on this process. Moreover, we are firmly determined to expedite inter linkage as we believe that this is very profitable for the quality of education and openness to others. To concentrate on enlisting Internet instruments and spreading the network culture in the educational sector is a fundamental option, for this sector is a radiating one through that can feed various economic, cultural and other national establishments with school and university graduates. Only two weeks ago President Zine El-Abidine Ben Ali approved the introduction of family computers at a cost not exceeding US$600 financed through easy-term loans. He also called for future reduction in the expenses incurred for Internet use so that Tunisia will be best known for supporting competitiveness.

**Ladies and Gentleman**

In this conference, you will have the opportunity of acquainting yourselves with national numbers or figures and comparing them with what is going on in the world around us. Tunisia has opted for broad openness, forged partnership with the European Union, staked on competitiveness and joined in a race of identification with the indicators of OECD countries and cannot lag behind under any circumstances in any figures or numbers especially those related to modern technology.

**Ladies and Gentlemen**

Our Muslim peoples are invited today to prop up their competitiveness and to make information technology an instrument for the augmentation of the returns of the older economy and an additional causeway into a promising new economy which has many highly paid employment opportunities while opening wider prospects for product and service exportation. In this colloquium of yours, you will also have a chance to get a clear idea about a special institution adopted by Tunisia and called 21-21 Fund. The role of this fund is to enhance the employability of the future generation, particularly degree holders, and to open prospects for employment before other groups, but fundamentally to urge people to initiate institutions in all fields and more emphatically in promising spheres. By the way, this fund which finances additional processes in sectoral policies has turned out to be the best incentive or motivator for all other policies to make them all combine together in the creation of institutions and, as much as possible, the promising sectors, which would lead to opening wider prospects for employment and breaking into new markets and sectors. The Fund has enabled people to make up for what they have missed and given a complementary additional qualification to those whose university training concentrated on specialisations that soon became out of date because of the rapid growth of modern technologies. At present we have many such teams inaugurated with two thousand graduates this year, to give training in information technologies whether in terms of systems, network or multimedia writing, and all other possible applications.

Nowadays, Tunisia is convinced that it has no choice but to join the general trend of the countries which surpassed it and that epistemological economy is the future itself. Passing into this economy comes only through control and even concentration on teaching, on research and renovation and on opening horizons for and diversifying production. There is indeed no genuine competitiveness in the future except for the products and services based on a large quantity of knowledge. Within this context, Tunisia has embarked on an ambitious policy related to the initiation of technological pivotal topics. In the university campuses and nowhere else rise renovative and profitable industries that are capable of true additional employment and are alone able to overwhelm other markets.

Tunisia today has what may be described as a stock of teachers and researchers and supplies of university graduates that are sufficient to create innovative industrial milieus and link teaching with the requirements of economy.

We have also an ambitious programme to renew the content of instruction and use information technology in this field. For remote teaching, for example, will not be viable unless we work out and write in digital terms an outstanding teaching subject matter. We have also started to invite teaching cadres to rewrite their university lectures and lessons, muster talents around each single lesson, analyse these lessons, come in contact with the best exhibits in other universities and translate these lessons into various languages. It is gratifying to say that we have found such an unmatched favourable response to participate in this programme, whereby we will be able to cope with the quantitative flow of expected students. We will also be able to expand the basis of utilising the best lessons. These faculty members will, moreover, be requested to simplify these branches of knowledge in the same digital terms, so that we will be able to spread benefit and make it cover larger segments, and to create a scientific culture which constitutes the essential element for building the society of knowledge and learning.

**Ladies and Gentlemen**
**Members of the Islamic Academy of Sciences**

I would like to conclude with thanking you for choosing Tunisia as a venue for your meeting. I also wish you a rich interlocution and a mutual benefit from the experience of each country. All of us are really waiting for the recommendations that you will arrive at, here in this arena as well as in others.

For the present world and the one in the offing is a rapidly changing world replete with surprises and can only be faced with a clear foresight and a sober and balanced approach. Consequently, we have to provide for a great deal of flexibility in our teaching and research institutions and share together our private initiative so that we may able to correctly predict what will come and to quickly get acclimatised to new developments. The main characteristics of this world as you notice is that it is an interlaced and open one where it is impossible for any state to work without continuously looking into its positioning within the context and framework of the work of other countries. We are moving under the same circumstances and we are careful to comprehensively meet together with major economies and other civilisations and cultures, which will be a difficult task unless we all hasten to get properly involved in these networks and concentrate on linkage instruments. Most particularly we have to be careful to contribute to the production and enlistment of our commodities, culture and policy within these networks.

The role you play is a great one in directing political decisions, and the recommendations which you will come out with are certainly important. It will indeed be my great pleasure to carry them to His Excellency President Zine El-Abidine Ben Ali who also is waiting for them. He is close to scientists and scholars and appreciates their intelligence and highly values their momentous contributions to improve the lot and elevate the status of their peoples and contribute to the success of our great Ummah.

Once again I wish you a happy and beneficial stay in Tunisia.

Thank you.

# Address of
# His Excellency Dr Abdel Salam Majali FIAS (Jordan)
# President of the Islamic Academy of Sciences

بسم الله الرحمن الرحيم

**Your Excellency the Representative of His Excellency the President of the Republic of Tunisia**

**Fellows of the Islamic Academy of Sciences**

**Excellencies**

**Ladies and Gentlemen**

السلام عليكم و رحمة الله و بركاته

It gives me great pleasure to address this august assembly of scientists and decision makers from Tunisia and the various OIC Member Countries. We are indeed grateful to H E President Zine El-Abidine Ben Ali for his kind patronage and support of this activity, that is bringing together experts and scholars form many countries.

Our meeting here in the city of Tunis is a special occasion in many ways. It comes only a few days after the conclusion of the Ninth OIC Summit in Doha (Qatar), convening in the same spirit of brotherly interaction and co-operation for the betterment of our Islamic Ummah. It is the first major activity that the Academy organises in North Africa, and is also the first to be organised after the turn of the century. It is special as well, I feel, because of the relevance and contemporary nature of the theme it addresses namely "Information Technology".

By focussing on this important topic, the Islamic Academy of Sciences is rising to the challenge of the new situations, new prospects, new needs and new concerns generated by the global information revolution, from which I think we can all benefit if we manage to harness information technology for development.

Moreover, in addressing this topic, we are fortunate to be able to rely on the history of our Islamic Ummah in always adapting to new sciences and technologies. Indeed scientific progress, knowledge and open-mindedness are part of our common Islamic heritage and hence they are a central concern to all Muslims.

**Mr Chairman**

One of our Academy's objectives is to promote the "free exchange of ideas and knowledge" and to "maintain, increase and disseminate knowledge." The emergence of a global knowledge society, based on the use of information and communication technologies unimaginable half a century ago, makes the fundamental mission of the IAS and its sister OIC organisations more topical than ever. Yet the extraordinary technical possibilities of Information Technology (IT) are no substitute for the required resolve of our decision-makers in the Islamic World to increase and indeed focus on individual and collective development, especially in science and technology.

Naturally, in our quest to formulate policies in the area of IT and development, we need to keep a number of fundamental principles constantly in mind. The right to education and access to information are but a couple of such principles that should govern our IT outlook.

Whenever we assess the potential of IT, we find ourselves somehow addressing the question - where will the IT revolution lead to, and – how can we as developing countries benefit from such a phenomenon? If we agree that the so-called IT economy is not an end in itself, but a means for the prosperity of a society and its members, then we have to conclude that our aim must be to build a "knowledge society," based on knowledge-sharing.

We are all gravely concerned by the risks of the digital divide that is developing between the IT advanced and the developing countries that are still trying hard to catch up. We are concerned by the inter-country digital divide too. If we do not overcome this digital divide, then we are left with a "knowledge economy" that is fragmented and mainly made up of small islands of wealth in a sea of dire need. Let us not make the same mistake today that was made for development in the past. Let us integrate the full social, cultural and ethical dimensions of sustainable human development into our approach to IT.

**Mr Chairman**

In every country, alongside the business community, it is the scientists, the academics and researchers who are the first to use E-Mail and Internet, while other large groups in our countries are left out of the knowledge revolution: the rural populations, the urban poor, the illiterate and the marginalised. In terms of contact and of content in cyberspace too, I feel that we are not really trying to ensure that the on-line world offers a place for all cultures and languages.

A review of the recommendations issued at the various IT fora organised recently especially highlights the goal of "access-to-all," and propagates a number of objectives, which I would propose that we adopt in formulating our IT policies;

- We need to focus on developing a learning culture;
- We must promote knowledge as a global public product available to all;
- We must encourage and respect cultural and linguistic diversity and local content in cyberspace, and
- We must establish a dialogue on info-ethics and work to establish an Islamic Info-ethics Programme.

In the area of education, I think we should work together to use the potential of the Internet for increasing learner participation and the provision of educational resources. OIC Member States need to define and implement policies on education and IT at all levels of learning: primary, secondary and third level learning. A significant effort in the use of IT in informal education and in lifelong learning is also essential if the new information society is to be an inclusive knowledge society.

We therefore need to provide education specifically designed for the new knowledge society, and to acknowledge that the fast-moving, connected society we are entering requires a new emphasis on the skills needed to adapt and respond to the rapid flow of information. Alongside literacy, every individual will need problem-solving, analytical and evaluative skills. These will become the new "basics", essential for dealing with the accelerating rate of knowledge accumulation.

For this, developing countries and their educational communities need wide access to IT for education. The international community should work to promote the sharing of educational experience and courseware, and in particular in making widely available educational material in the public domain.

One way to achieve this in the Islamic World would be to link all relevant sources into an Islamic Web-Park or OIC Education Portal which the IAS proposes to be established in collaboration with COMSTECH and the Islamic Development Bank. Such a Portal should become a world-wide recognised reference web site.

**Mr Chairman**

Most OIC Countries are not always able to allocate sufficient national resources to education. What resources are available have to be carefully divided up leaving precious little provision for facilities and opportunities for lifelong education along with the required level of IT support. Thus, we must be able to find the resources to provide concessionary rates for Internet access in schools, academic institutes and public libraries, as a sure means to encourage the various groups of society to engage in IT activities. Such schemes, sometimes known as “e-rates” have been successfully promoted in several countries, most notably the USA.

The recent World Education Forum in Dakar, Senegal, adopted a Framework for Action which holds the promise of a major new departure both for the quantity and the quality of educational provision. I hope that the role of NGOs in following up the Dakar recommendations, based on the co-ordination, strengthening and enlargement of education-for-all partnerships, will make IT access-to-all, central to its efforts in education.

I also feel that we need to encourage national policies to promote public domain information and to ensure the provision of information and applications to improve education, health, the environment and governance. The availability of public domain and other heritage information is an indispensable element in the development of a knowledge society for all.

To this effect, governments and publicly-funded institutes such as universities should be equipped and strongly encouraged to make their public domain information available.

Other key areas of concern that we need to address are the issues of cultural and linguistic diversity, of freedom of expression on the Internet and the threat to privacy. In this context, any Information For All programme must provide a platform for international collaboration on information access and on ethical, legal and social consequences of the use of IT. We need to look and evaluate the various Info-ethics Programmes that have been developed over the last few years, and develop one of our own Islamic version that would reaffirm the importance of universal access to information in the public domain and to define ways in which it may be achieved and maintained in the Global Information Infrastructure. Our Info-ethics programme will encourage international co-operation in the promotion of the principles of equality, justice and mutual respect in the emerging Information Society, as well as identify and encourage debate on major ethical issues in the production, access, dissemination, preservation and use of information in the electronic environment.

I feel that we as Muslims have a great deal to contribute to any Info-ethics programme or indeed any ethical reference that humanity need to develop. I say this specifically with the recent advances in Biotechnology in mind. I feel that with our comprehensive *Aqeedah* with its divine origin and universal application, are able to propose logical and scientifically sound answers to the questions that advances in this area pose.

**Mr Chairman**

The Islamic Academy of Sciences, inspite of its modest resources, has established itself as an institution of the *Ummah*, striving to bring the scientists of the Muslim World together. It has been fortunate in this endeavour to have the support of its distinguished patrons, the President of Pakistan and HRH Prince Al-Hassan of Jordan.

For co-sponsering this conference, our thanks go to the Islamic Development Bank, the OPEC Fund and the ALECSO. I must also thank the Advisory Science Committee, the Organising Committee, the Director General of the IAS and his efficient staff, and of course our local Fellows Marrakchi, Benlakhdar and Boukhris, who have done so much to realise this activity.

Finally Mr Chairman, I would thank H E the President of Tunisia for his patronage, and the government of the Republic of Tunisia for the hospitality extended to us during our stay in Tunis.

Thank you.

والسلام عليكم و رحمة الله و بركاته

# Address* of
# Professor Ahmed Marrakchi FIAS (Tunisia)
# Chairman, Local Organising Committee

**Excellencies**
**Distnguished Guests and Scientists**
**Dear Fellows**

It gives me great pleasure and honour to welcome you all this morning at the opening session of the Islamic Academy of Sciences 2000 Annual Conference. On behalf of the Local Organising Committee, it is my privilege to extend our most cordial greetings to you on this occasion and thank you for your presence and participation in today's inaugural session.

Our Conference, this year, is meant to address a very vital issue, **Information Technology for Development in the Islamic World** .The Science and Organising Committee attempted to cover the various aspects of the subject in the following manner:

- Speakers from different countries were invited to present their national experiences in the area of IT and to review and appraise the status of IT in the Islamic world so that strengths and weaknesses are identified.

- A number of speakers were invited to address scientific and technological advancements in the area of IT. Many distinguished young scientists from the Islamic world were requested to share their expertise with the Academy and talk about their exciting research areas in the field of IT

- Two thematic sessions will be dedicated to the **IT and Education** and **IT and Life Sciences.**

- In order to expose the participants to the views of one of pioneers of the Internet, the Academy, with the help of Tunisian colleagues arranged to have *Dr Vinton G Cerf* of WorldCom address the conference through a visio-conference from Los Angeles/USA at the beginning of the Session 3 on Monday 20 November 2000.

**Distinguished Guests and Participants**

Thank you again for joining us this morning and providing us an opportunity to spend some time in your company for the coming days.

*Assalamu AleykumWa Rahmatullah*

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* Delivered in Arabic.

# Information Technology in the Islamic World: Present Scenario and Future Prospects

HAMEED AHMED KHAN*
*Executive Director, COMSATS*
*Islamabad, Pakistan*

## 1 ABSTRACT

The Muslim World, in general, considerably lags behind advanced countries in the crucial sector of Information Technology. While the outreach of Internet is expanding, there is also a widening gap between information ‘haves’ and ‘have-nots’. The latter class is mostly in the third world, especially in the under-developed Muslim countries. The principal reason for this state-of-affairs is the lack of IT infrastructures (telephone lines, satellites, broad band backbones, network instrumentation and computer related industries) in Muslim countries. With the exception of a few isolated cases, by and large, the governments of Islamic countries are not in step with the unfolding IT revolution. Their inadequate response to a rapidly changing world can be either due to the lack of conviction or the lack of knowledge about the increasing influence of IT on human societies in terms of education, commerce, entertainment, etc. It is encouraging to note that during the recent years some Muslim countries have realised the IT’s potential. The UAE’s ambitious project of transforming Dubai into an “Internet City” and Malaysia’s “Cyber Jaya” are notable examples of the bold initiatives within Islamic world.

According to careful estimates, there would be over 300 million users of Internet by the year 2002 world-wide, with 60% from US and Western Europe alone. Muslim countries will have less than 2% of the Internet users mostly concentrated in Malaysia, Pakistan and the Gulf states. Presently, there are 2.1 billion web sites world-wide and over 60% of US businesses have Internet presence. By 2003, B2B e-commerce would be worth $7 billion. Approximately 70% of this trade will take place in Western Europe and the U.S. On the other hand, with the exception of a few countries, Internet trading is non-existent in the Islamic world.

* Professor of Physics and Fellow of the Islamic Academy of Sciences.

Information Technology is moving at such a rapid pace that governments all over the world are finding it hard to remain in step with new options. Keeping this in view, the US government made a conscious decision to allow private sector to assume the leadership role. This model has worked wonders for the US and can be utilised for our benefit too.

The countries that are reaping the benefits of IT today, started thinking of it decades ago. The leading countries had put in place plans and resources in the 80s. One must have a long-term implementable agenda. Talking of Muslim countries, only Malaysia and UAE come close to that. Besides, the enabling and modern physical infrastructure, another crucial factor in the growth of IT is education. Countries with a better literacy level, and good pool of IT professionals have been able to perform better than the rest. Therefore, schools, colleges and universities are vital to the IT savvy countries.

Electronic commerce will play an important role in international trade in the years to come. We need to make e-commerce a priority. The private sector should be encouraged to build the necessary infrastructure. Software development is an integral part of information technology. Governments need to put in place infrastructure to encourage the growth of the Internet. Fibre optic networking, digitisation, and upgradation of the telecom set-up are vital necessary actions. Infusion of money into IT now, will help us to reap tremendous benefits in the years to come.

At the moment, the situation of information technology in the Islamic World is rather bleak. The governments have to do a lot more than currently envisioned. A major overhaul in the planning is very much needed - starting from the grass roots. Governments themselves have to embrace information technology and re-train or hire staff with IT skills. Some of the Muslim countries are rich enough to implement IT savvy policies and may have taken some appropriate steps. However, the overall progress is very slow.

The IT data concerning the Muslim countries is not only scant but also not easily accessible. This is particularly true for the latest (uptodate) data. This paper is an attempt to make use of the limited accessible data to assess the present IT situation in Muslim countries. Based on this data some suggestions have been made for future line of action for the consideration of Muslim leadership and sector specialists.

## 2 INTRODUCTION

The Muslim World as a whole falls far behind the West, particularly in the Information Technology sector. Unfortunately, we are in the pool of those countries that could be regarded as ‘have-nots’ of the digital world. The rapid advances made elsewhere also means that the gap would be widening with the passage of time. To understand the pace of development, it would be useful to recall Moore’s law which has proven to be true during the last two decades. It states that the processing power of computer chip doubles after every 18 months. This is only one facet of the technical advances. There is a vast variety of other technical breakthroughs, which are changing the world around us in ways unimagined a few years ago. The connectivity of the people and businesses of the world through the Internet is changing the way people think, work and do business. The currents and undercurrents of these phenomenal changes should not be underestimated; certainly should not be ignored.

It may well not be too late to realise the importance of the on-going Information revolution and without further hesitation to go with full steam ahead. The starting points are, of course, the development of infrastructures; telephone lines, fibre optic backbones, satellite channels along with other hardware/software requirements and capacity building to generate and absorb the technological advances. These infrastructure and facilities will have to be provided to as large a section of population as possible. The revenues spent on these tools would ultimately help us achieve our long-awaited renaissance, since it is through these channels that we could hope to improve literacy rate and economic performance.

Before giving the present scenario of Information Technology (IT) in the Muslim world and discussing the future prospects, a brief account of IT and its development phases have been presented here.

## 3 INFORMATION TECHNOLOGY (IT)

### 3.1 Development Phases

The process of information exchange has passed through different phases during the long history of human civilisation. In the early times, useful applications were made of smoke signals, cave drawings and quill pens with a view to exchange information from person to person and place to place. Centuries afterwards, a significant development in this regard took place with the invention of a printing press, which can perhaps be called the earliest form of "Information Technology." This was the first solid evidence of the development of a tool for mainly expanding and speeding up the distribution or transfer of information to far flung areas and to a large number of people and places. Substantial time passed by till another worth mentioning development took place in this direction. The development, which followed, changed the whole concept of the process of exchange of information. This important phase in the history of Information Technology is due to discovery and applications of newly developed tools such as electricity, telegraph, telephone, wireless, radio, television, etc. It was quite noticeable that history of information went through drastic and sudden changes. Every discovery of a new process or invention of a new tool/gadget was followed by a development in the field of Information Technology. The form/mode of flow of information changed its shape from written words of printing materials to audio signals received through telephone, wireless and radio. Much more comprehensive exchange of information took place in the form of visual signals of a television. During this important change in the mode of information transformation, it was noted that flow of information was making a much greater impact on the recipients as compared to previous technologies.

No worthwhile further development could be observed in this process for a long time till the development of an important machine, called the 'computer.' Computers not only transmit information from one place to another and from one source to another, but more importantly, with the help of computers the information could be transmitted in a more organised way and could be manipulated/reshaped according to specific needs. This was perhaps the first useful combination of 'information' and 'technology,' which ultimately resulted in what can be justifiably called, the "Information Age."

Before we proceed further let us briefly define the term 'Information Technology.' The 'Information' is a data or fact, that can be stored, retrieved and manipulated. (Figure 1). A simple definition of 'technology' can be given as: the application of scientific knowledge to design, produce and use products and to develop new/better devices/services with a view to enhance the human potential/capabilities (Figure 1). "Information Technology," can thus simply be defined as a set of tools, products, processes, techniques, expertise which can be made use of to solve problems involving and utilising information (Figure 1). Information Technology can also help in the further refinement of the flow of information during the retrieval and utilisation of information.

**Information Technology**

**INFORMATION:** DATA OR FACT THAT CAN BE STORED, RETRIEVED AND MANIPULATED.

**TECHNOLOGY:** THE APPLICATION OF SCIENTIFIC KNOWLEDGE TO DESIGN, PRODUCE AND USE PRODUCTS AND SERVICES FOR THE PURPOSE OF EXTENDING THE HUMAN POTENTIAL TO IMPROVE AND CONTROL THE NATURAL AND HUMAN MADE ENVIRONMENT.

**INFORMATION TECHNOLOGY:** A SET OF TOOLS, SYSTEMS, TECHNIQUES AND KNOWLEDGE DEVELOPED TO SOLVE PROBLEMS INVOLVING AND UTILIZING INFORMATION

**Figure 1. Definitions of 'Information,' 'Technology' and 'Information Technology'.**

### 3.2 Main Disciplines of IT

Information Technology is actually not a single subject. Rather it consists of a number of disciplines. There are three main disciplines namely: Information Systems, Computer Science and Information Engineering (Figure 2) [1]. Information Technology deals with both software and hardware. Also, the subject matter is both machine oriented and people oriented.

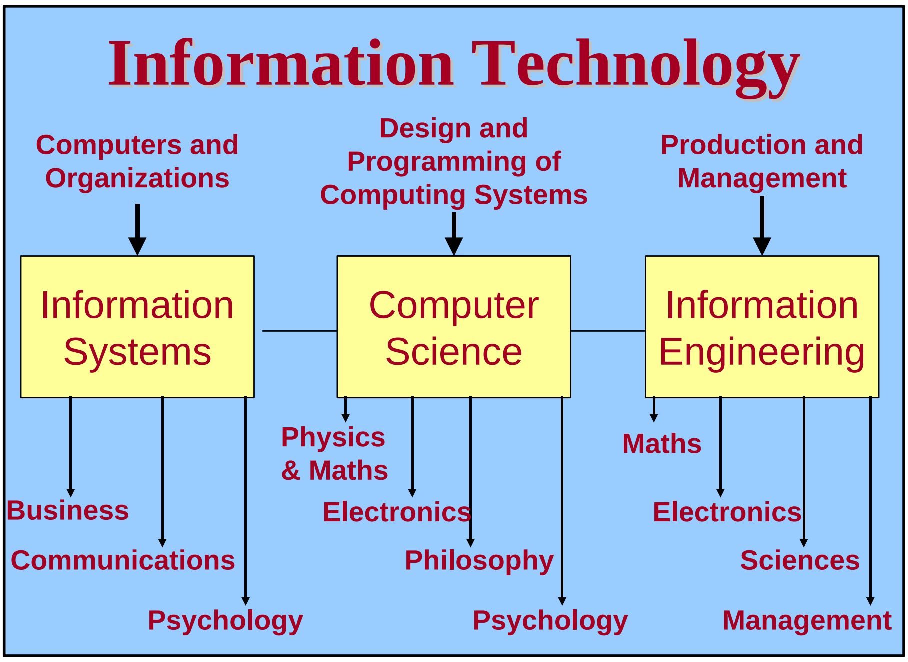


**Figure 2. Information Technology, its main disciplines, and the basic subjects.[1]**

*3.2.1 Information Systems*

A simple definition of an "Information System" is the system which studies the effects computing systems may have on people, set-ups and organisations (Figure 2). On the other hand, "Computer Science" and "Information Engineering" are relatively technology-oriented disciplines. The "Information Systems" deal with questions such as why some systems are more successful than others and using this knowledge to plan new systems which are likely to be the most successful. In these studies, it is assumed that the systems are technically sound and the emphasis is to find out the best possible steps to integrate these systems into a work-place according to the maximum satisfaction of the actual users. From the foregoing brief description of an "Information System," it is quite clear that this branch of "Information Technology" deals very little with the programming and concerns more with the human and business aspects (Figure 2). It may also be pointed out that the mathematical requirement in the study of "Information Systems" is relatively minimum when compared with the other two disciplines of Information Technology, i.e. Computer Science and Information Engineering, where knowledge of Physics and Mathematics plays an important role.

*3.2.2 Computer Science*

This branch of Information Technology deals with devising, building and programming of Computing Systems. To this end, one has to study not only the underlying computer hardware but also be well versed with software aspects, i.e. the programming of the systems. The study of Computer Science is based upon five essential subjects namely, Physics, Mathematics, Electronics, Philosophy and Psychology (Figure 2). In psychology, the knowledge of a subject known as Human-Computer-Interaction (HCI) plays an important role. The HCI is an extremely important factor in the design of a computer system. Therefore, this branch of computer science requires not only in-depth study of computing discipline but also takes into account human psychology and perception. Based on these two important factors, the design of a computer system is made which is not only technically sound but also is friendly to the computer users. Of course, programming is an important part of computer science. However, experience shows that programming is only a part and not everything. Through programming, we carry out different types of tests on a system and make it work according to certain instructions pertinent to a particular job/assignment. Certainly, programming is an extremely important part of computer science and it can be judged from the following statement:

"Programming is to computing as chemistry laboratories are to chemistry." However, as mentioned earlier, there is much more in computer science than the programming.

*3.2.3 Information Engineering*

"Information Engineering" mainly deals with industrial application of Information Technology. Normally, information and telecommunication engineering work on combined knowledge based upon electronics, communication, computer engineering, signal processing, mathematics, etc. (Figure 2). These days, electronics systems carry out functions such as computing, processing and analysing, storing, distributing and displaying the required information. Important examples of information, telecommunication and engineering are: Internet, a CD player, video recorder, a Tele-text, a cells telephone, etc.

From the foregoing discussion, it is quite clear that engineering aspects in information technology are fairly different from its scientific aspects. It is particularly worth mentioning that the focus of engineering is on the practical application of technology i.e. to carry out design and production in industrial environment. It is, therefore, clear that engineering aspects of information technology is based on scientific/mathematical knowledge as well as on technology and management.

## 4 WHY INFORMATION TECHNOLOGY?

In the twenty-first century, cost effective communication infrastructure and information systems are not just luxuries, but a necessity. In fact, they are strategic Technology has become the "Knowledge Tool" which is essential for the management of a country's economics. By involving IT, governments can transport, store, retrieve and disseminate information far more efficiently and hence improve the productivity of their nations.

Information Technology is perhaps one of the most dynamic and creative branch of present day technologies. Experience shows that there is a continuous supply of new problems. These problems are not only new but are also time targeted. These problems become more complicated because both technology and problems keep on changing with time. Apart from having a thorough knowledge of their fields, information technology people are required to work alongwith experts in other professions. This is particularly true when the problems so arising belong to non-computing areas. All this shows that working in the field of information technology, one never feels static. The challenges not only go on changing but also keep on growing. Information technology is, therefore, particularly suitable to those who have creative minds and who love to face new challenges of this extremely fast developing technology. If you can synchronise your thinking and work with the dynamic nature of information technology, you will be offered unimaginable opportunities.

It is interesting that information technology is not only extremely pervasive but also its history is recent. There is no doubt that in a short span of time information technology has reduced this world to a global village. Previously existing physical boundaries in education, commerce and communications have almost vanished. New scholarly, economic, political, spiritual alliances have been forged due to the role played by information technology. Multinational companies and worldwide businesses have come into being due to the extremely useful role played by information technology. This is because of its enhanced communication-capability, increased-access and streamlined financial operations. This all has resulted in what we call today “High Tech Industry”. This stage of development owes a lot to the dramatic surge in the development of information technology tools, systems and processing and some of the novel uses/applications of the valuable information obtained by using information technology. The entirely new segment of commerce has taken birth and has revolutionized the whole process of business and economy.

It may be mentioned that cellular phones, personal computers, world-wide access, satellite delivery systems – some of the tools of information technology used presently - are rapidly becoming interwoven in the fabric of life. Some of the important changes that have taken place include, information access in terms of time and scope, change of mode of information according to the format one requires and to learn, work and play according to time and place of our preference. In short, the impact of information technology is enormous on our day to day living. It has changed the way we think and live.

Revolutionary advances in IT reinforce economic and social changes that are transforming business and society. A new kind of economy, the “information economy” is emerging, where trade and investment are global and firms compete with knowledge, networking and agility. A corresponding new society is also emerging with pervasive information capabilities that make it substantially different from an industrial society: much more competitive, more democratic, less centralised, better able to address individual needs, and friendlier to the environment. A hundred years ago, strong industrial sector meant an economically strong country. Today, information revolution plays a pivotal role in any country’s economic success.

In 1991, annual sales of personal computers exceeded 50 million units as compared to 35 millions passenger cars worldwide. Using the right tools, companies can bring about efficiencies in their organisations. Entire enterprises, large and complex industries can only function smoothly if they are equipped with the right IT related tools. For example, financial market transaction volume, credit cards, e-commerce, online travel reservations, could not be possible without the use of information technology. Technology is having an impact. It is changing the world around us. If we do not adapt to the changes, we would be left behind.

## 5 INFORMATION TECHNOLOGY IN MUSLIM COUNTRIES: PRESENT SCENARIO

It is obvious from the foregoing sections of this paper that information technology is one of the most important and promising technologies of the present world. Muslim countries simply cannot ignore this field, which is relatively new, yet involves working at the cutting edge of technology. It is now an important part of our daily living. It can be found in cars, in super markets and even in day-to-day used automatic machines. It has wide spectrum of applications having science and engineering on one end and diverse fields such as commerce, psychology, medicine, art and music on the other end of the spectrum. In addition to the above diverse applications, it has an added attraction for young graduates to obtain financially rewarding and challenging careers with banks, large industrial complexes, computer companies and government departments, etc. It is thus clear that Muslim countries should make all out efforts to acquire and master this important technology without further waste of time. The proper planning ahead would not be possible without having the knowledge of the prevailing situation of information technology related development and status in Islamic World. This section attempts to present a comprehensive picture of IT in Islamic world with a regional perspective and country-wise status wherever possible.

Unfortunately, the situation in Muslim countries does not seem to be very healthy. There is no doubt that some countries are making serious efforts to master this technology and make its useful applications. However, whatever the activities and limited achievements of the Muslim countries may be, they are not well documented. Some scanty available documentation is either fairly out of date and /or is unreliable. The attempt is, however, made to present a collection of IT related facts and figures concerning the Muslim countries which the author could acquire/collect using the Internet, existing literature on information technology and through personal contacts with colleagues in various countries The limited data so collected, concerns the following countries: Malaysia, Indonesia, Turkey, Iran, UAE, Pakistan, Jordan, Saudi Arabia, Egypt, Bangladesh, Palestine, Qatar, Lebanon, etc.

This section is organised so as to take into account most of the important aspects/dimensions associated with the IT sector-development in a country, which include:

1. Access to Electricity / Power Infrastructure (availability per 1000 persons)
2. Telecommunication Infrastructure
   *a. Telephones lines per 1000 persons and tariff structure*
   *b. Digitisation of networks with communication links' quality and speed*

*c. Strength of cellular and wireless communication systems, paging and cable TV networks*

*d. Availability of modern data communication facilities like fibre optics, submarine cables, satellites earth stations, coaxial cables, and teleports*

*e. Sector growth rate, based on the prospects of sector reforms, favourable policy environment, and private sector participation*

3. Human Capital

*a. Strength of overall education sector, education policies, literacy rates and university enrolment ratio*

*b. Computer related education and training infrastructure (number of IT institutes/universities, the quantity and quality of graduates produced per year)*

*c. Composition of the workforce/ratio of IT professionals in various IT disciplines like networking, development, management, training/education, data communication etc.*

*d. The areas of professional surplus or shortage*

4. Internet Activity

*a. Usage rate/number of users and % of population online*

*b. Number of ISPs, market size*

*c. Quality of services in terms of connectivity, time and speed*

*d. Annual growth in usage per 1000 persons*

*e. Access costs*

5. Software

*a. Total market size and annual turn-over (general application, custom made applications usage)*

*b. Local production/development, import and export ratio*

*c. Growth rate*

*6. Hardware (Computers and Peripherals)*

*a. Computers per 1000 persons*

*b. Market size, market composition, and growth rate*

*c. Local production or assembly estimates, imports and exports*

7. IT Services

*a. Training and education services*

*b. Management consultancy*

*c. Customer support*

*d. Others*

The facts and figures provided in this section might not be representative of the actual state of affairs in different Islamic countries because of some limitations. However, an effort is made to present up to date and accurate official figures wherever possible. The main source of the facts and figures provided herein is the Internet. Very much relevant to the subject of this paper, the author has tried to make use of this modern and fast growing medium of IT for the data/information collection. The factors responsible for any data inaccuracy include the following:

- The IT related data changes very fast, even within days and months. The data presented here might be one-and-half month old by the time the paper is presented to the Islamic academy of Sciences;

- Non-availability of country specific data in the field of IT - most of the data is available in the form of regional break-ups like Asia /Pacific, Africa, Middle East etc.;
- Authenticity and reliability of data – since most of the facts and figures available were not the official estimates;
- The data collected from western sources might be biased;
- Non-availability of latest data is one of the shortcomings of this paper. In some cases the data is as old as five years, while in some it is as latest as of mid 2000. This would no doubt make the interpretation, analysis and area-wise comparison among the countries a bit shaky;
- Contradictory estimates at different data sources. There was high variability in estimates of country wise IT resources at different web site; and
- The units of the available data for different countries and different indicators were different. For example, somewhere the Internet usage was given per 100 inhabitants, while others would be per 1000 or in % of total population.

Despite all these limitations, the author has made best possible use of the available material and tried to present a reasonable picture of the current state of affairs concerning information technology acceptance and growth in Islamic Countries. This paper would give a general picture, which I hope would take a clearer shape and would be refined after the country specific facts and figures are presented by my other colleagues/Fellow of Islamic Academy of Sciences. After examining all the available papers and research studies we would hopefully come to a better conclusion and Action Plan at the end.

Based on this research paper, we can safely conclude that the Islamic countries mostly concentrated in Asia, Africa and Arab regions can be divided into three categories with reference to the current status and growth prospects of Information Technology sector:

1. **Major Players** – the countries comparatively advanced in respect of IT penetration and growth prospects. These are the ones that have already made some progress on IT map;
2. **Emerging Players** – the countries that have realised the importance of IT in today's world, possess the required resources and willingness to work on the IT enabling infrastructure. These countries are mostly located in the Middle East; and
3. **Under developed countries** – mostly in the African region, these might be willing to get into the IT race but lack resources to reap the full fruits of IT.

If we analyse the power supply and telecommunication infrastructure in Islamic countries, it would be evident that very few countries have strong and modern telecommunication lines available. The strong and emerging candidates in this area based on their currently installed systems and growth rates, include Saudi Arabia, Lebanon, Turkey, Malaysia, Qatar, UAE, Iran, Kuwait, Jordan and Pakistan. In Africa, the communications and information infrastructure has improved dramatically over the past 5 years. The Internet, satellite television, cellular phones and itemised billing are now widespread on the continent. What might have been unthinkable a decade ago is still a dream for the majority of Africans though - those who do not live in the capital cities and are not part of the elite. Access to telephones is still very scarce on the continent – there are only about 14 million lines installed - less than the number of phones in Manhattan (USA) or Tokyo. And most of the lines are concentrated in the urban areas, while over 70% of the population is rural. Likewise, cellular phone coverage is usually confined to the capitals and secondary cities. As Internet Service Providers are usually concentrated in the capital cities, it is a long distance call to the Internet for most of the (predominantly rural) public.

Most of the Islamic countries lack in skilled work force. The human resources development efforts in IT are not that much streamlined and there is critical shortage of IT professionals due to lack of trained personnel, and brain drain/emigration of experts to the developed countries. The Islamic countries that have good literacy ratios and some that have started investing in IT training and education include Turkey, Qatar, Lebanon, Jordan, Malaysia, and Pakistan.

In the hardware area, majority of the Islamic countries imports the computers and peripherals with 70-80% assembling being done locally. One or two countries like Malaysia have local production capacity.

On the software side, the major Islamic markets are catching up. With available skilled workers, many software houses have been successfully developing software for the domestic and export markets. Some have succeeded in winning partnerships and development contracts from the developed countries due to the lower labour costs and other comparative advantages. The list may include Turkey, Pakistan, Malaysia, Indonesia, UAE and Saudi Arabia. Others in the Muslim countries mainly in Africa, are still dependent upon the outside world to meet their domestic software needs. Many have not yet even started computerisation of domestic systems due to lack of resources.

Internet is one area that is growing fast in the Islamic countries. The access quality might not be good due to the absence of required infrastructure, more and more countries, however, are getting online, even the ones in the least developed areas of Africa. This is a healthy sign as the Internet alone could make the IT more accessible to this part of the world. The basic issues might include the content side of Internet and censorship.

After gaining some ground in the fields of internet, human resource development, and software, the Islamic countries can well jump into prospective sector of IT services, an area which has still not caught attention of the IT entrepreneurs. The available data in this area is also very limited to portray a reasonable picture of the current state of affairs. It may be concluded that this sector is still under development.

Overall, the Islamic Countries are still in the development stage as far as IT is concerned. Efforts can be seen emerging in the major countries to install and upgrade at least the basic infrastructures (electricity, telecommunications, computers, internet), which are the pre-requisites for starting on with the IT revolution. A few have already started investing in human resource development and Internet technologies, while the areas like software, hardware and IT services still need lots of attention and efforts to develop reasonably.

Comparative figures, charts and tables are attached.

In the light of the identified strengths and weak areas of the Islamic Countries, some recommendations have been compiled for the development of IT in the Muslim world and are given in sections 7.

**Table. 1 State of Electric Power Production/Consumption and Communication Facilities in Some Muslim Countries [2]**

| Country | Electric Power | | Telephone Mainlines | | | | International Tele-communications | |
|---|---|---|---|---|---|---|---|---|
| | Consumption per capita (kWh) 1997<br>1997 | Production average (annual % growth)<br>1980-97 | Per 1000 people<br>1998 | In largest city (per 1000 people<br>1998 | Waiting time (years)<br>1998 | Cost of local call (US$ per 3 minutes)<br>1998 | Outgoing traffic (minutes per subscriber)<br>1998 | Cost of call to (US$ per 3 minutes<br>1998 |
| **Albania** | 851 | **1.4** | 31 | 176 | 2.9 | 0.02 | 425 | 4.37 |
| **Algeria** | 566 | **6.4** | 53 | 55 | 5.2 | 0.02 | 76 | 4.70 |
| **Azerbaijan** | 1631 | **-0.7** | 89 | 184 | 10.0 | 0.13 | 94 | 12.49 |
| **Bangladesh** | 76 | **10.1** | 3 | 21 | 4.8 | 0.04 | 111 | -- |
| **Bosnia Herzegovina** | 476 | **-21.6** | 91 | 445 | 4.0 | 0.03 | 285 | 3.69 |
| **Cameroon** | 181 | **3.0** | 5 | 3.0 | 7.9 | 0.06 | 335 | 3.39 |
| **Egypt Arab Republic** | 803 | **6.6** | 60 | -- | 3.9 | -- | 32 | 5.84 |
| **Indonesia** | 329 | **13.5** | 27 | 225 | -- | 0.03 | 58 | 3.28 |
| **Iran** | 1163 | **8.8** | 112 | 286 | 1.6 | 0.01 | 24 | 7.71 |
| **Iraq** | 1353 | **5.4** | 31.75 | - | - | - | - | - |
| **Jordan** | 1196 | **10.2** | 86 | 232 | 1.1 | 0.04 | 239 | -- |
| **Kazakhistan** | 2595 | **-1.6** | 104 | 224 | -- | 0.00 | 113 | 2.68 |
| **Kuwait** | 12886 | **5.1** | 236 | 46 | 2.5 | 0.00 | 405 | 5.41 |
| **Lebanon** | 1930 | **4.0** | 194 | 96 | -- | 0.07 | 113 | 4.45 |
| **Libya** | 3505 | **7.9** | 84 | 94 | -- | 0.02 | 93 | -- |
| **Malaysia** | 2352 | **10.0** | 198 | 300 | 0.4 | 0.02 | 172 | 3.82 |
| **Mauritania** | -- | **--** | 6 | 16 | 1.6 | 0.10 | 427 | -- |
| **Morocco** | 423 | **5.1** | 54 | 115 | 0.2 | 0.08 | 119 | 4.50 |
| **Niger** | -- | **--** | 2 | 18 | 1.1 | 0.15 | 322 | -- |
| **Nigeria** | 84 | **4.7** | 4 | 11 | 10.0 | -- | 113 | -- |
| **Oman** | 2613 | **13.0** | 92 | 165 | 0.2 | 0.07 | 425 | -- |
| **Pakistan** | 333 | **8.9** | 19 | 61 | 1.4 | 0.03 | 30 | -- |
| **Saudi Arabia** | 4085 | **9.0** | 143 | 253 | 2.4 | 0.02 | 324 | 6.41 |
| **Senegal** | 107 | **3.8** | 16 | 47 | 1.3 | 0.13 | 225 | 4.48 |
| **Sierra Leone** | -- | **--** | 4 | 18 | 10.0 | 0.04 | 230 | -- |
| **Sudan** | 48 | **5.7** | 6 | 33 | 10.0 | 0.02 | 114 | 7.79 |
| **Syrian Arab Republic** | 776 | **8.2** | 95 | 140 | 10.0 | 0.05 | 70 | 26.71 |
| **Tajikistan** | 2177 | **0.4** | 37 | 150 | -- | 0.00 | 45 | 8.16 |
| **Tanzania** | 54 | **6.4** | 4 | 28 | 3.6 | 0.09 | 917 | 13.30 |
| **Tunisia** | 709 | **6.1** | 81 | 90 | 1.0 | 0.06 | 150 | 6.47 |
| **Turkey** | 1275 | **9.5** | 254 | 398 | 0.4 | 0.08 | 38 | 3.31 |
| **Turkmenistan** | 934 | **0.6** | 82 | 155 | 5.9 | -- | 43 | -- |
| **United Arab Emirates** | 7973 | **6.5** | 389 | 374 | 0.00 | 0.00 | 956 | 3.77 |
| **Uzbekistan** | 1645 | **0.7** | 65 | 231 | -- | -- | 42 | -- |

**Source:** ***The data are from the International Telecommunication Union' s (ITU)," World Telecommunication Development Report – 1999 (page-298)."***

## Table. 2 Information Age Statistics of Muslim Countries (2)

| COUNTRIES | DAILY NEWS PAPER | RADIO | TELEVISION | | MOBILE PHONES | FAX MACHINES | PERSONAL COMPUTER | INTERNET HOSTS |
|---|---|---|---|---|---|---|---|---|
| | | | SETS | CABLE SUBSC-RIBERS | | | | |
| | per 1000 people | per 1000 people | per 1000 people | per 1000 people | per 1000 people | per 1000 people | per 1000 people | per 1000 people |
| | 1996 | 1997 | 1998 | 1998 | 1998 | 1998 | 1998 | July 1999 |
| **Albania** | 36 | **217** | 109 | 0.0 | 1 | 3.6 | -- | 0.24 |
| **Algeria** | 38 | **241** | 105 | 0.0 | 1 | 0.2 | 4.2 | 0.01 |
| **Azerbaijan** | 27 | **23** | 254 | 0.1 | 8 | -- | -- | 0.23 |
| **Bangladesh** | 9 | **50** | 6 | -- | 1 | -- | -- | 0.00 |
| **Bosnia and Herzegovina** | 152 | **248** | 41 | -- | 7 | -- | -- | 1.38 |
| **Cameroon** | 7 | **163** | 32 | -- | 0 | -- | -- | 0.00 |
| **Egypt Arab Republic** | 40 | **324** | 122 | -- | 1 | 0.5 | 9.1 | 0.28 |
| **Indonesia** | 24 | **156** | 136 | -- | 5 | 0.9 | 8.2 | 0.76 |
| **Iran** | 28 | **265** | 157 | 0.0 | 6 | -- | 31.9 | 0.05 |
| **Iraq** | 19 | **229** | 83 | -- | 0 | -- | -- | 0.00 |
| **Jordan** | 58 | **287** | 52 | 0.1 | 12 | 8.6 | 8.7 | 1.17 |
| **Kazakhistan** | -- | **384** | 231 | -- | 2 | 0.1 | -- | 1.42 |
| **Kuwait** | 374 | **660** | 491 | -- | 138 | 27.6 | 104.9 | 23.76 |
| **Lebanon** | 107 | **906** | 352 | 1.4 | 157 | -- | 39.2 | 7.02 |
| **Libya** | 14 | **233** | 126 | 0.0 | 3 | -- | -- | 0.00 |
| **Malaysia** | 158 | **420** | 166 | 5.2 | 99 | 6.9 | 58.2 | 23.53 |
| **Mali** | 1 | **54** | 12 | 0.0 | 0 | -- | 0.7 | 0.01 |
| **Mauritania** | 0 | **151** | 91 | -- | 0 | 1.7 | 5.5 | 0.00 |
| **Morocco** | 26 | **241** | 160 | -- | 4 | 0.7 | 2.5 | 0.28 |
| **Niger** | 0 | **69** | 27 | -- | 0 | -- | 0.2 | 0.03 |
| **Nigeria** | 24 | **223** | 66 | -- | 0 | -- | 5.7 | 0.00 |
| **Oman** | 29 | **598** | 595 | 0.0 | 43 | 2.7 | 21.0 | 2.87 |
| **Pakistan** | 23 | **98** | 88 | 0.1 | 1 | 1.9 | 3.9 | 0.22 |
| **Saudi Arabia** | 57 | **321** | 262 | -- | 31 | -- | 49.6 | 1.17 |
| **Senegal** | 5 | **142** | 41 | -- | 2 | -- | 11.4 | 0.28 |
| **Sierra Leone** | 4 | **253** | 13 | 0.0 | 0 | 0.5 | -- | 0.14 |
| **Sudan** | 27 | **271** | 87 | 0.0 | 0 | 0.6 | 1.9 | 0.00 |
| **Syrian Arab Republic** | 20 | **278** | 70 | -- | 0 | 1.4 | 1.7 | 0.00 |
| **Tajikistan** | 20 | **142** | 285 | -- | 0 | 0.3 | -- | 0.24 |
| **Tanzania** | 4 | **279** | 21 | 0.0 | 1 | -- | 1.6 | 0.05 |
| **Togo** | 4 | **218** | 18 | -- | 2 | 4.1 | 6.8 | 0.17 |
| **Tunisia** | 31 | **223** | 198 | -- | 4 | 3.4 | 14.7 | 0.06 |
| **Turkey** | 11 | **180** | 286 | 9.2 | 53 | 1.7 | 23.2 | 8.06 |
| **Turkmenistan** | -- | **176** | 201 | -- | 1 | -- | -- | 0.56 |
| **United Arab Emirates** | 156 | **345** | 294 | -- | 210 | 21.0 | 106.2 | 39.44 |
| **Uzbekistan** | 3 | **465** | 275 | -- | 1 | -- | -- | 0.05 |

**Source:** *The data are from the International Telecommunication Union' s (ITU)," World Telecommunication Development Report – 1999 (page-298)."*

**Table 3. Online as of May 1999 (Millions) [ 27 ]**

| | |
|---|---|
| **Middle East** | 0.88 |
| **Africa** | 1.14 |
| **South America** | 5.29 |
| **Asia/Pacific** | 26.97 |
| **Europe** | 40.09 |
| **Canada & USA** | 90.63 |
| **World Total** | 165.00 |

**Source: Web site of Nua Internet, Ltd.**

**Table 4. Middle East: How Many Online? [ 27 ]**

| COUNTRY | DATE | NUMBER | % OF POPULATION |
|---|---|---|---|
| **UAE** | July 1997 | 45150 | 1.47 |
| **UAE** | January 1998 | 88552 | 2.99 |
| **Bahrain and Saudi Arabia** | July 1997 | 38480 | 0.19 |
| **Bahrain and Saudi Arabia** | January 1998 | 46538 | 0.23 |
| **Jordan** | July 1997 | 11940 | 0.28 |
| **Jordan** | January 1998 | 20213 | 0.50 |
| **Kuwait** | July 1997 | 29600 | 1.51 |
| **Kuwait** | January 1998 | 42350 | 2.15 |
| **Lebanon** | January 1998 | 43828 | 1.14 |
| **Oman** | July 1997 | 11425 | 0.52 |
| **Oman** | January 1998 | 20888 | 0.95 |
| **Qatar** | July 1997 | 8265 | 1.51 |
| **Qatar** | January 1998 | 17295 | 3.10 |
| **Yemen** | December 1997 | 2426 | - |

**Source:Web site of Nua, Ltd.**

**Table 5. Region-wise Internet Users Distribution**

| | | |
|---|---|---|
| **WORLD INTERNET USERS (2000) 377.65 M** | | **6.22 % OF WORLD POPULATION** |
| **Africa** | 3.11 M | |
| **Asia / Pacific** | 89.68 M | |
| **Middle East** | 2.40 M | |
| **Europe** | 105.89 M | |
| **Canada and US** | 161.31 M | |
| **Latin America** | 15.26 M | |

**Table 6. Internet Users of Some Selected Muslim Countries**

| COUNTRY-WISE | INTERNET USERS (2000) | % POPULATION |
|---|---|---|
| **Algeria** | 20,000 | 0.06 |
| **Cameroon** | 20,000 | 0.13 |
| **Egypt** | 440,000 | 0.65 |
| **Ghana** | 20,000 | 0.41 |
| **Ivory Coast** | 20,000 | 0.13 |
| **Kenya** | 25,000 | 0.16 |
| **Mauritius** | 55,000 | 4.66 |
| **Morocco** | 120,000 | 0.4 |
| **Nigeria** | 100,000 | 0.08 |
| **Senegal** | 30,000 | 0.30 |
| **Tanzania** | 25,000 | 0.07 |
| **Tunisia** | 110,000 | 1.16 |
| **Uganda** | 25,000 | 0.11 |
| **Bangladesh** | 30,000 | 0.02 |
| **Indonesia** | 400,000 | 0.18 |
| **Malaysia** | 1500,000 | 6.88 |
| **Pakistan** | 12,00,000 | 0.85 |
| **UAE** | 400,000 | 17.06 |
| **Syria** | 20,000 | 0.12 |
| **Saudi Arabia** | 300,000 | 1.4 |
| **Qatar** | 45,000 | 6.22 |
| **Lebanon** | 227,500 | 6.39 |
| **Kuwait** | 100,000 | 5.02 |
| **Jordan** | 87,500 | 1.92 |
| **Iran** | 100,000 | 0.15 |
| **Bahrain** | 37,500 | 5.96 |
| **Brunei Darussalam** | 4,000 | 1.19 |

**Table 7. Breakdown of Internet Users in Arab World**

| Country | Number of Subscribers | Number of Users per Account | Total Number |
|---|---|---|---|
| **UAE** | 160,000 | 2.5 | 400,000 |
| **Saudi Arabia** | 100,000 | 3 | 300,000 |
| **Bahrain** | 15,000 | 2.5 | 37,500 |
| **Libya** | 1,500 | 5 | 7,500 |
| **Sudan** | 2,000 | 5 | 10,000 |
| **Qatar** | 18,000 | 2.5 | 45,000 |
| **Oman** | 20,000 | 2.5 | 50,000 |
| **Kuwait** | 40,000 | 2.5 | 100,000 |
| **Egypt** | 55,000 | 8 | 440,000 |
| **Yemen** | 3,000 | 4 | 12,000 |
| **Lebanon** | 65,000 | 3.5 | 227,500 |
| **Syria** | 4,000 | 5 | 20,000 |
| **Jordan** | 25,000 | 3.5 | 87,500 |
| **Morocco** | 15,000 | 3.5 | 52,500 |
| **Tunisia** | 22,000 | 5 | 110,000 |
| **Total** | **545,500** | **3.5 (total average)** | **1,899,500** |

Number of Internet users in Arab countries edges towards two million – a Survey by the Research Unit of Internet Arab World Magazine - conducted in the First Week of February, 2000. **Source: DIT Online Editor, DUBAI: March 7, 2000.**

**Table 8. Internet Users in Arab World Close to One Million - DIT Survey Published in Dubai, 30 May 1999**

| Rank | Country | Subscribers | Subscribers | Users | %Growth in 4 months |
|---|---|---|---|---|---|
| - | - | *Dec 1998* | *April 1999* | *April1999* | *Dec'98-April'99* |
| 1. | **UAE** | 61,200 | 81,700 | 204,300 | 33.5 |
| 2. | **Lebanon and Syria*** | 30,700 | 52,900 | 132,200 | 72.3 |
| 3. | **Egypt** | 36,400 | 51,800 | 207,200 | 42.3 |
| 4. | **Saudi Arabia**** | 18,700 | 45,000 | 112,500 | 140.6 |
| 5. | **Kuwait** | 22,000 | 25,100 | 62,800 | 14.1 |
| 6. | **Jordan** | 16,600 | 20,100 | 50,300 | 21.1 |
| 7. | **Oman** | 12,700 | 16,000 | 40,000 | 26.0 |
| 8. | **Tunisia** | 4,700 | 6,000 | 15,000 | 27.7 |
| 9. | **Morocco** | 11,200 | 14,100 | 32,500 | 25.9 |
| 0. | **Bahrain**** | 11, 700 | 13,000 | 32,500 | 11.1 |
| 1. | **Qatar** | 8,500 | 11,000 | 27,500 | 29.4 |
| 2. | **Yemen** | 2,200 | 2,500 | 6,300 | 13.6 |
| **Total** | | **236,000** | **338,200** | **923,100** | |

Statistics were rounded to the nearest 100. Margin of error: ± 5
* Syrian subscribers form a small portion of the combined statistic. They mostly have only e-mail connection.
** Saudi statistics are conservative and could rank much higher. Bahrain statistics include Saudi subscribers – excluded from Saudi statistics.

**Table 9. Internet Subscriber Boom in the Middle East - October 1998**

| Country | Number of Subscribers | | | Number of Users | Monthly Growth Rate % |
|---|---|---|---|---|---|
| | July 97 | Nov 97 | Oct 98 | | |
| **UAE** | 15250 | 27000 | 52000 | 143000 | 8.5 |
| **Oman** | 3860 | 6490 | 11000 | 30250 | 7.2 |
| **Qatar** | 2800 | 5185 | 7000 | 19250 | 6.3 |
| **Bahrain and Saudi Arabia** | 13000 | 16000 | | | |
| **Bahrain** | 7000 | 8000 | 11000 | 20888 | 3.1 |
| **KSA** | 6000 | 8000 | 15400 | 16400 | 6.9 |
| **Lebanon** | 12000 | 15000 | 27500 | 75625 | 5.7 |
| **Kuwait** | 10000 | 14000 | 20000 | 46538 | 4.7 |
| **Egypt** | 2000 | 14500 | 32000 | 128000 | 6.8 |
| **Yemen** | 920 | 840 | 2000 | 5500 | 5.3 |
| **Jordan** | 4000 | 6000 | 14000 | 38500 | 8.7 |
| **Tunisia** | 1200 | 1400 | 4000 | 11000 | 8.4 |
| **Morocco** | 3000 | 4500 | 9500 | 26125 | 8.0 |
| TOTAL | **73830** | **110915** | **206400** | **607600** | **7.1** |

**DIT survey - Source: Fawaz Jarrah, DIT Online Editor, Dubai, October 1998.**

**Table 10. Number of Internet Service Providers (ISP's) in Selected Countries**

| | |
|---|---|
| **Algeria** | **4** |
| **Egypt** | **50+ (1999)** |
| **Morocco** | **250** |
| **Nigeria** | **12** |
| **Tunisia** | **5** |
| **Kenya** | **34** |
| **Malaysia** | **10+** |
| **Pakistan** | **55-70 (June 2000)** |
| **Indonesia** | **24+ (1999)** |
| **Jordan** | **10** |
| **Qatar** | **5+** |
| **Lebanon** | **15+** |
| **Saudi Arabia** | **30+** |
| **UAE** | **5+** |

**Table 11. Access Costs in Middle East – April 24, 2000**

| Country | Dial Up Access costs per number of hours (in US Dollars)* | | | |
|---|---|---|---|---|
| | 30 hours | 60 hours | 90 hours | 120 hours |
| UAE | 20 | 35 | 50 | 64 |
| Kuwait | 33 | 65 | 98 | 82 |
| Egypt | 40 | 57 | 74 | 92 |
| Oman | 44 | 55 | 65 | 96 |
| Bahrain | 32 | 58 | 83 | 108 |
| Qatar | 63 | 80 | 113 | 124 |
| Lebanon | 63 | 117 | 170 | 224 |
| Saudi Arabia | 76 | 152 | 209 | 245 |
| Jordan | 67 | 135 | 202 | 270 |
| Syria | 112 | 184 | 256 | 328 |
| AVERAGE | 55 | 94 | 132 | 163 |

**(*These Prices have been averaged from the total number of ISPs per country, and include subscription rates).**

## Macro aspects of Internet penetration

### Table 12. Participation of Women in the Internet [ 27 ]

| REGION | WOMEN'S SHARE (%) | SOURCE OF DATA |
|---|---|---|
| **SOUTH AFRICA** | 32 | Nua December 1999 |
| **ARABIA** | 4 | Nua June 1998 |
| **ASIA** | 22 | Nua April 1998 |
| **USA** | 38 | Nua June 1998 |
| **EUROPE** | 22 | Nua June 1998 |

### Table 13. Internet Costs as Share of GDP per Capita [ 28]

| COUNTRY | SHARE OF GDP PER CAPITA (%) |
|---|---|
| **Mexico** | 14.8 |
| **Turkey** | 12.8 |
| **Japan** | 2.6 |
| **Finland** | 2.2 |
| **USA** | 1.2 |
| **Australia** | 1.5 |
| **Uganda** | 107.0 |
| **Guinea** | 45.3 |
| **Sierra Leone** | 118.0 |
| **Ethiopia** | 76.8 |
| **Mozambique** | 69.6 |
| **Senegal** | 17.6 |

**Source: Internet & Developing Countries – Pros and Cons: Paper presented by Dr. Uwe Afemann, (University of Osnabruck, Germany) in Int'l Workshop on "Social Usage of Internet in Malaysia," March 22-25 2000.**

**Table 14: Human Capital Estimates of Some Selected Countries**

| Country | LR (%) | ER (%) | EE (US $) | TI |
|---|---|---|---|---|
| Turkey | 81 | 20+ | 102 | 25+ |
| Malaysia | 85 | 5-9 | 228 | 60+ |
| Pakistan | 40 | 3-4 | 11 | 40+ |
| Iran | 92 | 10-15 | 110 | 15+ |
| Jordan | 87 | 10-19 | 90 | 10+ |
| Lebanon | 85 | 10-19 | 150 | 10+ |
| Saudi Arabia | 73 | 10-19 | 78 | 5+ |
| UAE | 75 | 10-19 | 345 | 10+ |
| Bangladesh | 39 | 3-4 | 5 | 10+ |

*
LR – Literacy Rte
ER – University Enrolment Ratio
EE – Annual Expenditure on Education per person

# 6 SOME RECENT INITIATIVES BY ISLAMIC COUNTRIES

## 6.1 Silicon Valley of Malaysia

The Malaysian government has unveiled an ambitious plan to transform Malaysia into a digital economy. The Vision 2020 as it is called aims at making Malaysia a "knowledge-rich" country in a span of 20 years. To make this vision a reality, rubber tree and oil plantations around Kuala Lumpur have been turned into Eco-friendly smart cities, namely Cyberjaya and Putrajaya. Putrajaya is the new IT savvy government centre while Cyberjaya is expected to be the most advanced IT city in South East Asia. They are officially referred to as "Multimedia Super Corridor" (MSC). The idea is that MSC would enable Malaysia to become a global player in the information based economy.

Many major global players have already signed up for MSC status. Large corporations like Intel, Microsoft, Siemens, IBM, Ericsson, Oracle, Sun Microsystems are just a few of the IT leaders that are already its members.

The government of Malaysia is offering extremely attractive incentives to foreign companies. Tax holiday for ten years; unlimited import of "knowledge" workers; censorship free Internet coupled with most advanced infrastructure available, are some of the attraction to the foreign investment.

Multimedia Super Corridor is connected to a fibre optic backbone with 2.5 to 10 GBit bandwidth. The network supports multiprotocols including ATM, Frame Relay, ISDN, TCP/IP. Along with providing this infrastructure, the government has also promised reliability and performance guarantee at par with international standards.

At the same time, the government of Malaysia wants to transform itself into an IT savvy government. To achieve its goal it has formed "Media Development Corporation"(MDC). MDC's goal is to assist and invite IT companies in the MSC zone, and help them set-up and run offices there. It is also assisting in forming strategic partnerships with the government for the IT transformation. Companies like

SUN Microsystems, Oracle, Japan's NTT (Nippon Telephone & Telegraph) are already part of the MDC conglomerate.

This kind of interaction with the private sector is unique. Here the government is actually working with the private sector and is asking for its help in defining and implementing the new Malaysia.

The Malaysian government is focusing on the following seven projects to transform themselves in the new Millennium:

- Smart Schools;
- Telemedicine;
- Multipurpose smart card (ID, Drivers License, Passport, Health Record, Credit Card, etc.);
- Paperless e-Government;
- R&D clusters;
- Borderless Marketing; and
- Worldwide manufacturing web;

**Paperless E-Government:** While many Islamic governments are dreaming of having a paperless government, Malaysia is implementing one. The purpose, as the name signifies, is very simple:

- To re-structure government by improving its internal operations and public services;
- To create paperless government offices throughout the country;
- Linking citizens to govt. through Internet and electronic kiosks;
- Improve government response and speeding application approvals;
- Allow citizen to pay bills (utilities), renew licenses, etc. through Internet;
- Re-engineer and automate government purchase system.

These are ambitious goals, but are the need of the time. Ignoring them would only plunge the Islamic World into "Internet Dark Ages". The governments have to think ahead and start coming up with plans to implement such policies. It is no longer a choice, but a requirement. We owe it to our Muslim brothers and sisters.

**Smart Schools:** The smart schools are meant to initiate the following goals:

- To encourage students overall development;
- To provide students with opportunities to develop individual talents;
- To produce a thinking and technologically literate work force;
- To provide equal access to education;
- To increase participation by parents, the community and the private sector.

All the schools and universities would be interconnected and linked to the Internet. The purpose of the smart schools is simple. In twenty years, Malaysia wants to be an IT savvy nation, i.e. not importing technology, rather exporting its skills and technology through education rather, smart education. And it has to begin now.

**Telemedicine**

Telemedicine initiative is not just a point to point tele-consultation, it is actually designed to transform the health sector by inducing latest technology. It will change the relationship between doctors, patients, and hospitals. Users can have easy access to health information, and educational material. It can give information on medicines, doctors, hospitals etc. Hence, reducing the costs for everyone.

**Smart Card**

This is another ambitious project of Malaysian government. This will allow every citizen to carry one card that will act as the

- National ID;
- Driver's license;
- Passport;
- Health Information;
- Electronic Cash;
- Debit;
- ATM;
- Credit Card;

Today most of people carry many cards in the pockets. Driver's license, ATM cards, credit cards and, of course, cash. However, once the smart card is issued, one does not need to worry about individual cards. This one "smart" card will act as all, even allowing it to be used as electronic cash card. In case of medical emergency, this card (along with telemedicine initiative) would allow doctors quick access to the medical records.

**Borderless Marketing**

It focuses on using technology to improve customer services across time zones and cultures.

**Worldwide Manufacturing Web**

It aims at using technology to optimise manufacturing through a range of network support services e.g. R&D, design, engineering, procurement, and logistics and distribution support.

**R&D Cluster**

Here again Malaysia is breaking new grounds. They want to become Asia's first internationally focused R&D cluster by developing collaborations and networking among R&D centres, universities, and public research institutions.

If these initiatives remain on track and start delivering, Malaysia is bound to become a world leader in information technology. They will be at par or even ahead of Western Europe and North America. Tables 15-17.

## SOME STATISTICS OF MALAYSIA

**Table 15. Global II Rank of Malaysia/ Singapore**
**Out of 49 Countries [ 30 ]**

| COMPARISONS | MALAYSIA | SINGAPORE |
|---|---|---|
| Telecom – Infrastructure | 19 | 6 |
| Techology Infrastructure | 19 | 2 |
| Science Training in Schools | 19 | 2 |
| Computer Literacy | 28 | 2 |
| Information Technology | 13 | 3 |

*Source: Jabatan Telekom Malaysia.*

**Table 16. Statistical Data Concerning Literacy in Malaysia [ 31 ]**

| CATEGORY | 1980 (%) | 1990 (%) | 1995 (%) |
|---|---|---|---|
| Adult Literacy Rate: Male | 79.6 | 87 | 96.0 |
| Adult Literacy Rate: Female of Primary School | 59.7 | 74 | 85.7 |
| Children Reaching Grade 5 | N/A | 98 | 96.0 |
| GNP Spent on Education | N/A | 6.0 | 5.5 |

Source UNESCO January 1996

**Table 17. Information Concerning Some Important Users of Personal Computers from Malaysian Market [ 31 ]**

| Organisation Size | Market (%) |
|---|---|
| Medium Sized Enterprises | **30.63** |
| Small Sized Enterprises | **18.33** |
| Corporate | **17.35** |
| Home Users | **15.31** |
| Government | **10.21** |
| Education | **8.17** |

*Source: Research Asia Singapore.*

### 6.2 Dubai Internet City (DIC) [ 37 ]

Dubai Internet City (DIC) is being established to "create the infrastructure, environment and attitude that will enable new economic enterprises to operate locally, regionally and globally with significant competitive advantages." It is world's first free trade zone for IT, e-business and media companies and expected to be operational before the end of year 2000. It is the perfect location for the entire range of new economy industries. Global Internet-focused companies like IBM, Microsoft, Sun, CISCO, Yahoo and Infosys and more have been invited to set up regional offices and global software development centres at the Dubai Internet City. Also, global e-commerce companies are expected to join soon.

Some of the highlights are as follows:

- **World class technical infrastructure**: high bandwidth, low cost telecom infrastructure and secure, high speed support infrastructure.
- **State-of-the-art urban infrastructure**: cost competitive, flexible office space and world class housing, medical and education facilities.
- **Access to talent pool:** large pool of high skill, low cost knowledge workers.
- **Straight forward laws and regulations**: easy and fast company registration laws, hassle-free immigration process and straight forward legal procedures.
- **Gateways to markets**: access to regional markets in Middle East, North Africa and Indian Subcontinent.
- **Supportive environment**: Government is backing e-business initiatives, business incubators, venture capital funds and e-education programs.

The technical infrastructure at DIC is of world class. It will offer high bandwidth, low cost state-of-the art telecom infrastructure with redundant connections to Internet primary backbone providers. Top international companies will provide the complete spectrum of technical infrastructure such as data centres and server farms. DIC will also have Science & Technology Park that will house an R&D centre for new technology initiatives and take up developmental projects for the industry.

World's first Internet University is being set up at Dubai Internet City. It will offer a curriculum that covers all areas relevant to e-business like e-finance, e-marketing, multi-media, e-design, e-management, etc. It will be provided with an international faculty to ensure cutting-edge training and education. Dubai is a city that's brimming with talent. It is strategically located midway between two large pools of high skill knowledge workers - Egypt/Jordan and the Indo-Pak subcontinent. A talent Body Shop located at Dubai Internet City will provide companies access to a temporary and contractible skill pool.

Electronic business (e-business) is the latest revolution taking place in business today. It is unlike anything the world has seen before. It is transacted on the internet. This could involve : Business to Business (B2B), Business to Consumer (B2C), and Consumer to Consumer (C2C) transactions. These days, e-business is creating opportunities where none existed before, by enabling seamless interactions, helping businesses create new communities of customers and connecting manufacturers, distributors and customers with each other worldwide. As already mentioned, DIC will not only have world's first free trade zone for e-business, it will also have an

Internet University which will offer curriculum covering e-business, besides other important areas.

Dubai has a vast experience in successfully creating and managing free trade zones. About 500 companies operate from the “Jebel Ali” and “Dubai Airport” Free Trade Zones. Due to the significant progress made by the “Jebel Ali” Free Trade Zone (the largest in the world), Dubai now plays a leading role regionally and internationally in free trade zone management.

Dubai Internet City will offer ready-to-operate, modern, full serviced office space that caters for the needs of new economy companies. Companies can look forward to competitively priced offices with flexible lease agreements. The offices will offer leading edge technology and provide wired and wireless networks.

### 6.3 Pakistan’s IT Initiatives [ 4-25, 38-40 ]

Since 1990, Pakistan has tried to implement pro IT policies in the country. Rules and regulations were passed under various governments that helped & promote IT culture in the country. For example, providing tax breaks for software companies, establishment of ISPs in the private sector, duty free import of IT related equipment etc. These activities have been intensified manifold in the past year or so. The present government desires to see the private sector lead in IT based business opportunities. This government would like to concentrate on providing legal cover and making the environment more conducive to Information Technology development. Tables 18-22.

In mid nineties, the government allowed Internet service providers to launch the services in the private sector. Within five years, there are now over sixty ISPs operating in the country. They are not only providing jobs to thousands of people, but are also allowing citizens access to the internet at an affordable cost. Around the same time, the government also established Pakistan Software Export Board. The sole aim of the board was to introduce Pakistan software industry in the international market and facilitate local companies get leverage world-wide, with the result that, there are now over 300 software houses in the country. They are not only doing software development work within Pakistan, but are also exporting their services to companies world wide, including, USA, Canada, UK, Germany etc. The industry giants like Microsoft, Cisco, Oracle and NCR have already established offices in the country.

Recently, the government of Pakistan has placed IT as one of its top priorities. A separate IT and Telecom Division has been established within the Ministry of Science and Technology. The new division has been charged with the task of making Pakistan an IT savvy country. Within six months of its inception, it has already had an impact on the IT scene. Pakistan’s first IT Policy has been approved. Some of the key initiatives of the new division are as follows:

- Reduction of Internet bandwidth cost by 53%; thus allowing cheaper access of internet to its citizens. The unprecedented low rates of the internet are one of the cheapest in the South Asian region.
- Under an agreement with private sector ISPs and Ministry, public sector universities will get free Internet connectivity through the ISPs. Thus the private sector is also playing an active role in promotion of IT at student and university level.

- Government departments in third world countries usually take a long time to process simple documents and files. Keeping this in view, the government departments have been directed to process IT related documents, files, applications within reasonable time. The state Telecom monopoly, Pak Telecom, has also been directed to provide Internet bandwidth to companies within a month, a process that usually took over six months in the past.
- Electronic commerce is the wave of the future. To promote its growth in the country, State Bank of Pakistan has allowed setting up of Internet Merchant Accounts within the country. Ordinance to that effect is being formulated to provide legal recognition to digital signatures and electronic transactions.
- Rules are also being revised to facilitate the software industry. Banks can now accept business contracts as collateral. Previously, it was only possible against letter of credit.
- Software companies that are exporting their services are also allowed to keep 25% of their export earnings in foreign exchange.
- Villages and towns usually do not enjoy the same facilities as large cities enjoy in the third world countries. They usually lack the basic necessities, including roads, telephones, electricity etc. However, the present government wishes to change that situation. The IT division has made a conscious decision to promote IT in the rural areas as well. As a first step, these villages and towns that have telephone access can now make a local call to the nearest city to connect to the Internet. Previously, it used to cost the user a long distance call. The aim is to eventually connect every city, town, and village to the Internet.
- Tax breaks are offered to Software companies and IT training institutes. This is done in order to promote the establishment of IT culture in the country and help establish software engineering as a vibrant industry.
- There is a huge resource of engineers and scientists working for the government. A special program is being launched to re-train and re-equip them with Information Technology so that they may be more effective and efficient in the work environment.
- IT Universities are being established all over Pakistan. These universities will educate the youth of today to become IT leaders of tomorrow.

Like many other governments of the world, Pakistan is also striving to become an IT savvy nation. However, all efforts can only be fruitful and successful if the government is sincere and all hurdles in its implementation are cleared.

## Table 18(a). Pakistan's Network Status (as on September 30, 1999) (4-25)

| | |
|---|---|
| **Installed Lines** | 3.73 Millions |
| **Working Lines** | 3.02 Millions |
| **Telephone Exchanges** | 2,667 |
| **Digitalised Exchanges** | 86% |
| | |
| **Tele-density** | 2.35% |
| **NWD Stations** | 1257 |
| **International Gateway Exchanges** | 3 |
| **International Fibre Cable SEA-ME-WE-3 commissioned in Oct. 99** | |

**Table 18(b). Pakistan Market Size**

| US$ (MILLIONS) | 1995-96 | 1996-7 | 1997-8 |
|---|---|---|---|
| **Basic Telephony** | 1,086.0 | 1,038.0 | 1,120.0 |
| **Cellular Phone Services** | 295.2 | 317.1 | 356.3 |
| **Card Operated Pay Phone** | 7.7 | 8.7 | 12.6 |
| **Paging Service** | 1.7 | 1.9 | 2.3 |
| **Internet Services** | N.A. | 9.2 | 13.8 |
| **Data Communication Networks** | N.A. | N.A. | 18.6 |
| **TOTAL MARKET** | 1,390.6 | 1,1374.8 | 1,523.6 |

## SOME STATISTICS OF PAKISTAN

### Table 19 : Profile of IT Manpower by Occupational Category

| | |
|---|---|
| Networking | 9.4% |
| Technical support | 5.9% |
| Education & training | 6.2% |
| IT sales and Market | 6% |
| IT management | 6.3% |
| Development | 51.7% |
| | 100% |

### Table 20: Present IT Statistics

| | |
|---|---|
| Number of Personal Computers | 1.5 million |
| Number of Internet users | 200,000 (40% growth rate during last couple of years) 50-60% growth during last three months |
| Number of ISP operative | 55-70(June 2000) |
| Market capitalisation of ISP's | $100 million |
| Number of Software Technology Parks (6 more being established) | 01 |
| Number of IT Related Companies (products & services) | 700+ (1997) |
| Number of Software Houses | 300 |
| Total Software Exports | $30 million per year |
| Domestic Software Market Business | $10 million per year |

### Table 21: Exports Growth Rate

| Year | Revenue | Percentage |
|---|---|---|
| 1996 | $ 5 Million | - |
| 1997 | $ 8 Million | +60% |
| 1998 | $ 11 Million | +38% |
| 1999 | $ 16 Million | + 45% |

**Table 22: Percentage Share of U.S.A. and Other Suppliers of Official Imports During 1996:**

| | |
|---|---|
| **USA** | **14.7** |
| **Singapore** | **18.0** |
| **UK** | **14.7** |
| **France** | **12.9** |
| **Japan** | **4.7** |
| **Netherlands** | **4.0** |
| **China** | **3.8** |
| **Dubai** | **2.5** |
| **Germany** | **2.3** |
| **South Korea** | **2.2** |
| **Sweden** | **0.1** |
| **Other Asian Countries** | **4.7** |

Note: (*) denotes imports through official channel only.

### 6.4 Tunisia’s IT Initiatives

The Tunisian capital, Tunis, is listed by the current issue of French business magazine "Capital" as the world's key "new economy" capitals.

The magazine says in its October 2000 issue - "Tunisia is, along with South Africa, an exception on the African continent. Even in the remotest corners of the country, the Internet is accessible at the price of a local telephone call."

It adds that "last year, in suburban Tunis, the government launched a communication technology park. Six firms have already been implanted there, including start-ups. So, to-ensure not to run out of skilled labour, the Tunis high commercial studies institute has established a teaching cycle in information technologies and e-commerce."

The Tunisian business community is regularly encouraged by the government to tap the resources offered by new information technologies. During the last few weeks, Tunisia has launched the "e-Dinar", a virtual currency used in transactions over the web. One immediate use of the currency last month was the payment of registration fees of remote students in a number of institutes of higher education.

The setting up of six new private Internet service providers was also recently announced in Tunisia. Secondary schools, universities, research institutions, and medical centres are already connected to the worldwide web. Work is in hand to connect all primary schools to the Internet.

## 7 IT IN THE ISLAMIC WORLD: FUTURE PROSPECTS

In today’s world, success is highly dependent on the capacity to generate and absorb knowledge and technologies. As is evident from the facts given in the earlier sections of this paper, technological advances are taking place with the speed of light and the major contributors and beneficiaries of the technological age belong to the West and developed regions of the world. The reasons are apparent; their willingness and readiness to accept the change and the ability to exploit it to their advantage.

Information technologies, the mother of all scientific and technological innovations, are no exception, it is bearing fruits for the nations that have embraced it at right time. IT is one of the few technologies that can be as friendly to less advantaged countries as they are to the developed ones. It carries equal even more ripe opportunities for an LDC like Ghana as it does for any developed country like US, Canada or UK. The only thing that is required on the part of developing and / or Islamic countries is the commitment and efforts to prepare and launch themselves in the direction enabling for embracing these technologies.

Based on the statistics (Figure 9), there will be over 320 million Internet users by the year 2002, of which, 68 % would be in North America and Western Europe alone. While only 13.5% would be in the rest of the world (a mere 43 million users). Out of these, there will be less than 4 million from the Islamic countries.

Barring good efforts by Malaysia, United Arab Emirates and Pakistan, there is hardly any good example of rising IT economy. This is a dismal situation. It needs urgent attention of leaders of the Islamic world.

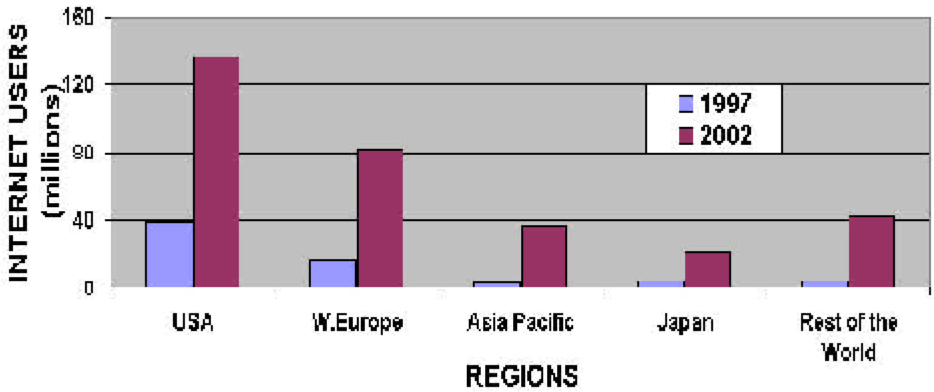


**Figure 9. Numbers of 'Internet Users' in Different Regions of the World for the Years 1997 and 2002 (Estimated)**

The proper approach here would be to base the future prospects of the Islamic World on the whole and/or individual countries on the existing scenario or current state of affairs as in presented in the previous section. The section, however, does not provide a reliable and sound launching pad for drawing any trend lines or making any predictions about what is to come for the Islamic world, say, in the next five years. The reasons as have already been mentioned, are the absence of authentic and up-to-date figures wit similar set of parameters and units of measurements for different countries and/or IT indicators; the factors that are imperative for making any comparisons and forecasts.

Overall the situation does not seem too rosy yet the silver linings can be found here and there. The pre-requisites for a better picture and for aspiring future leadership in the sector, include major overhauling of quite a few areas that are covered in the following section.

The changes taking place are so fast that governments around the world are finding it difficult to cope with the emerging situation. It is because of this reason that some governments (US, Malaysia, Canada, etc.) are asking their private sectors to lead the way. They are also working with the private sectors to re-form and re-equip themselves for an 'IT ready government'. The job of the government is now changing. They are now concentrating more on monitoring and policing the activities. This is exactly what Islamic governments need to do. Instead of trying to do all IT activities themselves, they should let the private sectors grow and thrive. Some of the preliminary steps that are necessary to have a prosperous IT savvy nation are mentioned below.

- Setting up of smart schools & universities.
- Re-structuring the telecom sector
- Promoting E-business & E-commerce
- Declaration of IT as an industry

These steps may take years or even decades to become functional and effective. Unless we think ahead, our future in the 'Information Age' is not secure.

## 8 SOME RECOMMENDATIONS FOR DEVELOPMENT OF INFORMATION TECHNOLOGY IN ISLAMIC COUNTRIES

### 8.1 Infrastructure Development (Telecommunications, Databases & Platforms, Technology parks)

**Objective:**
Development of world class enabling infrastructure for IT Industry that is both efficient and cost-effective to provide equitable access to national and international networks and markets

- **Actions:**
  - Ensuring reliable power (electricity) supply
  - Modernising Telecommunication Infrastructure 50
  - Providing fast access to the Internet through T3/T1 lines
  - Setting up satellite-based video-conferencing facilities
  - Establishing leading-edge and well-connected information
  - technology parks / incubators
  - Establishing IT management boards at province/regional level
  - Increasing the teledensity and introduction of new technologies such as wireless local loop for data and cable Internet.
  - Setting up national databases open to all that are reliable, secure, up-to-date and easily accessible

- ***Examples:***
  - Brazil, India, Singapore, Philippines and South Africa

### 8.2 Human Resource Development (Education &Training)

**Objective:** To develop an extensive pool of academically and technically skilled IT manpower at all levels to meet the local and export needs.

- ***Actions:***
  - Introduce basic computer education at secondary and post-secondary level.
  - Integrate IT-oriented education in engineering and management degree schools
  - Encourage non-degree technical programs / professional certifications / short term training in IT disciplines at graduate and postgraduate level to support continuous or life-long learning
  - Establish IT universities, Virtual IT Universities (distance learning), Educational Intranet (Linkage among the educational institutions / students)
  - Strengthen the existing IT institutes, Incentives for hiring of faculty from abroad (skilled expatriates)

- ***Examples:***

- University level IT programs in US
- Technical and vocational institutes in Germany and Korea
- IT network in India
- IT initiatives in Pakistan

### 8.3 Development of Internet Technology (Usage & Availability)

**Objective:** To revolutionise the way the people communicate and access information by encouraging the Internet growth and competition 51

- **Actions:**
  - Avoid unnecessary regulations
  - Provide low-cost reliable and broadband Internet access
  - Ensure free access to universities and development institutions
  - Support the development of national Internet content.

### 8.4 Awareness Creation and Promotion of IT Usage (Government, Economy, Education)

**Objective:**

To promote extensive use of IT applications in Government, trade, industry, homes, agriculture, education, health, and other sectors with widespread use of internet

- ***Actions***:
  - Launch IT awareness and promotion campaigns, participate in world IT/computer trade fairs, exchange delegations, post IT specialists in embassies / consulates, organise special events at regional and national level like exhibitions and competitions.
  - Encourage IT usage at all levels of government. Key projects may include Government Online, Electronic Governance and E-Commerce Network.

### 8.5 Enterpreneurship Development / IT Industry Development (Software, Hardware, Services Industries)

**Objective:**

To promote and encourage both local and foreign investors to ensure the development of IT sector (Software, Hardware and services industries) in Islamic countries and the use of IT products and services

- ***Actions:***
  - Eliminate bureaucratic procedures, and establish a one-stop process to incorporate a new company
  - Integrate efforts to develop software industry with focus on exports in addition to local market. This would include encouragement of the establishment of local software houses, local content development, national / regional language software development. Promotion of software exports through establishment of international marketing

networks. Fiscal and regulatory incentives for software exporters and joint ventures.

- Development of Hardware industry (technology transfer and R &D) not aimed at initiating aggressive competition with the developed world, rather to focus on developing areas that are within the reach of Islamic countries in terms of technology and resources and in which the country could have the competitive advantage. It would require waiver of duties and taxes on the hardware, incentives to reduce the costs of raw material and inputs, encourage and fund R & D in the universities and engineering colleges through faculty chairs, matching grants and focused joint projects.

- ***Example:***
  - Hong Kong (China)

### 8.6 Global Markets Development

**Objective:**

To help create strong domestic and international markets through linkages and marketing networks for local IT products and Services.

- ***Actions:***
  - Ensure TQM practices by introducing international quality and environment standards in the local industry
  - Subsidise global marketing efforts
  - Hire professional marketing firms for International campaign management and Promotion
  - Use political ties to develop captive markets in Middle East (UAE and Saudi Arabia) and Far East (Malaysia)

- ***Examples:***
  - US in South America and UK in former colonies
  - Ireland's Industrial Development Agency has 17 offices in the US
  - Chilean Economic Ministry
  - Israel and Taiwan

### 8.7 I.T. Research & Development

**Objective:**

To revitalise, emphasise and support the country's manufacturing and R&D potential

- ***Action:***
  - Launch well-funded national level R&D programs in various disciplines of IT in collaboration with leading domestic and foreign educational institutions

- ***Examples:***
  - Nationally funded programs at MIT, Harvard, Yale, Stanford and Princeton (USA)

- Max Planck Institutes in Germany
- Subsidised R&D projects in Israel

**8.8 Legal and Regulatory Framework, Incentives – (Role of Government Policies and Political Commitment to Development of IT)**

**Objective:**

To make the governments in Islamic countries a facilitator and an enabler to provide maximum opportunities to the private sector to lead the thrust in development of IT. To develop an enabling legislative and regulatory framework for IT related issues.

- ***Actions:***
  - Liberalise telecommunication policies; Eliminate monopolies for the Internet gateway, promote an intensely competitive domestic industry, reduce ISP licensing requirements and fees, impose strict intellectual property (IP) & Copyright rights, consumer protection act. Introduce legislative changes to encourage electronic commerce.
  - Provide various fiscal and non-fiscal incentives to nurture, develop and promote the use of IT at institutional and individual levels, strategic focus on promotion of venture capital industry through incentives, recognition of software development as priority industry for financing of banks and DFI, creation of investment friendly environment, building investors confidence and encourage the technology companies listing on stock exchanges

- ***Examples:***
  - US Anti-trust and IP laws
  - Recently adopted IP laws in Egypt
  - India's legal framework for IP rights 54
  - Ireland charges 10% corporate tax Rate in from IT-related companies
  - Special software-related tax incentives in Israel and Taiwan

**8.9 Information Exchange on Best Practices**

**Objective:**

To ensure continuous development through learning and global sharing.

- ***Actions:***
  - Provide access to relevant global / regional databases
  - Create and disseminate comprehensive reports on global IT markets, competitors, technologies and best practices

- **Examples**
  - Chilean Economic Ministry
  - Japan's External Trade and Research Organisation and MITI

**8.10 Co-operation Network of Islamic Countries (knowledge and technology flow from comparatively advanced Islamic countries to the less advanced ones)**

**Objective:**

To take advantage of the available expertise and technology assistance from within the Islamic block. The developed world is already on the move and is draining the developing world of its valuable human capital, which if retained can both administer and advance the IT applications to our own advantage.

- ***Actions:***

  - The advanced Islamic nations should place their representatives in the emerging Islamic markets like Saudi Arabia and UAE on permanent basis who should work in close collaboration with the local IT community to assess the national needs and to provide IT solutions against these requirements. The idea of establishment of IT incubators at the Diplomatic Missions in the host Islamic countries can serve the purpose of developing markets for the Islamic countries human resources, products and IT related services.

    For example, the advanced Islamic countries can study the needs of the emerging markets in the sectors like Financial Services, Oil & Gas, Small and Medium Enterprises (SME's) and develop software products and services with rapid implementation methodologies with training of manpower for handling the newly developed systems and providing necessary customer support as and when required.

  - Provide innovative IT Training Services (short courses, professional certifications, tailor-made training programmes for specialised clientele, degree programmes in latest IT tools, integrated and multidiscipline programmes, mobile training teams) that can be offered to help the host country develop its intelligent manpower pool. Offer services in the area of system integration and e-commerce, and developing joint ventures with the local firms.

  - The IT expert nations can develop Oil barter programmes with oil rich countries i.e. barter the IT services for oil and gas. It would strengthen both sides of the Islamic community, the oil rich countries would benefit from IT expertise while the IT expert would be able to secure the much needed resource of oil and gas for its country.

  - Arrange participation in and organisation of single country shows or exhibitions of Islamic world IT giants, which would serve as a platform to exchange the products and services and also would help create the industrial joint ventures.

## 9 ISSUES AND CHALLENGES OF THE INFORMATION AGE

The rapid development together with the increasing use of information and communication technologies are causing major repercussions on all aspects of private and public life in all countries. This development is transforming the traditional ways of functioning of our contemporary societies and is providing new opportunities and challenges for all. This situation makes it important for Islamic countries to keep abreast of the new ethical, legal and societal issues and opportunities offered by the

Information Society, which would facilitate Islamic Block participation in and contribution to the new digital world.

Globalization of the information society through educational and behavioral changes is promoting a more open society with better sharing of information resources and its sources, new collaboration and group work patterns, new cognitive tools, and cultural diversity. The sound governmental initiatives, action plans, policies and strategies implemented at the national, regional and international levels are required to prepare the transition to an Information Society.

**9.1 Challenges to Academia**

1. In academia, one pressing challenge is the need for the faculty to stay ahead of the market demands. More students are seeking to combine computing with a liberal education in the arts and humanities and to prepare themselves for jobs that increasingly require both technical and creative skills.

2. Another pressing challenge in academia is the need to attract and retain outstanding faculty in core Computing and Information Science (CIS) disciplines. Students with bachelors and masters degrees in these areas are demanding initial salaries higher than what tenured faculty are paid. Moreover, these industry jobs often provide the kind of intellectual challenge that attracts people to academic careers. While universities cannot match the financial opportunities in industry, we must strive to create an environment that is intellectually stimulating. Instead, the large number of undergraduates seeking computing related jobs has caused enormous teaching loads, adding an incredible burden on that very faculty enticed by exciting opportunities outside the university. We must do something to alleviate this strain.

3. Financial implications, resulting from ever changing standards and systems, need to constantly upgrade and refresh hardware, software and knowledge expertise & provide several administrative areas of concern. 4. An even larger challenge looms in managing and implementing technological change. Institutions must strive to ensure that assumptions made in decision-making and expectations placed upon the University Community do not create a "have/have not" scenario in terms of information technology resources. This challenge must be addressed not only by Institutions individually, but also by the global community of Higher Education.

5. The strength of the World Wide Web as an easily accessible means, by which information can be self-published in open forum, presents a major challenge. Previously, information, when disseminated through print or electronic means, was done so by a formalised structure that, for the most part, critically reviewed and validated the work. As there is no "gate-keeper" of the WWW, information can be posted that is factually incorrect, misleading, in poor taste, and in some instances, slanderous. The WWW is very much a "user beware" environment. Universities must strive to train students to critically review and validate information through sound research practices. Secondly, as the WWW offers a plethora of easily accessible information and resources in digital form and these resources can be easily re-purposed, modified and incorporated into derivative works, the copyright laws and intellectual property policies

currently in practice must be revised to reflect the advances in the distribution of and access to information, while still protecting the creative and scholarly works of authors and artists. In addition, Universities must continue to stress validated, original research with proper recognition of sources.

### 9.2 Societal and Psycho-social Challenges

1. The analysis of impact of IT focuses both on structural changes and changes for the individual at work and on the role as citizen. The main humanistic focus is on possibilities and prerequisites, related to IT, for influencing one's own life conditions, for social belonging, for a meaningful life content, and for learning and developing oneself. The problem areas are: employment, integration of various groups, organisational environments, competence development, and transfer of knowledge.

2. The Information Gap: Looking at our society as a whole, there are noticeable inequalities or "gaps" in the distribution of information and information technology. For various reasons, some people appear poised to garner greater benefits from technological advances than others. Observers have pointed to gaps that appear along several dimensions, including socio-economic status or income level, ethnic background, gender lines, or geographic gaps. Domestically, the geographic gap refers to a division between our urban metropolitan areas and rural regions. On an international level, it refers to the inequitable global distribution of technology and information. In other words, some nations have enormous technological prowess and capabilities, while other nations do not.

3. The social issues that need to be explored in greatest depth are those of employment (displacement, skill, control) and access to information (privacy and freedom of information), transborder data flows, social vulnerability and risk, militarization, social choices in design and the ethical responsibilities of information professionals

### 9.3 Ethical Issues of the Information Age

Today in western societies, more people are employed collecting, handling, and distributing information than in any other occupation. Millions of computers inhabit the earth and many millions of miles of optical fibre, wire and airwaves link people, their computers and the vast array of information handling devices together. There are many unique challenges we face in this age of information. They stem from the nature of information itself. Information is the means through which the minds expand and increase its capacity to achieve its goals, often as the result of an input from another mind. Thus, information forms the intellectual capital from which human beings craft their lives and secure dignity.

However, the building of intellectual capital is vulnerable in many ways. For example, people's intellectual capital is impaired whenever they lose their personal information without being compensated for it, when they are precluded access to information which is of value to them, when they have revealed information they hold intimate, or when they find out that the information upon which their living depends is in error. The social contract among people in the information age must deal with these threats to human dignity. The ethical issues involved are many and varied. However, it is helpful to focus on just four as mentioned below:

1. **Privacy:** What information about one's self or one's associations must a person reveal to others, under what conditions and with what safeguards? What things can people keep to themselves and not be forced to reveal to others?

2. **Accuracy**: Who is responsible for the authenticity, fidelity and accuracy of information? Similarly, who is to be held accountable for errors in information and how is the injured party be made whole?

3. **Property**: Who owns information? What are the just and fair prices for its exchange? Who owns the channels, especially the airways, through which information is transmitted? How should access to this scarce resource be allocated?

4. **Accessibility**: What information does a person or an organisation have a right or a privilege to obtain, under what conditions and with what safeguards?

### 9.4 Legal, Regulatory and Public Policy Issues

This framework brings together many policy areas for addressing the interests of business and consumers:

1. Security, privacy, electronic signatures and authentication, protection of intellectual Property (while guaranteeing important educational benefits from free Internet access), consumer protection, Internet content standards and taxation administration.

2. Legislation for the recognition of electronic signatures and related aspects of evidencing and recognising on-line contracts, broadly consistent with the Model Law proposed by the UN Commission on International Trade Law

3. Facilitating access to and use of authentication and encryption technology and systems, recognising that consumers and business (especially smaller firms) expect to have confidence in knowing the identity of other on-line parties.

### 9.5 Economic Perspective

With information technology now claimed to be the main engine of growth over the next couple of decades, many people worry that developing economies, which have far fewer computers and Internet connections than the rich world, will get left behind. The income gap between rich and poor countries will widen further. Pessimists point out that the rich countries account for only 15% of the world’s population but 90% of global IT spending and 80% of Internet users. Much of the developing world is too poor to buy computers or telephones. The 2 billion people living in low-income economies (with average incomes below $800 per head) have only 35 telephone lines and five personal computers for every 1,000 people, compared with 650 phone lines and 540 computers in America. One in two Americans is online, compared with only one in 250 Africans. Not only are developing countries less wired but the Internet may cause the gap between rich and poor nations to widen further due to three particular concerns:

1. The first-movers like America will establish a dominant position while the local firms in emerging economies will be frozen out of e-commerce.
2. The second is that the shift in power from sellers to buyers, due to the easy access over the Internet will harm poor countries. Since emerging economies, especially commodity producers, tend to come low down in the supply chain, their profit margins will be squeezed by rich-country firms.
3. The high-tech shares in rich economies have offered investors a much more attractive combination of risk and return than emerging economies, so poorer countries will enjoy less inward investment than they might otherwise have done.

The optimist argue that many emerging economies could nevertheless gain even more from IT than the rich world:

1. Developing countries can grow even rapidly by buying rich countries' technology and copying their production methods. As latecomers, poorer countries do not need to re-invent the wheel or the computer, but merely to open their economies to ideas from the rich world.
2. IT can even allow developing economies in the Islamic world to leapfrog old technologies. For example, by skipping intermediate stages such as copper wires and analogue telephones, wireless technologies require less fixed investment and maintenance than traditional wire-based ones. So, they are more effective in countries with sparse populations and tricky terrain. The Internet offers virtually free access to a huge amount of information and expert advice on subjects from engineering and plant cultivation to birth control and health care. A single Internet connection can be shared by many, giving schools access to the world's top libraries when they previously did not even have books. Distance learning gives students the chance to be taught by better teachers.
3. Another good thing about IT, from the emerging countries' point of view, is that it reduces the optimal size of a firm in most industries. Firms in emerging economies are typically smaller than in rich countries, and the Internet, allows such small firms to sell direct into global markets at lower cost. Firms in Africa can now bid online for procurement contracts tendered by America's General Electric.
4. Furthermore, by bringing down the cost of communicating with someone on the other side of the world, IT makes it easier for multinational firms to move production to emerging economies to take advantage of low labour costs, but ensure close contact with head office. That should help poorer countries to attract more foreign direct investment. IT also allows some previously untradable services to be traded just like physical goods. Any activity that can be conducted via a screen and telephone can be carried out anywhere in the world. Computer programming, airline revenue accounting, insurance claims and call centres have all been outsourced to developing economies.

**The challenges for developing economies include:**

1. IT will certainly increase the opportunities for emerging economies to narrow the income gap with rich countries, but wiring the country is only the beginning. It poses great challenges to the governments related to opening up of markets to foreign trade and investment, liberalising telecommunications, protecting property rights, improving education, and ensuring an effective legal system and efficient financial markets.

2. Many developing countries, especially in Africa, are at a huge disadvantage so long as telecommunications services remain in the hands of state-controlled monopoly. Because of inadequate investment, waiting lists for telephones are long and charges have not fallen as fast as in the rich economies. Developing countries pay, on average, three times more than rich-country users to access the net. This suggests that although IT may help many emerging economies to catch up with the developed world, it will also lead to a further widening in economic performance within the developing world itself. Whereas IT investment appears to boost growth in developed economies, the same is not true in developing countries. It seems that to reap the economic benefits from IT investment, developing countries need to put in place other policies as well.

The comparative advantage of emerging economies lies in applying new technology developed in rich economies, not trying to invent it. Fears that the "digital divide" will widen the income gap between rich and poor countries are exaggerated. Indeed, perhaps the biggest risk is that governments, businesses and aid agencies in emerging economies will get distracted by the Internet and concentrate all their efforts on getting wired, but fail to tackle deeper economic obstacles to development. The Internet will assist development, but it is not a magic drug for growth. Opening markets, breaking up telecoms monopolies and improving education are all far more important concerns. Those economies that get left behind should blame themselves, not technology.

## 9.6 Key Information Systems (IS) / Information Technology (IT) Management Issues in the Public Sector

Key issues facing Information Systems managers and professionals in the public sector are:

1. Technology management issues (IT infrastructure, communications, IT integration)
2. Strategic management issues (information architecture, planning integration, competitive advantage)
3. People management issues (human resources, organisational learning, security, educating senior management in IT)
4. Systems development and data management issues (data integrity and quality assurance, executive and decision support systems)
5. End-user computing

# 10 CONCLUSION

As information technology becomes increasingly indispensable for the development of society, the Developing World and Islamic Countries, can least afford to squander the vast opportunities presented by the ongoing information revolution. Faced with globalisation and the fact that IT has been proved to be the engine of development, the question is no longer if IT is applicable to less developed regions, rather the critical question is how should the developing countries adopt the new information technologies in order to meet the economic development challenges?

Islamic World’s rationale for participating in the information age is simple and strong: unless Islamic countries become full actors in the global information, they stand the risk of being excluded from the emerging global economy or suffering severe disadvantage in the competitiveness of their goods and services. Participating in the information age offers many opportunities for Islamic countries to "gain time on time"— to leapfrog over past development deficiencies into the future. A sizable number of Islamic countries have already made progress in their Internet links that have put them on the global connectivity roadmap.

Development can be seen as an increase of knowledge and skills and creative potentials that can be applied to improve the quality of life. Research shows that low levels of knowledge and inadequate innovative skills at lower, middle and higher levels have contributed to the continuous failures in African countries in all spheres. Information and knowledge are interrelated. Well-informed, knowledgeable and innovative citizens are causes for human centred development. Information technology facilitates the flow of knowledge in modern society. Observing the impact of information technology on economies, Islamic Block cannot afford to persist in a state of information poverty. Information technology, if properly harnessed, will help bridge the information gap and will give impetus to faster development in virtually all sectors. Information technology can improve economic performance, expand and sustain health services, promote education and research, enhance food security and gender balance in development, strengthen and diversify ties with trade partners, invigorate culture and tourism and alleviate man-made crises and natural disasters. In the area of human capital development, for instance, the systems of education in many Islamic countries suffer from serious shortcoming including low teacher-student ratios; limited availability of instructional material; and, poor quality of education, related to inadequate funding and inefficient use of available resources. Information technology offers a wide range of low-cost solutions, through for instance, distance education given its flexibility, and suitability for its widely scattered student bodies, particularly among rural schools where both teachers and students have no access to libraries, reading materials or communication with the outside world. Clearly, although ICT will not bring development overnight, it will certainly permit those who use it to be players in the world economy.

Information technology has created challenges and implicit solutions. The challenges involve adaptation of the technology to needs and the implied solutions are the possibilities of using the technology to attack the perennial problems of underdevelopment: poverty, low-productivity, inequality and environmental degradation. Though there is now growing recognition of the far-reaching impact of telecommunications and networking on the economies of Islamic countries, a number of problems restrict its diffusion through public institutions. It includes socio-economic problems crippling equal access to information and communication technologies, the resources at the disposal of governments are mostly directed to dealing with emergencies with little left for long-term investments in sectors that could trigger socio- economic development. Education, information and communication are some of the sectors that need immediate attention for development in Islamic Countries.

The absence of an efficient telecommunication infrastructure poses serious problems. Although most of the countries have established Internet links, access is mostly restricted to the capital cities and it is extremely expensive mainly because of the inefficiency of telephone services. Those in rural areas remain electronically isolated. Ironically, as a result of the quantum leap in technology, the inadequate state of telecommunications in many of our countries can be transformed into a great advantage if properly managed. The fact that the telecommunications sector is lacking in both coverage and density means also that the country is not burdened with extensive networks, built on obsolete technology, they can push to the cutting edge by ensuring that new infrastructure is based on the latest technology. The inadequate policies and incompetence of telecommunication management in most countries block achievement of socio-economic development.

The high cost of computers and software represents another serious impediment. The experts in the field suggest that bare-bone computers and stripped-down software perfectly serviceable for Internet connections, word processing, and graphics can be built today for a price, which is many times lower than current prices. And one way to induce producers to comply with such requirements is 'bulk-purchasing', which should be feasible given the potential market size of Islamic countries.

Unfortunately, most Islamic countries do not have any explicit plans or policies on information technology. The acquisition of information technology and software is a result of isolated initiatives without preconceived strategies and policies with little coordination and planning. There is thus a pressing need to devise clear national and regional long-term strategies and policies that cover the acquisition of information technology, its enabling environment and its applications. The strategies should quantify the investment requirements of the countries and identify the required changes in institutional, training, legal and regulatory frameworks that will foster the development of the information societies in the region. Such strategies would also serve as an explicit recognition of the challenges of the information technology and as instruments for attracting and co-ordinating donor assistance in this domain.

Entering the information age is not only about getting connected to the Internet and receiving information from the rest of the world. Islamic countries should have the material that will travel in the opposite direction, if they are to benefit from the global information system. Thus, national institutions responsible for data collection and processing need to be strengthened and their information collection and dissemination structures modernised. The local content of information would need to be developed even at rural community levels in as many languages as necessary given the pluri-linguistic and multicultural nature of many Islamic countries. This will encourage participation and speedy information diffusion to benefit the majority of Muslims. Islamic-to-Islamic countries information exchanges would need to be encouraged. Sub-regional information systems would need to be developed and improved to provide meaningful backing to national efforts in this area.

Equally important is the question of sustainability. It is pertinent, therefore, to invest in low-cost and locally adapted solutions, such as the use of solar driven appliances. It is also important to make the users pay, from the very beginning, for the services they receive.

Measures to expedite Islamic countries’ entry into the global information system must also address factors constraining the development of the information infrastructure. Reviewing the regulatory frameworks is important to encourage private participation not only in cellular telephony, but also in the operations of the state-owned telecommunication enterprises. Removing legal and regulatory barriers to the use of information and telecommunication technologies would promote interest on the part of the private sector.

# APPENDIX

## SOME STATISTICS OF TURKEY

### Table 23. Software market of Turkey (US$ Millions) [ 32 ]

| COMPUTER SOFTWARE IN TURKEY | | | |
|---|---|---|---|
| | **1993** | **1994** | **1995** |
| Total Market Size | 70 | 67 | 75 |
| Total Local Production | 30 | 32 | 35 |
| Total Exports | -- | -- | -- |
| Total Imports | 40 | 35 | 40 |
| Imports from the U.S | 22 | 20 | 25 |

### Table 24. Hardware market of Turkey (US$ Millions) [32 ]

| COMPUTER HARDWARE AND PERIPHERALS INTURKEY | | | |
|---|---|---|---|
| | **1993** | **1994** | **1995** |
| Total Market Size | 750 | 580 | 630 |
| Total Local Production | 160 | 140 | 150 |
| Total Exports | 20 | 20 | 30 |
| Total Imports | 580 | 460 | 510 |
| Imports from the U.S | 95 | 80 | 90 |

### Table 25. IT exports of Turkey (US$ Millions) [32]

| TURKISH IT EXPORTS | | | |
|---|---|---|---|
| | **1993** | **1994** | **1995** |
| Telecommunication Equipment | 70 | 80 | 90 |
| Telecommunications Services (export sales by local firms) | 400 | 450 | 500 |
| Computer Software | -- | -- | -- |
| Computers and peripherals | 20 | 20 | 30 |

## SOME STATISTICS OF INDONESIA

### Table 26. Software and Hardware manufacturing in Indonesia [33]

| ITEMS | 1994 (US$ Thousands) | 1995 (US$ Thousands) |
|---|---|---|
| **Computers** | 30,539.87 | 19,680.03 |
| Micro floppy disks | 18,041.86 | 37,607.48 |
| Software | 296.84 | 285.38 |
| Monitors | 229,295.84 | 276,982.77 |
| Floppy disk drives | 102,717.88 | 14,115.03 |
| Printers | 9,918.24 | 11,565.18 |
| Mouse | 1,606.36 | 1,142.54 |
| Case CPU | 1,387.48 | 1,097.50 |
| CPU | 339.76 | 228.08 |
| Keyboards | 296.30 | 526.72 |

***Source: Industrial Statistics, Central Bureau of Statistics, 1994&1995.***

## STATISTICS OF EGYPT

### Table 27. Software in the Egyptian market Place (Dec. 1999) [34]

| Software Tools | Packaged applications | Tailored applications | Multi-media & Localisation |
|---|---|---|---|
| Databases | Accounting | Government | Arabicization |
| Application Development Tools | Healthcare | Financials | Multi-media |
| New core technologies | Shipping | Manufacturing<br><br>Electronic Commerce | CD-ROMS<br><br>Education<br>Tourism |

## SOME STATISTICS OF JORDAN

**Table 28: Jordan's Software import and export in (US$ Millions) (Dec. 1999) [35]**

| Year | 1994 | 1995 | 1996 |
|---|---|---|---|
| Total Market | 10 | 12 | 15 |
| Total local production | 3 | 4 | 5 |
| Total Export | 2 | 3 | 4 |
| Total Import | 9 | 11 | 14 |

**Table 29. Jordan IT market (US$ Millions) (Dec. 1999) [35]**

| Year | 1994 | 1995 | 1996 |
|---|---|---|---|
| Total Market size | 30 | 35 | 40 |
| Total local production | 5 | 6 | 9 |
| Total export | 3 | 4 | 6 |
| Total imports | 28 | 33 | 37 |

**Table 30. Hardware market of Jordan (US$ Millions) (Dec. 1999)[35]**

| Year | 1994 | 1995 | 1996 |
|---|---|---|---|
| Total Market size | 30 | 35 | 40 |
| Total local production | 5 | 6 | 9 |
| Total export | 3 | 4 | 6 |
| Total imports | 28 | 33 | 37 |
| Imports form the US | 10 | 12 | 14 |

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**The Twenty-First Century**
**Internet Tidal Wave**

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## 1 ABSTRACT

The paper introduces the Internet Society of which the author is a founding member. The author, who is a leading authority** on the Internet, gives his personal views on current and future trends in Internet development and applications.

## 2 THE POWER OF THE INTERNET

In looking for ways of explaining what it is that is so powerful about the Internet and the information revolution, one of the analogies used in the past was to make an analogy between the power generation and distribution systems and the Internet (Figure 1). Instead of electrons flowing through wires, information flows through the Internet and rather than driving electric motors at the end of the power system, the information drives computers at the end of the Internet.

There is an infinite variety of things that electric motors can do in small and very large ways; from running elevators with very big motors to driving even the compressor in a refrigerator in the case of small motors. The point is that motors can be placed wherever needed in as small or as large quantity as necessary. The same is true for computers on Internet. Very big computers can be put on the net to service a large number of people, and very small computers can also be placed on the Internet including things like personal digital systems and even mobile phones to access the information and the services of the network.

In some sense the Internet revolution is very much like the industrial revolution except that it is perhaps more pervasive and may even be more powerful.

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* Vinton Gray Cerf PhD (UCLA), Senior Vice President for Internet Architecture and Technology, WorldCom.
** Editors' comment.

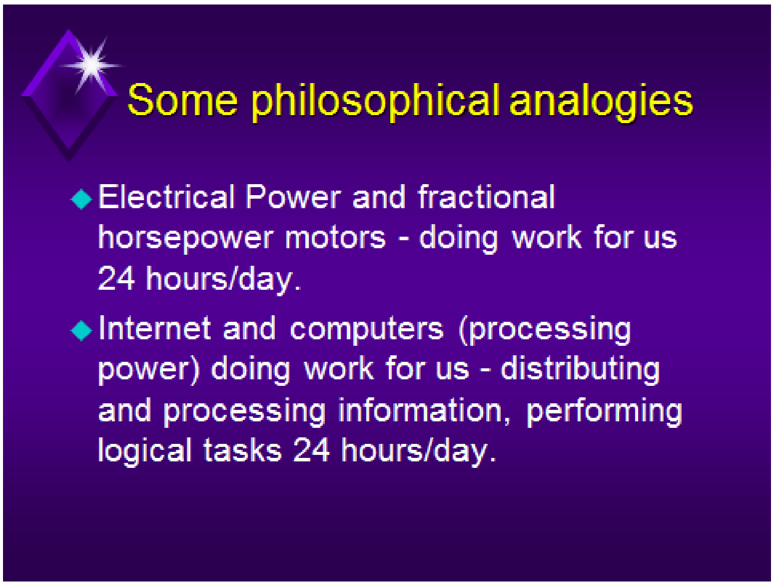



**Figure 1. A Philosophical analogy**

# 3 WHAT IS THE INTERNET?

## 3.1 General

The Internet is spoken of as if it is one thing. We know that it is not. It is really hundreds of thousands of networks that are interconnected around the world (Figure 2). Of course, the only reason that this works at all is that all the single networks and the wires that connect them are using the same set of protocols. The core protocol is called TCP/IP, the Transmission Control Protocol and Internet Protocol. This was developed and standardized as long ago in 1978. The current versions of the Internet Protocols, Version 4 was standardized and then rolled out across the United States and a little bit of Europe as early as 1983.

## 3.2 Transmission Control Protocol/Internet Protocol (TCP/IP)

The design of the TCP/IP protocols particularly the Internet protocol is very simple and intended to run over any underline communication system. When Robert E. Kahn and Cerf started this work in 1973, they knew that they did not know what new communication systems would be invented in the following decade and they wanted very much for the Internet to be able to absorb and use and be supported by those new telecommunication systems. And so, in the last 20 years, it was seen that things like X-25 and ISDN, optical fibers, satellite data channels and other radio channels are all being able to carry the Internet packet simply because a very small requirement on the underlying system was needed, simply move a packet of bits from one to another with some probability greater than zero, and that is all the Internet protocol asks.

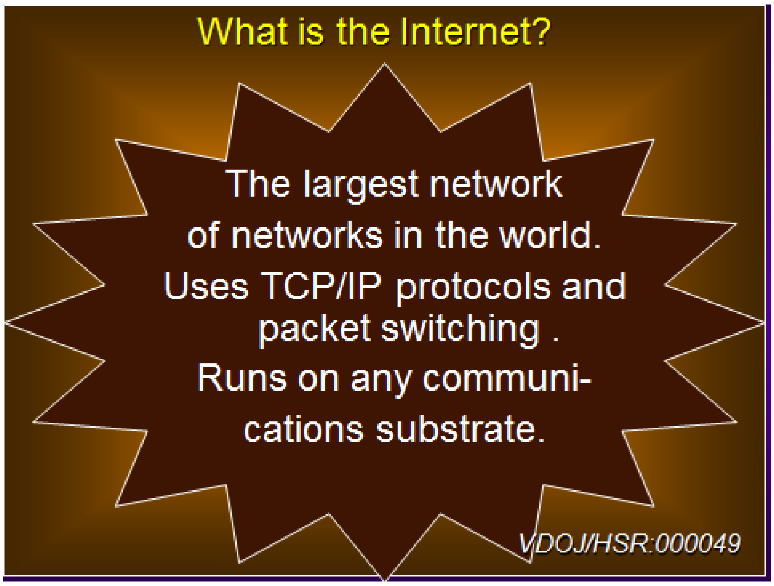



**Figure 2. What is the Internet?**

## 4 THE INTERNET GOLD RUSH

The world is still in the middle of what can be called an Internet gold rush. It is known that there are some important lessons people have learned from gold rushes in the past. One of those lessons is that the people that made the money in a gold rush are not necessarily the people who were looking for gold. The people who regularly make money in a gold rush are those selling picks and shovels to the other people who are looking for gold (Figure 3).

That is how the telecommunications industry is making money on the Internet today. It sells the equivalent of electronic picks and shovels for people who are looking for gold on the Internet.

Another thing learnt in the last ten years during which the Internet has been a commercial enterprise is that there are no roles defined or certain business models that make money on the net. It is still a very fluid period of time when business models are still being explored all across the network and by many people who are involved in trying to create Internet businesses.

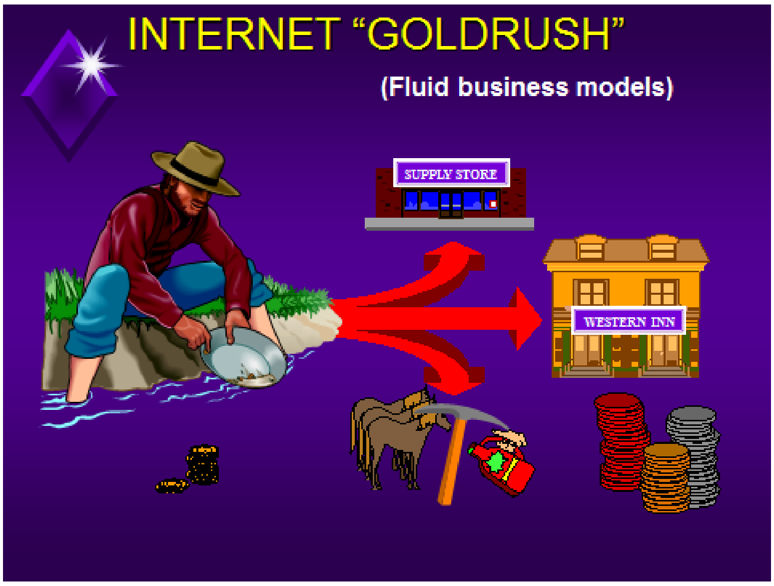



**Figure 3. The Internet gold rush.**

# 5 THE INTERNET EXPLOSION QUANTIFIED

## 5.1 Introduction

It would be useful to have some idea of how big this Internet explosion is. What is shown in Figure 4 is a 3-year comparison from the middle of 1997 to the middle of the year 2000 for various important statistics about the network.

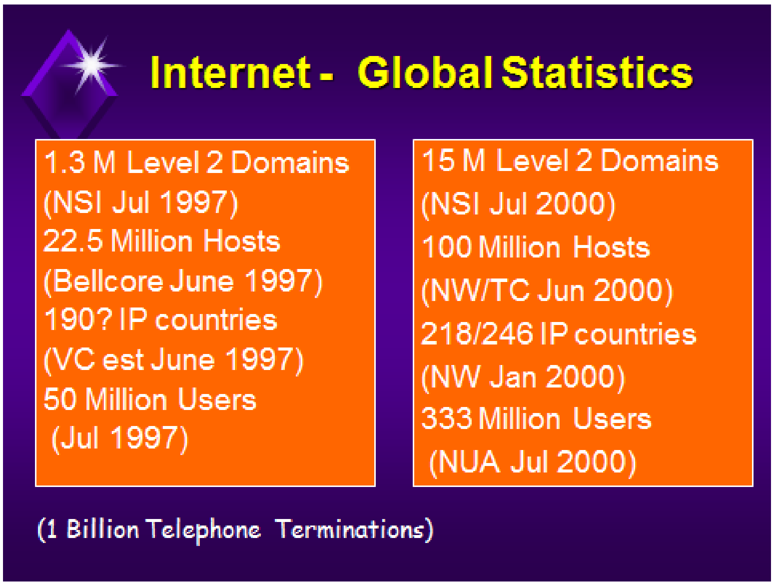



**Figure 4. Internet statistics comparison (1997-2000).**

If we just look at domain names, the number has grown from 1.3 in the middle of 1997 to over 15 million in the middle of the year 2000. Of course by this time the numbers are probably up to the order of 20 million.

The number of computers that are on the network that are servers, not PCs and not lap tops and so on or dialogues, but things that fix Internet addresses has gone from 22.5 million 3 years ago to over a 100 million today. Countries that are on the network have increased from less than 200 to over 215, 218 by last count. All have access to the network to some degree. This of course, is not uniform. Some places have very high penetration, for example, the Scandinavian countries where perhaps 70% of the population may have access to the Internet as well as mobile cell phones.

In many parts of the world, especially developing countries, the penetration rate is somewhat lower but is beginning to climb.

The number of users on the network worldwide has grown from about 200 to 300 million in the year 2000. Cerf estimates that there will be 360 million users all around the world by the end of the year.

It helps to keep this perspective to know that the number of devices that are on the telephone network today exceeds 1 billion, about 700 million of those are wire line telephones and about 300 million of them are cell phones.

## 6 INTERNET PENETRATION: REGIONAL COMPARISONS

Figure 5 shows the distribution of users on the net. As can be seen, fewer than half of the 333 million users are in North America. A few years ago, this would have been quite different. It would have been seen that more than 80% of all the users on the net are in North America but clearly the rate of growth outside North America has been quite dramatic.

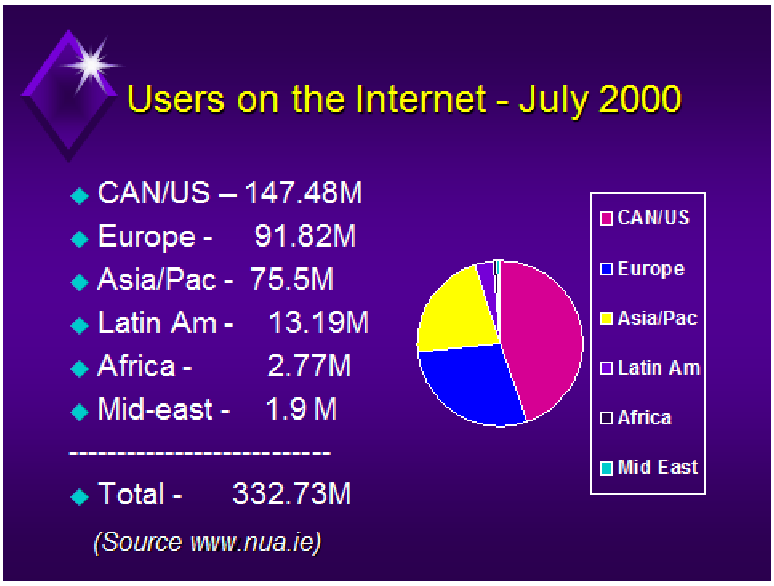



**Figure 5. Global Internet penetration.**

The European community has grown almost 100% in the last year from around 47 million to 91 million users. In Asia and the Pacific Rim where there are almost 2 billion people, the number of users has doubled.

The figure for Africa is encouraging however most of these users tend to be concentrated in South Africa, Egypt, Tunisia and Morocco with a small number of other users in the rest of the continent. It is however the case now that every country in Africa now has some access to the Internet.

Figure 6 shows a picture that was sent to Cerf by two young men who live in Uganda in the village of Kihihi. They built themselves a power converter, a satellite antenna and they hooked themselves up on the Internet by that means. A few months ago they sent Cerf an email with two digital picture attachments showing themselves up on the roof adjusting the satellite antenna so they can communicate with the rest of the world on the net.


**Figure 6. Hooking up to the Internet at Kihihi (Uganda).**

The idea here is not to claim that Africa is on the net. What it means is that people who are interested in getting onto the network will by any means possible look for some way to do that and, of course, such initiatives should be encouraged.

## 7 INTERNET GROWTH

Figure 7 gives a sense of the number of users that Cerf expects will be on the Internet between now (November 2000) and the end of the decade. Cerf estimates that if the level continues to grow at current rates, the number of users will exceed 3 billion people. That is roughly equivalent to the number of people who have access to the telephone system today. So, by the end of the decade, if these numbers hold up, half of the world will have access to the Internet.

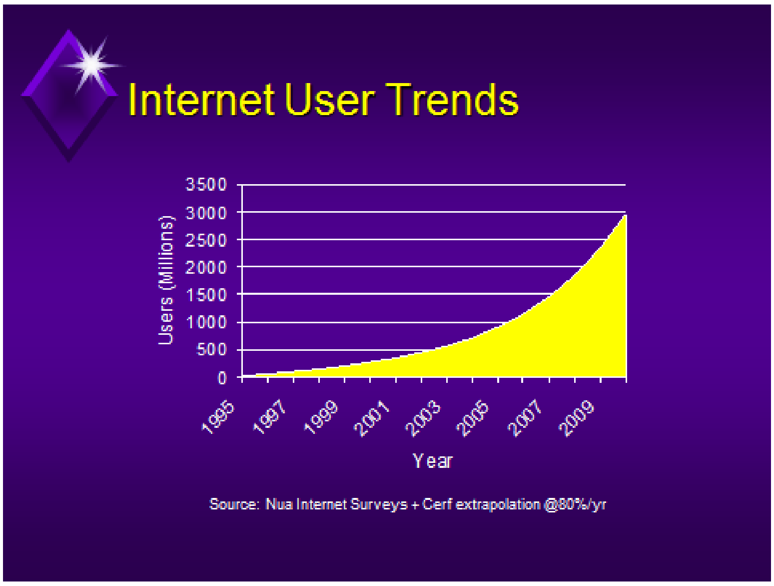



**Figure 7. Internet user trends.**

## 8 HOW BIG WILL THE INTERNET GET?

Figure 8 shows another important statistic. One of the things we are concerned about is how big will the Internet get? How many things will be on it? There histogram in yellow shows Cerf's estimate for the number of servers that will be on the Internet between now (2000) and the year 2006. Cerf estimated that about 900 million servers will be on the Internet by that time which will make that about that same size as the current day telephone system.

Cerf neglected some other interesting statistic which he obtained from Ericsson in 2000 and that is an estimate of the number of mobiles that will be internet enabled on the Internet by 2006 and that estimate says almost 1.5 billion devices in addition to the 980 million servers will be online. The total will be over 2 billion in six years' time. Remembering that the current versions of the Internet (Internet version 4) use a 32 bit address base, then that means enough addresses for 4.2 billion devices if every single address is used.

It is well known however that we do not make a very efficient allocation of the address base. It is probably no more efficient than the telephone systems allocation. Assuming that if we were so good as to get 60% efficiency (which is unlikely to be achieved) then we would run out of address space in the 32 bit at 2.4 billion devices.

This suggests that we may run out of IP version 4 addresses by the year 2006, and that will motivate important new developments which addressed later on in the paper.

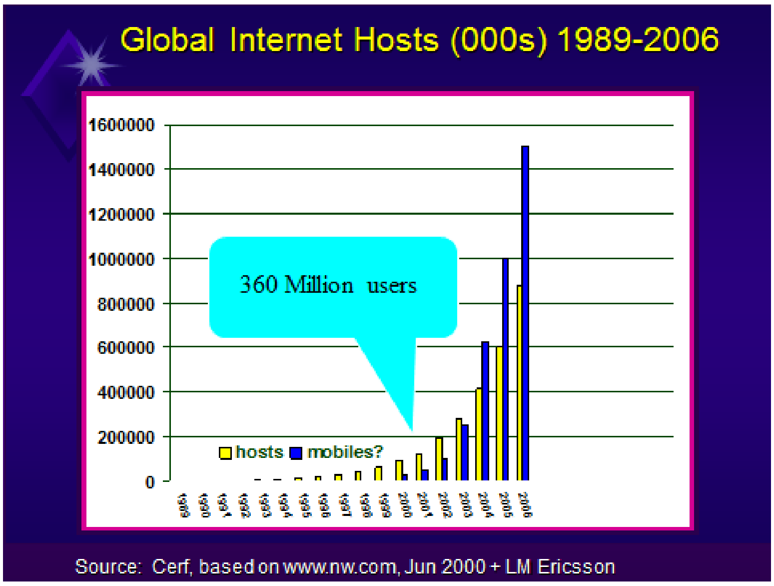


**Figure 8. Global Internet hosts (000's) 1989-2006.**

## 9 SOME INTERNET APPLICATIONS

### 9.1 General

The Internet was designed initially to have a data communication between computers but in fact it is now being asked to support video, telephony and radio over the same packet switch network. Today we actually achieved sending sound through the network. This is done by transmitting one wave of a series of packets to the target which interprets the data as sound.

One can do this with relatively low data rate; 15-20 kilobits per second is ok for sound and that is why we have perhaps 8 or 9 thousand radio stations putting their sound on the Internet today on a regular basis.

Video is very similar, except that it takes about 400 kilobits per second to deliver good quality video image and in fact that would be the full screen 30 frame per second view.

There is no easy way of delivering 400 kb/second to everyone on the Internet. That is about 8 times the speed that can be obtained with the best dialup telephone line and that is not what everyone gets physically. It does not stop people from trying to look at videos on the Internet anyway. In fact the lower data rates than 400 kb can sometimes see a little 2-inch screen with a small image inside and maybe 6 to 7 frames per second.

In the long run, there are new technologies that will deliver very high bandwidth to the target. There are modems that operate in the mega bit per second speed, there are radio lengths equivalent to cable, some of them called MMVS for example, and of course there are also digital subscriber route technologies that turn the twists that occur in a typical telephone system.

We are starting to see the older technologies carrying Internet traffic, for example digital broadcast satellite can carry Internet packets embedded inside the MPEG encoded television signal. This makes it possible for a broadcast satellite to transmit data at 25 megabits per second to many receivers all at the same time. This could be very useful if we are transmitting things like new software update or other important data to the target (Figure 9).

We are starting to see new ways of interacting with the network in addition to keyboards and mice, and those include handwriting and speech.

You can see the handwriting interaction specially from people who use Palm Pilots, personal digital systems that allow you to write on the surface of the tabloid. That information is converted into bits and bites and characters and that can be stored away as easily as what we would type on a keyboard. The more interesting and exciting possibility is that we could speak to computers on the network and they would understand what we say. That, in fact, is going to be a very important phenomenon as 2001 opens up in just a month and a half's time.

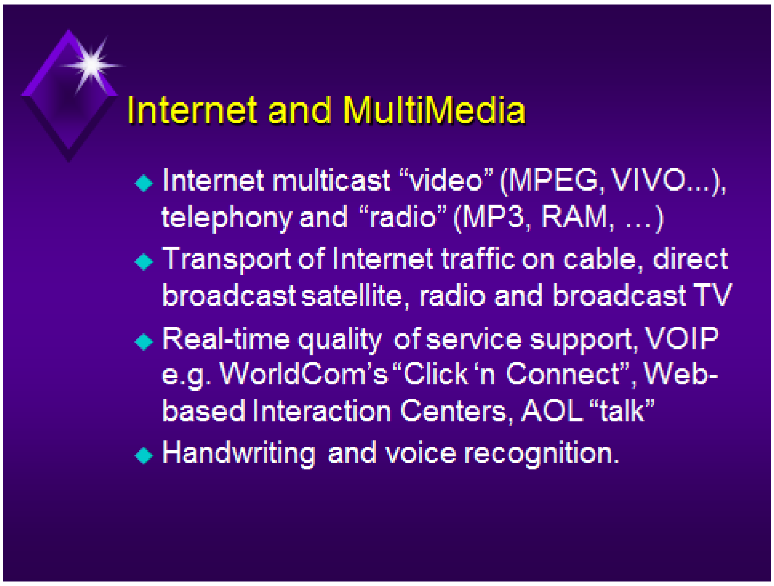



**Figure 9. Internet and multi-media**

## 9.2 Impact of speech recognition

Any computer that can understand speech can be given information to understand through the telephone system or through the Internet itself. Once you can understand that speech you can take actions having understood it. It is possible for example to put devices on the Internet that will accept control from a speech understanding computer. The impact of this could be very dramatic because it makes it possible to speak to your computer that understands what you say and have it turn around and control various appliances and other systems on the network in response to your speech (Figure 10).

So for example if we put a video cassette recorder on the Internet and we *say* to it through the speech processor "please record Star Trek at 10 o'clock Tuesday night," it is entirely feasible to talk to your video cassette recorder and make it do what you need to do.

You can imagine a variety of new applications for speech enabled services and devices that are on the Internet.


**Figure 10. Internet-based speech recognition.**

## 9.3 The two chip web server

In order to understand why it is thought that there is going to be a large number of devices on the net that can be controlled, attention should be drawn to something that happened in July 1999.

Two graduate students at the university of Massachusetts invented a two-chip web server, one chip did the TCP/IP protocol and the other chip did the file transfers that put up the web pages for people who logging in and pulling this information from the net. This little two-chip web server was about the size of two American quarters. It is certain that this chip costs more than 50 cents but as things are committed to hardware the cost tends to come down and it can be predicted that there will be many such devices on the network (Figure 11).

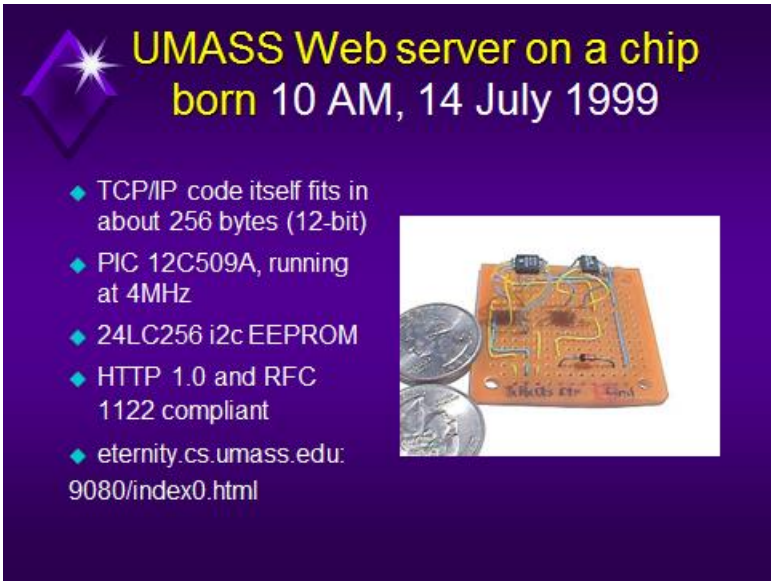



**Figure 11. The birth of the UMASS chip.**


**Figure 12. Control device population.**

Figure 12 shows some important relevant statistics. In 1999, over almost 5 billion device controllers were shipped to be used in devices that were not necessarily on the net, and in the year 2002 the estimated number of such device controllers will grow to 7.3 billion. Not all of those will be Internet enabled but even a small fraction of them, even 10% of them, will result in hundreds of millions of devices on the net capable of receiving control from some other Internet enabled device. That is one of the reasons why it is thought that speech enabled control devices on the net will be a very popular application.

## 9.4 Internet-enabled Appliances

The Electrolux company of Sweden has introduced the web enabled refrigerator. This device has a liquid crystal display on the surface possible for a refrigerator which is online to do electronic mail, search the net and possibly do other kinds of applications that one can programme into this Internet enabled system (Figure 13).

There are other examples of what you can do with an Internet enabled refrigerator.


**Figure 13. Internet enabled appliances.**


**Figure 14. Internet telephony.**

## 9.5 Internet telephony

Something that just emerged in the last 4 or 5 years is internet telephony (Figure 14). We speak of something called SIP (Self Initiation Protocol). It is a new protocol which is very general. It is intended for inter process negotiation to determine what kinds of communications features are needed by these two processes and then they, after having this negotiation, will ask the underlying Internet to set up the appropriate facility for proper quality of service. SIP is being used as a way of initiating Internet telephone calls, and it is now sufficiently well developed that companies are beginning to offer services including World Com.

Cerf uses a SIP enabled telephone to place calls around the company and even to the rest of the telephone network by going through a gateway that links the Internet on the rest of the telephone system. It is expected to see an increasing number of each device appearing on the market.

## 9.6 Other Internet-enabled devices

There is a rather surprising product that was shown at a consumer electronic show earlier this year. It is an Internet enabled picture frame. This is a very simple device. It does not have a keyboard and it does not have a mouse (Figure 15). It does not even have an interactive display. It is plugged into the wall to get power and connected it to the telephone system, and every so often it will dial up through the telephone net to the Internet and call pictures down from a predetermined website and then display these pictures one after the other.

This sounds like a rather simple kind of device. The idea here is that some devices are going to be very narrow in their purpose. They are on the net to do only one thing. We will see many more of these things in the future.

In Japan, a company called Jaguar International is making web enabled sewing machines that download fonts that can be used for sewing script into a piece of fabric or even logos that you can apply to the fabric (Figure 16).

That is actually a rather clever way of using electronics to download information from the net to make the sewing machine more functional. Instead of having to use old mechanical devices to vary the stitching patterns the electronic equivalent can be used. So this looks like a consumer device that is going to be available in Japan at least and also perhaps outside.

There are already a number of Internet enabled devices on the market (Figure 17). Web TV is an Internet enabled television set that goes out through the telephone network or through a cable modem and pulls web imagery and allows you to do email. A printer can be attached and it becomes a sort of a primitive keyboard.

Many Palm Pilots and other kinds of personal digital systems that people use today are Internet enabled.

The Nokia 9000 is an example of a cell phone, which is really a pre purpose device. It is a telephone, it is a pager and if you open it up length wise, you get a small keyboard and tiny liquid crystal display and you can use it to send and receive email.

Sony, Nintendo and Sega are three Japanese companies that make video games of which many are being sold in the US. They have announced that they are going to make Internet enabled video games, so that groups of people can play the video games even if they are not together in the same room. This could lead to some very interesting possibilities because the people who are playing these games would like to be able to hear each other, by adding a microphone to the video game and distributing the sound to each one of the players. To enable the players to see each other cameras could be mounted in front of the television. It is possible to tape the image of each of the players and send those out to the rest of the group as well. This raises a very interesting prospect because now we have a group of people who are physically separated but who can see and hear each other.

Fancy video conferencing gear used today, including visio-conferencing equipment, may ultimately be replaced by video games that people bring in to the office because they are consumer devices and wind up using these things to do video conferencing.

There are other appliances that are going to be on the net, one of which is the Internet enabled refrigerator mentioned earlier. Some people suggested that a bar code scanner should be put on the refrigerator. In many shopping or grocery stores each one of the objects that people buy in a can or a bag has a bar code on it which can be scanned by the cash register. This could be looked at by the refrigerator leading to the interesting possibility that a refrigerator which is on the Internet could search the network for recipes depending on whatever food is there in it, and through a pager advises its owner while at the store to say “Don’t forget to buy some sauce, I have everything I need except for that for spaghetti dinner tonight.”

There are lots of other examples. In fact there is a bathroom scale made in Japan that is also on the internet. When one steps on the scale, one’s weight is sent to the doctor and becomes part of one’s medical record. “Some people ask what happens if the refrigerator gets the same information and then refuses to open because you are supposed to be on a diet?”

Other examples include the new Internet enabled automobiles that have information about their location as well through the global positioning satellite system. The combination of knowing where you are and to be able to access the Internet to get geographically indexed information is very powerful because as you are driving it is entirely possible to have Internet information flowing to you to say what is available in the neighborhood.

You can even ask a speech understanding computer on the net "Where is the nearest restaurant?" You can get back an answer, you can get directions for driving to that restaurant, you might even be able to see the menu and place an order ahead of time. All this is possible once automobiles are online. Some people are saying that mobile phone will have a similar capability, and will eventually have a global positioning satellite system that can tell the person where he is.

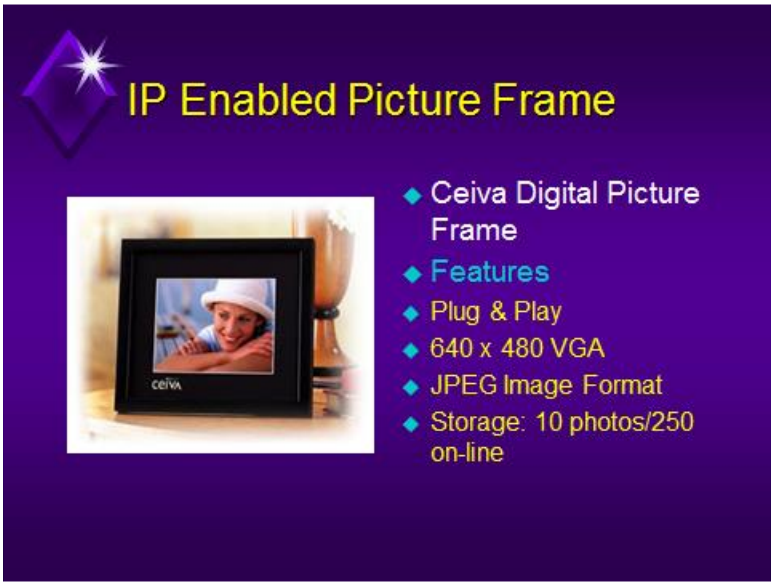



**Figure 15. Internet enabled picture frame.**

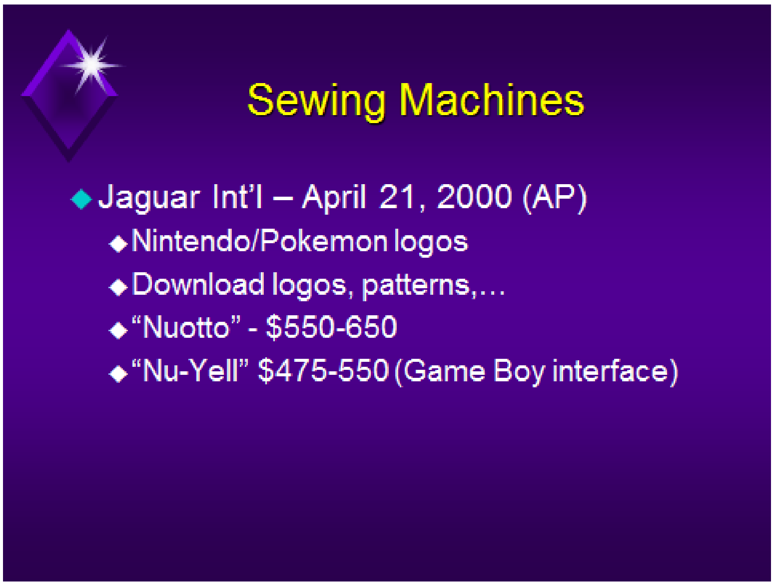



**Figure 16. Internet enabled sewing machines.**


**Figure 17. Internet enabled devices.**

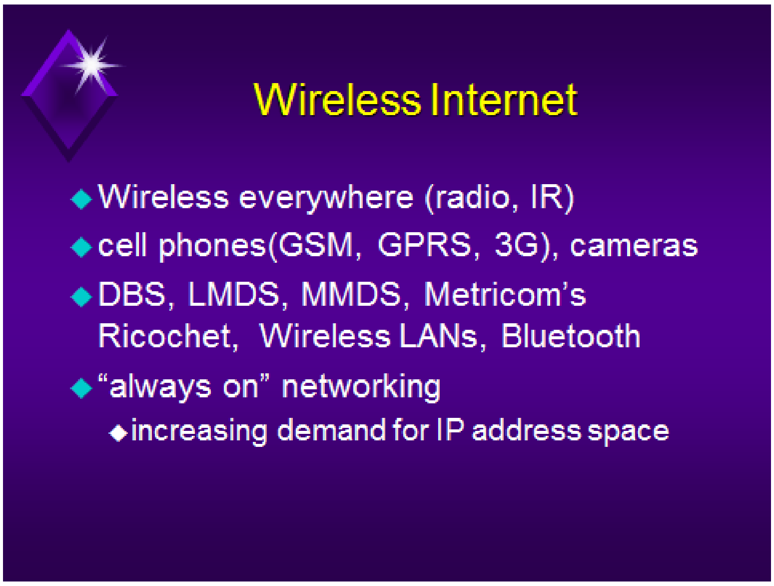



**Figure 18. Wireless Internet**

## 10 WIRELESS INTERNET

The Wireless Internet should be of great importance to all of us especially those of us in "developing countries." This is because we have seen in most parts of the world where the wire line telephone system has limited implementation, many people are getting services by simply getting on the wireless network. Many of these wireless devices are now Internet enabled notably the GSM telephones that are very popular in Europe and other parts of the world.

We know that there is an evolution taking place in the wireless world from the current GSM standard to something called General Packet Radio System or GPRS and from there to a what is called "Third Generation" mobile phones.

The third generation mobile phones are expected to have a first data rate of over 2 million bits per second. That is not a continuous data rate but it is a first rate. A great deal could be done with that kind of bandwidth and when such devices are on the net, it will become quite an attractive tool.

Figure 18 has in the middle a number of letters. DBS stands for Digital Broadcast Satellite. LMDS and MMDS are Digital Radio Transmission Systems that are substitute for cable communication. They are very high data rates, sometimes hundreds of megabits per second channel. In the US, there is a service called Recochet, which is a hundred megabits, sometimes 100 kilobit per second radio channel that connects people to the Internet.

Wireless local area networks that have small ranges of about 1000 feet or so but transmit at data rates that are an excess of 10 megabits per second are common in the US.

There is a recent development from LM Ericsson called Bluetooth which is a very small low power radio transmitter that can be used to connect devices in a local area, for example, your computer connected to a printer or perhaps several PCs connected to each other. The Bluetooth transmission system will eliminate a lot of wires in at least the local area.

Finally there are side effects of being online in this wireless fashion. One of them is that once the radio is on you are online all the time, which means that you need an Internet address all the time. That simply puts additional pressure on the Internet address base because there are only 4.2 billion addresses available in the IP version 4 and more and more of these are consumed by Internet enabled appliances and devices that are connected by wireless means. Thus, we may indeed run out of address space at some point.

In Figure 19, we see what we can do about that. For sometime now there has been a law defining specification for a new version of Internet protocol called IP version 6. It can be noticed that we have gone from version 4 to version 6. Version 5 was a 'use of the Internet protocol for voice communication' which in fact was considered a dead end and so we abandoned that sometime ago without really abandoning the version number, and that is why we are at version number 6.

The version 6 protocol has a 128 bits of address space. That is $10^{38}$ possible hosts and that is surely going to be enough to last for a while anyway.

IP version 6 also includes requirements for security and encryption of traffic. Every one has to be able to do what is called IP stack. In addition, there is a notion of a flowing identifier in the IP version 6 format and that might help us in dealing with various qualities and classes of service that the Internet can offer beyond the current best effort communication.

It is now the case that IP version 6 is officially allowed to be allocated for commercial purposes. WorldCom has been allocated some space and it uses one of it's networks called vBNS+ to supply commercial IPv6 space however there has not been a huge demand for that yet. The IPv6 forum has been pushing the industry towards implementing IP version 6 in anticipation in running out of IP address space in just a few years time.

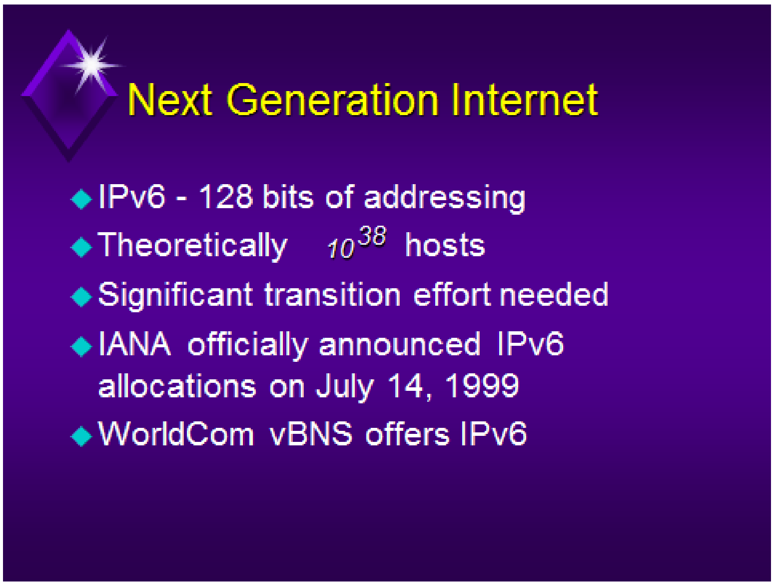



**Figure 19. Next generation Internet.**


**Figure 20. Internet policy issues.**

## 11 POLICY ISSUES

There are many policy issues that the Internet has raised all around the world. There is a range of issues that the Internet has put before us from the policy point of view. The technology challenges of the Internet are now over shadowed by the policy challenges in front of us (Figure 20) .

It maybe more difficult to solve these policy problems because they are not necessarily objective in nature and the solutions have to be global in their scope because the Internet is global in it's nature and doesn't know anything about the international boundaries that it may cross as traffic goes from one part of the world to another.

Decisions about where we resolve commercial disputes on the net are being complicated by not necessarily knowing where the parties are that are engaged in the economic con. If taxes are to be charged, it is not clear where those taxes should be charged or who should be the recipient of them. There are questions about privacy that come out regularly. There is an open debate on privacy related jurisdiction.

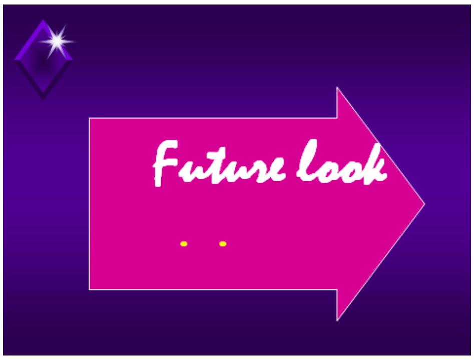
Such questions will be will be encountered in the years to come.

## 12 FUTURE LOOK

In Figure 21, you see a picture of planet Mars. This is a reminder that we have been as a species exploring our solar system by sending various robotic devices out to various planets and satellites and asteroids in the near space. NASA has launched a number of such missions including the one from a few years ago, the Rover, that went on Mars and sent back all these beautiful images of Mars to us.

What is peculiar about all these missions is that in the past none of them has been able to be used in subsequent missions. The protocols were unique to each mission. Communications facilities were unique to each mission. The engineers of the jet propulsion laboratories and I got together two years ago to talk about the possibility of standardizing space protocols and to extend the Internet to be used in space so as to allow each subsequent mission to make use of previous missions' assets and resources assuming they were still there.

In the long run creating an architecture for a space base Internet communication will not only help the exploration of the solar system and the scientific information that that can provide but may also help us support commercial use of space as time goes on and as we manage to get off the planet and make use of resources outside the near space.





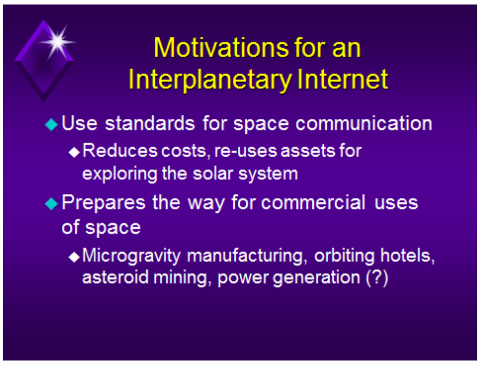



**Figure 21. Future Look: Interplanetary Internet.**

Looking at same figure we can see what the future plans are. The jet propulsion laboratory and the speaker intend to launch several missions to Mars over the next several years. Some of them will come as early as 2003 where two Rovers are going to land on Mars. They will be carrying the new interplanetary Internet protocols with them.

The interplanetary Internet protocols have been prototyped as of August 2000.

A satellite has just been launched in an orbit around earth called SCRE1 C and SCRE1 B. The latter contains the Internet interplanetary protocols and will be using that satellite to test them to make sure that they are ok before they are put out on board the Mars missions.

By 2008 we expect to have at least 8 satellites around Mars that will be carrying the interplanetary protocols, and by the end of this decade there will be a two planet Internet system in operation.

In the longer term, as new missions are launched to different parts of the solar system, each one will carry some bit of the interplanetary Internet back bone until finally in 2020 or perhaps some years beyond that, there will be a fully operating Internet interplanetary back bone that will ultimately allow commercialization of communications in space when that is appropriate.

The important thing about this strategy is that only the parts of the back bone are built as missions are launched that need it so we do not have to build the whole thing ahead of time. We only build it as new mission requires it.

# 13 THE INTERNET SOCIETY

## 13.1 Mission

The mission of the Internet society is very simple. It is to support and facilitate Internet evolution and expansion. It helps to sponsor the Internet research task force and most societal task forces. Each of these looks at and tries to bring sensible advice to the general public and to legislators and to technologists as they think about new ways of using the Internet (Figure 22).

## 13.2 Activities

The Internet society has sponsored workshops for some years. It has retrained over 2500 engineer from over 115 countries. The trainees tend to go back to their countries and create new bits and pieces of Internet where the system grows and eventually many of these turn into public services and sometimes profitable companies.

They also hold annual Internet meetings. The next one which comes in the early part of June 2001.

Among the most important ways that the Internet society helps to facilitate the expansion and growth of the Internet is to sponsor Internet society chapters all around the world, one of which is in Tunisia. Members are relied on to keep track of what is going on locally and to convey to local officials important aspects of Internet as legislation which, for example, is considered to fit the Internet into electronic commerce framework.

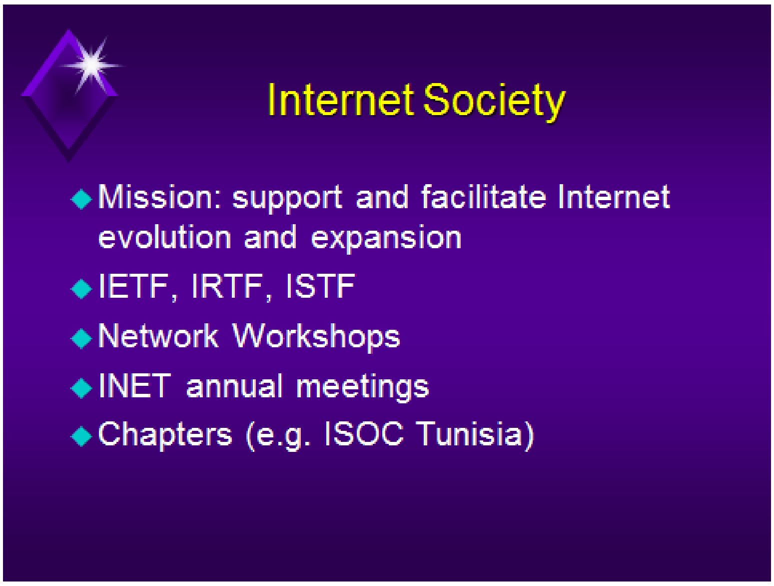



**Figure 22. The Internet Society.**

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# The Internet, Now and Tomorrow: A View from the Academia

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## 1 ABSTRACT

This paper presents the major technological evolutions of the Internet that enabled this network to become a global information network. Technologies such as signal digitalisation, coding and compression, high speed transmission mobility and the new Internet protocol (IPv6) are among the most significant ones. They are driving the convergence between the Internet and telephony especially mobile telephony. Internet is becoming the basic infrastructure for numerous innovative multimedia applications such as distance education, e-commerce, communications among people, entertainment, health etc.

Distance education is then introduced. It is an application that provides the opportunity for working adults as well as students to take courses independently of distance and time. For developing countries, it would greatly contribute to the dissemination of knowledge to populations and hence to the development of the knowledge society. Electronic commerce is the second application studied in this paper as it allows understanding today's economic challenges: i.e. competitiveness and Globalization. The players and some technologies involved in e-commerce such as EDI, security, and payment systems are introduced. Several issues of e-commerce are also outlined and the importance of the introduction of these technologies in the developing countries is underlined.

## 2 INTRODUCTION

The Internet is a global network based on the interconnection of worldwide existing networks. It is based on the TCP/IP architecture adopted by the end of the 1970's. The Internet was initially deployed between universities at an international scale. By the end of the eighties, it opened to commercial use like we have today. Since then its growth has been exponential. In fact, in 1994, only 3 million people used the network, mostly in the US. By the end of 1999, around 100 million people were connected to the Internet worldwide and experts predict that the number will rise to one billion by 2005.

This evolution is the result of three factors: (i) More servers with more content and faster feed, (ii) More users with faster modems and more demand in data and finally, (iii) More increase in network capacity by the providers. Several technologies, such as

Web technology, digitalisation and compression, have contributed to this expansion.
Globalization and democratisation on the one hand and the transport of multimedia flows and the mobile dimension on the other have led the Internet to become more than a technology, but rather a new way of communicating, working, doing business etc. It influences commerce, non-merchant exchanges, organisations, communities, users, citizens, consumers, workers, international and local relations as well as culture and industry.
After a brief presentation of this technological evolution of the Internet, this paper will focus on two major applications: distance learning and electronic commerce.

## 3 TECHNOLOGICAL EVOLUTION

During the first decade of the Internet, the available applications were classical applications i.e. FTP, Telnet and email. The World Wide Web has given a new multimedia dimension and made of the Internet a global information network based upon web servers whose information is structured and linked around the hypertext and hyperlink concepts. Distributed and displayed information is constituted of documents constructed in HTML (Hypertext Mark-up Language).
The transmission of multimedia data requires the integration of several technologies:

### (a) Digitalisation and compression technologies

Multimedia means the manipulation of different types of data such as voice, image, video, audio, etc. Audio and video have to be first captured from their analog form and stored digitally to be manipulated by the computer and sent through the networks in a compressed form. It would otherwise require a massive bandwidth for its transmission (see Table 1). All these operations must happen in real-time to facilitate communication and interaction.
Many techniques are currently used for audio and video compression and several standards have been defined in this field to allow interoperability between implementations and products. The most important standards for compression are summarised in Table 1, which also shows the gains in speed. The MPEG4 standard is adequate for the transmission over the Internet as it allows the manipulation of objects and the integration of synthetic video. Furthermore, this standard allows the adaptation of the transmission speed to channel capacities (scalability). Other standards such as MPEG 7 and 21 are under consideration.

**Table 1. Compression standards**

| **Standard** | **Service** | **Digital signal speed** | **Compressed signal speed** |
|---|---|---|---|
| **H261** | Visio conference | +100Mbit/s | Nx64kbit/s |
| **MPEG1** | Compact disc | 20 Mbps | 1,5 Mbps |
| **MPEG2** | Numeric TV | +216Mbit/s | 2-8 Mbps |
| **MPEG4** | Video | +100Mbit/s | 10kbit/s – 20 Mbps |

**(b) Transmission and diffusion technologies**

The transmission of multimedia traffic flows necessitates capabilities to satisfy the quality of service requirements of various data types. In fact, as shown in Table 2, some data types are sensitive to delay, while others are sensitive to reliability.

**Table 2. Traffic characteristics**

| | **Data** | **Voice** | **Image** | **Video** |
|---|---|---|---|---|
| **Delay Sensitive** | No | Yes | No | Yes |
| **Reliability Sensitive** | Yes | No | Yes | Yes/No |

These requirements have led to the development of multiservices networks such as ISDN, ATM and Internet. ATM technology combines the best qualities of circuit-switched and packet-switched communication. ATM can support different data transmission speeds, multiplex signals of different data types and provide several classes of services to enable various multimedia applications.

Reliability and quality of service provided by the Internet are not as efficient as those of the ATM. It is however much more cost effective and widely deployed. Furthermore, several IETF (Internet Engineering Task Force) specifications have been defined to allow the Internet to become a truly multiservice network:

***(i) The IPv6 protocol***

The actual version of the IP protocol, IPv4, does not provide the quality of services required by multimedia applications. IPv6, a new version of the IP protocol provides mechanisms to be exploited by higher protocols to ensure the requested quality of service within new frameworks like Diffserv and Intserv. Furthermore, the addressing space of IPv6 is much larger than IPv4's and it is necessary to support the increasing number of Internet hosts and users.

***(ii) The Multicast Backbone or Mbone***

Originated in 1992 from an experiment to transmit a live (audio and video) IETF meeting, the Mbone constitutes the core of the network for applications that require audio-video transmissions in real time to multiple destinations. The Mbone provides an efficient way to deliver the same data to multiple destinations thanks to multicast routers and to the specification of group concept with a unique address. Hosts who wish to receive the data have to join the group.

Multicast routers, in order to be informed about active groups, usually use the IGMP protocol.

During the transmission, multicast routers encapsulate packets inside regular IP traffic and set the destination to another multicast router. To intermediary routers in the Internet, data looks like unicast data (one to one transmission).

**(c) The "Last Mile" problem**

Even with these capabilities and with high speed links between routers, the transmission speed over the local loop connecting the end user to the Internet over dial up lines is usually very limited (56kbit/s). This is known as the « last mile problem.» To overcome this gap, several technologies have been developed such as DSL (Digital Subscriber Line) technologies that allow for asymmetric transmission up to several megabit/sec on the actual telephone lines, the use of satellite (hybrid nets) for the transmission of voluminous data and the new generation mobile phones specified by the UMTS standard which should allow speeds of up to 2 Mbps. As a matter of fact trends in Internet and mobile technology exhibit similar patterns of growth. The mobile phone may well become the dominating Internet access terminal.
Internet is thus becoming the major communication infrastructure of the beginning of the 21st century with multimedia applications running above the IPv6 protocol. Several tools have been developed for a whole range of multimedia applications such as Internet videoconferencing and telephony. Multimedia applications may be classified in five categories :

- Communication among people : Voice communication ( Voice over IP, IP telephony), Video Conferencing;
- News and Entertainment : News in all its forms ( paper, web ), Movies (on demand) and TV, Interactive games;
- Distance Education and Training;
- Business Applications : E-Commerce, Banking, Publishing...; and
- Medical Applications : Telemedecine...

In what follows we will examine two of the most promising applications : Distance Education and E-Commerce

## 3 DISTANCE EDUCATION

### 3.1 Benefits of Internet distance education

The need for providing education is increasing as a consequence of the tremendous growth in the number of students throughout the world and the need for life-long learning. Furthermore, the growing importance of knowledge and information and the new basic skills needed in the labour market enhances the need for education. However, many situations compete for time such as family, job, business travel etc… and the difficulty to commute to campus for classes. Distance education provides the opportunity for working adults as well as for students to take courses at work or at home independently of distance and time. Some courses allow for flexibility in completing coursework, particularly those offered through the Internet. Therefore, in addition to convenient locations, it provides rich instructional resources while managing the telecommunications costs. Furthermore, distance education allows expanding access to educational resources, increases engagement in learning, contributes to labour market skills, and links teachers and teaching resources.
At the end-user's side, the environment of distance education can be easily integrated

into the computing environment that the user is already familiar with, increasing in this way the value of computers.
On the other hand, trained teachers are vital to any successful technology integration as training leads to acceptance and use. Distance education over the Internet will allow pre-and in-service training and practice for teachers with continuous reinforcement of their knowledge.
At the social scale, distance education will contribute to increased access to educational opportunities to populations such as rural population, to women and it will increase access to higher education. It also will contribute to increasing fairness when sufficient care is taken for the design of programmes.
However, distance education needs an ever-working technology with regular maintenance, repair and upgrading to succeed.

### 3.2 Background

Distance education focuses on delivering interactive classes to geographically distributed audiences. Before the expansion of the Internet, remote education was performed thanks to room video conferencing that require specially equipped rooms with expensive hardware. Advanced computer technology such as faster processors and better data compression and transmission schemes have made it possible to integrate audio and video into the computing environment.  This has resulted in desktop videoconferencing that does not have the drawback of having to physically move to a special location and to incorporate data from other computer applications into the conference.
Remote education can be seen as a one-to-many interaction conference where distinct and unequal roles are assigned to the participants to allow an asymmetric communication among them. There are typically one lecturer and several students. The lecturer is in control of the conference. The lecturer may ask for interaction from the students in the form of questions or discussions. Students may indicate their desire for interaction by raising their hands. Some available products have many valuable features such as the ability of students to queue up to indicate their wish to ask a question, to «raise their hands» by a pull function, to send written comments without disturbing the lecturer and to send messages to each other.  These features are valuable as their contribute to enhance the interaction between the lecturer and the students as well as between the students themselves.
Distance education is in its infancy and it should constitute the core system to build the knowledge society.  Several models of distance education exist:
**- Enhanced classrooms**: This model is used to enhance traditional classrooms by the use of presentation tools, which allow performing demonstrations, simulations, and experiences in classrooms.
- **Virtual classroom**: This model is essentially based on videoconference tools and other technologies such as cable television and the Internet to allow remote access to courses.
- **Self-learning with multimedia tools**: It uses the learner’s desktop, CD-ROMs transmitted by postal services or downloaded from available sites accessed through networks. The didactic approach allows for a personalised learning process.
**- Learning through information networks** (web-courses): This model is also based on the user’s desktop who searches and accesses learning sites, mainly websites, through the Internet.

- **Network learning**: This uses multimedia desktops for access to the information and also as a tool for real time synchronous communication (videoconference, teleconference, whiteboard…) or asynchronous communication (e-mail; forum, co-operative work…). This allows performing teamwork and the creation of group discussion.
- **Just in time reinforcement learning**: This type of learning is provided essentially to professionals and it depends strongly on the tasks performed by the learners. This kind of distance learning provides the suitable training when required. It is usually considered as complementary to the production process.

Each of these models presents advantages and drawbacks. The first enhances the classical «face to face» approach while the second gives an extension to the first and it requires the simultaneous presence of the teacher and the students. It has the drawback of high costs disabling in this way its use at a large scale. Other models are characterised by the fact that the learner is the core of the learning process and present significant change in the learning approach. Network learning and just in time learning constitute the most advanced distance learning mode.

### 3.3 The enabling technology

#### *3.3.1 General*

All distance-learning systems require hardware that captures and digitises the audio and video. Audio is necessary for communication between lecturer and students and video enhances this communication by creating a sense of presence. An additional feature found in most systems is a shared drawing area usually called whiteboard, which is analogous to the whiteboard found in classrooms. These whiteboards usually allow participants to import drawings or graphics and make annotations. Other facilities available are the possibility to transfer files between participants and applications sharing. Internet is becoming the major network to support distance education. Several free or commercial products are available on the Internet and are designed for the user's desktop such as videoconference, video on demand, whiteboards, virtual reality.

The challenge however of transmitting audio and video over the Internet has led to the specification by the IETF of new protocols to provide support for sequencing, timing and quality of service for point to point or multipoint applications.

#### *3.3.2 Development tools for the didactic content*

These are author languages and tools that aim to allow pedagogues, educators, to easily develop the training software including several components such as interaction with the student, simulation, exercises, evaluations, self-evaluations…

#### *3.3.3. Perspectives*

Distance learning constitutes the object of several research projects worldwide. Many countries are increasing investments in educational technology by first adoption of computers and connecting schools to the Internet.

Furthermore, many pilot projects are being realised and they experiment new approaches such as network training, virtual classroom, university, campus...

# 4 ELECTRONIC COMMERCE

## 4.1 General

One of the major challenges companies face today is to meet increasing consumer demand. Short delivery time, and improved customer services are key to competitiveness. Because the Internet is a democratic and global network, it is offering new opportunities to SMEs: it can improve their competitiveness by reducing the barriers to global trade and the intermediation costs. Electronic commerce and new communication systems enable organisations to conduct business on a global basis. Business entities or individual consumers anywhere in the world can have an interactive exchange with other organisations or individuals. Issues associated with global electronic commerce include overcoming differences in interpersonal communication styles, business methods, transportation infrastructure, customs procedures, legal and commercial codes, privacy, cross border data flows, monetary exchanges and cultural and sociological aspects.

## 4.2 Background

The commercialisation of the Internet in 1991 and the development of the World Wide Web has led to the development of the Internet based e-commerce. Companies discovered an increasing number of ways to transact business electronically. Industry has embraced the concept of e-commerce and a worldwide survey of 500 large companies in 1999 found that 90% of top managers considered that the Internet would transform or have a big impact on the global marketplace by 2001 [3].
Four categories of electronic commerce have been defined:

- B2C or Business to Consumer,
- B2B or Business to Business,
- B2G or business to Government and
- C2G Consumer to Government.

The B2B category amounts of $US114 billion in November 2000, [4] and will increase fivefold by 2003.
The greater importance of B2B category shows that consumers have embraced e-commerce with less enthusiasm than industry. This is due to concerns of privacy, security, functionality and ease of use. However the B2C category is expected to grow from $US8 billion in 1998 to $US108 billion in 2003. These optimistic expectations [3] result from improvement and enhancement of mechanisms related with consumer concerns.

## 4.2 Definitions

**Electronic commerce** (e-commerce) is any transaction completed over a computer-mediated network that involves the transfer of ownership or rights to use goods or services. Transactions occur within selected e-business processes and are «completed » when agreement is reached between the buyer and the seller. Completed transactions may have zero price.

- **Electronic business** (e-business) is any process that a business organisation conducts over a computer-mediated network. Business organisations include any for-profit, governmental, or non-profit entity. These processes include production-, customer-, and internal or management-focused business process.

It can be seen that e-business is used as a term that embraces e-commerce in its commercial exchange or transaction stages.
Both e-business and e-commerce are subsets of a larger new concept, « e-venturing », which is changing rapidly many accepted and established principles of economics and norms of effective management.

- **E-venturing** can be defined as the application of all possibilities inherent to the Internet phenomenon and its alliance with IT and communication technologies, to the quest to derive all forms of organisational benefits [2].

#### 4.3 The Actors

**The seller**: the most significant example of a company that has benefited from Internet commerce is Dell Computer Corporation, which expanded from a US$602 million US-based business in 1985 to US$21.7 billion international business in 1999. Its success is the result of the direct B2C model, which revolutionized the PC industry worldwide.
**The buyer:** The consumer is the main buyer in B2C while B2B involves commercial transactions between companies. The buyer may be an SME or a large enterprise. In B2G and C2G the buyer may be a citizen or a company.
**The banks**: Independently of e-commerce activity, banks have seen the Internet as an additional information, communication, marketing and sales channel. This resulted in the development of web based home banking. However, in addition to this multi-channel approach where the capabilities of the Internet are combined with classical data base tools, in Internet commerce banks are playing a new role in the settlement phase of the electronic transaction. Virtual banks are also emerging.
**The intermediaries**: Electronic commerce is seen as a direct connection between the buyer and the seller. Traditional intermediary functions (distributors, banks, or other third parties) are being reduced, this is called «desintermediation» of commercial relations. The Internet would then be seen as a global market place where everyone, even SMEs, can directly reach customers everywhere with no intermediation.
However, it has been shown that the development of the Internet commerce has led to the apparition of a new form of intermediaries (ISPs, web portals, certification authorities, on-line auctions, on-line brokers).
New intermediary functions may be summarised as:

- Matching buyer and seller including determination of offering, selection/searching and price discovery,
- Facilitating of transaction: negotiation, settlement, payment, logistics and delivery,
- Resolving disputes and enforcing laws and regulations.

### 4.4 The Enabling technologies

Electronic commerce is not a technology by itself, it is rather a combination of several technologies such as :

#### 4.4.1 EDI (Electronic Data Interchange)

EDI is the «computer to computer exchange of data related to commercial transactions using agreed upon formats and networks»[4]. In general, EDI is considered as the exchange of structured data between partners and is not restrictive to electronic trading.. Administration, transport, financial and health care also use EDI for the transfer of their related documents. EDI has been used for business-to-business communications for almost a quarter of a century.
EDI technology has been mainly on messaging systems in compliance with OSI standards (OSI-X435). New approaches are being developed in the internet environment (EDI-lite, XML based EDI...).
Standards are also needed to define a structure for the exchanged messages and data contents to ensure machine interpretation of received data.
Over the years, many national and sectoral standards (ANSI ASX12, TRADACOM, ODETTE …)[4] have been adopted by collaborating communities. The need for a common inter-community standard has led to the specification by the United Nations of an international and branch-independent language: EDIFACT (Electronic Data Interchange For Administration Commerce and Transport) [5].

#### 4.4.2 Security

As trading partners conduct more electronic commerce, the security of data and systems becomes increasingly important. In addition, the confidentiality of customer's and trading partner's data and relationships must be maintained through appropriate practices and technologies, not only to preserve existing relationships but also to comply with industry codes of conduct and relevant laws and regulations. Organisations must develop and implement security procedures that are appropriate to the level of risk to which they are exposed. Several techniques are available to provide security services to e-commerce practitioners such as encryption, authentication, public key infrastructure, firewalls,…
Several working groups have been created within the IETF and several specifications have been defined to provide security at the network layer (Ipsec), at the session layer (SSL) or at the application layer (S-HTTP, SET, S/MIME). Furthermore, to secure the communication channel between trading partners involved in B2B e-commerce, the Ipsec protocol is used to create virtual private networks (VPN). This allows to create secure tunnels between organisations' intranets.

#### 4.4.3 Electronic payment systems

There are several payment systems, the most commonly deployed are:

- *Credit card systems* are designed for small to medium payments and consist in sending credit card information over the Internet. The SET standard has been defined by a Visa-MasterCard consortium. It specifies a standard infrastructure for the use of credit cards online.

- *Electronic money* is particularly suited to micro-payment. It includes two main forms: prepaid cards or storage of cash in electronic form. One of the more immediate applications of micro-payments might be for online newspapers or databases and games.

### 4.5 Legal Issues

#### 4.5.1 Privacy

The development of B2C e-commerce has resulted in the creation of «personal information market» due to the ability to gather and compile easily the information collected about consumers as they perform electronic commercial transactions and surf on the net. Technologies such as cookies combined with online and offline data, have led to the widespread ability to collect and sell data about consumers. The revelation of private information has raised strong concerns with privacy issues. This has led legislators and regulators to set up legal frameworks for online privacy. The industry has also developed technology-based solutions for web privacy protection based on security and encryption mechanisms.

#### 4.5.2 Intellectual property

In the trading of physical goods and services, e-commerce can accelerate the transaction process without skipping the physical delivery of goods or the performance of services in the real world. On the other side, with non-physical (immaterial) goods and services such as music, animation, video and multimedia contents, the entire process can be undertaken over Internet. This has resulted in the rise of conflicts linked to copyright and intellectual property in the digital market.

#### 4.5.3 Other Legal Issues

Successful introduction of electronic commerce demands answers to some legal questions concerning the status, admissibility and enforceability of electronic records, contracts and signatures. Other regulatory issues include the assignment of liability in electronic transactions and protection for the customer as well as for the provider. Many countries have adopted a legal framework for electronic commerce. However, national regulations may vary considerably from one jurisdiction to another, causing confusion and complexity for the new electronic commerce industry.

### 4.6 Training and careers in e-commerce

Rapid changes are being noticed in the e-commerce labour market. In fact, while some jobs are being lost (those which involve repetitive data entry or paper shuffling) as a result of Internet commerce, the growth of e-commerce activities has resulted in the creation of new jobs and new career opportunities, which did not previously exist. These e-commerce employment opportunities have been categorised in:

- Web development and design of e-commerce systems and solutions. Jobs in this category are linked to the technical infrastructure for e-commerce
- The second category is a service category and is concerned with business analysis, sales and consultancy, management and strategic planning, education and training and research.

- The last category is related to legal aspect of e-commerce and comprises lawyers, legislators and policy makers.

This evolution has been paralleled by an equally impressive rise in the number of university degrees/courses in E-commerce/E-business to meet the demand for trained professionals in this field. In order to respond to the fast growing needs of companies and governments , Universities have established training and research centres and institutes for e-commerce or e-business, which are connected to the economic world and to the state administration. They create therefore conditions whereby the students can practically experience e-business environments and get involved in studies, pilot projects, prototype and solution developments for local needs.

## 5 CONCLUSION

Internet is experiencing a tremendous growth. Numerous innovative multimedia applications have been developed and experimented over the net. However, Internet today cannot respond to the whole range of applications and user's requirements. Many research teams are working to propose novel specifications and implementations for the Internet of the future usually called «the new generation Internet». Five challenges should be solved: quality of service, availability, trust, transition , security and economy.

The Internet new generation is seen as a high speed, always available and wireless network. It can then be described as a high-speed communication channel that would allow users to access to all available services such as telephone, television, personal communications. People would have to just ask the network for information without having to record it on their computers. Classical devices will be replaced by new nomad devices with friendly human to machine interface used to access the desired services. New security services will be available to allow for personal privacy, authentication, and anonymity to the network.

Countries which would invest in the new generation Internet, will be the first to benefit from a more efficient and less expensive infrastructure. Their economies will win in competitiveness thanks to cost reduction and the increase in exchange fluidity. They will also benefit of a technological and economical leadership. In several fields such as medicine, distance education, meteorology, cartography, defence, enterprise organisation, … high speed networks will accelerate research and also the design of new products and services.

For developing countries, the Internet will contribute in providing the technical solutions to overcome many encountered problems such as lack of resources and skills, inadequate basic infrastructure and language barriers. In fact, wireless access with some automatic translation and multimedia will enable these countries to participate in the digital economy and to communicate and to engage in electronic commerce activity across language barriers.

Furthermore, the development of electronic commerce activity in government (Business to Government) will change the way people interact with their government Several government services will be provided electronically to all customers including individuals, business, government and education. This will probably have a very positive impact on several areas such as fairness, education and training.

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# Proposed Model IT Strategy and Action Plan for Member Countries

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## 1 ABSTRACT

During the past few decades, the Information Technology (IT) revolution has taken the world by the storm. Despite its many champions and advocates, the IT explosion has often left many people feeling confused regarding its proper place and use. In the Muslim world, one finds some Muslim, particularly from a scientific or business background, eager to embrace the latest technology with open arms, while others, particularly those in Islamic disciplines, are often more reserved in their receptiveness to such technology.

This paper describes how information technology can be implemented among the Organization of Islamic Conference (OIC) member countries. It also explores and analyzes ways to expand the market share of the OIC member countries in the world market.

## 2 INTRODUCTION

The Muslim Ummah today is striving to overcome the problems of backwardness and poverty and achieve progress and prosperity within the framework of its Islamic beliefs and integrity. However, we faced with the stark reality that there is a big gap to be bridged between where we are today and where some of the industrial and even some developing countries have reached in terms of economic development and progress.

It is well known that the industrial countries have achieved outstanding results in improving the socio-economic conditions of their people by intensive application of know-how in information technology and organization of information transforming into knowledge, which helps in the development of every activity in our lives. It is only through a vigorous effort to apply and use information systems based on the latest development in the field of information technology that progress could be achieved in the shortest possible time to shorten the gap that exists between the advanced countries and the Muslim Ummah.

The challenge of the Muslim world today is to gear up the potentials of Information Systems for the development and progress of the Muslim Ummah. The Islam world has over a billion people with rich tradition of knowledge and culture, which deserves to be channeled through Information Systems and networks, in order to realize its immense potentials. It is now the responsibility of information specialists in the Muslim Ummah to address the issues of penetration and interconnectivity amongst its populace, and hence the need to develop the Information Systems for a knowledge-based community.

Information and Communication Technology (ICT) and the Internet are powerful enablers. It allows us to create a place where communities can co-exist, information and experience exchanged, and productivity generated. We see ICT as the great equalizer that will help bridge the Muslim communities within the Organization of Islamic Conference (OIC) member countries, facilitate trade among them and enabling the sharing of ideas and experience among Muslim across the world. By effectively leveraging on ICT and the Net, we will be able to strengthen the social fabric among the OIC member countries, improve access to education and learning resources, improving networking among trading partners and inter-government agencies.

In addressing the digital divide issue among the OIC nations, the Islamic Development Bank (IDB) and Mimos Berhad joint ventured and set up OICnetworks Sdn. Bhd. The vision of the company is to make OICnetworks - a Global Internetworking Holding Company - stimulating the growth of the OIC member countries and the Ummah globally. Among its missions are:

- To establish a global infrastructure to provide secure, affordable and equitable access for people in the OIC member countries
- To establish and promote the development of critical content and portals
- To cater for the needs of governments, businesses and communities
- To establish and enter into profitable and/or self-sustainable commercial ventures with selected business partners

## 3 HOW DOES OICNETWORKS FIT INTO THE PICTURE?

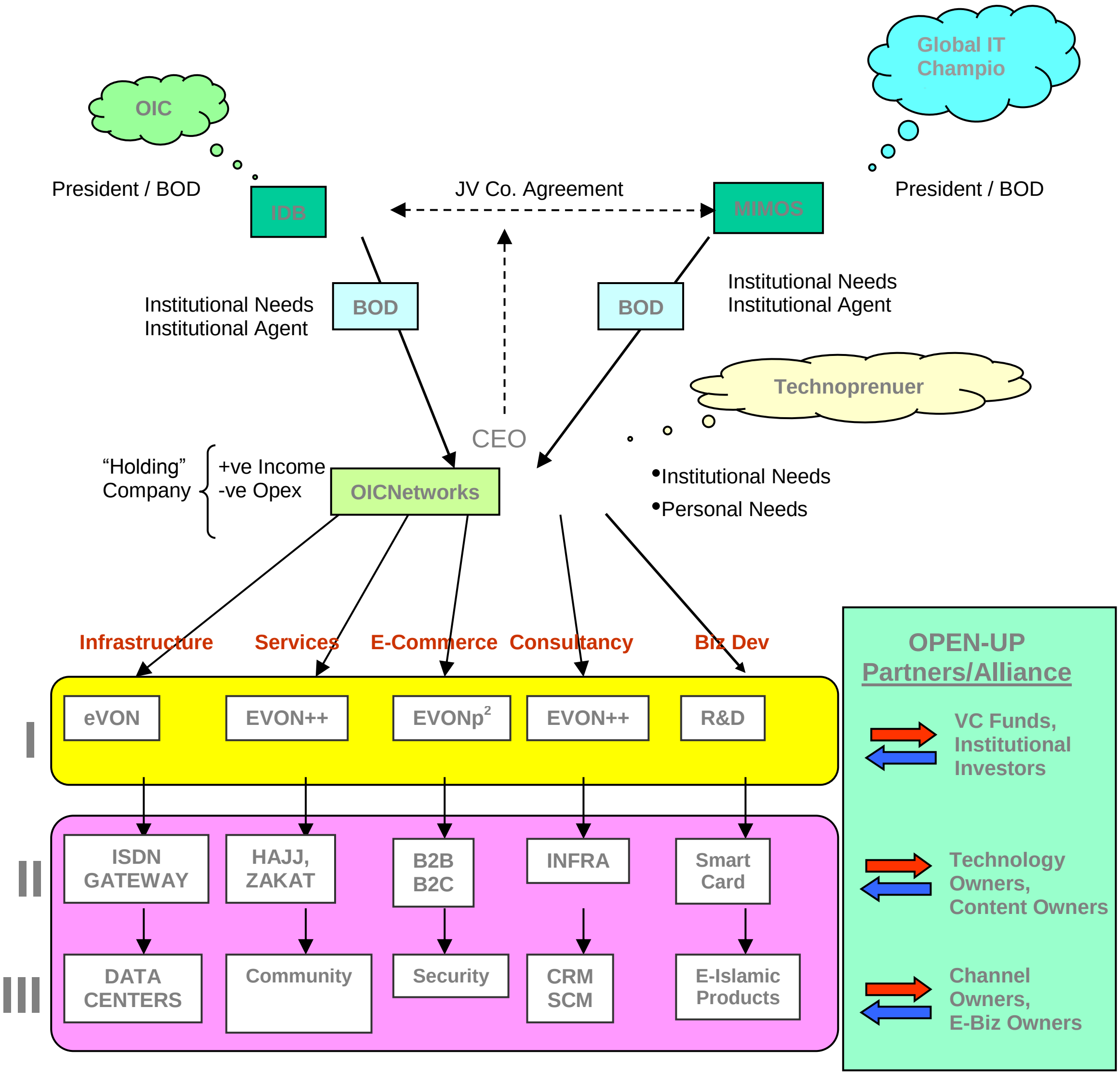



**Figure 1. OICNetworks: Fitting into the picture.**

OICnetworks, with a paid-up capital of USD$ 3 million, is a joint venture company between two reputable organizations, Islamic Development Bank (IDB), based in Jeddah, and MIMOS Berhad, based in Kuala Lumpur, Malaysia.

IDB attaches high significance to the socio-economic development and progress of the Muslim countries and communities. In its efforts, IDB has given great importance to the promotion of IT with special emphasis to networking for exchange of information by developing various information systems. Mimos, on the other hand, is a premier Research and Development corporation that plays a pivotal role in developing capabilities in ICT in Malaysia and hopes to establish a global infrastructure to provide secure, affordable, and equitable access for people in the OIC member countries. With a large pool of expertise and resources - both technological and financial services - on hand, OICnetworks felt that the Muslim Ummah stands to benefit from its activities and offerings.

OICnetworks have divided its offerings into five main categories:

1. Infrastructure.
2. Services.
3. E-commerce.
4. Consultancy.
5. Business Development.

### 3.1 Infrastructure

The category is divided into three levels. In the first level, OICnetworks establishes the Enhanced Virtual OICnetwork (eVON) whereby venture capitalists and institutional investors are welcomed as partners or alliances. From there, ISDN gateways are being established at the technology and content owners level and database centers are being formed at the channel and e-biz owners level.

### 3.2 Services

The category is divided into three levels. In the first level, OICnetworks establishes the Enhanced Virtual OICnetworks' Services Enablers (eVON++) whereby venture capitalists and institutional investors are welcomed as partners or alliances. From there, several services are being formed like hajj and zakat by technology and content owners, which will be opened to the community via many channel and e-biz owners.

### 3.3 E-Commerce

The category is divided into three levels. In the first level, OICnetworks establishes the Enhanced Virtual OICnetworks' Pillar Portals (eVONp$^2$) whereby venture capitalists and institutional investors are welcomed as partners or alliances. In the second level, Business-to-Business (B2B) and Business-to-Consumer (B2C) relationships are given the priority to cater the needs of technology and content owners' needs. In the third level, Customer Relationships Management (CRM) and Supply Chain Management (SCM) are established at the channel and e-biz owners level.

### 3.4 Consultancy

Similar to the Service category, the Enhanced Virtual OICnetworks' Services Enablers (eVON++) whereby venture capitalists and institutional investors are welcomed as partners or alliances is establish in the first level. However, in the second and third level, infrastructure and security issues are the two main issues being addressed.

### 3.5 Business Development

Like any other company, Research and Development (R&D) is an important area to address the future challenges of the ever-evolving Internet world. In the first level, venture capitalists and institutional investors are welcome as partners or alliances in the R&D area in developing future technology, infrastructure or system for the betterment of the OIC member countries. Next in line is the issuance of smart cards, which can perform multiple functions and are more secure due to high security mechanisms such as advanced encryption and biometrics. In the third level, a number of E-Islamic products like the perpetual Muslim Prayer Computer, Personal Digital Assistants (PDAs) and software, will be made available to consumers at the consumer and E-Biz owners level.

With these in mind, OICnetwork has develop a cluster of vertical portals for information and E-Commerce Services to spur growth of the OIC member countries and Ummah in global. The objectives of the portals are to:

- Collectively pool all resources to position the OIC member countries and the Ummah in the governance of the E-World;
- Aggregate all financial resources to support the spawning of global web enterprises, and
- Establish OIC's own transnational entity to create and develop its own global web enterprises.

## 4 ISLAM AND THE AGE OF INFORMATION

According to University of Richmond, Professor Dr. Azizah al-Hibri, the Information Revolution has created a New Economic Order, which has made the world smaller but individual human experience much larger. Unfortunately though, at this point the Muslim World, with the exception of a few South East Asian countries, is still struggling to catch up with the technological revolution, and remains a witness rather than a participant.

The Information Age is here to stay and it presents both challenges and opportunity for all. Basically, the Age has three main characters:

1. Discontinuity with the past and the present.
2. Turbulence and change that is ongoing and pervasive.
3. Vast opportunity due to new challenges.

An influential futurist, Marshall McLuhan, foresaw the approaching changes associated with the Age of Informatics, and he understood that this age would bring about a new society characterized by greater connectivity and networking. McLuhan argued that the printed word is being quickly replaced by the electronic medium. To illustrate his point, he coined the phrase "The Medium is The Message," meaning that the electronic medium is non-lineal, simultaneous and interconnected whereas the medium of print is visual, mechanical, sequential and lineal. The non-linear Third Wave thinking compels integration with commitment, participation and decentralization.

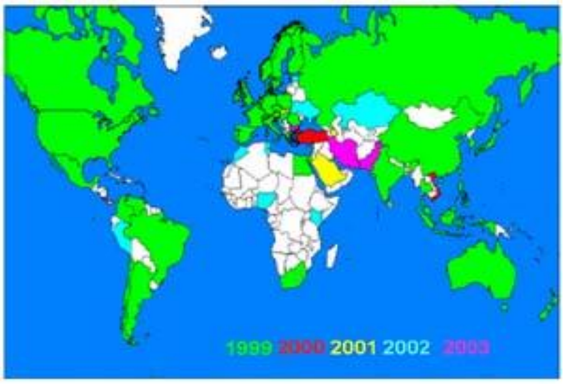
Basically, the major drive force behind this change is the ICT. Recent events have made it brutally clear that the world is interconnected through a complex web of transnational networks. This interconnectivity is an expression of globalization, the pace of which has only accelerated over the last few decades, along with a growing awareness of the world as a whole. Global interconnectivity is also what demarcates the Internet, a medium that allows us to communicate and interact with one another, regardless of physical proximity. And in today's state of global disorder, this ability to connect with people will lead to a better understanding of the world as a whole, for it is through communication that we can discover our shred humanity and destiny.

## 5 THREATS OF IT ON THE MUSLIM UMMAH

### 5.1 Control of Network Infrastructure

Currently, giant conglomerates monopolized the global infrastructure, shutting out local providers in a region or a country. According to Senior Vice President of Operations for Gartner, Bob Hayward, although the countries rolled out their own undersea cables, satellites, etc, to connect to each other, they still depended highly on the US Internet backbone. The limitation, because of different logistics and distribution network among regional countries, was causing all Internet routes to and from each country to transit first to the US for "neutralization and adjustment".

**Case Study No. 1: Concert PLC, a joint venture between AT&T and BT**




Concert PLC, created by two communication market leaders - AT&T and BT, is a shared vision of global communications designed from the bottom up to meet the requirements of all its global customers. Owned equally by AT&T and BT, Concert is a freestanding, USD$10 billion company that combines the innovation, creativity and drive of a start up with the strengths, experience and stability of its parent organizations.

With no single geographic headquarters, Concert has 6,500 employees across 52 locations worldwide. Today, it is the world leader in international traffic carrying 25 billion minutes annually. Concert also connects more than 10,000 customers to more than 1,000 cities in more than 280 countries.

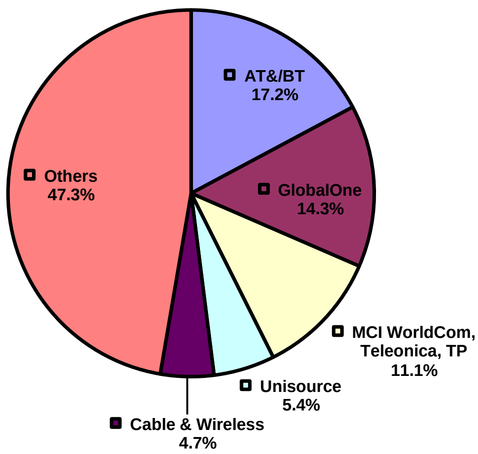
Concert has a network of some 50 distributors in 51 countries covering 80 percent of telecommunications markets as well as a worldwide family of alliances especially in the United States, South American, Europe and Asia-Pacific regions. However, its service does not cover the majority of the OIC countries especially in the African region as one can see from the map.

**Case Study No. 2: Global Crossing Ltd**


Global Crossing Ltd, with a market capitalization of USD$34 billion, was launched in 1997 under the direction of its chairman, Gary Winnick. The company provides telecommunications solutions over the world's first integrated global IP-based network, which reaches 27 countries and more than 200 major cities around the globe. Global Crossing operates throughout the United States, South American and Europe, and provides services in Asia through its subsidiary, Asia Global Crossing. Like case study no. 1, its service does not cover the majority of the OIC countries especially in the African region.

**Case Study No. 3: Emerging Global Alliances (Shares of the International Traffic Market)**

**Total, 1997: 81.2 bn minutes**




*Note: Traffic shares relate to minutes of outgoing traffic from members of each alliance.*
*Source: ITU/TeleGeography Inc. "Direction of Traffic, 1999: Trading Telecom Minutes"*

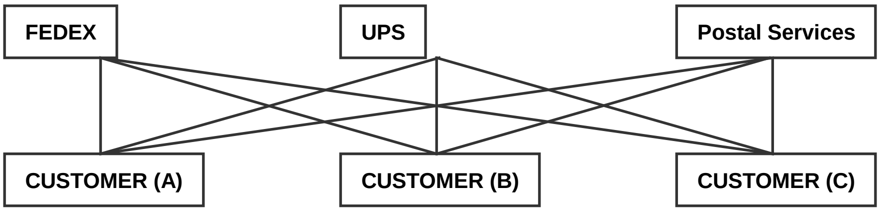
In 1997, the total minutes of outgoing traffic amounts to 81.2 billion minutes. According to “Direction of Traffic, 1999: Trading Telecom Minutes” by ITU/TeleGeography Inc., first to fifth positions are ruled by giant conglomerates, totalling 52.7 per cent, and the balance of 47.3 per cent is by Others, comprising regional and country local providers. AT and/or BT controls 17.2 per cent of the total traffic shares followed closely by GlobalOne (14.3 per cent) and MCI WorldCom, Teleonica, TP (11.1 per cent). In the fourth and fifth positions were Unisource (5.4 per cent) and Cable & Wireless (4.7 per cent). Like case studies 1 and 2, many OIC member countries do not cover the said traffic.

## 5.2 Commerce and Finance Redefined

As we enter the second millennium, we experience one of the most important changes in our lives – the move to an Internet-based society. One of the areas that is significantly affected is the way we conduct business especially how we mange the marketplace and commerce. And sadly, giant conglomerates monopolized the business.

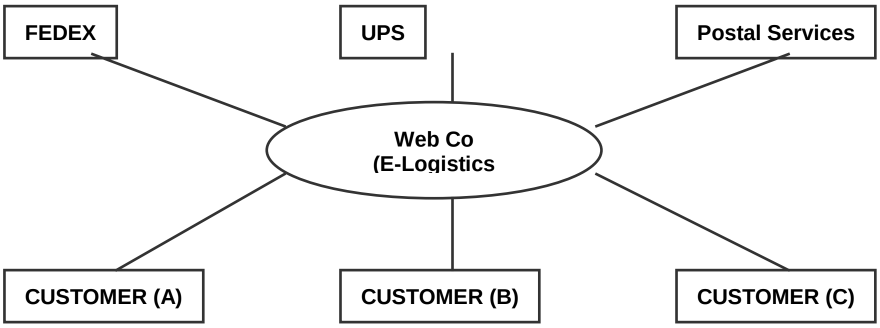
**Case Study: How E-Commerce Hubs Take Control Over Traditional Business Relationship**

**<u>Illustration A:</u>**




In a traditional business, such as the courier service, each company needs to find its own customer base. For example, the Federal Express (Fedex) needs to talk to three different customers. So do United Parcel Sevices (UPS) and the local postal services. It is an expansive and time-consuming practice as seen in Illustration A.

**<u>Illustration B:</u>**




In Illustration B, the three companies need not talk to three different customers on their own as they can appoint an Internet-based company, which specializes in E-Logistics, to handle their customers on their behalf. This could save time and cost for the three companies.

According to Wigand, 1997, it can be found that the widespread of IT, which is characterized by low-cost and high performance, together with the emergence of communication infrastructure and its maturation in bandwidth and speed, has encouraged industry change the way it does business. This change is reflected in what is called the new-generation business: a fundamental transformation that goes against the traditional business paradigm.

However, Muslim countries are generally lacking behind their Western counterparts in the use of Internet and conducting business in cyberspace.

### 5.3 Rise of Borderless Communities

The vast amount of information and the access to Internet for example help us in globalization; but yet it creates the issues of privacy and security. Crimes such as hacking and invading privacy of others have taken place in the use of the Internet. The Internet does make our world seems smaller; yet it creates inequalities in our society, i.e. digital divide. People who cannot afford to access the Internet are deprived from the rights to information and knowledge made available on the Internet.

Like all technology, however, it can be used for both positive and negative uses. It is up to an individual to decide for what purpose does he or she uses the Internet. Among the advantages of the Internet, which can be beneficial to the Muslim Ummah, include:

1. The Internet contains a wealth of information on all kinds of topic that users can access relatively quickly and easily.
2. IT enables Muslims to access Quranic recitation, translation, and *tafsir* (Quranic exegesis), books of Hadith, *fiqh* (jurisprudence), *fatwa* (juridical opinions) and numerous other Islamic databases in various languages online.
3. The *ulama* (religious scholars) and students of Islamic studies are now able to conduct research on a wide variety of Islamic topics, unrestricted by past limitations such as inadequate library resources or prohibitive costs.
4. The Internet serves as an invaluable notice board for the Ummah by storing and providing information on various Islam organizations, places of worship, academic institutions specializing in Islam, student organization, conference, seminars, upcoming community events, entertainment etc.
5. IT is a powerful tool for *dakwah* (Islamic propagation).
6. The Internet is a valuable instrument for networking and exchanging ideas with both Muslims and non-Muslims, and therefore breaking down the barriers between people.
7. The Internet has become a powerful tool for various Muslim political interest groups.
8. The Internet provides a tremendous opportunity for economic growth via E-Commerce.

### 5.4 Global Web Enterprises

The emergence of cyberspace as a significant place to do business is a fundamental shaping force that will transform business and society. Businesses that understand the forces that are at play may ride a wave of opportunity and prosperity. Those that don't may not survive.

In 1991, the Internet has less than three million users around the world and its application to E-Commerce was non-existent. By 1999, an estimated 20 million users accessed the Internet and approximately one quarter of them made purchase online from the E-Commerce sites, worth approximately US$110 billion (OECD, 2000)

However, Muslim countries, especially the OIC member countries, are generally way behind their Western counterparts in the use of Internet and conducting business in cyberspace.

**Case Study: Global Web Enterprises**
Creation of New Wealth Vehicles (Gaining Financial Leverage through Market Gap)

**Figure 1:**

| Net World | Market Value (US$b) |
|---|---|
| Microsoft | 385 |
| Cisco | 395 |
| America Online | 126 |
| Oracle | 180 |
| MCI-Worldcom | 109 |
| Yahoo! | 65 |

| Traditional World | Market Value (US$b) |
|---|---|
| General Motors | 507 |
| General Electric | 480 |
| AT&T | 159 |
| CitiGroup | 195 |
| Coca-Cola | 116 |
| Pfizer | 146 |

*Source: Yahoo Biz, April 14, 2000*

According to Business Week Online, venture capital investments in E-Commerce companies, B2B companies, and Internet content companies peeked in the third quarter of 1999 at US$ 4.8 billion. For example, based on Figure 1, Microsoft is worth US$ 385 billion, which is gained over a short period of time, compared to General Motors (US$ 507 billion), which has been in business since the early $20^{th}$ Century.

**Figure 2:**

| Web Companies | IPO (US$) | Recent Price (US$) | Market Cap |
|---|---|---|---|

| | | | |
|---|---|---|---|
| ARIBA | 16.2 | 62 | 12 |
| Chemdex | 3.2 | 224 | 7.4 |
| CommerceOne | 14.4 | 82.4 | 6.37 |
| FreeMarkets | 3.7 | 54 | 1.94 |
| Internet Capital Group | 35.1 | 38 | 10 |
| Neoforma.com | 0.4 | 52.38 | 10.3 |
| PurchasePro.com | 2.7 | 25 | 0.78 |
| SciQuest.com | 0.3 | 10 | 0.27 |
| VerticalNet | 9.2 | 28 | 2.01 |

Source: Forbes Global, February 21, 2000

**Figure 3:**


**The technology-heavy NASDAQ stock index peaked in March 2000**

While investors are familiar with such fundamental industries like real estate, utilities and financial services, the Internet represented an entirely new and largely unknown universe of investment opportunities. Brash, young, unproven entrepreneurs, who were charged with developing and implementing untested business models, led these related companies. The result was a rash of initial public offerings (IPOs) that defied business and economic logic, as seen in Figure 2 and Figure 3.

### 6 Dominating Physical Space through Virtual Space

In the last two decades, the IT has been reshaping how the world communicates and receives information. Many Muslims have joined the bandwagon in extolling its merits and virtues. Evidence of the eagerness on the part of some Muslims to embrace such technology, has been the proliferation of Islamic sites on the Internet, some of which are devoted to Islamic education and propagation, while others being of a more commercial or entertainment nature.

In competing in the rat race, we need to create our very own:

- **Network Infrastructure**
  Local providers in every OIC member country should cooperate with each other and formed a network to cover the 56 OIC member countries and provide cheap infrastructure for everyone to enjoy the benefits of the Internet. Cheaper bandwidth would also increase the number of information and application providers in an OIC member country.

- **Business Models**
  Once the network infrastructure is intact, it is time to establish web enterprises in every OIC member country, which in turn will develop the economic growth of the individual country.

## 7 THE SHORTCOMINGS OF CYBERSPACE

**3-Cluster Classifications**

| Level of Progress | Number of member countries / Muslim countries | Countries |
|---|---|---|
| **HIGH** | 19 | **Canada**, **USA**, **Japan**, **Singapore**, Kuwait, Bahrain, UAE, **Hungary**, Qatar, Brunei, Lithuania, Malaysia, Lebanon, **Brazil**, Kazakhstan, Surinam, Saudi Arabia, Turkey, **South Africa**, Kyrghyzistan, Jordan, Turkmenistan, Tunisia, Azerbaijan, Oman, Libya |
| **MEDIUM** | 18 | Syria, Iran, Albania, Uzbekistan, Algeria, Tajikistan, Egypt, Indonesia, Morocco, Maldives, Gabon, Iraq, Cameroon, Pakistan, Bangladesh, Mauritania, Nigeria, Comoros |
| **LOW** | 19 | Togo, Djibouti, Sudan, Senegal, Benin, Yemen, Gambia, Chad, Uganda, Guinea-Bissau, Mozambique, Guinea, Sierra Leone, Burkina Faso, Mali, Niger, Palestine, Somalia, Afghanistan |
| **Total** | 56 | |

Note: Bold countries are for benchmarking purposes
The Member Countries' Level of Progress in accordance with 3-cluster classification methods (MIMOS)

What is the Cyberspace? Well, according to Gibson's appropriation in "Neuromancer", cyberspace refers to the dimensionless world of all computer data and electronic communications, i.e. virtual space. Cyberspace does not replace the physical space but may be even more important in the Information Age.

Despite impressive statistics, the Internet penetration and E-Commerce application is happening unevenly around the world. The top 10 world economies represented 80 per cent of the global E-Commerce market in 1999. For example, Red Herring reports less than one per cent of the populations of India, Vietnam, Indonesia and the Philippines are online, and only three per cent of the population of Brazil is online. This strands in contrast to the United States, Canada and the UK, each of which have approximately one-third of their populations online.

Therefore, it is important that we take control of the cyberspace. In doing so we need strategic policy interventions on both global and national levels, which we can do so by combining our efforts and resources in bringing up the Muslim Ummah to be as part as the non-Muslims.

## 8 THE CHALLENGES OF CYBERSPACE

Considering the numerous benefits IT offers to Muslim, why is that so few Muslim countries are developing an indigenous IT capacity? There are a number of shortcomings resulting from the use of IT. Among them are:

- How to accelerate the aggregation of our fragmented resources – Islamic contents, applications and intellectual capitals?
- How to accelerate the establishment of a global infrastructure to provide affordable and equitable access for people in OIC member countries?
- How to aggregate our financial resources to create global enterprises (infrastructure and web enterprises)?
- How to position OIC member countries and the Ummah in the emerging E-World governance platforms?

Muslim countries are among some of the poorest countries in the world. Even in those countries, which have high rates of GDP, there is not even distribution of resources. Although some argue that one of the merits of IT (particularly the Internet) is its low economic cost, for many individuals in the developing world (of which Muslims countries are part), such costs are relatively high.

The acquisition of hardware, development of software, provision of training, maintenance, and R&D requires an extensive outlay financial capital that many debt-ridden Muslim countries simply cannot afford. Due to economic factors, access to such technology is still very much limited to those in upper socio-economic income brackets.

Dr Atta-ur-Rahman argues that there is a growing boundary in the Islamic world “between the have and have-nots, between those who claim to have knowledge and those who posses money.” Apart from Dr Atta-ur-Rahman, Bruce Lawrence, who stated that IT serves to "reinforce global capitalist structures and asymmetries" and further the "marginalization of the already marginalized", was also holding this view. In light of such predictions, Muslims living in Africa and Asia will be among the least likely of its beneficiaries.

And, how do we help our fellow Muslims? Well, for a start, we can create or establish the OIC Member Countries' own cyberspace.

### 8.1 A Proposed Strategic Action Plan

#### 8.1.1 Acknowledging the E-World Existence

Each member country should recognize the strategic importance and urgent need to response to the cyberspace. As a start, a member should establish its own ICT strategic council, and linked to each other to form a network for the betterment of the Ummah.

#### 8.1.2 Establishing a One Stop Center

In positioning the OIC member countries and the Muslim Ummah in the governance of the E-World, it is important that all resources are pooled collectively and the OIC group creates a special platform to address the E-World with the knowledge economy framework.

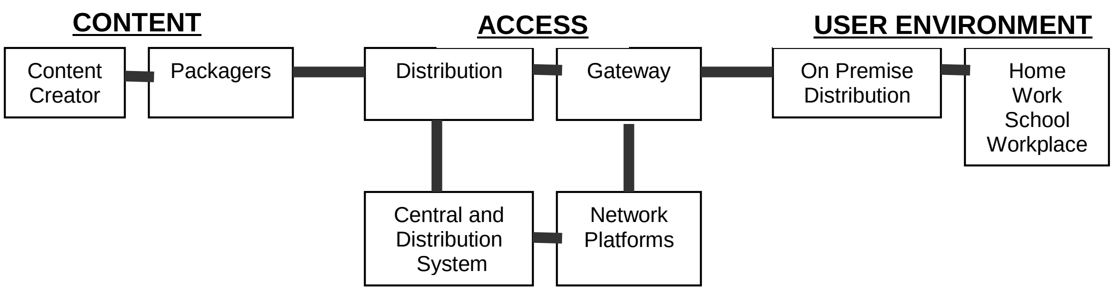
#### 8.1.3 Pooling All Financial Resources

In order to support the spawning of global web enterprises, the OIC member countries need to aggregate its financial resources by establishing an OIC capital market place.

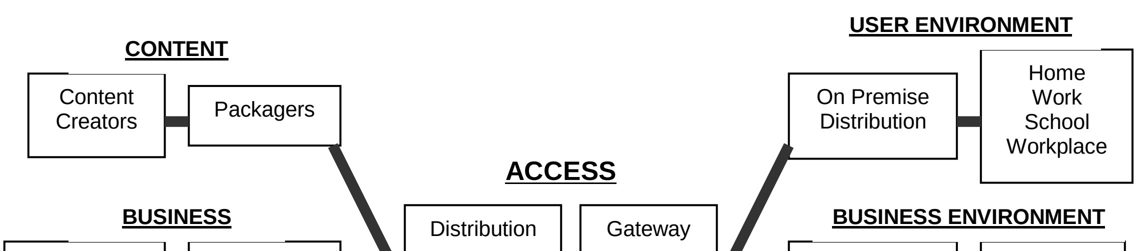
#### 8.1.4 Establishing Own Transnational Entity

It is important that we have our very own transnational entity to create and develop the member countries' global web enterprises. Therefore, we should take advantage of OICnetworks Sdn Bhd, a joint venture between IDB and MIMOS.

### 8.2 OICnetworks Virtual Space



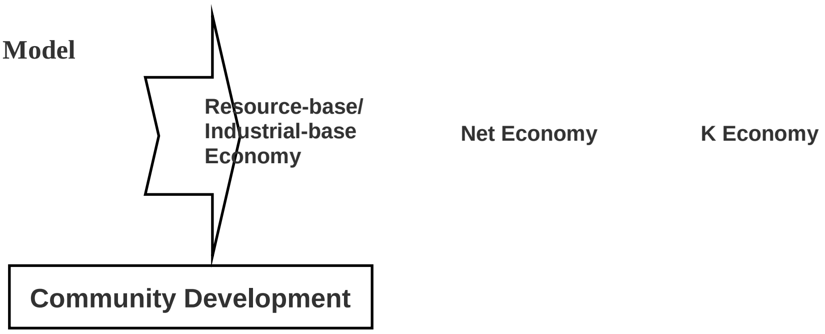

The OICnetworks Virtual Space provides a virtual and physical platform for networking in an effort to bring together Muslim communities within the 56-member OIC. THE OICnetworks Virtual Space is the official portal for the OIC countries and is mandate to undertake ICT projects as well as to work and collaborate with the member countries by having them linked together under one roof for wider reach.



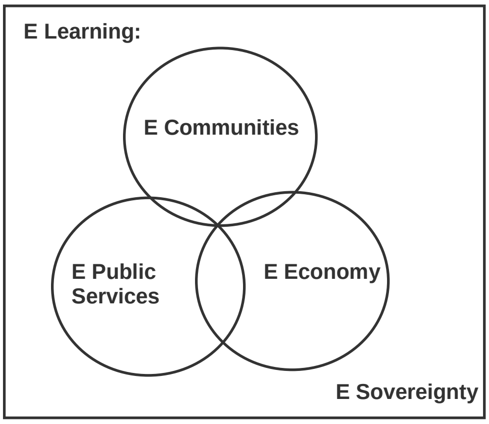
OICnetworks operated together with a wide array of partners that covered a complete integration of connectivity, back-end technology, content and application as well as front-end interface. The portal caters to B2B, B2C, Business to Government (B2G) transactions and other combinations such as B2B2C.

## 9 MANAGING THE TRANSITION INTO THE E-WORLD

**A Malaysian Model**




The foundation of OICnetworks Sdn Bhd is based on Malaysia, en route towards achieving Vision 2020 goals. The knowledge paradigm of development focuses on enhancing the human ability in using information and knowledge as the primary factors of change and value-creation. ICT, being a suit of technologies that can elevate people's ability to learn, to acquire new skills and to exploit new opportunities for self-improvement, serve as a vehicle for the desired empowerment and transformation of a person into a knowledge worker.




At the level of the nation-state, a mass process of knowledge empowerment will theoretically enable a society or nation to leapfrog development stages and achieve knowledge society status where presumably the gap between the "haves" and the "have-nots" would decrease or crease to exist.

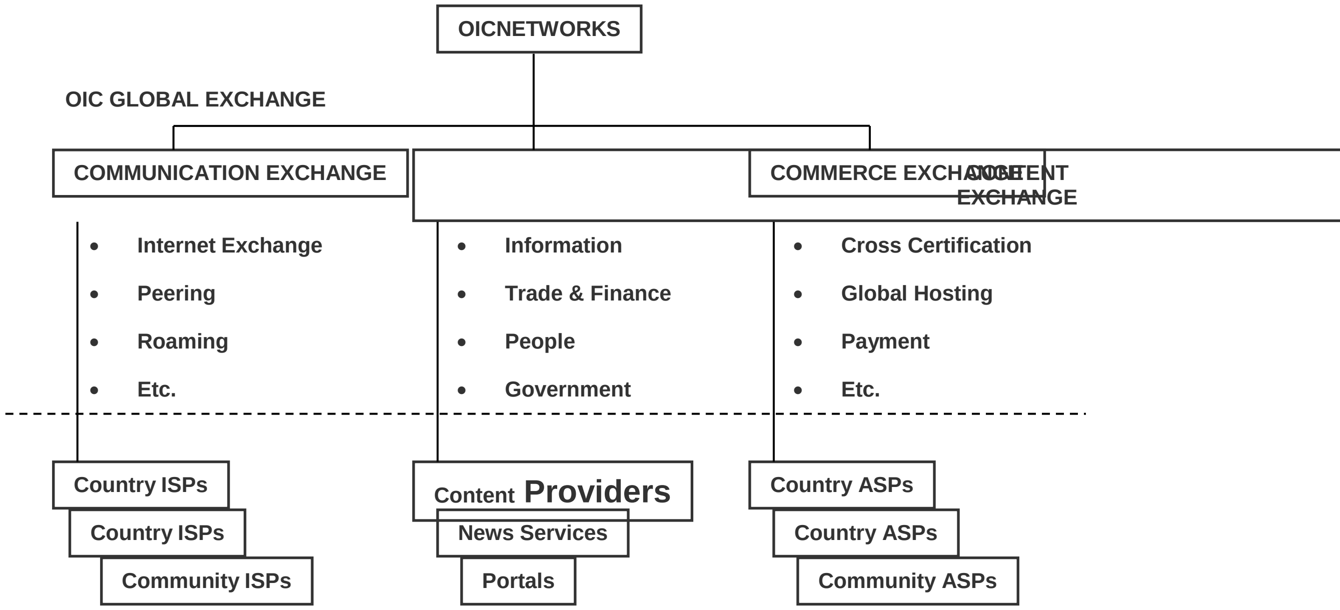
Malaysia has accepted this knowledge paradigm of development as manifested by the creation of the National Information Technology Agenda (NITA) and the Multimedia Super Corridor (MSC). Both are initiatives designed to leverage on the potentials of ICT to create a knowledge society and economy so that Malaysia may prosper in the 21st century and beyond.

Below are the timeline towards Malaysia's knowledge empowerment in the 21st century.

**1994** NITC: Strategic Leadership
**1995** MSC: Testbed of Ideas and Ideals

**1996** NITA: A Framework for Dev using ICT
**1997** DAGS: Community Testbeds
**1998** SJ2005: Testbed for Community and Governance Transformation
**1999** E World: Exploring New Governance Models
**2000** K Economy Plan: To catalyst K Economy

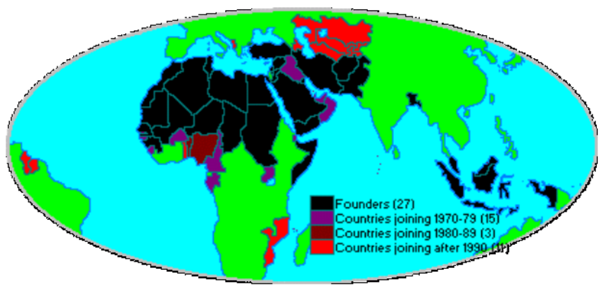
## 10 OICNETWORKS' OPERATIONAL PLATFORM




One of the prime objectives of the project was to establish a foundation from which industry specific portals are built promoting vertical growth. Other aims included creating virtual and physical communities that promote internetworking among OIC members, and providing an exchange to aggregate and package comprehensive OIC related information and services.

The information would specifically focus on OIC member countries. The portal would provide immediate market reach for businesses, local organizations as well as governments, and colloboration and internetworking with various international on-line and off-line establishments.

## 11 TAPPING INTO THE OIC MARKET




| | 1990 (%) | 1997 (%) |
|---|---|---|
| Total Land Area | 23.3 | 23.3 |
| Midyear Population | 18.3 | 20.5 |
| GDP at Current Prices | 6.8 | 8.4 |
| Merchandize Exports | 7.5 | 11.6 |
| Merchandize Imports | 6.2 | 11.2 |
| Arable Land Area | 14.9 | 19.3 |
| Irrigated Land Area | 20.1 | 25.7 |

OIC Member Countries (shaded region) span an area from Central Asia on the north to Mozambique on the south from Surinam on the west to Indonesia on the east.

### 11.1 Total Population of the OIC Member Countries (1995-1998)

| | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|

| | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | 19.66 | 20.37 | 20.89 | 18.80 | Malaysia | 20.11 | 20.55 | 21.00 | 22.18 |
| Albania | 3.61 | 3.67 | 3.73 | 3.79 | Maldives | 0.25 | 0.26 | 0.27 | 0.27 |
| Algeria | 28.06 | 28.57 | 29.05 | 29.80 | Mali | 9.94 | 10.19 | 10.44 | 10.69 |
| Azerbaijan | 7.49 | 7.57 | 7.63 | 7.64 | Mauritania | 2.28 | 2.35 | 2.46 | 2.53 |
| Bahrain | 0.58 | 0.60 | 0.62 | 0.64 | Morocco | 26.39 | 26.85 | 27.31 | 27.78 |
| Bangladesh | 118.60 | 120.60 | 122.70 | 124.80 | Mozambique | 15.82 | 16.18 | 16.54 | 16.92 |
| Benin | 5.41 | 5.59 | 5.83 | 5.78 | Niger | 9.15 | 9.45 | 9.76 | 10.08 |
| Brunei | 0.28 | 0.30 | 0.31 | 0.31 | Nigeria | 98.95 | 101.41 | 103.9 | 106.41 |
| Burkina Faso | 10.20 | 10.78 | 11.09 | 10.68 | Oman | 2.13 | 2.23 | 2.31 | 2.38 |
| Cameroon | 13.28 | 13.56 | 13.92 | 14.31 | Pakistan | 130.30 | 134.15 | 138.15 | 130.58 |
| Chad | 6.71 | 6.90 | 7.09 | 7.27 | Palestine | 2.39 | 2.54 | 2.78 | 2.89 |
| Comoros | 0.61 | 0.62 | 0.65 | 0.66 | Qatar | 0.55 | 0.56 | 0.57 | 0.54 |
| Djibouti | 0.60 | 0.61 | 0.62 | 0.62 | Saudi Arabia | 18.25 | 18.84 | 19.49 | 20.18 |
| Egypt | 57.61 | 59.31 | 64.73 | 65.98 | Senegal | 8.57 | 8.80 | 9.04 | 9.28 |
| Gabon | 1.08 | 1.11 | 1.14 | 1.19 | Sierra Leone | 4.19 | 4.29 | 4.42 | 4.57 |
| Gambia | 1.11 | 1.15 | 1.19 | 1.23 | Somalia | 8.20 | 8.47 | 8.82 | 9.24 |
| Guinea | 7.15 | 7.28 | 7.33 | 7.34 | Sudan | 26.62 | 27.16 | 27.72 | 28.29 |
| Guinea-Bissau | 1.06 | 1.11 | 1.14 | 1.16 | Surinam | 0.40 | 0.41 | 0.42 | 0.41 |
| Guyana | 0.83 | 0.84 | 0.85 | 0.85 | Syria | 14.15 | 14.62 | 15.10 | 16.60 |
| Indonesia | 194.80 | 196.80 | 199.90 | 204.40 | Tajikistan | 5.84 | 5.92 | 6.05 | 6.10 |
| Iran | 68.36 | 61.13 | 60.59 | 61.63 | Togo | 4.06 | 4.17 | 4.28 | 4.40 |
| Iraq | 20.09 | 20.61 | 21.18 | 21.80 | Tunisia | 8.96 | 9.09 | 9.22 | 9.33 |
| Jordan | 5.73 | 5.94 | 6.13 | 6.30 | Turkey | 60.61 | 61.54 | 62.51 | 63.45 |
| Kazakistan | 16.07 | 15.92 | 15.75 | 16.32 | Turkmenistan | 4.51 | 4.57 | 4.24 | 4.86 |
| Kuwait | 1.80 | 1.89 | 1.98 | 2.03 | Uganda | 19.26 | 19.85 | 20.44 | 21.03 |
| Kyrghyzistan | 4.51 | 4.57 | 4.64 | 4.64 | United Arab Emirates | 2.31 | 2.44 | 2.58 | 2.72 |
| Lebanon | 3.01 | 3.08 | 3.14 | 3.19 | Uzbekistan | 22.56 | 23.01 | 23.56 | 24.05 |
| Libyan Jamahiriya | 5.41 | 5.59 | 5.78 | 5.34 | Yemen | 15.37 | 15.92 | 16.48 | 17.07 |
| **Sub-total (A)** | **603.60** | **606.10** | **619.50** | **628.50** | **Sub-total (B)** | **542.1** | **555.82** | **569.86** | **573.83** |
| | | | | | **GRAND TOTAL (A)+(B)** | **1146.00** | **1161.90** | **1189.30** | **1202.30** |

Note: 2000 - Estimated population close to 1.5 billon

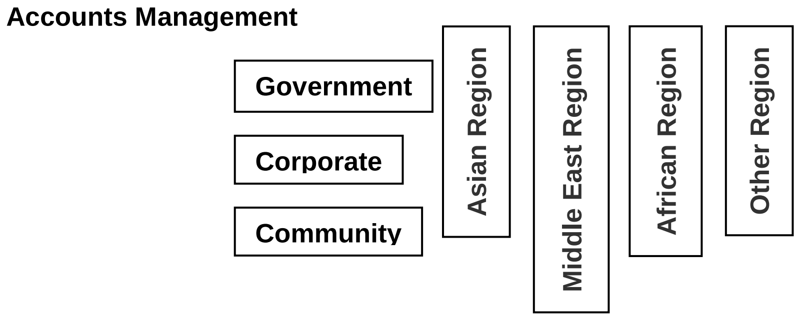
As a group, OIC Member Countries account approximately for one-sixth of the world land area and one-fifth of the world population (nearly 2 billion).

The trade volume within member countries as well as with non-OIC countries amounted to US$ 430 billion a year, but only 10 per cent of this amount was being traded between OIC member countries. OICnetworks' aim is to act as the catalyst in improving business traffic within OIC member countries and with the exchange, it is hoped that the utilization increases by one per cent every year.

### 11.2 OIC Member Countries

| No | Africa | Americas | Arab States | Asia & Pacific | Europe & CIS |
|---|---|---|---|---|---|
| 1 | Benin | Surinam | Algeria | Afghanistan | Albania |
| 2 | Burkina Faso | | Bahrain | Bangladesh | Azerbaijan |
| 3 | Cameroon | | Djibouti | Brunei Darussalam | Kazakstan |
| 4 | Chad | | Egypt | Iran (Islamic Republic of) | Kyrgyzstan |
| 5 | Comoros | | Iraq | Indonesia | Tajikistan |
| 6 | Gabon | | Jamahiriya | Malaysia | Turkemenistan |
| 7 | Gambia | | Jordan | Maldives | Turkey |
| 8 | Guinea | | Kuwait | Pakistan | Uzbekistan |
| 9 | Guinea-Bissau | | Lebanon | | |
| 10 | Guyana | | Morocco | | |
| 11 | Mali | | Oman | | |
| 12 | Mauritania | | Palestinian Authority | | |
| 13 | Mozambique | | Qatar | | |
| 14 | Niger | | Saudi Arabia | | |
| 15 | Nigeria | | Somalia | | |
| 16 | Senegal | | Sudan | | |
| 17 | Sierra Leone | | Syrian | | |
| 18 | Togo | | Tunisia | | |
| 19 | Uganda | | United Arab Emirates | | |
| 20 | | | Yemen | | |
| | **19** | **1** | **20** | **8** | **8** |

### 11.3 Managing the OIC Member Countries

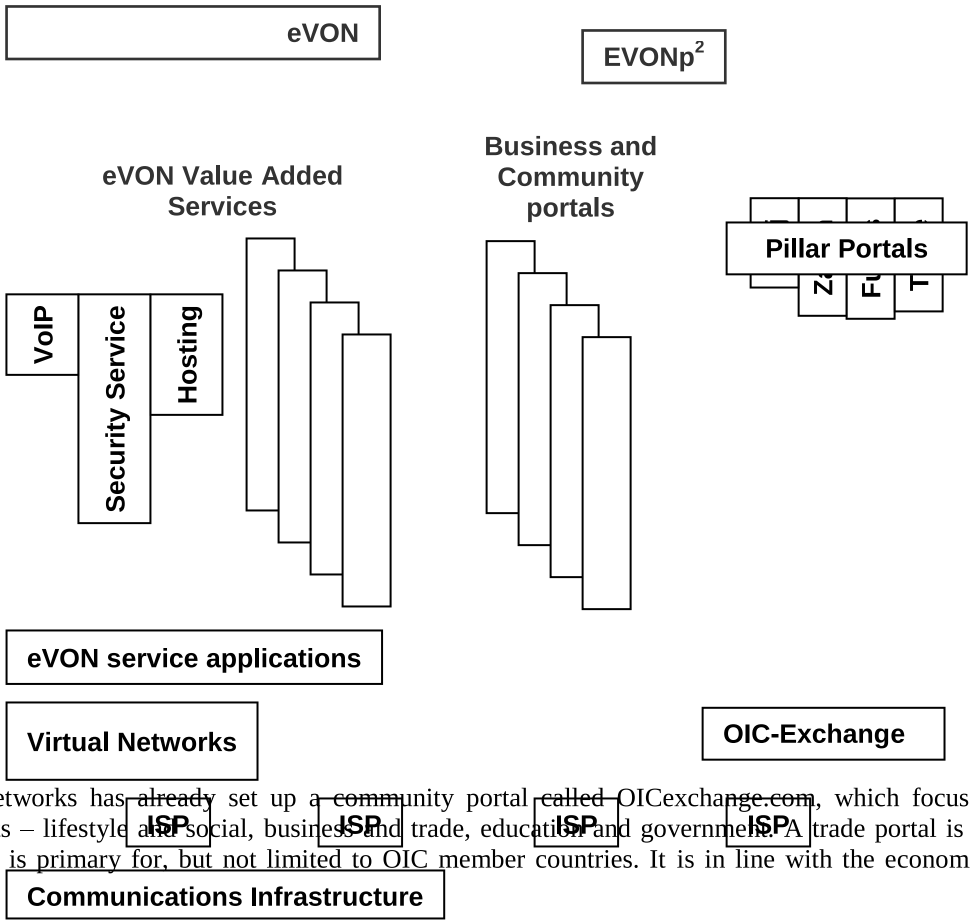



In achieving its target market, OICnetworks has divided the regions into four: Asian, Middle East, African and Other, and the target groups into three: Government, Corporate and Community. This way it is easy to identify the special needs of each individual group or region.

## 12 OIC's One Stop Center

At the moment, there is the digital divide issue among the OIC member countries. A roadmap has been developed to find ways to improve IT network connectivity and context among members, and also to review their growth plan and IT planning. OICnetworks has focus on efforts to beef up the IT and network infrastructure of each country to partnerships and alliances with industry players. Among its efforts is establishing alliances between Internet Service Providers (ISP) and telecommunications companies to agree to certain standards.

By having all OIC members use the same standard, it will make it easier to conduct business electronically or for transfer of technology between member countries. OICnetworks has come up with an OIC standard connectivity and content layer to enable the creation of an electronic marketplace for member countries.




Note: eVON = electronic Virtual OIC Networks, $eVONp^2$ = eVON pillar portals

OICnetworks has already set up a community portal called OICexchange.com, which focuses on four key aspects – lifestyle and social, business and trade, education and government. A trade portal is in the pipeline, which is primary for, but not limited to OIC member countries. It is in line with the economic globalization process that is currently taking place. The trade portal will cater to B2B, B2C, B2G transactions and other combinations such as B2B2C. Other portals in the making include hajj, zakah and funds.

OICnetworks is also targeting to have at least 30 per cent of OIC member countries connected to the Internet within four years as it is working towards establishing a point of presence in terms of Internet infrastructure. It is expected within the next few years, OICnetworks will be connected to major ISPs in member countries.

OICnetwork is also expected to interlink member countries and facilitate improved flow, exchange and dissemination of information between them. Besides infrastructure and connectivity, OICnetworks also offers consultancy services.

## 13 CONCLUSION

Development using ICT in the Information Age must be integrated and managed. OIC and its member countries need to leverage on their people and their knowledge economy; and be ever ready to respond and adapt to changing situations. OIC and its member countries are ready to formulate policies and strategies for transformation. It is simply a question of what, why, how and when, not if. OIC and its member countries to consider the proposed strategic action plan.

# Development of the IT Sector: The Indonesian Perspective*

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## 1 ABSTRACT

Indonesia is using a two-pronged approach to gain benefit from the global development in the IT sector. First, by adopting the technology and exploiting it to make its service sector globally competitive, and second, to gear its manufacturing sector to export software and hardware products used in the application of information technology, benefiting from the surge in global demand for IT equipment. The development of the physical infrastructure as a platform for the use of IT is an important part of the program. Special considerations have to be taken for its design because of the specificities of Indonesia regarding its geography, population, ethnic and cultural variety. Research and development activities in IT are conducted at major universities, research institutes and industry, where the majority of activities are directed towards the application side, and less to the theoretical side. The demand for human resources in IT is large and the education and training institutions are reacting positively. A new phenomena is the demand for IT professionals coming from abroad, mostly from the US and Europe. For a technology to be useful, it should give a positive contribution towards the socio-economic-cultural life of a society. Although the use of IT in various sectors of the society is already in progress, its real benefit is not yet apparent in all sectors, but a clear benefit is coming from the manufacturing sector which is working overtime to satisfy the global need of IT equipment.

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* A short roundtable presentation.

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## 2 INTRODUCTION

Information Technology (IT) has been recognized as one of the major technology enablers that will fuel the development of the world to new heights. The reason is its wide impacts in influencing how individuals, governments, and other small and big social organizations interact and try to develop a new formula for creating a non-zero-sum game using this new tool. Its global nature, and the competitive advantage given to the party that can master this tool, whether it is an individual, government or other social organization, has triggered a fervent activity at all levels to capture its potential. Indonesia is not an exception.

It is using a two pronged approach; first, by adopting the technology and exploiting it to make its service sector globally competitive, and second, to gear its manufacturing sector to export software and hardware products used in the IT industry globally, benefiting from the surge in the global demand for IT equipments. A National Telematics Agency has been instituted to coordinate the use of the technology. Use of modern IT in various service sectors such as banking, commerce, and health is growing, while the numbers of Internet Service Providers (ISPs) and Internet users are increasing. Although these numbers are all indicating a positive growth there is still doubt whether IT is already giving a positive contribution towards the Indonesian economy, or is only an expensive hobby of the few who can afford it.

## 3 IT IN INDONESIA: DEVELOPMENT OF THE PHYSICAL INFRASTRUCTURE

Indonesia started early in the development of its IT infrastructure. Special considerations have to be taken regarding its design because of its unique socio-geographical structure, namely as a maritime continent covering three time zones and consisting of a conglomeration of 17000 small and big islands a few degrees north and south of the equator, with a population which is the fourth largest in the world and various ethnic and cultural backgrounds.

In the early 70's when communication satellites started to make their presence felt as a reliable transmission media, Indonesia saw its potential, and launched its first domestic satellite, Palapa A, in 1976 for communication and education purposes. Since then, it has been followed by Palapa generation B, C, and D. These satellites are launched and operated by Indosat, one of the Indonesian public enterprises. Other companies, public and private, are joining the satellite bandwagon, and launching their own satellites, e.g. Garuda's PSN (Garuda is the national airline of Indonesia). The whole archipelago is presently connected via satellite, optical fiber, terrestrial microwave, coaxial cable, and wires, for telecommunication, TV and radio.

With the increasing demand for bandwidth due to IT, the public telephone company, PT Telekom, is building added capacity by using the ring-of-ring structure. A broadband ring is established on the big islands and between several smaller islands in a region, and these rings are then connected again in a national ring. Broader bandwidths are established in metropolitan areas, depending on demand. Most of the connections to homes are done with normal telephone cables. Subscriber TV is distributed via satellite and coaxial/fiber optic cable. These links are now being increasingly used for symmetrical or asymmetrical Internet services. Several sectors of the Indonesian society are presently using the network.

The government sector has traditionally been using their own network in addition of using the public network. It is expected that with the increasing demand for bandwidth by the government, it is more economical to use the services of the public network offered by the telecommunication service providers. Big users from the government sector are the National Bureau of Statistics, harbour and airport services, National Agency for Meteorology and Geophysics, besides for normal day-to-day operation of the government itself.

The education sector is also continuously requiring more bandwidth because of their need to access information centres for research and teaching activities. The Open University has been using this information network to conduct degree courses for a number of years already.

The health services sector is also a potential user of IT. The hierarchical structure between the rural areas and the population centres to conduct medical services to overcome the lack of resources, will make broadband telemedicine a more valuable tool to improve the system.

The banking sector has been traditionally a big user of satellite transponders to link their branch offices with the central office, and their demand is continuously rising. New on-line services are continuously introduced by the banking sector together with the trading sector, such as e-commerce.

Rather specific for Indonesia is the demand for bandwidth by the forestry and mining industry for their day-to-day operation, and to link their relatively affluent communities, usually located in remote areas, with the rest of the world.

## 4 SCIENTIFIC DEVELOPMENT ASPECTS OF IT IN INDONESIA

Centres for R&D in IT are located at major universities, research institutions and industry. The Directorate General of Higher Education, The State Ministry of Research and Technology, and the Ministry of Trade and Industry, are all putting R&D activities in IT as a priority. The Directorate General of Higher Education has a program called University Research for Graduate Education (URGE) partially funded through a loan from the World Bank, where IT has a strong presence.

The main objective of this program is to keep the university staff up to quality, and producing researchers for the other institutions. Because most of the research in IT is conducted by the engineering schools, the tendency of the approach is applicative and less in basic research. Pick-up by the local industry of the results of this applicative research has to be improved, although some local industries are starting to market the products of this R&D activity internationally with considerable success.

Based on a recommendation by the National Research Council, the State Ministry of Research and Technology has declared the field of Information Technology and Microelectronics as one of 11 priority areas. Three programs in this field are funded by the State Ministry, whereby two programs are peer reviewed and initiated by the researchers covering basic research and another one covering applied programs where participation of industry is required.

In this program, funding is done jointly with industry, where the Ministry is funding the development work, engineering is funded jointly with industry, while production is funded fully by industry. If these two activities are more inspired by small isolated groups in laboratories and industry, a third program funded by the State Ministry is considered more strategic and national in nature. It is a top-down activity linking institutions and ministries to form a stakeholder group. National capability roadmaps and milestones are formulated together with the stakeholders to achieve a specific goal. This activity is presently centred around the Bandung High Tech Valley (BHTV), to support an initiative of the Ministry of Trade and Industry to reach an export target of 30 Billion USD in the year 2010 (presently at a level of about 4 Billion USD annually) coming from the export of products and technical services by the Information Technology and Microelectronics (ITME) industry.

Since Indonesian companies have a lot to learn regarding international markets and technology, most of the production and export will be conducted by international companies operating in Indonesia through the Foreign Direct Investment (FDI) scheme. The link between the strategic research activity and the Bandung High Tech Valley is designed to help the Indonesian companies to link themselves with their international partners and make Indonesia more attractive for FDI.

The method of approach is the formation of socio-economic-technology clusters of firms and organisations to achieve technology targets within the broader socio-economic framework.

If the weakness of the Indonesian ITME companies is their international exposure, the weakness of the R&D institutions in Indonesia is their inability to do engineering, which is bringing their functional prototypes, as a product of their R and D activity, to a production prototype ready for manufacturing. Filling these gaps at company and R&D institution level while following a strategic national technology capability roadmap, are presently the priorities of the Strategic Research Initiative within the BHTV project. To facilitate the creation of small and medium scale technology companies and bridging the gap between research and industry, companies doing technology insurance and venture capital funding have been created.

Another weakness of the present Indonesian R&D in IT is the lack of basic research. If basic research in Microelectronics, at least at the material level, is conducted in the Physics Departments of the big state and private universities, a very minimal activity is conducted by the Informatics Departments regarding research in Information Science, studying Information Theory at the theoretical/philosophical level of Norbert Wiener and Claude Shannon.

From the users of Information Technology, who are mostly coming from the Socio-economic discipline, R&D activities are focused on two areas, namely the problems of cyber crime and cyber law, and studying the new approach in management, called knowledge management, where information is only part of knowledge. Research activities in these areas are conducted in the industrial management and law departments of major universities.

## 5 EDUCATION AND TRAINING OF IT USERS AND PROFESSIONALS

Computer literacy and IT literacy have been very often taken as synonymous. Although the ability to operate computers are essential these days, but this is not enough. The awareness of the importance of information, and being able to use it to improve the value of products and services, besides having the ability to increase the value of the basic information itself, is essential for IT professionals and the general public as well.

From this point of view, it is important to educate two groups of people, namely those who will be able to see the potential of IT and use it as a tool to give added value to whatever activity they are engaged in, and those who are able to use and produce the essential tools, nowadays mostly microelectronics based hardware and its associated software, to assist those who want to utilise it.

The education and training of the first group of people, namely those to be made aware of the potential of IT and to be made conscious of the value of information, are much more difficult compared to the second group of people, who are mostly technical people, and not necessarily having managerial and entrepreneurial skills. Short courses conducted by professional groups are catering for the managers and entrepreneurs and usually based on a fee basis, while government subsidised short courses are organised for people coming from small and medium scale enterprises. The courses usually contain case studies of productivity improvements gained by using IT and new opportunities created by the new technology, especially for global marketing using virtual presence, and the potential of multi media techniques via the Internet.

The education and training of hardware and software people who are going to do the total spectrum of activities starting from research, development, engineering, manufacturing, trading, operating and maintaining, and finally financing, are conducted at already existing education and training institutions.

According to presently existing demand projections for people with medium and high level IT qualifications, Indonesia will need a total of about 350,000 during the coming ten years (2010), which means an average of 35,000 per year. These numbers were derived from projections made by the Ministry of Trade and Industry, planning for a yearly output of the IT industry of about 8 Billion USD in 2010.

The demand for IT professionals from outside Indonesia has also increased, especially from Europe and the US. The required skills are usually very specific, working in a team to solve a certain problem, using certain tools in a specific environment.

## 6 SOCIO-ECONOMIC ASPECTS OF IT IN INDONESIA

Indonesia is urging its people to use IT with the expectation to benefit from the IT revolution in the form of an improvement in its global competitiveness in providing goods and services. This competitiveness will create employment and income for the people, which will improve their general welfare. If the number of Internet subscribers is an indication of the penetration of IT, Indonesia presently has only about 500,000 subscribers with a sharp increase expected in the near future.

This is indicated by the sharp increase of already licensed Internet Service Providers (ISP), about 100, and 50% already fully operational. Figures for the number of stationary and mobile telephones for Indonesia are also still low compared to the total population of 210 million, but since the densities in the metropolitan areas are already high, it is expected that a critical mass could be reached in these areas for IT to be effective as an economic factor.

Indonesia also expects to benefit from the sharp rise in the demand of microelectronic equipments due to the boom in IT. An important ingredient which triggers the boom in computers and telecommunication, and hence IT, is the huge body of knowledge and industrial investment in microelectronics. The development in microelectronics will continue to improve the performance of electronic equipments, to make it smaller, more energy efficient, faster signal processing, and less expensive. The application of electronic technology for computers and telecommunication and afterwards using it to give added value to information, is just one application of microelectronic technology, although this particular application seems to be growing in importance with time.

Indonesia has traditionally been a producer of electronic equipments, subassemblies, and components, and is planning to make the Information Technology and Microelectronics (ITME) equipment manufacturing industry a major contributor of its economy. This industry is now number 3 in its export value outside oil and gas, and exceeded only by the export value of the garment and wood industries. However, because of the much faster growth of the export of ITME products, it is expected to be number one in the near future. The investment in this industry is mostly through Foreign Direct Investment (FDI) and the activities are mostly in the form of assembling, testing and packaging.

These types of industries are still very labour intensive and produces moderate to low local added value (about 20%). Indonesia is vigorously pursuing these types of industries because of its high social-economic value, high ITME manufacturing content, but low ITME technology content. To make Indonesia more attractive for investment in the ITME industry, a special effort is launched to develop the supporting industries and the preparation of the human resources. The presence of these factories producing IT related products, although mostly for export, will support the domestic use of IT to make the domestic economy more competitive. This export drive in IT related products should be accompanied by a complete liberalisation of imports of IT equipments which is still lagging behind.

Foreign direct investment looking for comparative advantages in cheap labour, have the tendency of being “foot loose,” and trying to relocate to another country where labour is more competitive. To avoid this, the host country together with the investing industry, should try to build “roots” for the industry, to persuade it to do a long term investment, to make the work force more productive so that its welfare can be improved.

Also in relation with the increasing importance of IT, the handling of this industry should not be purely bureaucratic and based only on investment or export considerations, but also involving the professional and scientific/academic communities in the process.

## 7 CONCLUSION

Although the promise of the digital economy is bright, the socialisation of modern IT as a tool to produce added value is still not well established in the Indonesian society. Maybe still in question is the "cost benefit ratio" of this new digital tool, which is also a function of the familiarity of the user with the new tool to fully appreciate its total potential. This strengthens the argument that the most strategic investment to be able to reap the benefits of the IT revolution is in education. Again, it should be the right education.

# Development of IT Sector:
# The Jordan Perspective

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## 1 ABSTRACT

The IT sector is Jordan is well developed especially in banking sector. The government sector has come a long way with 92% of its organisations introducing IT in their operations The National Information System (NIS) of Jordan went on-line in 1996. Information on several sectors is available on-line including economy, agriculture, labour, health, tourism, industry.

The telecommunication sector is developed a great deal in the last two years, especially in data communication area. Analog and ISDN services are available, digital leased lines with 64kpbs up to 2Mbps are also available.

The paper include several statistics and indicators related to IT sector in Jordan.

Internet came into Jordan in 1995 and since then, twenty ISPs were licensed, 10 of them are operational. There are several ongoing initiatives aiming at developing the IT sector n the private and public sectors. This paper addressed the following initiatives: E-government, REACH, Administrative Reform, and SDNP.

## 2 IT IN JORDAN

### 2.1 IT Capacity

It is estimated that there are 85,000 computers in Jordan, with a penetration rate of 1.7 per 100 inhabitants.

Introduction of IT in schools started 15 years ago, and to date all secondary schools are equipped with computer labs utilised in the teaching process.

The total IT market in Jordan is estimated to be $60 million per year, 73% of the estimated market is hardware and 27% software.

To enhance the development of IT industry and promote investment, a modern Intellectual Property Rights law is in force. This together with the abolishment of all customs duties related to IT imports, and investments promotion laws that are in place, provide appropriate environment for IT industry development.

## 2.2 IT Statistics & Indicators

The following statistics and indicators (Figure 1) are based on 86 government institutions (public universities and schools are not included)

**Hardware**

| Item | Qty |
|---|---|
| Enterprise Server | 40 |
| Departmental Server | 83 |
| Group Server | 157 |
| PC | 6888 |

**Software/Operating System**

| O.S | #of institutions |
|---|---|
| Unix Based | 47 |
| WINDWS NT | 43 |
| NOVEL | 21 |
| WINDWS 95/98 | 86 |
| Others | 8 |

**Database Management Systems**

| DBMS | #of institutions |
|---|---|
| ORACLE | 48 |
| INGRES | 9 |
| INFORMIX | 4 |
| FOXPRO | 34 |
| MS-SQL | 13 |
| Others | 15 |

**Applications**

| Type | % of institutions |
|---|---|
| Administrative | 82 |
| Client Service | 76 |

**Figure 1. Some IT Statistics and Indicators for Jordan**

## 2.3 Human Resources in IT

There are around 10,000 personnel working in IT field in the country, with 2,300 new graduates form universities and colleges going into labour force each year. However there is a shortage in critical skills such as network engineering and management, system engineering, quality control.

The problem of brain drain is quite evident with a turnover rate estimated at 30-40% especially in the last 3 years. 17 out of 20 universities grant the BSc degree in IT related fields, in addition to 15 colleges that grant the diploma in system analysis and programming.

## 2.4 Internet

The National Information Centre introduced Internet to Jordan in October 1995. Since then, the culture has spread in both the public and private sectors (Figure 2).

| | | |
|---|---|---|
| No. of licensed companies | = | 20 |
| No. of ISP (operating) | = | 10 |
| No. of international links | = | 10 |
| No. of leased line connections | = | 120 |
| No. of account holders (Dial-up) | = | 35,000 |
| Internet Penetration Rate | = | 0.7/100 |
| No. of organisations with web presence | = | 1,000 |
| No. of Internet cafes | = | 160 |

**Figure 2.** **Internet Indicators**

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# 3 TELECOMMUNICATIONS

## 3.1 General

The Telecommunication sector in Jordan has developed a great deal in the last few years. Networks are becoming widely used in all sectors. LAN's are considered a common place, however , WANs are constantly being developed, yet, value added services are still bellow the expected level.

Jordan Telecommunication Company established recently as a result of the commercialization of the Telecommunication corporation, still has a monopoly on basic telephony services. Never-the-less, other communication services are open to the private sector, namely, mobile telephony, paging, public pay phones and data transmission. A regulatory body was established in 1995 to regulate and monitor the telecommunications activities in Jordan , namely the Telecommunication Regulatory Commission.

## 3.2 Voice communications

In- so-far as telephone lines are concerned the rate per 100 inhabitants is around 11.6 and is expected to reach 20 by the end of 2003. Most exchanges have been upgraded/replaced by digital ones, and fiber optics links (3000 km) have been installed.

There are two licensed Mobile telephone operators, only one is operational with a penetration rate of 2%. Two paging service operators and two public telephone operators are well established in the Jordanian market. It is important to point out that all the above operators are 100% private sector companies.

## 3.3 Data Communications

As for data communication and networking, the situation is developing at a fast pace. Apart from the few private WANs that have been established in the public and private sector, twenty service providers (SP) have been licensed to provide data communication services. These SPs are concentrating mainly on Internet services (ISP) with some providing X25 communication services and high speed local data transmission services.

| Service | Penetration Rate (100) |
|---|---|
| Fixed Telephony | 12.0 |
| Mobile | 1.75 |
| Paging | 5.4 |
| Internet (Dial-up) | 6.68 |

**Figure 3. IT Modes Penetration Rates**

## 4 NATIONAL INFORMATION SYSTEM (NIS)

In 1993, the government of Jordan issued a decree to establish and manage an integrated National Information system, linking information collecting and generating centres in the public and private sectors, and co-ordinating their activities through national networks. Developing and processing information, ensuring its flow to users, so as to enhance the management and organisational effectiveness, thus promoting socio-economic development.

NIS is a totally distributed system with well-established linkages. Information is classified into sectors and information-generating centres are identified in each sector where data is collected, generated and processed.

Information centres within each sector are grouped in one cluster, with one centre acting as a focal point. Detailed information remains at the sources, while aggregate information is transferred and kept at the focal point. Connectivity among centres of one cluster constitutes a sub network as part of national network, which is the basic component of NIS.

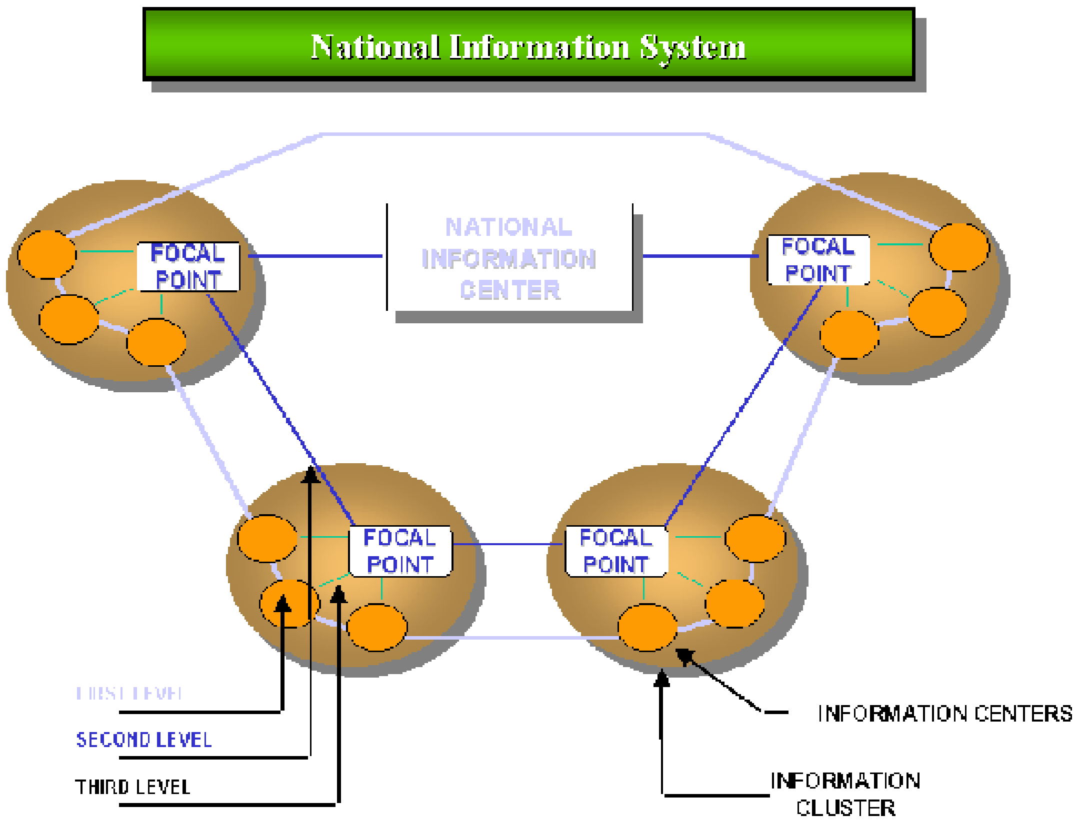


**Figure . National Information System Set-up**

The National Information Centre (NIC) is entrusted with tasks including the development of information sources in co-operation with concerned institutions, setting up unified procedures and standards, providing access to timely information, networking related information centres, manpower development, promotion and development of the information sector in Jordan so as to achieve its goal of establishing NIS.

Within the framework of the NIS, national sectoral committees have been established by NIC to work on sectoral information strategies and activities, prevent overlapping and contradictions, utilise unified classification and coding systems and facilitate the exchange of information among their institutions.

Sufficient progress has been made to justify implementation of action plans in the following sectors: Labour, Economy, Industry, Agriculture, Social Affairs, Health, Tourism, Housing and Population.

NIS went online in 1996. Since then 80% of the public organisations have been linked to the NIS network and have established web sites.

### Table 1. Examples of available information

Housing and population: Settlements, population, demography, housing, public establishments, statistics. *Source:NIS.* For more information, please visit http://ww.nic.gov.jo

| | |
|---|---|
| Economy: | National accounts, public finance, monetary, external trade statistics, investment, prices, economic indicators. |
| Labour: | Distribution of organization, labour force, job seekers. |
| Industry: | Industrial organization index, industrial cities, industrial loans, investment climate, exhibitions, statistics |
| Agriculture: | Crops, irrigated areas, animal, agricultural products. |
| Social affairs: | Local community development projects, pension and social security, women and childhood, poverty, unemployed, average income, living cost. |
| Tourism: | History of Jordan, tourist sites, museums, hotels, travel agencies, statistics. |
| Health: | Health centers, health system, statistics. |

# 5 ELECTRONIC GOVERNMENT

## 5.1 General

The world is experiencing an Information knowledge revolution that is fundamentally transforming the way in which business, citizens and government operate and interact. Advances in information and communication technologies-especially the Internet- have sharply driven down business operating costs and are allowing small firms to compete on an even basis with large firms in business-to- business e-commerce. Individuals are also gaining substantial benefits through easy and efficient access to information, services and goods online. Governments too are embracing the Internet and associated technologies to enhance service delivery.

Electronic government is being adopted by governments world wide as a means of improving their services to business and citizens, promoting economic and social development and enhancing the effectiveness and efficiency of government operations. E-Government is a means to achieve citizen- and business-focused governance.

## 5.2 The E-Government initiative in Jordan

The E-Government initiative in Jordan was discussed in the context of wide–ranging changes in economic policy and governance concepts, in pursuit of His Majesty King Abdullah II’s vision of transforming Jordan into a knowledge-based economy, and streamlining government to improve public services and government's performance.

An e-government task force was formed from leading experts drawn from the private and public sectors to develop an e-government strategy for Jordan. The task force received technical assistance from an international and Jordanian consulting team.

### *5.2.1 Vision*

The long-term vision for e-government is to create a society where Electronic Government is a major contributor to the economic and social development of Jordan. E-government will empower and benefit all the society:

- Through access to government information and continuous education, whether in business or as citizens;
- By providing equal opportunity for all to reach their fullest potential;
- Through improved and new public services which would provide information, improve communication and enable effective and simple transaction between government and citizen;
- Delivered in a variety of ways to meet different individual needs throughout Jordan and abroad;
- By a dynamic modern public service through partnership with various public sector agencies and with business and citizens;

To realise the vision of the e-government, the task force will focus on four major areas of activity:

- Government-to-Business (G2B)- encompassing a broad range of transactions and interactions including procurement, taxation, licensing etc.;
- Government-to-Citizen (G2C) –Spanning the "birth to death" range of citizen services including civil registration, health, education, and municipal services, among others;
- Government-to-Government (G2G)-encompassing a variety of intra-governmental transactions such as inter-agency payments, permits, etc.; and
- Creating the legal, institutional, infrastructure and management framework to pursue the strategic direction.

The move to e-government will enable:

- Businesses to improve their effectiveness and efficiency by obtaining information from a variety of government sources in a format which is focused on business needs and by reducing the burden and cost of complying with government legislative and administrative requirements and simplifying the underlying government processes and procedures. This may be achieved by providing business with a single portal on a range of business related e-services, crossing traditional organisational boundaries and enabling the single input of information to enable transactions to be completed;
- Citizens to have access to simple and clear information, set out in ways which are relevant to the citizen's view of everyday life, thus enabling them to save the time, effort, cost and also frustration of dealing with Government;
- Government to improve its internal communication by enabling government staff to know more clearly who is responsible for what and where and to receive and sent internal communications on-line, and integrating databases and networks.

#### *5.2.2 Building Blocks*

To achieve the overall goal and objectives, the strategy will propose major building blocks of work divided into realistic, achievable and affordable projects, which will yield direct results for government, business and citizens. These are:

- E-Service application identification (through pilot projects);
- Technology infrastructure development;
- Legal and regulatory framework development;
- Education reform framework development; and
- Management arrangements for developing and implementing the strategy.

# 6 IT-BASED PUBLIC SECTOR ADMINISTRATIVE REFORM

## 6.1 General

In July 2000, the Public Sector Reform Committee prepared a report and presented it to His Majesty, King Abdullah II and the Economic Consultative Council.

The report addressed five major areas:

- Efficiency and Effectiveness of the government services;
- Finance administration;
- Manpower development;
- Transparency issues;
- Information Technology;

The following section will focus on the Information Technology element of public sector administrative reform.

### 6.2 Information Technology

#### *6.2.1 Objectives*

- Computerisation of administrative and financial information systems;
- Connecting public institutions through high-speed digital networks;
- Facilitating information exchange among public institutions;
- Simplifying procedures and enabling transactions to be performed electronically;
- Improving manpower capabilities and skills in the field of IT;
- Creating IT awareness in the Jordanian society;
- Utilising IT in economic and social sectors; and
- Publishing up-to-date information.

#### *6.2.3 IT programme*

- Developing a national plan for IT in the public sector;
- Upgrading ICT infrastructure;
- Manpower Training in IT related fields;
- Replacing manual procedures with electronic transactions where possible;

- Enabling citizen to access government information and services through the government network;
- Supporting the National Information System;

#### *6.2.4 Responsibilities*

**<u>National Information Centre (NIC)</u>**

- Preparing a computerisation master plan for public organisations;
- Assessment of Communication infrastructure, and proposing a national network to link all government institutions;
- Preparing a concept paper for Decision Support Systems and suggesting pilot projects; and
- Development of a national labour information system.

Telecommunication Regulatory Commission, Ministry of Planning, Ministry of Education, and other concerned organisations received a clear statement identifying what to do within a specific period.

## 7 REACH INITIATIVE

In its efforts to develop the IT sector in Jordan, the Jordan Computer Society with local and international expertise devised a national strategy for IT called REACH initiative framework that embraces actions in terms of:

- Regulatory Framework;
- Estate (Infrastructure);
- Advancement Programs;
- Capital; and
- Human Resource Development.

The overall goals of the Reach initiative include developing an internationally competitive IT industry in Jordan, one that attracts both foreign and local investment, generates high-value jobs, and produces substantial levels of experts in the near to medium term. The strategy's implementation will facilitate modernisation of both the government and the private sector. Finally, the long-term goal is to position Jordan favourably within the knowledge-based economy of the future.

Achieving these goals will require the sustained implementation of a range of actions in a number of inter-related areas. The plan consists of focused and time-bound actions with six strategic thrusts:

- IT Industry Development;
- Policy and Regulatory Strengthening;
- Human Resource Development;
- Government Support;
- Capital and Financing; and
- Infrastructure Improvement.

Several workshops have been conducted, and a mechanism for following up the recommendations was established.

Further details can be obtained from the Reach web site, http://www.reach.jo

# 8 SUSTAINABLE DEVELOPMENT NETWORKING PROGRAMME (SDNP)

## 8.1 General

SDNP is an enabling mechanism geared to helping Jordan attain goals of sustainable development. This project is the first phase of a long term undertaking to provide Internet connectivity and access to sustainable development related information for project stakeholders, and the beneficiaries of sustainable development: the people of Jordan. The project has five essential expected results:

1. SDNP infrastructure and pilot connectivity implemented in key organisations;
2. A working modus operandi set up and all users familiarised with how SDNP works;
3. Access to local databases, populated with national and regional information related to sustainable development, and made available to all parties;
4. Basic international connectivity established, providing access to sustainable development related organisations and information world-wide; and
5. An expansion plan for the second and subsequent phases, addressing the ever-increasing demand for sustainable development related information.

## 8.2 Problem to be addressed

### *8.2.1 General*

Current impediments in accessing relevant information on the state of the environment, and sustainable development trends and policies in Jordan, in the region, and world wide, adversely affect policy makers, legislators and others in defining priorities to be addressed, ways to address priority issues, and marshalling resources and expertise to resolve them.

What information is available in Jordan is neither widely known, nor easily accessible.

The lack of participatory processes that would allow stakeholders a role in the development of appropriate policies and practices for sustainable development, means that policies and legislation may not reflect needs of all stakeholder groups, especially at the local and community level.

The lack of public awareness of the principles and practices of sustainable development as they relate to Jordan are a prerequisite for creating an enabling environment for sustainable development. A first step is to influence attitudes in order to change behaviour among stakeholders and the public in general. Enhancing connectivity is a way of helping this to happen.

The SDNP can help to increase awareness and capacity to use tools for computer-based applications such as World Wide Web pages, electronic mail and electronic conferencing, and other similar applications, as ways of facilitating collaboration and information exchange.

The SDNP can accomplish this general objective in a phased approach, wherein the foundation for a long term sustainable development network is established in the first year, and the thus-established network monitor thereafter to ensure that it continues to respond to user needs.

*8.2.3 Beneficiaries*

The Jordanian stakeholders that will benefit from this project, are those who, in particular deal with the following issues:

- Indicators of sustainable development in general, and especially pollution levels and standards, both local and international;
- Cleaner production technologies and practices;
- Natural resources and energy issues;
- Government policies, rules and regulations, information resources, including bibliographic references, news and calendar of events.

SDNP Jordan is to be an inter-disciplinary facility, disseminating information at three levels as follows:

**Decision-making level:**

Demand at this level is mainly found in governmental institutions. Information needs at this level are specific and include mainly SD policies and regulations, pollution standards and abatement methods, and clean production technologies.

**Research level:**

Demand at this level is mainly found in research and academic institutions and some NGOs. Information needs at this level are wider and include all issues related to SD, although pollution standards and abatement methods, clean production technologies, population and energy show higher demand.

**<u>Awareness level</u>**:
Demand at these levels is mainly found at the NGOs level. Information on activities undertaken by international NGOs is also important at this level.

*8.2.3 Current Status*

A network is established. More than 20 institutions (Government, NGOs, media, Universities) are linked, 10 of them received UNDP support in the field of training, awareness, and equipment. Several websites were developed and SD related information can be accessed through the SD National Node at NIC.

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# Development of the IT Sector: The Malaysia Perspective

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## 1 ABSTRACT

The Information and Communications Technology (ICT) revolution is here. It has given rise to a new dimension of information and knowledge acquisition, primarily spurred by the exponential escalation of the Internet. Its advent globally gives a great impact on our daily lives. It is transforming the very world in which we all live and work. At the dawn of the 21st century, government in many countries is investing in this new medium in the attempt to move into a new economy. Many government programs and strategies have been intensified to encourage their public's participation in this era of change. Be it developed or developing countries, they are all jumping into this new bandwagon: no one wants to be left behind. This paper tends to look at the utilisation and the development of the ICT sector in Malaysia. In particular, the paper will discuss the primary strategies undertaken by the Malaysian Government in creating the necessary and right environment to facilitate the nation's transformation into K-Economy.

## 2 INTRODUCTION

The Information Age has arrived and the rate of change it brings is accelerating. This change is ongoing and pervasive, affecting everyone, each society, and all institutions. There is no doubt that those who are best prepared for the positive changes will enjoy a future marked by abundance. ICT will empower those seeking to access fresh new inputs required by the Information Age, that is, useful information and knowledge. But, of course, every nation will have to define its own tailor-made strategy for meeting this Information Age head on.

This is where the Malaysian confidence in ICT stems from. If ICT is properly harnessed, the realisation of its potential can and will lead to an improved quality of life for all, in every sphere of the human life – social, economic and political. By leveraging on the knowledge economy, where intellectual capital becomes a primary factor of growth, then the intellectual assets and knowledgeable workers produced with time will ensure Malaysia's national and global success.

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** President and CEO, OICNetworks, Malaysia.

In the Malaysian perspective, ICT is therefore seen as the driving force, the enabler and the facilitator of the Information Age. As Malaysia paves her way into the new millennium, the challenge is to meet the Information Age straight on, and fully equipped with the required knowledge and information to succeed.

## 3 GLOBALISATION

When discussing any issues pertaining to ICT, we can never run far from the subject of globalisation as the two goes together, hand in hand. With the accelerated pace and scope of globalisation we are currently experiencing, the world will eventually result in shrinking space, minimized time and blurring borders. As our world becomes smaller, the future and prosperity of nations become more inter-reliant, and people's lives become more intensely intertwined. Without a doubt, we will become a global village at the end of the day; one that is of intensified interaction, and a clear sense of interconnectedness and interdependence: socially, economically, and politically.

Clearly, the convergence and deployment of ICT is the key-driving force, the enabler, and the facilitator to this global process and the Information Age. Apart from facilitating globalisation, the greatest impact of the ICT revolution will soon be felt everywhere people live and work: the major transformation of global economy, the eventual absence of physical distance, and the rise of a completely networked society at the global, regional, national and local levels. In short, with the convergence of ICT, and the realisation of Information Age, globalisation is indeed inevitable.

A fierce competition, then, is expected to come out of all this. Economic competitiveness, whether one likes it or not, is good, and shall only result in a greater economic efficiency and growth; with cost/waste reductions, productivity gains, and higher standards of living for workers and their families. With globalisation and the Information Age-driven change within the economic dimension, comes the trade, services and systems liberalisation. With globalisation, it means, we will be endowed with the necessary 'givens'.

## 4 THE PROMISE OF THE AGE OF INFORMATION

In the Information Age, knowledge is empowering. Knowledge IS power. Lack of knowledge means weakening. Indeed, it is becoming clear that knowledge, imagination, innovation and new technologies may well form the key strategic ingredients for Malaysia's success in the 21st Century.

The knowledge paradigm of development focuses on enhancing the human ability in using information and knowledge as the primary factors of change and value-creation. Knowledge enables an individual to think, to analyze and to understand the existing situation, and the internalities and externalities of each action. Knowledge empowers an individual to form his or her own opinion, to act and transform surrounding conditions, hence improving one's quality of life.

ICT, thus, being a suite of technologies that can elevate people's ability to learn, to acquire new skills and to exploit new opportunities for self-improvement, will serve as the vehicle to transform people in the society into knowledge-workers. In short, people will be empowered by knowledge to participate more actively in society. Greater access and availability of information would then, promote equity.

At the national and state level, the mass process of knowledge empowerment will theoretically enable a society or nation to leapfrog development stages and achieve a knowledge-society status where presumably the gap between the ‘advantaged’ and the ‘disadvantaged’ would decrease or even cease to exist. Simply put, information and knowledge divides will be overcomed. In turn, diversity will be acknowledged and celebrated.

## 5 WITHER THE INTERNET?

Beginning with mainframes in the 1960s, and up to the end of the 20th century, the world has witnessed the rapid development of information. From the advent of centralized computing, we moved into distributed and networked personal computing, and soon after, into cooperative computing. Towards the end of the 20th century, the Internet boomed into the world; fast becoming a fundamental global resource with its power of universal connectivity and widespread effect upon every sphere of the human endeavour.

This rapid progress is clear evidence of how information is rapidly becoming a primitive need, and turning into a basic human right. Before we know it, information will become a utility, just as water, electricity, and telephone are. Beyond the millennium and into the 21st century, safe access to information and services will become available and affordable to anyone, anytime, and anyplace. The buzzword of the future will no longer be just the Internet, but information.

Information, as a tool, will be so powerful, more so than what the Internet has been. Information utility; an integrated, high bandwidth, digital, multimedia fabric of ‘pipes’ and computers with massive amounts of information and computer within, will revolutionise the world. With it, humans will not only have easy access to data, but even future appliances are expected to become ‘informative’ gadgets. Such information appliances will be dedicated to a particular task, and be named by their respective tasks – washing machines, or video cassette recorders – and hence, be intuitively easier to use.

## 6 THE MALAYSIAN EXPERIMENT: TRANSITIONING INTO K-ECONOMY

### 6.1 Towards Vision 2020

Malaysia is a nation whose growth has been carefully shaped and guided by strategic five-year development master plans. Providing the ultimate backdrop to these programmes is Vision 2020, a national agenda that sets out specific goals and objectives for long-term development. A highly optimistic, yet realistic aspiration, Vision 2020 draws upon past achievements and embodies the collective hopes of the Malaysian people. The chief architect of this vision is Malaysia's Prime Minister of 18 years, Dato' Seri Dr Mahathir Mohamad, and Malaysians all around have responded robustly to his challenge to become a fully-developed, matured and knowledge-rich society by year 2020.

The Malaysian ultimate hope and aspiration is to transform the Malaysian society into an information society, then to a knowledge society and finally to a civil or values-based knowledge society. As a strategy to achieve this vision, Malaysia has embarked on an ambitious approach to leapfrog into the Information Age by providing intellectual and strategic leadership. Using ICT as a means toward this end, the plan leverages on both the economic and social realms.

This means investing in the economic aspect to encourage the utilisation of information, value-creation, and knowledge economy, the fair and equitable distribution of wealth, and a competitive yet dynamic economic condition. By leveraging on the social aspect, the ICT is strategically placed to eventually achieve a united and developed, yet creative, and self-governing nation; rich in information, empowered by knowledge, and infused with a highly unique value- and culture-system by the year 2020.

### 6.2 Turning Ripples into Tidal Waves

With all this in mind, Malaysia bases herself on the theme "Turning Ripples into Tidal Waves" and experiments her way towards the creation of value, in order to provide equity and access to all Malaysians, and to qualitatively transform them into the mentioned values-based knowledge society. The Malaysian agenda seeks to achieve these objectives by generating ripples of ideas, which in turn are anticipated to grow into tidal waves of positive change.

As focused initiatives by the government, these "ripples" are defined and implemented to create the necessary environment and to empower the people. Such ripples or key-strategic drivers include the National IT Agenda (NITA), the Multimedia Super Corridor (MSC), the Demonstrator Application Grant Scheme (DAGS), and the E-World framework. MIMOS, as Secretariat, manages and administers this strategic experimentation, with the same vision in mind as professed through its value proposition.

### 6.3 National IT Agenda (NITA)

En route with the Malaysian Vision 2020, the National Information Technology Council (NITC), Malaysia, is the responsible authority to help Malaysia navigate her path towards this knowledge empowerment goal. With the belief that information and knowledge are the nation's most valuable assets in facing the new millennium, the Council functions as the primary advisor and consultant to the Government on all matters pertaining to ICT.

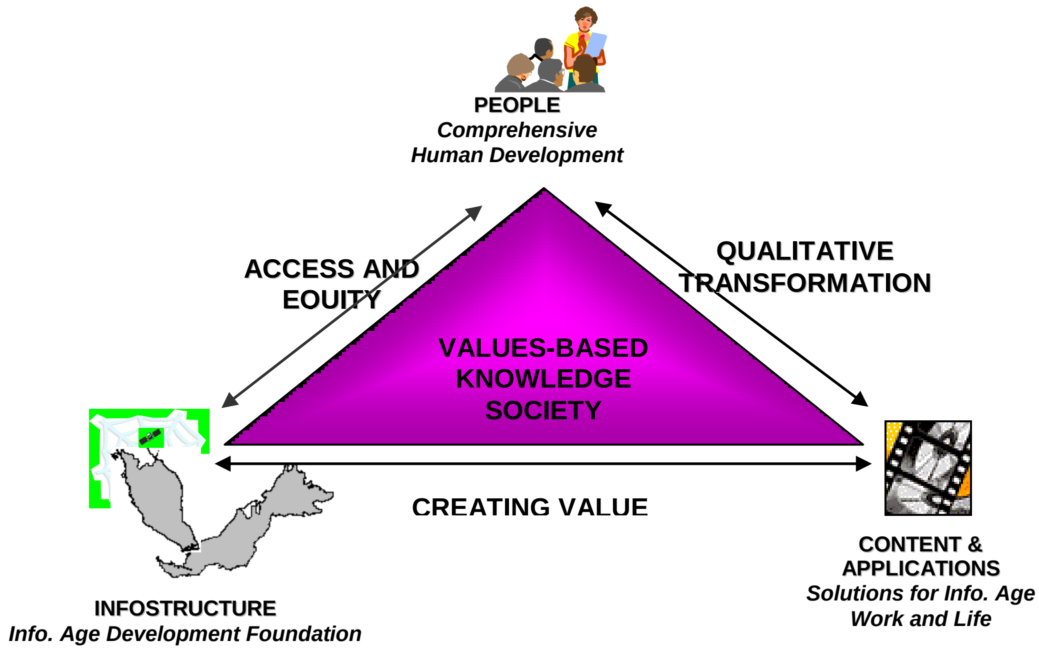
As a government think tank at the highest level, the NITC has formulated the NITC Strategic Agenda, namely, the National IT Agenda, a strategy for Malaysia's migration to the E- and K-World of the new millennium. Launched in December 1996, the NITA is a comprehensive and strategic framework for Malaysian development in the Information Age. NITA provides the foundation for the utilisation of ICT to transform Malaysia into a developed yet values-based knowledge society in our envisioned Malaysian mould.

### 6.4 The Heart of NITA

To achieve the Malaysian goal, the NITA framework focuses its efforts on an equal deployment and development of three key components that work in tandem. The framework is best viewed as an interconnected triangle consisting of three key elements: People, Infostructure, and Applications. These elements make up a strategic combination under the rationale that societal value can only be realized when people are equipped with the necessary knowledge and skills, supported by the appropriate infostructure, and provided with equitable access to ICT and applications.

This virtuous cycle of constant improvement in creating societal value is anticipated to result in a qualitative transformation of the Malaysian society into the desired state of knowledge empowerment as envisioned in Vision 2020. Each of the three elements has its own strategies, all of which work in synergy towards the achievement of a K-society.

The placement of the people element at the apex of the triangle, shown diagrammatically below, signifies the primary importance of the human factor in this process of transformation towards a comprehensive human development, and hence, a values-based knowledge society. The triangle itself reflects the three key concerns surrounding this change environment, namely, access and equity, value creation, and qualitative transformation.




The framework duly recognizes the principle that all citizens need access to information in an equitable manner. As such, the infostructure element is seen as the very foundation to Information Age development and comes in both hard and soft infrastructure. The hard infrastructure involves the computer hardware and the relevant telecommunication components whereas the soft infrastructure includes databases, networks, laws, and regulations.

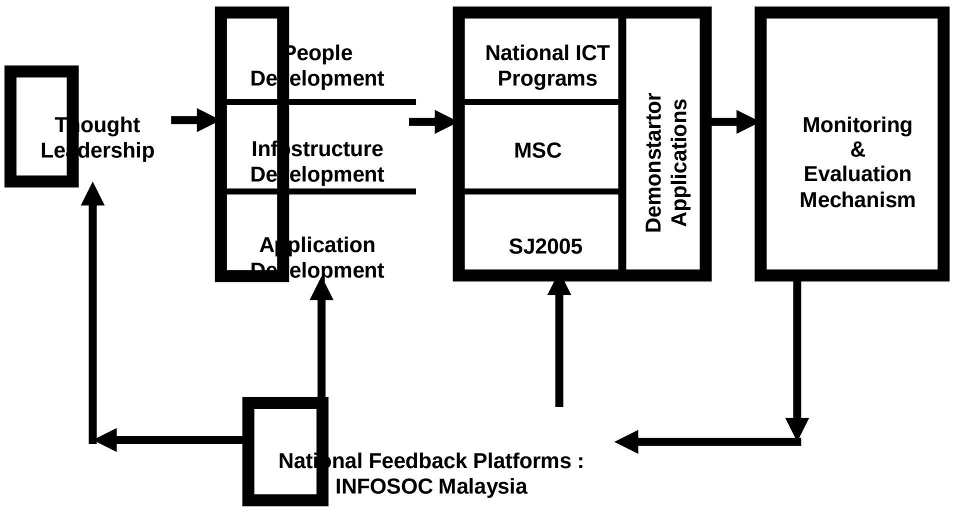
The third element of applications revolves around the development of proper and cost-effective content and/or applications that is needed by all ICT players, national and global. This is deemed critical to ensure that Malaysia is able to maintain its competitive advantage for many many years to come. Hence, great importance is given on local content and culture compatibility as total solutions for the Information Age life and work.

### 6.5 Global Waves, Local Webs

To effectively facilitate the migration of Malaysians and institutional structures into the K-economy, the key challenge is thus how to engender the requisite mindset in our people and institutions to successfully participate, develop and grow in this emerging networked global society of the 21st century. This migration must be ipso facto a people-driven transformation. If the NITA is to succeed, the entire nation has to be mobilized in using ICT as a strategic development tool.

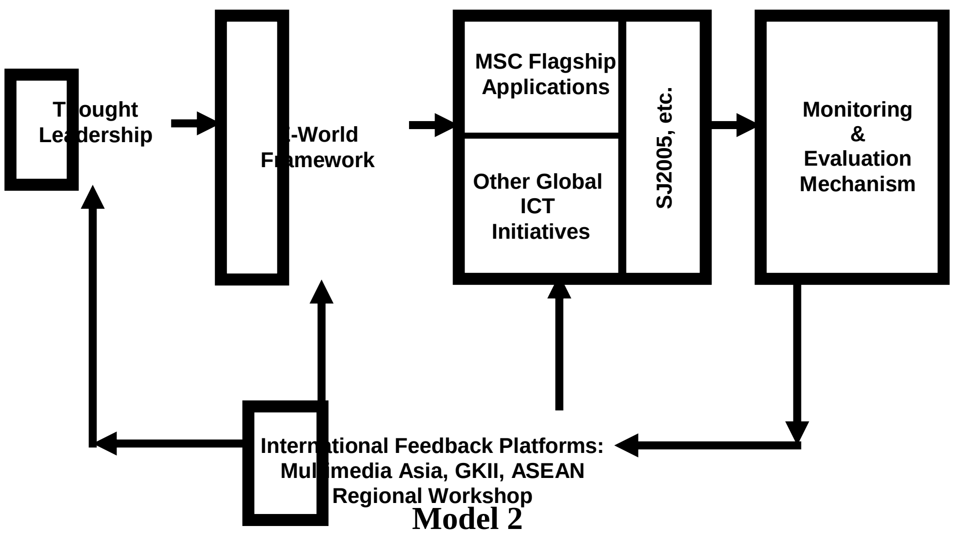
It requires pursuing a combination of top-down and bottom-up approaches, which have proven to work well in Malaysia. The key is basically to grow on the webs locally, and to make waves globally. The former refers to a national mobilization that requires the physical formation of smart partnerships and strategic alliances to carry out the various national mandates. As for the latter, leadership by doing and thinking at a global level is the order of the day. Diagrammatically, the current models adopted in pursuit of this strategy is depicted below:

**National ICT Strategy:**
**Growing Webs Locally**




**Model 1**

**National ICT Strategy:**
**Making Waves Globally**




**Model 2**

### 6.6 Cross-Sectoral Solutions Mechanism

The strategy further involves an orderly transformation from the current governance structure to a more participatory one, involving an active tripartite partnership between the public, private, and community sectors comprising of the non-governmental or non-profit organizations (NGOs or NPOs), the society and the media. This tripartite partnership serves as the mechanism for cross-sectoral planning, cooperation and solutions in the Malaysian development plans.

Through the generated findings and feedbacks from these sectors, the NITC proposes and makes policy recommendations to the Malaysian Cabinet, to be mandated and assigned to the ministries at the federal, state and local levels, as well as, to the public sector agencies. In full interest of the nation and its development, the NITC brings together all segments of the Malaysian society, and all other associated agencies, hence creating a win-win-win strategy for all.

The NITC provides a platform where views and feedbacks are generated and compiled through a planned policy intervention at 3 levels: the national NITC level, the national inter- and intra-agency level, and the organisational level. The feedback loop begins from the first national level, made up of council members representing the three public, private and community sectors that are appointed by the Chairman, the Malaysian Prime Minister. It is at this level that strategic initiatives and planning for the application and development of ICT in Malaysia, such as policy frameworks, are mandated. It then continues to the second national level, consisting of inter- and intra-agencies, where cross-sectoral programs and initiatives are tactically carried out. At the third intervention level, ICT based activities are executed to fulfill its operational function at this organisational level.

### 6.7 Multimedia Super Corridor (MSC)

As one of the ripples in the tidal waves, the MSC is both a physical area and a new paradigm for creating value in the Information Age. Physically, the MSC is a length of Greenfield “Corridor”, of 15 kilometres wide and 50 kilometres long spreading south of Kuala Lumpur. The Kuala Lumpur City Centre (KLCC), itself an intelligent precinct housing the world's tallest buildings, is the northern gateway to the MSC. In the east, the Kuala-Lumpur-Seremban Highway; in the west, the North-South Expressway Central Link; and as the Southern gateway, is the region's largest airport complex, the Kuala Lumpur International Airport (KLIA).

The MSC is a gift from the Malaysian government to its people and the world. It is a gift to Malaysians wanting their country to prosper, to neighbouring countries aspiring to partner with a technology hub, to worldwide technology developers and users seeking to deliver high-value multimedia services and products to customers across a global world. As a comprehensive test-bed for ideals and ideas, the MSC places itself strategically to undertake risks and tolerate failure, only to become the first place in the world to bring together all the elements needed to create an environment that engenders a truly mutual enrichment for all kinds of ICT and multimedia ventures.

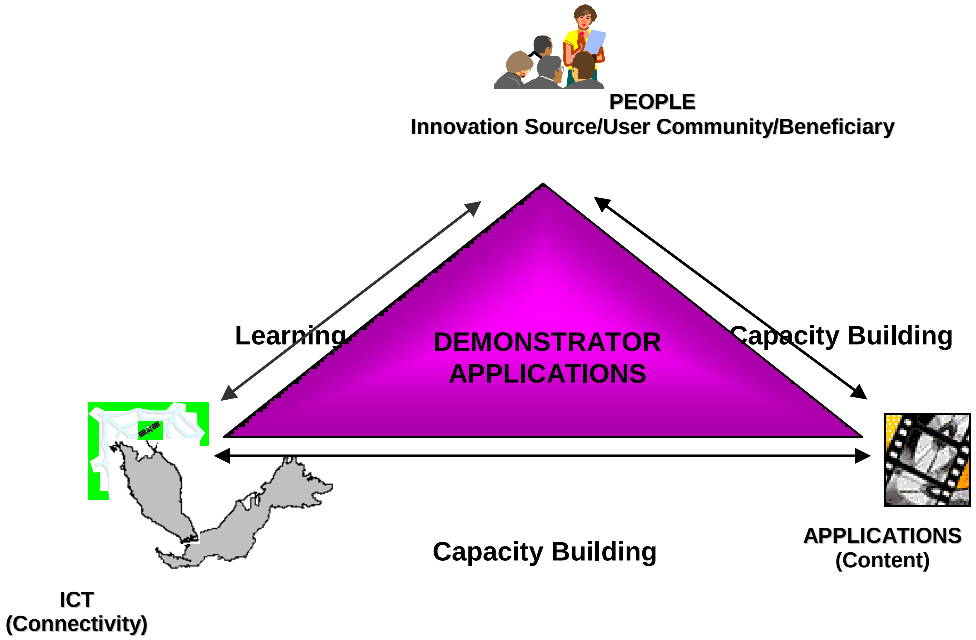
Empowered by the same overall vision, the MSC is seen as another big step, another strategy, another ripple, for Malaysia to migrate into a values-based knowledge society. With its seven-focus areas – the E-Government, Smart Schools, Telehealth, Multipurpose Card, R & D Clusters, Borderless Marketing, and Worldwide Manufacturing Web – Malaysia has embarked on an ambitious plan to successfully leapfrog and accelerate Malaysia's entry into the Information Age by providing intellectual and strategic leadership through the MSC.

In this attempt, the MSC works by going global while leading at a regional level. By regional leading, the MSC is engineered to catalyze a highly competitive cluster of Malaysian multimedia and ICT companies to become world-class over time, thus enhancing domestic productivity. This will then help to create an ideal multimedia environment for world-class companies to use Malaysia as a regional hub, and hence creating a common value for Information Age businesses of the new world order.

### 6.8 Demonstrator Application Grant Scheme (DAGS)

Proposed by the NITC in early 1998, DAGS is another key initiative and catalyst for the realisation of objectives set out in NITA towards Malaysia's migration into K-economy. The scheme was granted RM50 million under the 7th Malaysia Plan, which ended in December 2000. Under 8th Malaysia Plan (Jan 2001 - Dec 2005), the government has allocated RM100 million to DAGS. NITC Secretariat was appointed to manage this government-funding mechanism for ICT-based projects, essentially to administer and award the grants to projects accredited as Demonstrator Application (DA), referring to small, focused and short-term projects.

The concept of DA acts as a microcosm of NITA, and is aimed at creating, developing and promoting new applications using the connectivity of ICT, which will create new value of content or applications, for the people or community development in Malaysia. In this case, the user community is seen as the sole beneficiary and source of innovation to such DAs. To this end, the DA approach leverages on learning and capacity-building capabilities as reflected in the triangulation.




As it is designed to facilitate the social and economic progress of Malaysians through the innovative use of ICT, DAGS therefore primarily serves to enhance the quality of life, that is, by way of having maximized ICT applications, integrated network of electronic communities, dynamic web growth, enabled entrepreneurial communities, enhanced co-operation and collaboration between all sections of society, and ICT-innovated Malaysians.

Some funded projects so far include My-Biz, Asian Review of Biodiversity and Environmental Conservation (ARBEC), CyberCare (Networking orphanages), SMASY (Smart Community), TaniNet (Farmer's Net), Family Place (Networking families), E-Public Services, and E-Bario.

### 6.9 E-World Framework: Strategic Thrusts for Mindset Change

Another key facilitator to Malaysia's migration into the K-Economy and borderless world is the E-World framework, which uses a people-driven approach that has five thrust areas as its migration strategy, these being: E-Learning, E-Public Services, E-Economy, E-Community, and E-Sovereignty. The E-World framework is deemed critical to the Malaysian migration experiment as the world today is fast emerging into one that is characterised by escalating electronic interactions in all spheres; the social, economic, and politics.

Through a culture of learning, unlearning and relearning, it is expected that E-learning will be the primary vehicle to accelerate the development of Malaysia's intellectual capital. As learning is the first step towards capitalising on knowledge the scope of E-Learning extends further to govern the worldview of three other strategic thrust areas, namely, E-Public Services, E-Economy, and E-Community. These thrust areas operate closely together within the physical, national boundary.

Under the strategic area of E-Public Services, the public, private and community sectors work together in order to provide an efficient electronic delivery of public services; one that is people-oriented and customer-focused. Similarly, the E-Community strategic thrust area focuses on facilitating the interests of various communities in order to improve the quality of life through electronic means. Through the E-Economy strategic area, all sectors of the Malaysian economy are envisioned to create value and wealth through successful participation in the emerging knowledge-driven global economy.

Outside of the national border lies the E-Sovereignty thrust area, which is the surest and most constructive manner for any nation to achieve a secure national sovereignty in tomorrow's borderless world. With this calculated move, it is envisioned that Malaysian citizens and institutions will garner an enhanced national identity, integrity and societal stability despite facing the challenges of a borderless globe.

### 6.10 SJ2005: A Testimony to a Better Tomorrow

May 1999 had earmarked Subang Jaya, an all ready live-in community, as a test-bed for the migration of Malaysia into the E-World, and then, K-World. It is seen as the very platform to evaluate and study the social, education, political, economic and technological impact of ICT on communities.

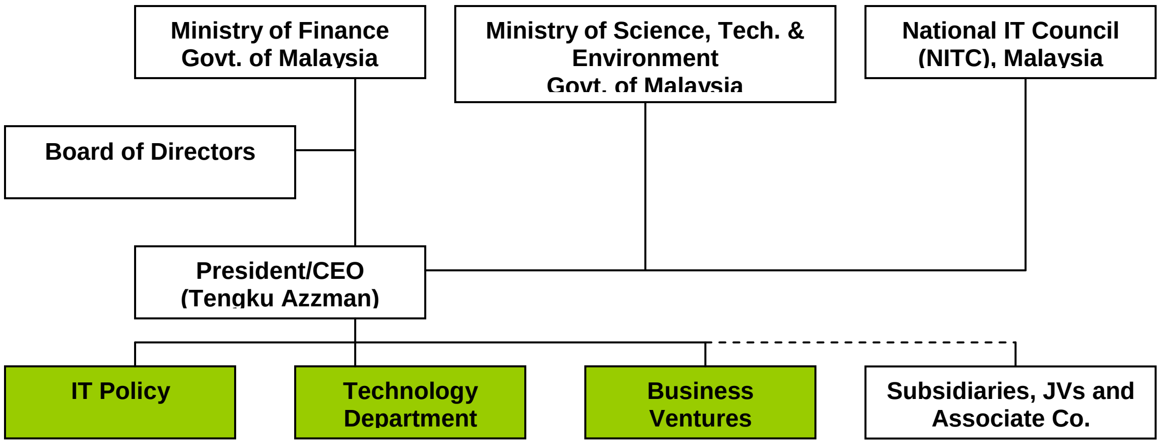
The project, which is called the "SJ2005 Smart Community Program", envisions a dynamic, knowledge-based, and interactive community of value, an improved quality of work and life, and a sustained residential development. Using a tripartite model between the Government sector, private entities and communities, the project is expected to be completed by the year 2005. Indeed, the project thus far is a testimony to a better tomorrow for Malaysia.

## 6.11 MIMOS Value Proposition

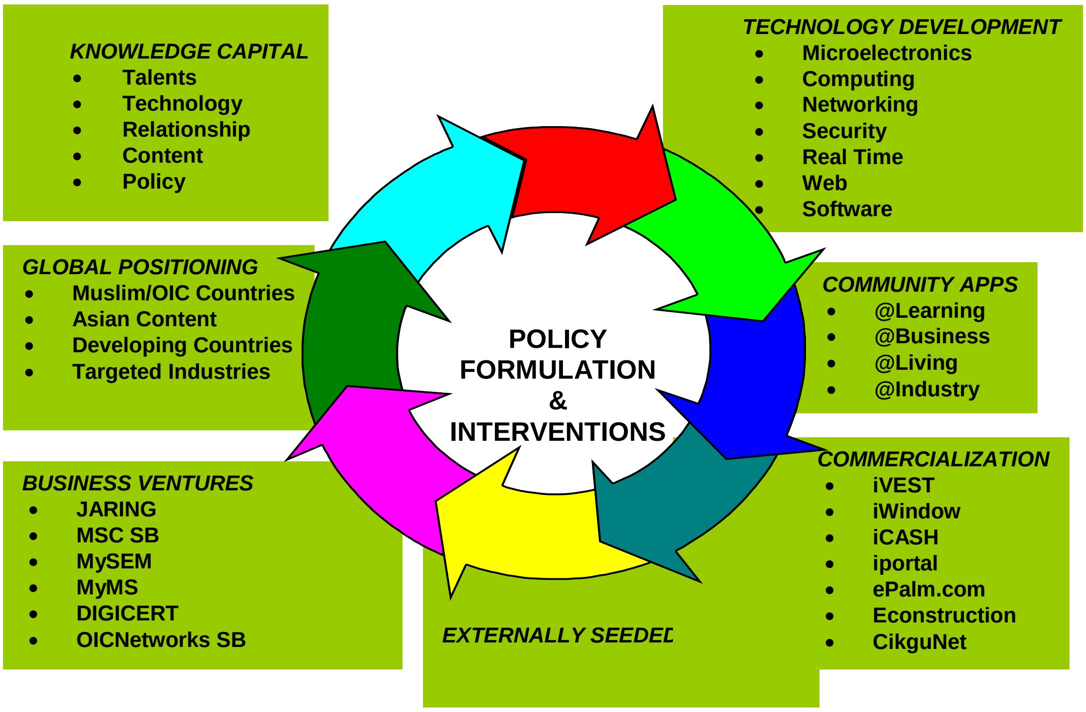
MIMOS Berhad was established as the Malaysian Institute of Microelectronic Systems on 1 January 1985, with the full support of Prime Minister Dato' Seri Dr Mahathir Mohamad. In the early days, MIMOS functioned as a small unit in the Prime Minister's Office. It became a full-fledged organisation under the Ministry of Science, Technology and the Environment (MOSTE) in 1990. In January 1995, MIMOS was appointed Secretariat to the NITC.

On 1 November 1996, MIMOS underwent a 'corporatisation' exercise. It emerged as MIMOS Berhad, empowered with greater flexibility to create value-added innovations for the Malaysia industry, society and nation.

MIMOS continues to be an ICT Research & Development (R & D) organisation that functions as the advisor to the Malaysian Government on technologies, policies and strategies relating to ICT development. The MIMOS organization model shown below illustrates this close relationship between the Government of Malaysia, the NITC and MIMOS Berhad in their nation-building efforts.



As shown in the previous chart, the organisation has adopted a three-branched approach in its development model, focusing on policy, technology, and business. This approach is what is termed the MIMOS value proposition, which capitalizes on various innovative technology developments and business ventures that are governed by a planned policy formulation and interventions. Among these pioneering developments, ventures, and strategies are diagrammatically illustrated below.




## 7 THE FUTURE DIRECTIONS OF MALAYSIA: EIGHTH MALAYSIA PLAN (8MP)

### 7.1 Bridging the Digital Divide

Not only in Malaysia, but leaders and experts from around the world, are increasingly recognising how crucial the human resource capacity development is, in bridging the digital divide in developing countries.

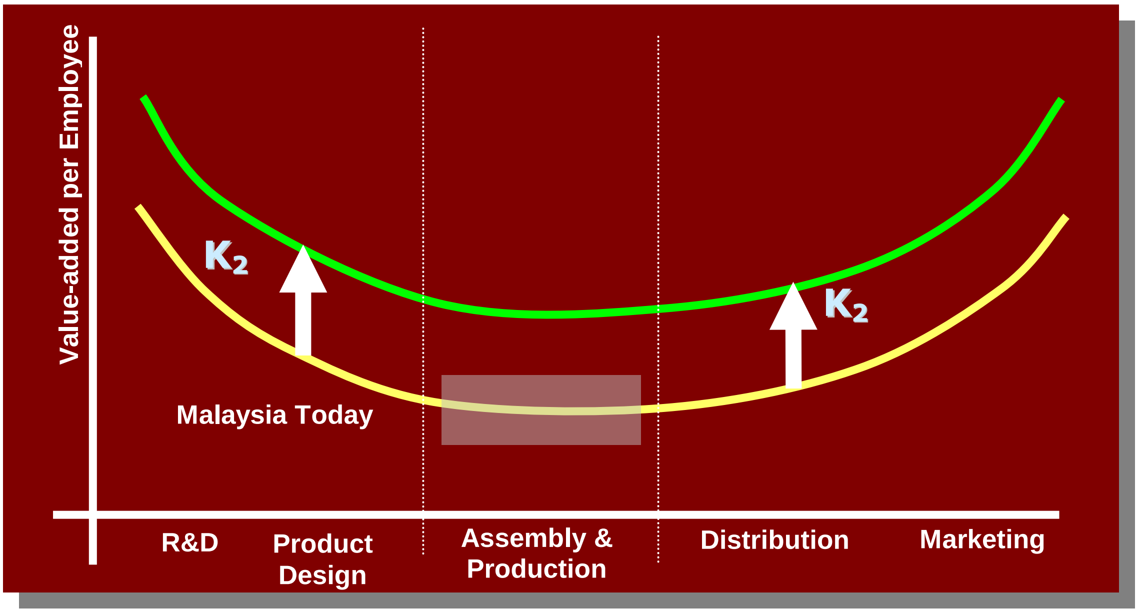
Where in Malaysia, there is a further 'people divide' – the socially advantaged to the disadvantaged – to the apparent digital gap between the people and the infostructure, our efforts should be in line and focused towards the 8MP to effectively bridge these divides. Themed "Achieving Sustainable Growth with Resilience", the 8MP is primarily aimed at sustaining economic growth and competitiveness in the face of growing globalisation and liberalisation. To sustain growth under the new Plan will require careful macroeconomic management to ensure optimum and efficient utilisation of resources.

As such, the idea of bridging the digital divide is, really, a national policy recommendation to include everyone in the community and its associates: the state and local government, the public, private and community-interest sectors; all under the same solutions framework. The desired end result would be developments in all the three core aspects of the Malaysian transformation agenda into the K-Society and K-Economy, that is, the people, infrostructure, and content and applications developments, hence successfully bridging the existing divides in the Malaysian community.

### 7.2 Transition from P- to K-Economy

In line with the 8MP to enhance a productivity-driven growth by 2005, is the nationwide need to undergo a structural shift from Production (P-) Economy to K-Economy in the industrial sector. As the approach of the 8MP will be to shift the Malaysian growth strategy from an input-driven to one that is knowledge-driven; this requires for the development of a new K-based and K-intensified industries as well as restructuring the existing sectors and organizations.

As diagrammatically shown below, Malaysian firms today traditionally focus on the lowest level of the value chain, that is mainly, in the Assembly and Production area. In order to greatly enhance and increase the K-content (as denoted by $K_1$ and $K_2$) in the Malaysian industry sector, this traditional value chain must be shifted into all directions. This means that a nationwide K-drive into all significant areas of the industry zone (R & D, Product Design, Distribution, Marketing, and etc.) is called for, thus enhancing our entrepreneurial capacities.




**$K_1$** - *Widening the Base*
ICT to drive K into R&D and Innovation Systems
ICT to drive K into Distribution/Marketing Systems

**$K_2$** - *Deepening Knowledge & Skills*
Integrate into global supply chain management
Create sectoral portals to capture Virtual Marketplace

**Source: Second Industrial Master Plan**

This structural shift is expected to turn around the present high-volume production to high-value and measurable inputs, processes, systems and outputs. Moreover, the active leverage on values: ideas, relationships and communication, and the positive networking based on this value-system is expected to exponentially grow and produce value-added workers in terms of knowledge and skills in future.

### 7.3 National Sovereignty in a Global World

As an ongoing strategy of the country to instill and strengthen moral and ethical values, commendable attributes such as honesty, discipline, diligence, integrity, commitment, respect and tolerance will continue to be nurtured and inculcated through the education system, religious, social and business organisations, and the media.

Under the 8MP, the inculcation of positive values and belief in good moral and ethical conduct as a way of life among Malaysians will be the cornerstone for the nation's success, and hence, will promote a secure national sovereignty in the face of a global world. This combined with the other discussed strategies undertaken by the Malaysian Government is indeed a carefully-designed move, and a surest way to achieving an enhanced national identity, integrity and societal stability although faced with the challenges of a borderless globe.

## 8 CONCLUSION

Through all the pervasive and turbulent changes and challenges of the Information Age, the ICT will be the enabler. And given that nations around the globe are all racing towards information and knowledge competitiveness, Malaysia then is clearly getting its act right by implementing a national ICT development plan. Now, the government is giving the ICT a top priority in the implementation of most of Malaysia's development plans in various areas and industries.

Some describe it as a much too grandiose move by the government, or too philosophical, or simply, too impossible to achieve. The majority of Malaysians, however, takes on this challenge or rather, this opportunity, full force and fully equipped. Although in reality the agenda may seem bold and daunting, the Malaysian spirit is ignited to progressively move forward amidst the many great global resistance.

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# Information Technology in Pakistan:
# An Imperative for Sustainable National Development

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*Islamabad, Pakistan*

## 1 ABSTRACT

The phenomenon of the great digital divide that we are experiencing today is a good indicator of the speed with which the world is changing. Intelligent generation and deployment of science and technology applications, specifically information technology, is driving this change and development. The sad fact, however, is that we in the developing world are the least useful contributor to that, which makes us the ones standing at the wrong side of the divide. The question no longer remains of whether we need IT to supplement our development, but rather working out a feasible way to catch up with the leaders. That is the challenge. If we still do not heed to this challenge that this tremendous wave of change is posing to us, then we might not be able to leave any significant marks in world history.

## 2 WHY IS INFORMATION TECHNOLOGY AN IMPERATIVE?

Technology has become the driving force of change in the modern world. It has altered our economic structures and the ways we communicate. It has even changed how we relate to one another. Technology, even in small amounts, is helping developing nations and communities overcome convention and tradition to take leaps forward. The world today stands sharply divided between a limited number of advanced countries that have invested heavily in Science and Technology and have forged ahead of the vast majority of developing countries. The latter ones have confined themselves to investing in low value-added goods such as agriculture, textiles, leather, etc., and have been therefore left behind. In this knowledge-driven world, only those countries, which can harness the power of Science and Technology, can progress. This is truer now than ever before since technology is transforming our lives in a multitude of ways. Within the life times of many of us we have seen man’ s first venture into space and walk on the moon. We have seen the marvellous progress in the field of Genomics, which promises to revolutionise life, as we know it on planet earth. We have seen the advent of computers and the Internet age that have transformed the world into a global village - and science continues to transform society at a mind boggling pace.

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When we talk of Information Technology, the situation in Muslim countries seems no different from any other scientific and technological field. They are far behind than their counterparts in the developed world. Information Technology that has reduced this world to a global village blurring the physical boundaries in education, commerce and communications, presents many lucrative opportunities to the developing world. New scholarly, economic, political, spiritual alliances have been forged due to the wide access to diverse information resources. In the 21st century, cost effective communication infrastructure and information systems are no longer considered luxuries, but a necessity. They are strategic factors for a nation that are critical to the development process and to poverty reduction. By synchronising national planning and work with the completely dynamic nature of information technology, developing nations, especially, can tap unimaginable opportunities.

The term Information Technology (IT) encompasses all forms of technology used to create, store, exchange, and use information in its various forms (business data, voice conversations, still images, motion pictures, multimedia presentations, and other forms, including those not yet conceived). It is a convenient term for including both telephony and computer technology in the same word. It is the technology that is driving what has often been called "the information revolution."

One hundred years ago, a strong industrial sector meant an economically strong country. Today, that notion has changed. The information revolution is set to play a pivotal role in any economic success. New segments of commerce have taken birth and have revolutionized the whole process of business and economy as clearly indicated by facts like increased spending by US companies on IT in recent years. The figures show that during 1991, information age capital spending by US companies exceeded industrial age spending for the first time, after which the graph kept on climbing. The same year, annual sales of personal computers exceeded 50 million units as compared to 35 millions passenger cars worldwide. According to the published figures, the success of the IT industry is rated as the single largest factor in the USA’s rise to become the world’s top economic power as IT and communication technologies contribute more than 40% of its total revenue earning**.**

As the US Federal Reserve Chairman Alan Greenspan recently told the Joint Economic Committee, “Something special has happened to the American economy. Information technology jobs are high paying jobs, averaging $53,000 per year, compared to an average of $30,000 per year for all private sector jobs. Technology has played a key role in restraining inflation. Price changes in IT-producing industries, compared with the rest of the economy, have resulted in a lowering of domestic inflation by one full percentage point per year during both 1996 and 1997. Investment in computers and information technologies in the 1990s by every sector of our economy - from carmakers to farmers - has cut production costs and boosted output. The result has been to hold prices down and increase American competitiveness internationally.”

IT contribution to real domestic economic growth continues to increase. The US Commerce Department's recent report, The Emerging Digital Economy II, put it this way: “Over the past four years, IT industries' output has contributed more than one-third to the growth of real output for the overall economy.” Again, quoting Greenspan, “The newest innovations, which we label information technologies, have begun to alter the manner in which we do business and create value, often in ways not readily foreseeable even five years ago.” Since 1980, America and Japan’s IT and Communication economy has grown 4 times to its present market worth of US$ 4 trillion, with the growth rate of over 18% annually. At present, the IT industry has more than 800,000 jobs worldwide, which are yet to be filled up. Activities like market transaction volume, credit cards, e-commerce, online travel reservations, would not have been possible without the use of information technology.

Electronic transactions are now commonplace in the business and government environment in the industrialised world. In the United States alone, over 50 % of all companies are exchanging data electronically while engaging in accounting, controlling, production management, funds transfer, record-keeping, purchasing and selling activities. Consumers too use various information technologies daily to buy products via their credit cards, to transfer funds, to buy stocks, and to browse through electronic catalogues. We are entering a new era in electronic commerce characterised by firms and customers conducting business on the Internet spontaneously, on a 24-hour basis and worldwide.

With the phenomenal growth of the Internet, a unique and new electronic market place is evolving. Various estimates (ranging from 100 million to over one billion) have been advanced in terms of the total number of people who will be connected to computer networks as they expand to include telephones, televisions, computers, as well as a range of intelligent devices such as the 'market choice box.'

Electronic commerce is expected to grow in various forms such as electronic data interchange and various multimedia services such as interactive television and home shopping, multimedia kiosks and cable-based video-on-demand services. Offshoots may be desktop video-conferencing and computer networks affecting the way we communicate and the overall need to travel. E-Commerce activities worldwide are estimated at about US$ 45 billion that are likely to cross the target of US$ 1.5 trillion market in the next three years. Due to the ever-growing Internet connectivity, all over the world, data based products and services have registered the highest growth rate at present. The Internet based cyber world exists on satellite or marine surface optic fibre cable links or inland telecom networks. After 1990, 25 projects of submarine fibre optic cable worth over US$ 15 billion have come up for providing the backbone to Internet traffic. Over 60 new satellite projects have come up in the 90’s to provide connectivity to the Internet users. The combination of telephone, mobile phones, computers, and Internet is going to dominate the world scene in next 5-10 years. International Telecommunication Union (ITU) estimates for 2005 hold the number of telephone users at 1.4 billion, mobile phone users at 1.1 billion and the number of Internet users more than 600 million. According to E-Commerce Times (February 24, 1999), Media giant IDC released a news report indicating that corporate spending on Internet-related technology has now reached "frantic" levels, with US sales expected to top $85 billion in 1999, and $203 billion by 2002. According to the IDC report, the spending frenzy is being fuelled by the widespread move toward e-commerce, and will continue “well into the new millennium.” The spending bonanza is not expected to be limited to certain industries either. In the year ahead, IDC forecasts that financial services companies will spend $16.6 billion on Internet technology. Manufacturing companies will spend $24 billion. Retail businesses will invest $6.2 billion, and online media and communications companies will spend $10.7 billion. According to IDC's report, companies realise that e-commerce and e-business offer the opportunity to establish new competitive standards by expanding distribution channels, integrating internal and external processes, and offering a cost-effective method to provide products and services.

Gross Domestic Product (GDP) of a country is a very significant indicator of national growth and development. According to some surveys, IT products and services contribute significantly to national GDP’s. For example, they contribute over

25% to the GDP of Singapore, for South Korea the contribution is 15%, and in India alone, the IT industry grew from US$ 281 million (1985-86) to over US$ 4.5 billion (1999) in the last 15 years, reflecting an increase of 1500%.

Education sector acts as a backbone to national development as it drives the growth of knowledge and intellect, which ultimately translates in to strengthened resource base of a country. This vital sector is another beneficiary of the information age. The applications of IT to the academic world are tremendous. The 2.3 billion pages on the Internet have information and opportunity for all segments of academia. Just a small example can be the viewed from the way Internet has revolutionized the concept of distance learning. Thanks to international networking and electronic exchange, students in far off lands can now link up with the best of universities in the US or other countries through Internet based distance learning programmes. Information technology can change the process of learning and allow students to move beyond dependence on their teachers. Along with many others in education, it has the potential to make learning more relevant to young people, and to foster higher-order thinking. If IT were introduced and organised properly, and if teachers were adequately prepared, information technology would have a wonderfully positive role in education, right from the earliest grades of elementary school. In the classroom IT essentials comprise a computer, printer, CD-ROM player, and modem, although it does not necessarily follow that each computer needs all that equipment at all times. There are, of course, expansion components, such as stereo speakers, which enhance sound quality, and plotters for certain kinds of computer-generated drawings.

There are other technologies that may be useful for instruction, such as the relatively new videodisks and that old standby, the overhead projector. Also, there are technologies used for other school-related purposes, such as voice-mail to allow parents to verify homework assignments; and there are specialised software programs for everything from planning the school bus routes to controlling energy use in the school. Other applications may include student assessment, students using networks to gather information, and linking teachers together and allowing them to learn more easily from each other and to share lesson plans and teaching strategies. Besides the information and other instructional technologies as tools for learning and teaching, almost as a by-product, students also learn computer literacy, how to use the intimidating box that sits on the desks of too many managers unable to turn it on. Our children will learn the skills to exploit its full range of capabilities.

Information technology is dramatically reshaping the world. The private sector is using it to drastically improve customer service by making services available from anywhere and at any time. If federal, state and local governments are to be responsive to the needs of their citizens for improved services at lower cost, they must integrate information technology into their information and service delivery mechanisms. Governments at all levels have begun to take seriously the need to improve service delivery, as demonstrated by the progress of successful innovative projects using voice and kiosk-based technologies. Some of the present and near-term technological solutions that will enable improved government service delivery and access to government information include, intelligent multilingual kiosks, automated telephone voice processing systems, public computer bulletin boards, electronic funds transfer, interactive cable television, on-line information, expert systems, and document imaging and retrieval systems. Different countries have developed local languages software that has allowed government departments to provide basic utilities like passport or tax forms among many others on the net.

When we consider the impact of information technology in the social context, it seems enormous on our day-to-day living. It has changed the way we think and live. New society is emerging with attitudes more competitive, more democratic, less centralised, better able to address individual needs, and friendlier to the environment. Cellular phones, personal computers, world wide access, satellite delivery systems are rapidly becoming interwoven in the fabric of our lifestyle. Teleworking, tele-banking, tele-shopping permits people to live anywhere, including rural areas, while still participating fully in society.

During the last decade, the adjective "virtual" has become a commonplace descriptor of social forms where people do not have to live, meet or work face to face in order to develop or maintain significant social relationships. While computer-networks figure frequently as enablers of these virtual social forms, other kinds of communication technologies, including paper mail, telephone and fax can also play key roles in linking people and groups.

## 3 SOME RECENT IT INITIATIVES IN PAKISTAN

Considering the significantly positive role of IT related products and services in the overall development of a country and/or region, quite a few developing nations have forged ahead to embrace it. Like many others, Pakistan did not even have an IT Policy or any IT Action Plan at the start of the new millennium. The first major and ambitious IT initiative in the history of Pakistan was launched by the government during March 2000, under the leadership of newly entrusted Minister of Science and Technology. To start with, a blueprint of the first IT policy was prepared by the 11 working groups comprising some 250 leading IT professionals largely from the private sector. Within a record time of 4 weeks the document of the IT policy was in place. The policy subsequently went through 20 different revisions and the IT policy and IT action plan were approved by the Cabinet within 3 months of the initiative being started. To fulfil the need for a clear action plan that is linked to the policy document since a Policy represents general (and often vague) statements of the broad directions of work to be undertaken, usually seems over ambitious and unrealistic. A clear action plan, which is time-targeted and has clear financial requirements built in, taking into account the ground realities, could transform the policy document into reality.

It is remarkable that no money from the government of Pakistan was spent in preparing the policy or plan. It represented a huge effort and the tremendous support that was received from those who worked day and night without any compensation, driven by national patriotism. The government's role was seen in the policy as that of an enabler and facilitator, with its investment being largely in education and training as well as to remove the bureaucratic hurdles so that the private sector could play its role effectively in this effort.

The IT initiative covers the following dimensions / sectors:

- Human resource development
- Infrastructure development
- Networks - Internet and backbone
- Convergence - Multimedia
- Legislation
- IT promotion and awareness

- Software development and export
- E-commerce
- E-government
- Urdu and regional languages
- Hardware industry
- Incentives
- Databases and content development

The IT division presently comprises only five persons including the Minister and his secretary - and all the excitement that it had been able to generate in this sector in the last several months illustrates what can be done by a small group of persons with public support. The policy and plan have been very well received both within the country and abroad. Overseas advisory groups were established comprising eminent expatriate Pakistani IT professionals settled in USA/Europe. One overseas strategic advisory board in the field of Information Technology was established in San Francisco under the chairmanship of Mr Masood Jabbar, President, Sun Microcomputers. Another group (Dareecha) was established in New York. These IT professionals have been continually advising the government on the way forward.

The major challenge that Pakistan faces today is to develop the requisite quality and number of skilled IT professionals in this important field. It has therefore earmarked about 60% of the funds allocated to the field of Information Technology to human resource development. Seven IT universities are in the process of being established during the current financial year, two in the private sector and 5 in the public sector. Two of these, COMSATS and FAST, have already been granted charters and thus gained a degree awarding status while others are in the process of being set up. An exciting project, which should have far reaching implications, is that of the Virtual University involving distance learning. This university will be set up within the next few months and the programmes of the university will be implemented through both television and the Internet for training people in the field of Information Technology. A special TV channel is being planned in this connection. Short, medium and long term training programmes have been initiated simultaneously for training of human resources. The short-term programme includes training of data feed operators and medical transcriptionists and it will be later extended to legal transcriptionists. This programme has already been started and is likely to lead to the production of some 25000 trained personnel within the next 12 months.

In the medium term plan the government is in the process of retraining professionals who already have graduate or master's degrees in physics, mathematics, engineering sciences etc. This retraining will be carried out in three-month modular courses in fields such as JAVA, XML, C++ etc. so that they can procure jobs in various fields of Information Technology, and a countrywide programme is being launched in this area. In the longer-term perspective the IT initiative aims at strengthening computer science departments in the universities by providing them with faculty and manpower.

Efforts are also being undertaken to get faculty from abroad so that the IT institutions can be strengthened. These measures would result in a significant improvement of the quality of IT education in Pakistan.

Steps are also underway to improve the basic infrastructure involved in Information Technology. One important issue, which needs to be addressed, is that of affordable universal Internet access. The cost of bandwidth prevailing in Pakistan about 18 months ago was over US$70,000 per megabyte per month. This has been brought down to about US$3000 per megabyte per month, thereby making Pakistan the most attractive place in the Afro-Asian world for investment in IT related ventures.

These dramatic reductions in the bandwidth costs have been possible due to bulk bandwidth purchases at much cheaper costs and the use of submarine cable instead of the more expensive satellite. This has created tremendous excitement both at home and abroad and it is expected to trigger the rapid growth of IT related businesses. In August 2000, the Indian government announced a 10-year plan for the spread of Internet programme across India. On 17 August 2000, Pakistan announced a 4-month programme for the spread of the Internet across the country – and it has already been delivered!

Within the last three months Internet, which was confined to 29 cities in the country till 17th August 2000, has now spread to over 300 towns, cities and villages, covering over 75% of the population of the country within a period of 3 months!

This is a historic and unprecedented growth of Internet, unmatched by any country of the world and it goes to show what can be achieved when one acts with determination and speed. Pakistan has an excellent Telecommunications infrastructure based on a 100% fibre optics back- bone. It is now being expanded to various parts of the country so that fast, efficient Internet access becomes possible.

Various revolutionary measures have been taken by the government to promote Information Technology and these steps have transformed the country into a kind of Free Export Processing Zone for the IT industry. The government has announced 0% income tax on software companies for the next five years on export of software. The duties on computers and computer parts have also been removed. Software exporters can retain 35% of their export earnings in foreign currency accounts. Venture capital companies have been given 7 years tax holiday for investments in the IT field.

These and other measures have made Pakistan the most attractive place for investment in the Afro-Asian region and have created a tremendous amount of excitement in many parts of the world. This is now beginning to draw significant investments into the country. A US$30 million project was signed recently with a British company to set up a large telehousing facility in Pakistan in collaboration with PTCL. This project is likely to be completed by April 2001 providing cheap rapid Internet access to ISPs and other customers. A US$50 million venture capital fund was launched recently in the USA, which will help the software companies to obtain funding and technology from USA. This fund was contributed largely by Pakistani expatriates settled in USA and is now in the process of being expanded with inputs from other venture capital investors.

An MoU was signed with the World Bank to set up a national portal for e-commerce and for other related activities. Oracle, a major US company, has decided to invest US$20 million in Sindh province for IT education. CISCO has decided to set up a network of CISCO Academies in Pakistan. Lockheed Martin, one of the largest US companies, is in the process of starting major initiatives in the country.

In an Editorial of the Daily Dawn in November a question was posed "Is this an IT revolution?" The answer for Pakistan is yes, it is the beginning of one.

A major e-commerce initiative is in the process of being launched through changes in laws and through appropriate training of bank officials. Moreover, an ambitious e-governance programme is being launched to computerise the government. This would also provide funds and experience to our software companies thereby giving them the much-needed track record, which they can use to win projects at an international level. Marketing offices are being established in San Francisco, London, Tokyo and

Singapore to procure business from abroad and also to identify niche opportunities, which would emerge with time.

## 4 CONCLUSION

The measures detailed above indicate that Pakistan has taken the first important step forward in becoming a global player in the Information Technology field.

However, it still has a long way to go. As stated above, it is only the beginning. A sustained and determined effort would be needed to catch up. It is hoped that subsequent governments will build and carry forward the important programmes, which have been initiated so that Pakistan can continue to make rapid progress in this vital sector. Pakistan presents a picture of the whole Islamic world that is blessed with very hard working and creative people. There is absolutely no reason why we cannot forge ahead given the will and determination. However, we need to nourish a sense of hope and foster our patriotic zeal and commitment to our country. We must not allow frustrations and despondency to take over. We must rise to the challenge and we must deliver. It is our duty to work devotedly and untiringly so that we can emerge from the present economic difficulties with dignity and honour.

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# E-Commerce in Saudi Arabia:
# A Survey


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## 1 INTRODUCTION

The numbers clash, estimates conflict with each other and experts do their best to come up with pragmatic estimates and give proper definitions, when we talk about e-commerce. The phrase is generating increasing interest and concern amongst experts and specialists. This is not surprising considering that trade and commerce have a direct impact on people, society and affects our day lives in all aspects.

Utilising the Internet and conducting a search on any search engine will give very large results e.g. “Yahoo” will show at least 86 categories and more than 800 sites that address the topic of e-commerce classified by countries, programs, under various subjects such as commerce, economics, companies, organisations and e-commerce.

Once we address the topic of e-commerce then many players will have a role which will include computer specialists, communications experts, network security who all have a major role to play and who were outside the interest circle of commerce activities before. Once a search is initiated, then we come up with well-known universities (1&2); leading companies (3) and specialised magazines. All these address the issue of e-commerce from their own specialised perspective and the electronic magazine expression starts to emerge.

In order to get a first hand information on e-commerce in the Kingdom of Saudi Arabia, this study has been planned and conducted with the help and assistance of several people particularly the Jeddah Chamber of Commerce.

## 2 OBJECTIVES

E-commerce concept, applications, effects, and the planning for its implementation is becoming a major concern to companies, organisations, establishments, people and even countries and communities. As it imparts a new approach and direction to trade and commerce and the way it is conducted. The application of e-commerce is increasing day after day in almost an exponential manner. It is, therefore, important that we have a close look at the subject and explore its concepts and contents in this market and compare it with the trend in the US and may be Europe

This study makes an endeavour to present in brief the understanding of executives and decision-makers in Saudi Companies and establishments the concept of "E-commerce" and their inclination or willingness to apply the same. Willingness to attend training courses was used as an indicator to apply e-commerce. The expected dates for conducting training courses was the other indicator used for the willingness and readiness to apply e-commerce. The essential requirements for implementing e-commerce have been listed and an attempt has also been made to indicate the various hurdles faced in applying e-commerce by companies and establishments in the Kingdom.

# 3 METHODOLOGY

A detailed questionnaire, which had more than 25 questions on different aspects of e-commerce, was designed and distributed after it had been reviewed by several specialists and experts in the field. The responses received were analysed in order to come up with the results.

# 4 QUESTIONNAIRE

The detailed questionnaire covered issues such as knowledge of e-commerce, its concept, application and level of training. Questions regarding advantages and risks of e-commerce, any plans to implement it, including any hurdles foreseen were also covered. The questionnaire also addressed the importance of e-commerce, its security and its compliance with Shari'ah.

The questionnaire also had questions to define the companies requirements for different services associated with e-commerce, company size in terms of number of staff, paid-up capital, type of ownership, turn-over, use of technology which help in providing many indicators such as the relationship between company size and its different needs and requirements.

# 5 DATA COLLECTION

## 5.1 General

The Information Centre of the Jeddah Chamber of Commerce helped arrange distribution of the questionnaire to a large number of companies, establishments, covering different sectors as will be explained in the analysis part. The total number of responses was one hundred and fifteen (115).

## 5.2 Analysis and Results

Descriptive statistics was used to obtain results which show consistency and reflect the true picture of the understanding of e-commerce in different companies and establishments, as can be seen in Figure 1.

### *5.2.1 Knowledge of E-commerce*

A majority of the participants who responded to the questionnaire stated that their knowledge of e-commerce varies between general to well-versed without any application (84%); while 3% of respondents said they have no knowledge of the subject; and 14% indicated sufficient knowledge (well-versed) and seem to have implemented e-commerce in their work operations. Almost the same percentage of respondents stated that they have conducted operations (either buying or selling) over the Internet or via e-mail twice or more.

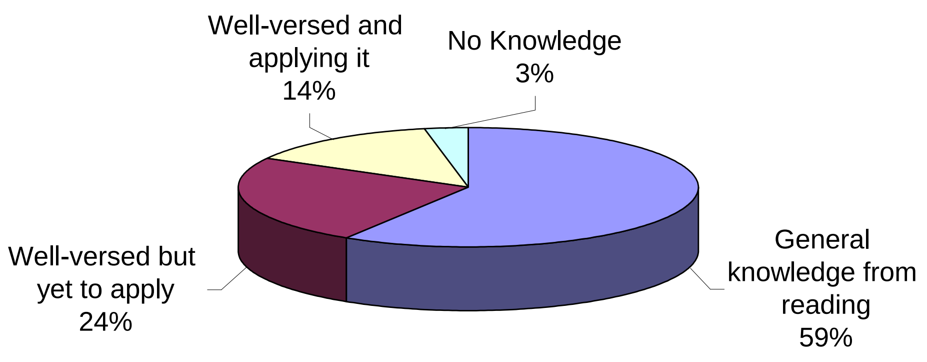



**Figure 1. The Extent of Understanding of E-Commerce**

### *5.2.2 Buying and selling through the Internet*

3% of respondents stated that they have used the Internet to purchase once and 77% of them stated that they did not, as illustrated in Figure 2.

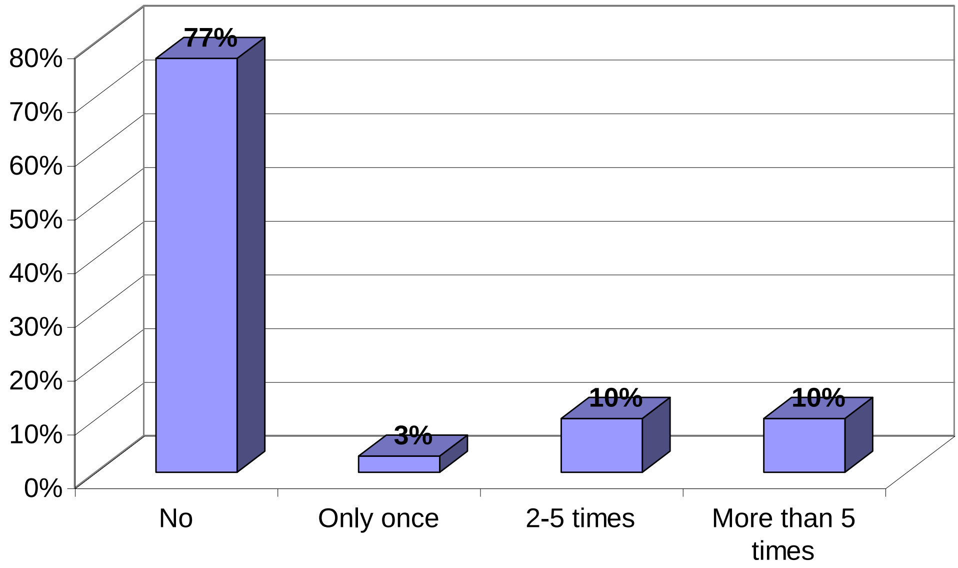



**Fig. (2) Buying/Selling through Internet or the E-mail**

These results are in contrast with studies conducted in Europe and the US. There the percentage of people using e-commerce is much higher. The results of one on-line study carried out by Ernst Young and EDC who collected data from 1200 Internet users in the US from both sexes had shown that 55% of men used the Internet and bought books from amazon.com while 49% of women did the same. The study concluded that both men and women buy books, computers and CDs over the Internet in addition to other merchandise. Household income, buyers job and geographical location were all determinant factors on electronic purchases.(7)

The above shows that we in Arab and Islamic countries are still in the beginning as the Internet penetration rate is still limited and the necessary components to have e-commerce such as credit cards, mailing addresses to which goods can be posted or delivered, as well as the legal and organisational framework are not yet in place. It can however be noticed that the present status will not last as the e-commerce subject is attracting more and more interest from all parties including companies, banks and others which are already paying increasing attention to it.

*5.2.3 Understanding of E-commerce*

The limited usage and application of e-commerce conforms to the responses on one of the questions on the concept and understanding of e-commerce where 16% stated that e-commerce means getting information and payment while 10% stated that it means conducting the entire transaction including payment for the goods and customs clearance through Computer. A majority of the respondents (71%) however, stated that to them e-commerce means only on the goods by the computer getting information only while 3% replied that it has another meaning without specifying what that meaning is, as can be seen in Figure 3.

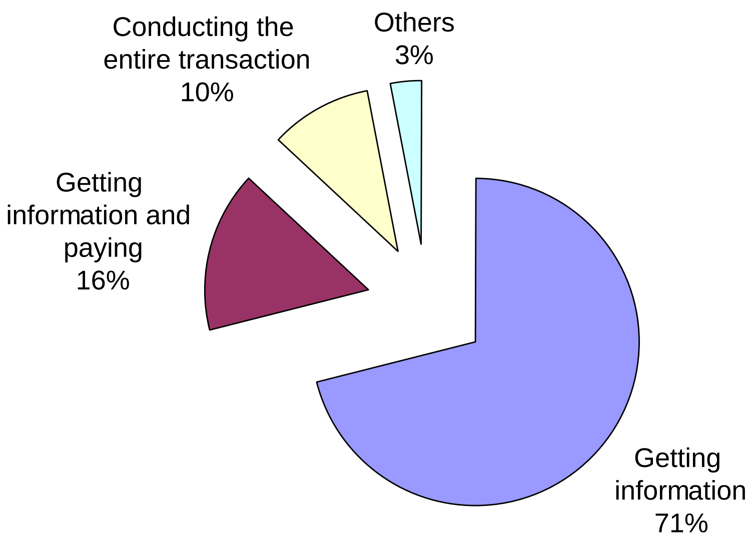
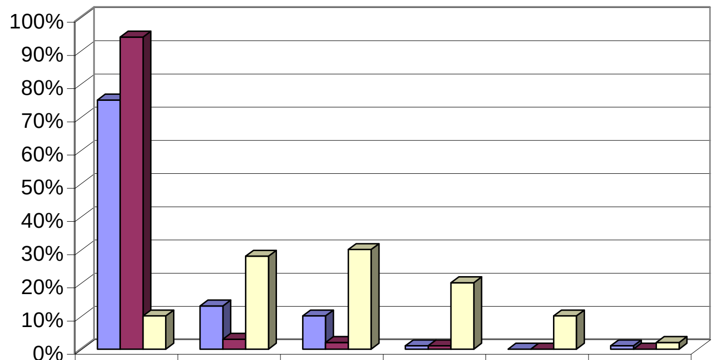



**Fig. (3) Understanding of E-Commerce**

This clearly indicates that the categories of people surveyed have very limited understanding of e-commerce and they still have only a basic knowledge. This is especially true knowing that e-commerce in the West means, largely, conducting the entire transaction of buying and selling over the computer network and communications.

*5.2.4 Training on E-commerce*

Comparing the answers on the understanding of e-commerce to these questions on training courses will find them in agreement as 75% of respondents did not attend any training course while 13% attended a lecture of not more than two hours; 10% attended a one-day training course and only 1% attending a training course of one day or more as depicted in Figure 4. Therefore, the limited understanding of e-commerce came as a result of the limited knowledge and training on its methodology and application.




| | No | One lecture of 2 hours | Lecture\Training for 1 day | Training for 2 days or more | Long intensive training | Other |
|---|---|---|---|---|---|---|
| Attended a training course, lecture or seminar | 75% | 13% | 10% | 1% | 0% | 1% |
| Organized a training course, lecture or seminar | 94% | 3% | 2% | 1% | 0% | 0% |
| Willing to attend a training course, lecture or seminar | 10% | 28% | 30% | 20% | 10% | 2% |

**Fig. (4) Training Courses, Lectures or Seminars Attended**

It can be seen that only a small percentage not exceeding 3% of companies and organisations conducted a lecture not exceeding 2 hours on e-commerce while only 2% conducted one day training course and only 1% conducted a two days or more training course. There was a widespread and clear cut desire to attend training courses as the response to this question shows an overwhelming 78%. This warrant a further study and research to explore what looks like a conflicting findings. This may be due to the fact that there seem to be a general interest in e-commerce due to the publicity without really understanding what it entails. Figure 4 also shows the findings on lectures and training courses on e-commerce in general including those being attended, organised and the willingness to attend.

### 5.2.5 *Planning for E-commerce*

The results showed that 29% of the companies and establishments plan to implement or apply e-commerce within one year; while 19% plan to apply it within 3 months as illustrated in Figure 5.

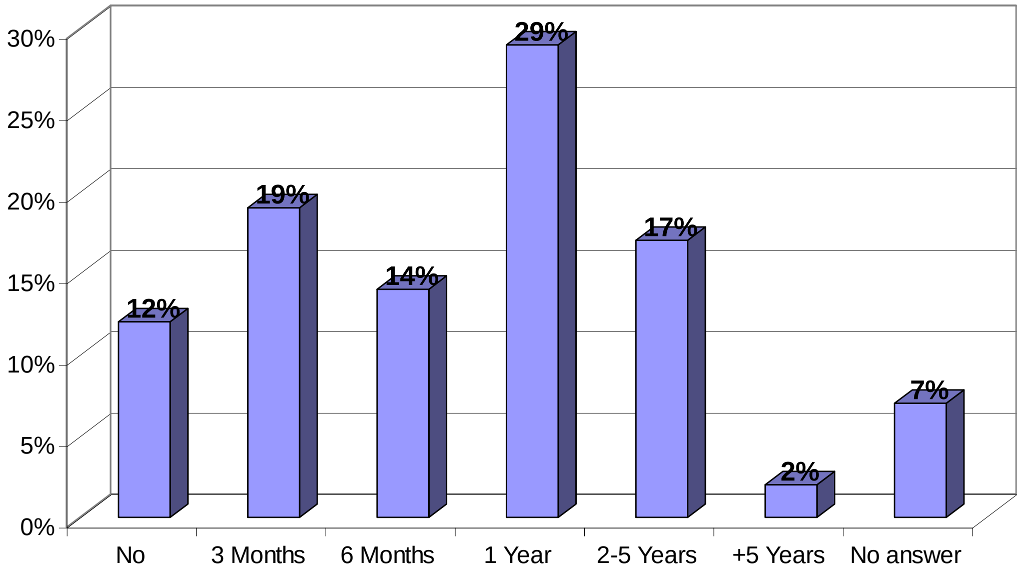



**Fig. (5) Planning for E-Commerce**

### 5.2.7 *Obstacles in implementing E-commerce*

These responses are in agreement with what has been published by some of the specialised magazines [8] regarding the widespread potentialities for e-commerce in the region. 27% of the respondents stated that security is a major obstacle in applying e-commerce; while 22% indicated that non-availability of trained staff; 17% gave internal organisation issues as the reason; while 14% gave legal and external organisation reasons; while only 8% expressed their trust in e-commerce; 13% cited other obstacles. These results are shown in Figure (6),

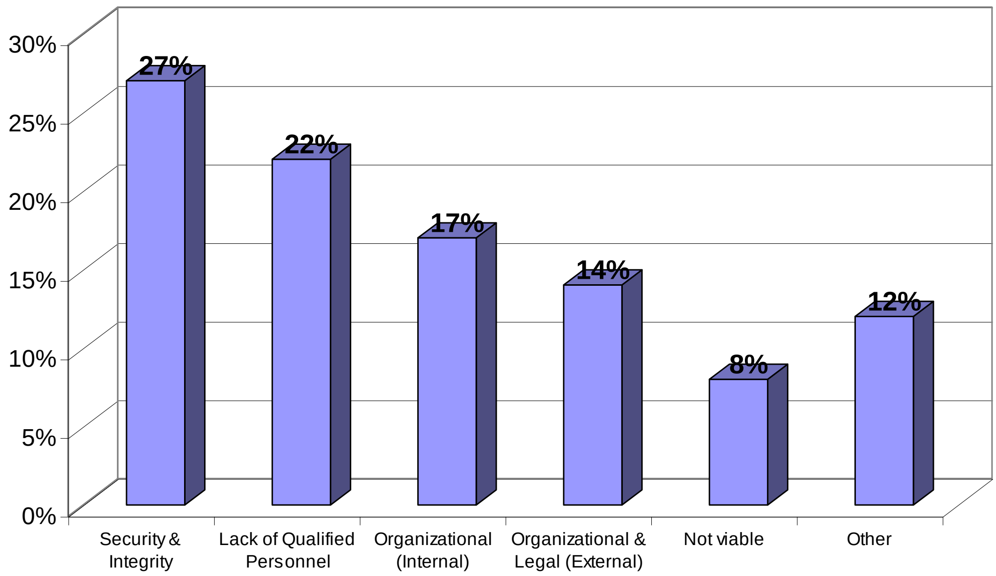



**Fig. (6) Obstacles in Implementing E-Commerce**

It can be seen that these responses differ from studies that were conducted in the West. However, this reflects the status of e-commerce in most Arab countries in general and the majority of Muslim countries. If we compare these results with the Western studies it is evident that the concern over security is declining in the West as can be seen from the study conducted by KPMG [4] and it is well understood that the shortage in trained manpower in the West is much less when compared to the Arab and Muslim countries.

Applying e-commerce whether in the KSA or in Arab and Muslim countries will require certain elements and basic infrastructure other than H/W and S/W [4], [9]. These requirements include organisational and legal framework including defining and specifying the percentage of customs, adopting acceptance of digital signature and other related topics which will take some time before these are put in place. Once the organisation; framework and infrastructure are in place we can expect e-commerce to move at an accelerated pace in the region.

### 5.2.8 *Benefits of E-commerce*

The results of the advantages of e-commerce come close to each other and percentages range between 10% and 17% whereby 10% of the respondents cited a 24 hours a day service as one of the main advantages of e-commerce; while 17% cited exposure to a larger market and merchandise. Others (12%) felt that its advantage lies in reduced cost which is the same percentage that gave the advantage from a business perspective as it enables increased sales. the advantage being flexibility in reaching customers and easier advertising had similar 15% percentage while the percentage who cited keeping up-to-date was 16%. The results are shown in Figure 7.

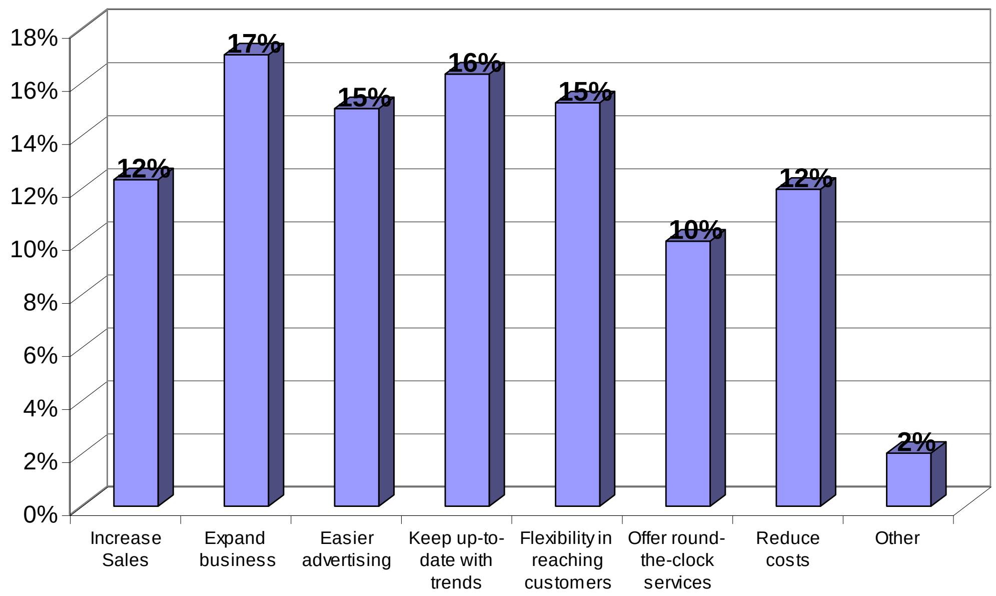



**Fig. (7) Benefits of E-Commerce**

*5.2.9 Risks of E-commerce*

In response to the questions of risks of e-commerce, 37% listed customers non-seriousness (window shopping); while 32% feared the risk of competitors accessing company's confidential information; while 22% feared increased exposure to piracy and theft of the company's information and 8% cited other risks. These results are shown in Figure 8.

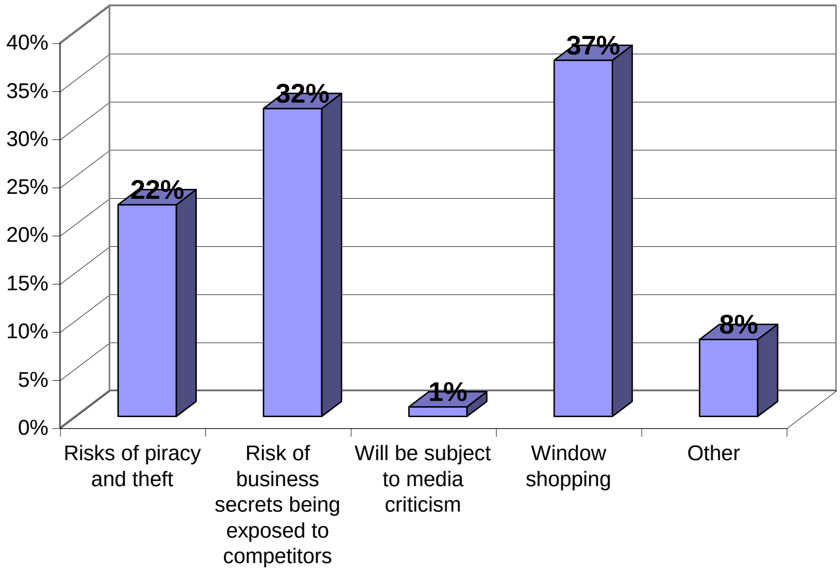
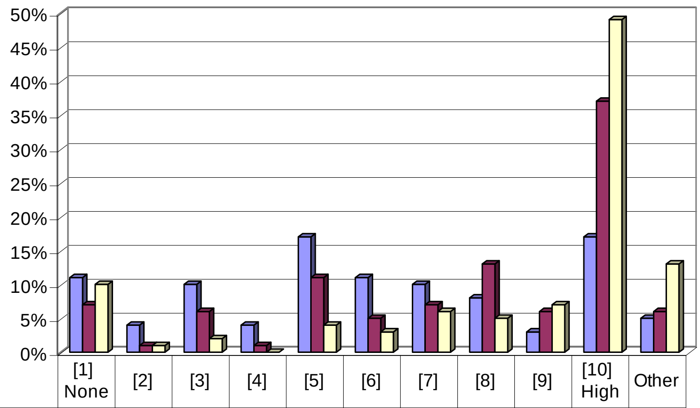



**Fig. (8) Risks of E-Commerce**

*5.2.10 E-commerce security and compliance to Shari'ah*

High degree of importance was given to e-commerce, computer security and the compliance of e-commerce with Islamic Shari'ah by all respondents although the percentage varied between 17% for interest in e-commerce; 37% for computer security and 49% for the compliance of e-commerce with Shariah as can be seen in Figure 9.




| | [1] None | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] High | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| How much importance does your company give to E-Commerce | 11% | 4% | 10% | 4% | 17% | 11% | 10% | 8% | 3% | 17% | 5% |
| What importance does your company give to Internet and E-mail security | 7% | 1% | 6% | 1% | 11% | 5% | 7% | 13% | 6% | 37% | 6% |
| What importance does your company give to complying with the principles of Shari'ah | 10% | 1% | 2% | 0% | 4% | 3% | 6% | 5% | 7% | 49% | 13% |

**Fig. (9) Importance given to E-Commerce, Security and complying with the principles of Shari'ah**

*5.2.11 Various Aspects of E-commerce*

A majority of respondents expressed interest in attending training courses on different aspects of e-commerce. They also expressed their interest in obtaining software and consultation on the Internet and its applications as can be seen in Figures 10, 11 and 12 below.

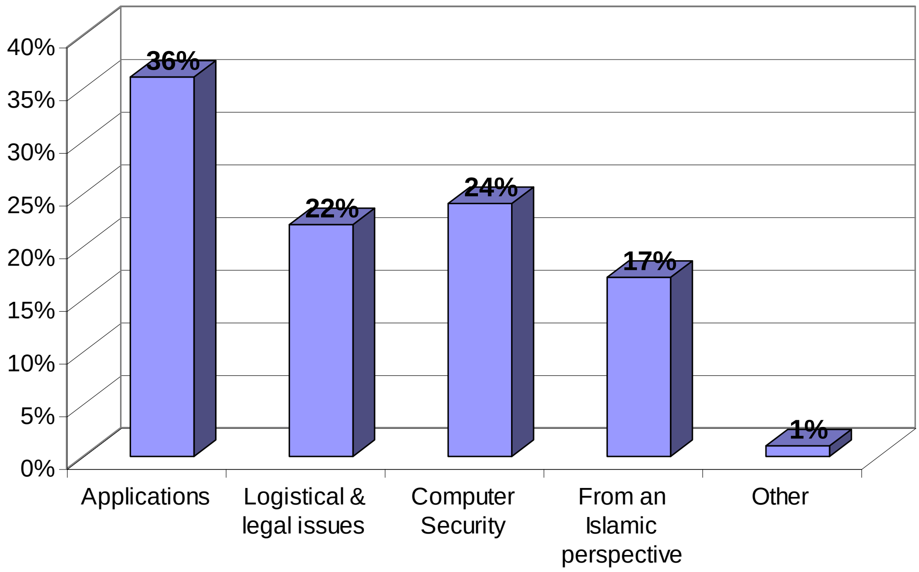



**Fig. (10) Subjects Preferred to Gain More Knowledge of E-Commerce**


**Fig. (11) Acquire H/W, S/W or Other Products for E-Commerce**

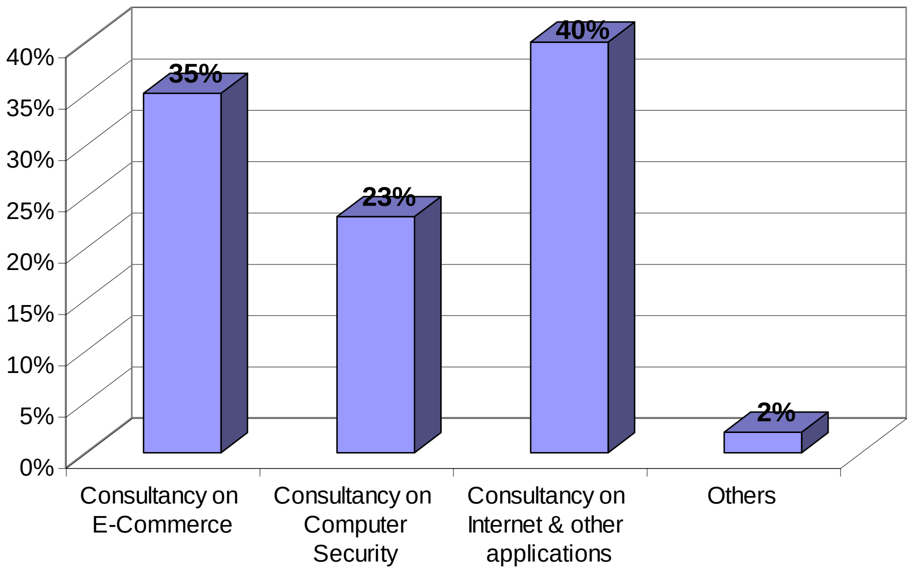



**Fig. (12) Services Required on E-Commerce and relevant subjects**

## 6 Background of respondent companies

Table 1 shows information on the companies and establishments that have been surveyed. As can be seen from Table (1), 57% of companies and establishments surveyed are private; 35% with mixed ownership; 1% are governmental and 7% did not respond to the question Figure 13.

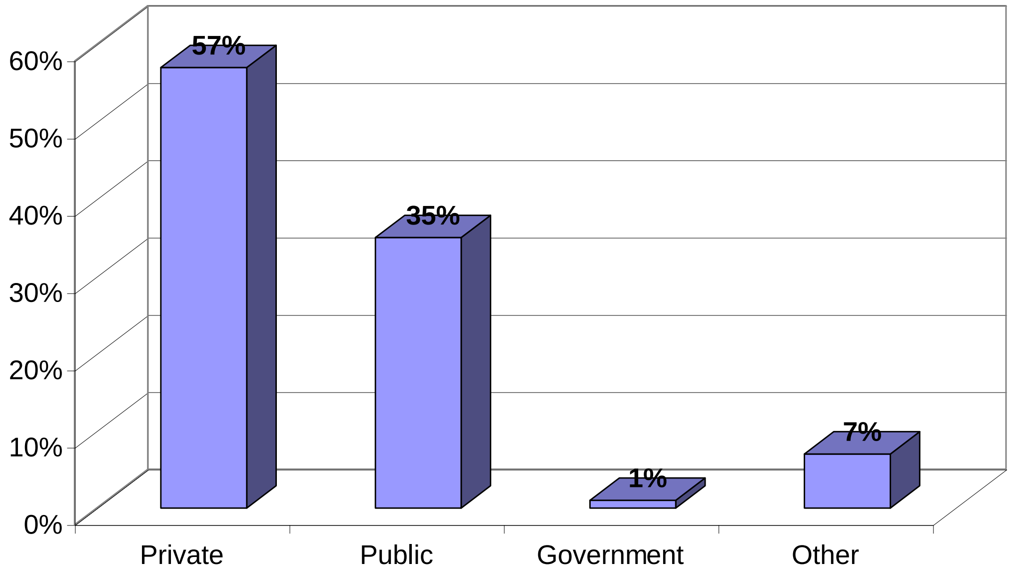



**Fig. (13) Company Ownership**

| **Number of Employees** | 1-50 | 51-100 | 101-200 | 201-500 | 500 and above | No answer | - |
|---|---|---|---|---|---|---|---|
| **Percentage** | 38% | 12% | 20% | 10% | 16% | 4% | - |

| **Paid-up Capital** | Below one Million | 1-5 Million | 5.5-20 Million | 21-50 Million | 51-100 Million | Above 100 Million | No Answer |
|---|---|---|---|---|---|---|---|
| **Percentage** | 19% | 30% | 18% | 5% | 9% | 7% | 11% |

| **Information Technology** | Less than 10 Computers | 11-50 Computers | More than 50 Computers | Local Area Network (LAN) | Wide Area Network (WAN) | E-Mail Users | Internet Users |
|---|---|---|---|---|---|---|---|
| **Percentage** | 34% | 27% | 17% | 17% | 3% | 24% | 23% |

**Table (1) : Information on Companies and Establishments**

Figure 14 shows that 33% of the respondents were general managers; 6% deputy or assistant General managers; 6% finance or admin. Managers; 3% internal audit managers; 5% I.T. managers; 3% purchasing/procurement managers; 6% assistant managers; 8% heads of departments; 11% others; while 10% did not respond.

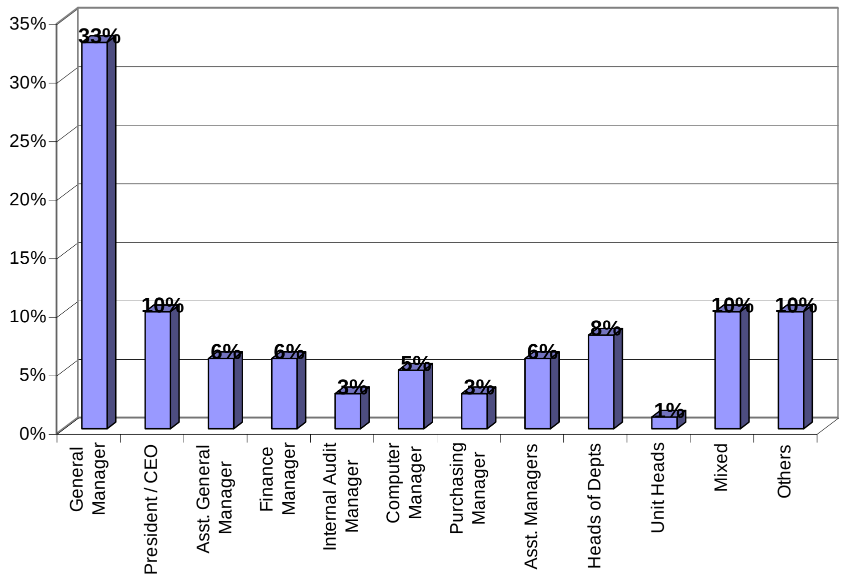



**Fig. (14) Respondent Positions**

## 8 CONCLUSION

It is evident that e-commerce was born to become very big in a very short period. All current estimates of e-commerce run into tens of billions of dollars even if these estimates vary. It is also clear that so far there is a specific trend in e-commerce in which computers, books, CDs and other goods are being traded. However, e-commerce activities in Saudi Arabia are increasing and spreading widely but gradually. It can also be noticed that the Internet is the main platform for e-commerce. The results of the current study show that there is an increasing interest in e-commerce that is in agreement with many other studies which also show that Arab and Muslim countries are still in the early stages. The implementation of e-commerce requires a much more organised and structured approach and if this approach is to be successful, it has to be

i) Comprehensive;

ii) Integrated; and

iii) Periodically updated.

Studying different approaches and experiences that have been used, it is believed that the Malaysian approach to develop e-commerce could be the most appropriate one to be adopted in Saudi Arabia [10]. The same approach has to be modified and adopted to suit the special environment each country has and specifically Saudi Arabia.

The results of the study also show that there is a demand and need for continuous training courses, consultation and awareness programs on e-commerce and its applications.

Close co-operation between private and public sector is essential if this approach is to be successful so as to be competitive in this World.

## 9 ACKNOWLEDGEMENT

Despite the fact that this Paper has been prepared with limited effort, however, this could never have been possible without, first of all, the mercy and help of Allah SWT and the help and assistance of many brothers who participated in different aspects. I specifically would like to thank the brothers in the Jeddah Chamber of Commerce and Br. Ibrahim AlSulaiman in person, in addition to Dr. A. Bello, Br. Mohammed Al-Haddad, Br. Khalid Bougily and Br. Ashfaq Ahmed. May Allah SWT reward all of us and make our deeds specifically for Him and Him alone.

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# Development Of IT Sector: The Tunisian Perspective*

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## ABSTRACT

Since the early eighties and due to an ever-growing interest in modern technologies, Tunisia has relied on information technology by reserving a special chapter for this sector in four consecutive five-year economic and social development Plans. Such interest has been enhanced through both a **conviction** and a **strong will** clearly expressed in Tunisian policy during the last decade and showed in the acute solicitude of President Zine El-Abidine Ben Ali continuously giving a significant impulse to the development of the IT sector aiming at making of it an economically active, strong and fruitful sector.

## INTRODUCTION

The word economy has been undergoing a fundamental transformation. Some of the most obvious outward signs are in fact among the root causes of its revolutionary technological advances including powerful personal computers, very elaborate and intelligent software, high speed telecommunications, and the Internet. This contributed to a new market globalised environment variously labelled "**information economy,**" "**network economy,**" "**digital economy,**" and "**knowledge economy,**" which altogether can be simply referred to as the " **New Economy.**"

## THE INFORMATION SOCIETY

Such an evolution in the world economy, mostly due to digital revolution, resulted into a new society based upon more and more dense and elaborate information and upon the technologies needed to make such information accessible, exchanged and broadcast. This is referred to as the Information Society.

Such a revolution will certainly have a major impact on each country and will be differently watched and lived from a country to another. Indeed, the rapid development of information technology will create a digital divide between the "technological haves" and the "technological have nots."

***** *A policy paper.*

**** Dr** Montasser Ouaïli, Former Secretary of State of Information Technology, Tunisia. Currently (2001),He is the Minister of Higher Education.*

At one end of the spectrum will be those who will be full members of the information society, while at the other end, we will find the excluded ones.

## THE TUNISIAN CHOICE

Aware of such huge stakes and the impact of globalisation, Tunisia showed its firm determination to be a fully-fledged member of the information society and made the wise choice of being in tune with the rhythm of modern changes. This is the reason why it made efforts to get endowed with the relevant policies and to take necessary steps in order to take the best advantage from the digital revolution and to be among those countries with "technlogical haves."

This solicitude has been all the more emphasised through the President fifteen-point political program proclaimed in October 1999, in which he pointed up the urge of :

- Investing in knowledge to contribute to the edification of Knowledge Society;
- Putting much more capitals on developed technologies and on Higher Value-Added sectors in order to improve competitiveness and to work Tunisia's way up to the world marketplace; and
- Being well-positioned within the information society and expanding the influence of Tunisian civilisation and culture through the development of multimedia industry.

Further attention on the development of information society technologies has been as well given by the Chief of State in his speech delivered during November 2000 while celebrating the commemoration of the 13$^{th}$ Anniversary of the Change (of leadership in Tunisia). It is thus understood that a strong political impulse lies behind the clear-sighted strategy set up for Tunisian IT sector.

## IT IN DEVELOPMENT PLANS

For the last five years, constituting the 9$^{th}$ Economic and Social Development Plan, i.e., 1997-2001, Tunisia followed a comprehensive and integrated national computerisation policy aiming an optimum use of computer resources along with a more significant command of information and communication technologies. This was done in accordance with the requirements of the national economy and its continuous interaction with international environment. Obviously, this clear orientation is due to the choice Tunisian government made of being open to the world and of taking the best advantage from the opportunities offered by IT in order to take shortcuts, tighten the gap and eventually join the developed countries.

## NATIONAL IT STRATEGY

A national strategy has been built up on **five major and complementary main lines** with the double target of enrolling Tunisian economy within the world scene and making it well-prepared with utmost tools so as to better face the challenges of the future. The strategy relies on :

### *1.* <u>The telecommunication infrastructure development</u>

Tunisia made the strategic choice to get connected to the universal network, Internet, thus enabling economic companies, SMEs, schools and universities, research institutions, libraries and so on, to be in step with the most advanced countries' experiences, and to be able to be present and play an active role internationally. Within this framework, a national backbone for the Internet has been implemented and several incentives have been granted namely the reduction of telecommunication rates. Moreover, mobile telephony is being expanded at a large scale all over the country.

### *2.* <u>The information infrastructure development</u>

In this respect, the Tunisian strategy rests on making every endeavour to further develop the information patrimony. This concerns mainly the building up of National Information Systems covering various sectors and fields, namely economy, health, education and social sectors with the purpose of broadening Tunisians' knowledge of the socio-economic environment.

Several national projects fit in with the strategy objective of developing the info-structure. Among the main projects, "**MADANIA**" is a national system for the management of civil status networking all municipalities all over the country so as to make it possible for citizens to get the various certificates evidencing their civil status (birth, marriage, decease, etc…) similarly and in the same convenient conditions from any point of the republic.

"**GEONAT**" is also a significant project to be mentioned. It is a national GIS with the objective of the achievement of a common reference framework along with a digital mapping background for the whole Tunisian territory.

Several other major projects are being carried out; the National University Network (RNU), the National Network for Research and Technology (RNRT), the National Education Network (EDUNET), the National Health Network (RNS), the National Agriculture Network (AGRINET), and so on…

### *3.* <u>Promoting human resources</u>

A keen interest has been given to human resources. The state has invested for about four decades on education and human capital. Today and given the new order of IT and the opportunities it offers, Tunisia is increasingly promoting the development of human resources not only for domestic use but also to be able to seize external opportunities. It is thought crucial to put a sustained and continuous emphasis on computer culture dissemination and computer education at all levels : primary, secondary and university. Training of experts and technicians in that field is, as well, among national priorities.

## *4.* **Promoting IT private sector**

The state established a specific policy to enhance the development of the private sector and help to turn it into a stronger and more competitive work force. The action plan includes :

- Creating and developing the market for IT engineering and software development companies, by urging public institutions to resort more and more to outsourcing and sub-contracting to the private sector ;
- Implementing sector support programs ;
- Carrying out an upgrade programme on behalf of the sector of computer services ;
- Promoting and developing High-Tech parks; and
- Granting fiscal incentives dedicated to computer services and engineering sector, namely:

1. Fiscal privileges for the investment in IT;
2. introduction of stock options; and
3. VAT exemption for IT training.

## *5.* **Setting up a legal framework**

The outgrowth in the use of Information Technology involves the prior resolving of legal disagreements regarding for instance royalties, intellectual estate, Information Systems protection, conformity with standards and electronic transactions attestation, and so on…. The urge to establish a specific legal framework for IT has become more pressing particularly when a national thinking on electronic commerce raised. Consequently, two committees emerged to work out the project on the national scale. These issued, among others, the following recommendations:

- The set up of a series of pilot projects of virtual shopping centres (www.ecom.tn);
- The recognition of electronic signature as a classic signature provided that certain conditions are met;
- The disclosure in August 2000 of a law on the electronic exchanges and e-commerce. Such a law envisaged, more particularly, the implementation of a specific infrastructure for electronic signature as well as the creation of a national certifying agency along with a certification service provider's network..

In addition, further focus on training at all levels is being placed. Various human resources training programs are being planned and carried out.

## BENEFITING FROM THE DIGITAL REVOLUTION

Matched up with the awareness to draw full benefit from the digital revolution, the state is more and more banking on education. For, it is no wonder a conviction that distance learning has a crucial role to play in this respect. The global electronic education, or what is commonly known as "e-education" is now widely forecast to be a business worth $50 billion by 2003. The relevant industry for this purpose is also being implemented. That is the reason why, the state adopted an incentive policy to support the growth of the private sector generally in the fields of ICT and more particularly to enhance the constitution of a multimedia industry.

Such an industry will serve not only as a modern technique in education but also as a means to preserve sovereignty by expanding and making the most of the Tunisian cultural patrimony in an era where internet cultural contents are proliferating.

On the other hand, taking into consideration the urgent national, indeed even international, need for skilled and experienced computer experts, the state has put a series of measures to foster the development of "custom-made on-request" human resources training programs; such programs are Government subsidised.

The state has, moreover, implemented special IT Innovation Funding (FITI), to promote private initiatives, encourage young graduates to turn their innovating ideas into projects and rise the start-up creation initiative. These measures will be matched, in the next couple of years, with parallel efforts related to research development by means of investment.

## TUNISIA IT INITIATIVES

Obviously, the choice and will Tunisia had to quicken the pace of the development of information technology needed an imaginative and ambitious program so that to succeed in taking up the main challenges. Indeed, the state has put a great amount of faith in digital opportunities and the chief of state showed a strong determination to turn the promise offered by information technology into a prosper reality. The political program he proclaimed in October 1999 is a glaring evidence of that.

In addition to the valuable acquisitions Tunisia won along the decade, the spurring effect of the political program for the five coming years contributed substantially in entering Tunisia the Information Society. In fact, it has been stressed in the program-speech that the vision to radical world changes should be both ambitious and optimistic on a well-founded basis : **"Tunisia is today resolutely turned toward the future. It thinks ahead in order to win and knows how to integrate modernity without disowning its roots, how to take advantage of progress without renouncing its age-old values, and how to go with the tide of history with great assurance and determination. …. I believe in my country. I have confidence in**

**our people and their capacity to meet all challenges. I am proud of the genius of our men and women who made countless glories through over three thousand years' history."**

The fifteen-point program emphasised a great deal on information technology and addressed IT in seven points out of fifteen. IT has been considered as a tool and a way to win the challenges of the future. Now that the economy is more and more based on intangible activities, Tunisia is counting on its manpower's intelligence to grasp the opportunities offered by a vast market. Consequently, relevant measures to prepare young Tunisians to be effective actors in this new economy are being taken.

## IT AND EDUCATION

As for education, it has been decided that computer studies be performed in all schools to better prepare Tunisian children for the use of new technologies and make them accustomed to what constitutes an essential vehicle for the transfer of knowledge and culture. In addition, having already connected universities, research centres and high schools to Internet in 1997, investing in learning, in research and in development programs is among the top priorities.

Furthermore, a particular emphasis will be put on primary and basic school with the ambition of extending the network to 4,500 basic schools in the coming years, along with a progressive till intensive use of teaching-oriented multimedia material. For, efforts will be directed to teacher training, and to the creation of Internet clubs at all levels of education along with the intensive use of multimedia material for both educational and cultural purposes.

Other core orientations regard :

- The enhancement of **immaterial economy** through an ever-increasing incentive effort to develop digital content production and the support of job opportunities it offers ;
- The promotion of ICT Tunisian genius and the reinforcement of its presence overseas ;
- The modernisation of Tunisian administration in order to improve the type and quality of public services offered to Tunisian citizens wherever they could be through a better use of the ICT, i.e., e-government
- The further development of ICT specialised human resources in number and in level of skills in order to meet domestic needs and those linked to the development of the service and engineering export activities ;
- The strengthening of ICT as a subject and a tool within the training syllabus (basic, secondary and university education, professional and continued training, adults training, etc…) in accordance with the guidelines of the "**School Of Tomorrow**" program ;
- The consolidation of ICT in the culture of Tunisian citizens so as to better prepare them to be the model citizens of the Knowledge Society.

## E-GOVERNMENT

Furthermore, several projects are to be launched in order to better introduce ICT in Tunisian administration within the framework of the development of what is known as : e-government, let us mention among others :

- The set up of Intranet within Ministries and public administration institutions
- The building of Web sites for public administration
- The generalisation of Electronic Document Management Systems in the public administration
- Remote procedures and public services.

## A PHILOSOPHICAL VIEWPOINT

In the Information Society, it is becoming more and more widely understood that our most valuable assets are intangible in nature. Wealth and employment creation is driven mainly by services, software, telecommunications and digital content. Tunisia is among the countries which understood the main stakes of the Global Knowledge Economy and the many opportunities it offers for economic growth. This is the reason why we are more determined than ever to work harder and harder, to deploy all necessary means and tools, to devote all skills and experiences acquired throughout the decades so as to tighten the gap with the North, succeed a smooth and fruitful transition to the Information Society and be a full-fledged member of it.

## CONCLUSION

Considering the obvious roots linking Islamic countries to each other, IT this revolutionary field of potential transformation of our economies and our societies will open the chance of an enlightened and dynamic co-operation among our countries. Tunisia is quite open and ready to exchange successful experiences with others Islamic countries and to co-operate fully with this endeavour.

Tunisia is optimistic and the objectives are worth the challenges. The best end is in these words uttered by the Chief of State while presenting his millennium political program : **" Tunisia's future is promising. It is within our reach. The challenges of today will be the triumphs of tomorrow. We rely on our people's power and on the commitment of our youth to secure for their country the standing it deserves in the years and decades to come. It will be the duty of our rising generations, to whom the gates to knowledge have been wide open, to build Tunisia of the 21st**

**Century. …. In faith to these values, we'll try together, to ensure for Tunisia, at this turn of century, a place in the community of the advanced nations. "**

# DEVELOPMENT OF THE IT SECTOR: THE TURKISH PERSPECTIVE

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## 1 INTRODUCTION

With their ever-growing uses, information technologies (IT) are affecting the way the people live, think, communicate, learn, teach, and interact. Thus, almost all the aspects of communal establishments need to be questioned and, if necessary, revised to support the demands created by IT. The scope of such an effort is vast since IT brings forth many possibilities with issues in security, privacy, ethics, and law as well as technology, infrastructure, and hence economy. Without any doubt, the biggest share in the revision process is to be expected of the governments bearing the responsibility of development of policies.

The Turkish government has realized the need for such a revision and development program in mid 1990s and has initiated the Turkish National Information Infrastructure Master Plan (TUENA: short for the Turkish "Türkiye Ulusal Enformasyon Altyapısı" project). Thusfar, the government agencies responsible for TUENA have completed a very broad survey of the current situation in the IT sector in Turkey with comparisons to several selected countries both in the west and east, and have set forth the scope and goals of the activities to be completed for a successful transition to the IT era. The goals and cost estimates were reported as early as 1998. Current information as well as monitoring of future projections in 1998 can be reached at http://www.tuena.tubitak.gov.tr/. The information in this site (except the "Final Report") is in Turkish. One goal of this paper is to summarize the information in the TUENA reports.

While the TUENA project office helps form the future trends in IT, both private and government sectors have adopted the blessings and blemishes of IT. A few examples based on media reports and personal observations will be mentioned at the end of the paper in order to illustrate how the recent advances in IT affect the everyday life.

## 2 TUENA: TURKISH NATIONAL INFORMATION INFRASTRUCTURE MASTER PLAN

In 1995 a group, which was established to evaluate Turkey's technological position in the informatics area, reported on the strategic importance that the IT sector will have in the near future. It was emphasized that this sector not only pushed the recent technological advances, but also affected the society in a variety of ways. This effect would unfold changes at many levels; including but not limited to communication, trade, production, governmental activities, policy and law making, and security. Due to the importance of the matter, the

National Security Council called upon many governmental agencies to come together to elaborate on how the IT could be used with maximum national benefit and to come up with a master plan to accomplish this goal. Hence, the first of a series of meetings, which would later be conceived as a part of the TUENA project, was held in January 1996.

As a result, the preparation of the national informatics master plan was initiated under the coordination of the Ministry of Transportation and the secretariat of TÜBİTAK (Turkish national science foundation). A project office was established in TÜBİTAK and a task force was put together immediately. As illustrated in the following diagram, the TUENA project was subdivided into sub-tasks of (i) Determining world trends, (ii) Evaluating the current situation in Turkey, (iii) Planing of the infrastructure, (iv) Determining the national contribution, and (v) Forming the required organizational sctructure.

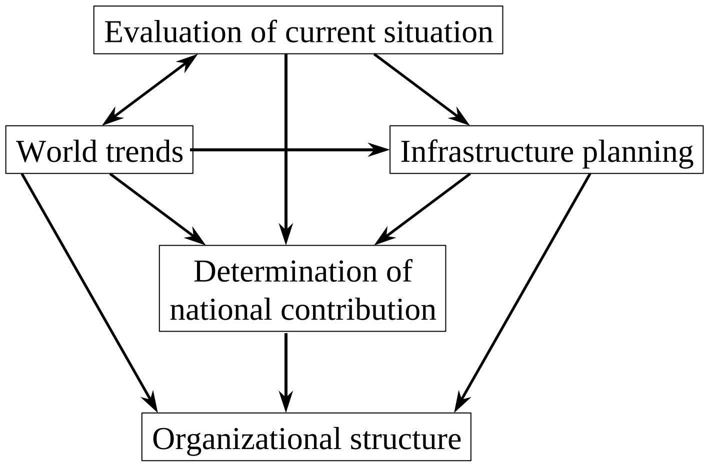


**Figure 1**. **Scope and tasks of the TUENA task force.**

In what follows, the goals of these sub-tasks and their outcomes will be summarized with a special emphasis on the evaluation of the current situation. However, one should be warned that the statistical data reported under “current” situation was collected in 1997.

### 2.1 Evaluation of World Trends

The organizational structure of the IT sectors as well as technological trends in several countries around the globe were investigated in this sub-task. Main topics included in this inspection were software platforms, mobile communication systems, security in telecommunication networks, local networks, and latest technological advances in these fields. Special attention was given to health information systems, multimedia publishing, academic and research networks, services for the underprivileged, Internet, smart transportation systems, e-government services, and distance learning. Besides the technological aspects, the organizational arrangements made by different countries were also inspected.

Within the scope of this sub-task 416 documents from 22 countries (including USA, Germany, Australia, Brazil, Canada, China, England, Finland, France, Israel, Japan, New Zealand, and South Korea) were inspected in terms of their aimed areas of information and telecommunication technologies production, information infrastructures, use of IT in the government sector, and reorganizations in the telecommunications sector. As a result, it is seen that that the leading countries seem to concentrate more on hardware production followed by multimedia content development and services.

The main roles of organizations for forming the infrastructure can be listed as: trying to form a consensus among the political parties and the public regarding the necessity of an IT infrastructure and how worthwhile it is to set aside funds for it, coordinating the efforts of establishments in this field, determining the goals to become an information society, and developing policies to achieve these goals. The structures of regulatory organizations for telecommunications differ from country to country. In countries that aim to gain the overhand by improving their national information industries (such as Japan and South Korea) the regulatory organizations are government dependent. In most other countries, these organizations are either partially or fully independent. Similarly in those countries that aim a global benefit from IT hardware production, strategies are planned and executed by joint effort of the government agencies and private industries.

### 2.2 Current Situation in Turkey

The current situation in Turkey was inspected with respect to several categories. Probably, the most interesting result came out of a public survey measuring the accessibility and usability of IT equipment by the general public. The survey was carried out in towns with more than 20,000 in population. 4000 people (representative of the household distribution in those towns) contributed to the survey. Table 1 summarizes the percentile ownership of the IT equipment. Note that there are more computers than answering machines. However, only a fraction of these computers are connected to the Internet. It is expected that the number of computers that have Internet access is growing rapidly after the establishment of several Internet service providers since 1999. Another point regarding the Table is that a telephone ownership of 81.8% is at best not satisfactory.

**Table 1. Household IT equipment ownership.**

| IT Equipment | % of homes |
|---|---:|
| Telephone | 81.8 % |
| Computer | 6.5 % |
| Answering Machine | 5.8 % |
| Fax | 1.5 % |
| Modem | 1.3 % |
| Internet connection | 1.2 % |

A part in the survey questionnaire asked what kinds of services would better be done over the Internet. In other words, what services would people use if offered over the Internet. The ranked results are summarized in Table 2. The first thing that catches the eye is that willingness to use the internet is quite high since all the areas covered get more than 50% interest. The first item in the wish list is almost fully realized nowadays. The second and “take part in debates and polls” items are truly an indication of the strong public support for e-government. It is worthwhile to note that e-banking seems to receive a very low rate of interest.

**Table 2. Interest to services provided over the internet.**

| Services | Percent interest |
|---|---|
| Bill info and payment | 82.6 % |
| Petition and answer | 75.5 % |
| Reservations and tickets | 73.5 % |
| Movies, music, art | 73.2 % |
| Exchange information | 73.2 % |
| Take part at debates and polls | 69.6 % |
| Education transcript services | 66.8 % |
| Library, museum and art gallery services | 64.9 % |
| Buy / Sell goods | 62.0 % |
| Banking and brokerage services | 58.6 % |
| Job application | 57.2 % |

In order to respond to this high interest of "going on-line" (or at least to the wish thereof) without discrimination, the current distribution of household telephone and computer distributions with respect to socioeconomic level needs to be inspected. The results of such an evaluation is given in Table 3. In this table, each contributor to the above survey was classified into one of the five socioeconomic levels. As expected the distribution of the telephones is quite homogeneous. However, the ownership of a computer is still a sign of high socioeconomic level. Another point that is not apparent in the given tables is the level of usage of the present equipment. As a basic measure people were asked about the services (such as call waiting, forwarding, 3-way conferencing, and wake-up service) offered by the telecommunication company. Only a fraction of the people stated they were aware of these services and almost none used them. Hence, not only accessibility is a problem.

**Table 3. Distribution of major IT equipment with respect to socioeconomic level.**

| Equipment | Lowest (20%) | Low (20%) | Middle (20%) | High (20%) | Highest (20%) |
|---|---|---|---|---|---|
| Computer | 2.9 | 7.4 | 12.4 | 24.8 | 52.5 |
| Telephone | 13.7 | 19.5 | 21.0 | 22.4 | 23.4 |

Based on these statistical data the following points are recommended for any action plan. In order to cope with the imbalance of computer distribution within the society, healthy economic and sociological planning is a must. The imbalance can be fought by providing privileges to rural subscribers. Open public terminals is another way to fight imbalance. However, these open-public projects must be planned well and executed timely. Since the public at large does not seem to fully employ the available technologies, increasing awareness and education must be of high priority in the lists of both the public and private institutions. Finally, "ease of use" should be a primary property of whatever infrastructure is to be developed.

The above surveys and points regarded only the public sector. Similar evaluations were also carried out for the government as well as the production, health and education sectors. These studies suggest that these sectors are capable of fully employing a high bandwidth national infrastructure in a very short amount of time.

In addition to the above surveys, an inventory of hardware and software in the country was prepared and an assessment of the present technologies was reported by a private firm. Also, the production capability in terms of both software and hardware was also inspected. This yielded the conclusion that the $1.6 billion production rate is not enough for global competitiveness. However, desired levels of production can be achieved with careful planning and policy making. This point of view is supported by Richard Hawkins of the Science Policy Research Unit (SPRU).

Based on the evaluations mentioned in this and the previous sections, the vision of the national information infrastructure is determined to be:

- Maximization of socioeconomic benefits for sustainable development;
- Increasing the national contribution in the hardware, communication services, software, and content fields of the information and communication sector;
- Assumption of a leading role in the near geographic region for achieving a global market share; and
- Realization of policies and restructuring to achieve the above goals.

### 2.3 Planning of the Infrastructure

Following the establishment of the TUENA vision, studies toward determining the physical size of the infrastructure to be realized were initiated. To this end, it is aimed that 75% of the households of towns with greater than 20,000 in population and 25% of the households in smaller towns is to be connected to the network by the year 2010. This aim is twice of what could be achieved without proper planning and execution in terms of computer ownership. It is also ten times exaggerated in terms of network access with no government intervention. Contacts with the government, education, health, and industry sectors have revealed that a high bandwidth network is becoming more and more needed. After determining the specifications of the infrastructure to support these needs, the Turkish Electronics Industries Association (TESİD) was contacted to estimate the technologies needed and the cost required to establish such a network. With the assumption that the cost of technology decreases by 2/3 in 10 years, the cost of becoming an information society is estimated to be $38 billion for Turkey. Investment plans till 2010 are also prepared within the efforts of this estimation.

### 2.4 National Contribution

Once the amount of needed investment was determined, Turkey's strengths and weaknesses in the global IT market were studied by comparing its status with those of regional states. In conclusion, the greatest national contribution to the global IT is expected to be due to the geographical location. Similar national contributions can be seen in the cases of Brazil in Americas, South African Republic in Africa, and Malaysia and Singapore in Asia-Pacific. Tools to realize the determined national contributions were also inspected and it was seen that most of these tools (such as the focused public projects, industry-university partnership, and reservation of funds for R&D) were missing from the current political scene.

### 2.5 Forming the Required Organizational Structure

Based on these shortcomings, a series of recommendations for establishing a "ministry of information society" was proposed. The initial efforts of this ministry would be supported and executed through the Turkish Telecom while different organs of this ministry come into action. These organs would include the Information Society Council that would function as the policy making body and as a coordinator of government and private sector efforts. This organ would be supplemented with a regulating body and an organization that would be in charge of proper dissemination of the major funds of the ministry in terms of projects such as establishment and running of networks. The major tasks that would be assumed by this organizational structure would include:

- Work towards equalizing opportunities
    - Balance incomes
    - Adjust computer prizes
    - Establish free public centers
- Make the innovations simple to comprehend
- Educate general public about internet
- Educate K12 teachers
- Produce high quality educational material
- Encourage distance and contributory education
- Encourage in-house production of hardware
- Prevent geographic and socioeconomic divisions in terms of IT
- Encourage the penetration of IT into the medical circles (a 6 billion dollar sector)
- Establish national databases with single indexing
- Assign high priority to complaints from the small and moderate size industries
- Encourage "software houses"
- Provide fast resolution of laws and legal matters in IT.

## 3 GENERAL OBSERVATIONS OF IT PENETRATION

A simple way to assess the penetration depth of IT in Turkey is to follow the media. Some of the recent topics extracted from the news bulletins reveal that:

- Use of optical fibers and digital communication lines is becoming common place.
- There are currently four cellular phone providers and more than ten internet service providers all privately owned.
- A smart ID has been recently issued to 140 million citizens of which approximately 70 million are deceased. All governmental records will henceforth be referenced by the smart ID.
- Police and security infrastructure is enhanced by establishing a common database for passport services and customs and illegal trade departments in the police force. This database is secure and accessible through special terminals located in all police stations.
- Paperwork barrier is trying to be alleviated through in-house research regarding electronic signatures.

- Institutional computing is being established where computationally intensive tasks are handled by PC clusters.
- Organized industrial sites (such as GOSB) containing smart buildings, software houses, central control agencies, etc. are being established.

## 4 CONCLUSIONS

Turkey has realized the critical role that IT will play in the twenty first century. She has taken action towards establishing a sound information and communication network by preparing a national information infrastructure master plan; TUENA. This plan has evaluated the current situation of Turkey in terms of IT with regards to other states and has proposed a budget as well as an organizational structure to become an information society in 2010. Media reports indicate that steps are being taken towards the realization of this master plan.

# Aspects of IT Development in Tunisia*

AHMED FRIAA'**
*Ministry of Communications*
*Tunis, Tunisia*

I highly commend your success in choosing for this conference a theme which occupies a high position in the priorities of nations and peoples i.e. "Information Technology as a Means of Development," an issue which is unquestionably a primary one of the Third Millennium and a pivotal topic of numerous recent academic and economic researches, studies and analyses.

I will adopt the following approach to present this modest contribution to avoid lengthiness and repetition of the themes programmed else where in your deliberations:

1. First: It is necessary to highlight two main conclusions:

- The First Conclusion: The technological revolution which we are living at present is in, in fact, the outcome of decades of significant inventions in several field attained after the stage of complete amalgamation.
- The Second Conclusion: The profound and accelerated shifts witnessed by our contemporary world, especially in the area of exchanges and globalization thereof, is a result of contemporareity between the aforesaid technological revolution and the openness of economies following the retreat suffered by classical ideologies.

2. The Second Element deals with the presentation of Tunisian strategy and acquaintance with the future options of His Excellency President Zine El-Abidin Bin Ali which are merged within the radical transformation witnesses by our present world.

   They provide a preliminary step toward a society that contributes to the enrichment of human knowledge; a society saturated with the present time culture; cooperative, secure, proud of its civilizational affiliation, capable of facing competition, confident of it wise choice, and reliant on its own talents and on the intelligence of its members.

3. Thirdly: I will try to point out the present and future challenges, the necessity of proper interaction with the requirements of the present stage, change of some mentalities, importance of joint international work so as to avoid falling into a bottomless pit of a new type that divides the world into some nations that control the technology of the age and others which are kept away from it.

**Ladies and Gentlemen:**

During the last decade the world saw deep and quick technological transformations preceded by numerous researches and studies and covering various fields. Such shifts have led to results that stunned even the researchers and scientists themselves. We are talking now about remote activities like remote teaching, remote medication, remote trading and diverse remote transactions.

At another level we have come to talk about information technology or communication technology and digital culture as human transactions will be basically carried out in the

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* A short policy paper.
** His Excellency Prof. Ahmed Friaa' is Minister of Telecommunications, Tunisia.

future through electronic and not material means, adopting digital technology for communication. An ignorant person in the years to come will be the one who cannot appropriately deal with these new instruments.

The most important distinctive qualities of these technological transformations may be the following:

First: Merger of technologies with one another as the relevant networks and equipment have become able, with the potentials provided by digitalization, to pass communications movement and process various types of information vocal, visible or written, unlike what used to happen in the recent past when specialization or classification used to take place according to the type of transmitted signals.

Secondly: The rising intelligence or smartness of these networks which have become able to carry out a good number of remote services without resorting to human intervention.

Thirdly : Securing the continuity of communication regardless of the site of actual presence. This is being done by mobile technologies like the digital cellular telephone or adoption of satellite technology.

Fourthly: Development of capacity; for this technology could not have been developed and the fields of its utilization would not have been widened but for the formidable potentials provided in the field of capacity and energy in processing and transmitting information.

Fifthly: Easy Usability: At present, the use of modern means of communication does not require, as was the case in the past a special preparation in particular fields, but it is sufficient now to acquire a minimum amount of training sufficient now to acquire a minimum amount of training in the use of end equipment and some basic software, to enable one to properly to utilize these instruments and exploit the new opportunities and prospects they offer in various fields and activities.

Sixthly: Low cost; for modern technologies are characterized by an interesting quality i.e. continuous decrease in their cost corresponding with the accelarated development of their capacity and the continuous growth of their capacity of processing information.

Moreover, the simultaneity of these technological shifts with the liberalization of economies, globalization of exchanges and adoption of the market economy by most transformation of the world into a global village in which distances have been shortened and various types of barriers have been manginalized, - a world where new concepts have been formed related to the assumed reality and the assumed presence as the new framework encompassing mutual transactions and acting as an instrument through which trade and economic and cultural exchanges are being carried out.

It is common knowledge now after the collapse of the Berlin Wall, the end of Cold Ware at least in its current sense, and the decline of classical ideologies in the late nineteen eighties and at the beginning of nineteen minutes, that the world has entered into a new political stage, the most significant of whose characteristics, with regard to our topic today, may be the openness of economies, adoption of market economy as a pivotal option in most countries for pushing development forward, bringing in investments and creation of new kinds of wealth and additional opportunities for work.

**Ladies and Gentlemen:**

We as Tunisians feel proud that our country is among the group of countries which worked for enhancement of its capacity to forestall events, predict the future and keep abreast of technical and economic changes an variables. This has come about through the approval of several measures that embody the outstanding role of the modern techniques of communication in supporting national efforts aiming at comprehensive development and bolstering the radiation of Tunisia at international levels.

This field, it must be said, has recieved special care and attention from H. E. President Zaynul-Abidin Bin Ali within the framework of a pioneering futurist policy to enlarge the scope of utilizing communication network based on three strategic props which successinely aim at:

- More support and modernization of infra structure besides diversification of services and bringing them closer to people.
- Drawing up an integrated organizational framework to insure keeping abreast of the profound and accelerated transformations experienced by this sector at national as well as international levels.
- Following an integrated policy to disseminate digital culture in an endeavor to efficiently and capably involve our country in the organization of communication community.

The special attention paid to this sector becomes tangible through the duplication of the investments allocated for the development of communication technology. These investments amounted to 1500 million Tunisian dinars during the ninth economic and social development plan vis a vis 860 million dinars in the eighth plan. Before the end of the present quinquennium (1997-2001) this sector achieved a growth rate of over 17% i.e. about three times the average of the national economic growth as a whole.

As a matter of fact, efforts have been directed towards the achievement of a developed infrastructure by using the most sophisticated and most responsive technologies to the evolution and diversity of the needs of people related to dependence on Tunisian frameworks and talents at various phases starting from the study level through operation of networks and ending up with the levels of utilization and maintenance.

The number of subscribers to communication networks rose to about 1.1 million people by the end of September, 2000 compared with only 220000 subscribers in the year 1987. By the end of the year 2000 the number is expected to exceed 1.2 million subscribers, which will make it possible to raise telephone coverage to 12 lines per 100 inhabitants as against 3 lines for the same number in 1987. Endeavors are being currently made to raise telephone coverage to 25 lines per 100 inhabitants by early 2004, to fulfill the requirements of the pioneering futurist program of President Zaynul-Abidin Bin Ali in this field.

In this connection, it should be said that the total digitalization of the telephone network has been completed since June 1999; in other words 2 a half years ahead of completing the ninth development plan in addition to placing 3500 km of optic fibers cables to make them amount to 6500 km before the end of the year 2001.

At another level, national networks have been installed to insure mobile communication services. At present work is going on relentlessly in order to complete expanding the digital mobile telephone network to cover almost all the regions of the country side by side with raising its capacity to the level of 400000 subscribers.

Within the framework of the efforts that aim at further modernization of communication infrastructure, various uptodate technologies have been introduced in the arena of linking subscribers by the adoption of the Wireless Local Line (WLL) and lines provision system over and above reinforcement of the general centers network of telecommunications, postal services Internet, which enabled us to spread the services related to communication technology all over the entire country in a very easy way at very low costs.

Our country was also ahead of others in engrafting the national communication networks with the highest and most responsive technologies to the aspirations of users in this field. This was instrumental in doubling eighty fold the capacity of linking Tunisia with the global Internet during the last three years; for it has developed from the level of 0.5 megabyte/second in 1997 to 40 megabyte/second in the year 2000, which makes this country stand foremost among the developing countries in this sphere.

With regard to internal linkage a structured backbone national network was completed. It comprises seven transit centers linked with one another by means of optic fiber connections with such as a high capacity as to be commensurate with good quality requirements on the one hand and to guarantee the smooth flow of incoming movement by taking into account the expected growth in the number of subscribers on the other hand.

Meanwhile the number of Internet users has risen from only a few dozens in the year 1997 to over 250000 users at present, not to mention the growth in the number of public Internet centers from 11 during November 1997 to more than 170 centers covering various parts of the country.

The Tunisian experience of public Internet centers was received with wide interest at both regional and international levels owing, on the one hand, to its response to Tunisian social, cultural and economic particularities, and, on the other hand, to its active role in the dissemination of digital culture and in the enhancement of employment efforts.

Taking into account the keen interest of our country in investment in human power, and because of the evaluation of Tunisian intelligence and placing high stakes on Tunisian creative, renovating and outstanding talents, the City of Communication Technology has been established to represent a fully integrated space for construction, research and production in the field of communication technology.

This promising futurist presidential achievement which is enjoying an increasing interest at booth regional and international levels is employing over 300 communication technology engineers, - a number which is likely to grow to about 1000 engineers up or the completion of the other stages of the project.

This technological slope includes an incubator for the projects which provides young researchers in communication technology with the best opportunities to promote and successfully accomplish their projects in addition to providing the necessary requirements of framing, comprehensive and support.

Audio-visual interlocution technology has also been subjugated to remote control via modern communication networks and is being applied in numerous fields and specializations like remote medicine, remote preparation and other different activities.

As an evidence of the high degree of the efficiency and expertise attained by Tunisian human resources in this sphere, the National Bureau of Communication " Tunisia Communications" won an international deal to complete and utilize a digital mobile telephone network in the Islamic Republic of Mauritania which was operated one month ahead of the originally fixed date.

In addition, our country participates in the most significant international communications projects like the Arab Satellite named "al-Thurayya" (Pleiades) and the African Communications Project "Africa One," the African Satellite RASCOM and the international sea cable made of optic fibers "Oxygen."

In sum, with the end of the projects currently being completed or most programmed for the forthcoming short period, Tunisia will have a communication network which is one of the most uptodate ones existing around the Mediterranean Basin.

**Ladies and Gentlemen:**

Through the guidance of the Head of the State President Zaynul-Abidin Bin Ali, we in Tunisia have been able to provide an integrated organizational and legal framework that responds to the profound and accelerated changes witnessed by the technology sector of communication at both national and international levels.

For after the code of obligations and contracts has been revised and electronic signature and documents have been formally legalized, as is the case with hand-written signature, the low and Electronic Exchanges and Commerce was promulgated during last August as a basic constituent to secure an effective concomitance of the accelerated variables witnessed by communication technology at different technical, commercial and organizational levels in addition to securing the interests of various parties involved and encouragement to properly benefiting from the technology of the time in accordance with a special vision which duly observes the national economic and social particularities while consulting previous international experience in this field.

The promulgation of the Law of Electronic Exchanges and Commerce in Tunisia came only a few days later than the most advanced countries in this sphere, as an evidence of the time precedence which Tunisia has successfully achieved thanks to the wise guidance of H. E. President Zaynul-Abidin Bin Ali, who approved in November 1997, the creation of a national committee for electronic commerce, and involvement of all concerned parties in studying the issues related to electronic commerce from all sides.

At the same time endeavors to publish the new communications code are well under way with a view to boosting competition, production and investment in the field of communication technology and laying down the necessary legal guarantees to state clearly the rights and duties of all involved parties while widening the scope of benefiting from communication services.

Side by side with that, there has been an outburst of many projects related to formation, sensitization, dissemination of information culture and encouragement of research and control of technology within the framework of carrying out the pioneering future program of H. E. President Zaynul-Abidin Bin Ali and the concerted efforts of all the constituent elements of Tunisian society and all ports of the country without anyone being excluded or marginalized.

In this context one should refer to linking all the university and secondary and preparatory education institutions to the Internet while waiting for the start signal within the framework of the tenth development plan, to link elementary schools also and, consequently, opening the door wide open for the Tunisian Youths to train in the proper use of modern means of communication and benefit from the wide prospects they offer.

Starting from a judicious exploratory vision conscious of the increasing importance of communication technology in the promotion of competitive capacity, encouragement of investment, and support of employment efforts in addition to the reinforcement of Tunisia's radiation and active presence at international level, His Excellency the President of the Republic provided on June 9, 2000 on inner cabinet meeting which was devoted to looking into the non-material economy program. At that meeting a number of pioneering historical measures were approved, aiming at securing proper utilization of modern means of communication, investment in knowledge and insuring that Tunisia is effectively incorporated within non-material economy.

Following are some of the particularly important decisions taken at the meeting:

- Gradually and electronically providing various administrative, commercial and economic services through modern means of communication.
- Providing a minimum level of qualification and training in proper use and utilization of communication and information technology for young people below 16 years of age.
- Laying down a national plan for qualification in communication and information technology, and supporting scientific and technological research in this field.
- Continued support of communications infrastructure with a view to providing the necessary means for non-material economy.

It is noteworthy, in-this connection, that during the month of August this year (2000) an electronic payment device has been devised which makes remote payment possible through internet in assumed national currency "E Dinar." It is an instrument of electronic payment that has been developed at the level of Tunisian post in accordance with solutions and conceptions that duly observe national economic and social distinctive qualities based on a 100% Tunisian special vision.

Within model projects which are the first of their kind at the national level, this device has made possible the procedures of remote registration at the qualified higher education institutions. The Tunisian payment device the Electronic Dinar has also been met with great international admiration and appreciation awing to its easy and smooth handling and high degree of security and safety.

This national electronic payment device is expected to required activities of new economy and boosting the electronic exchanges movement at the national level.

Moreover, H. E. President Zaynul-Abidin Bin Ali has, in his speech on the 13th anniversary of the propitious change movement, approved a series of measures that aim at further reinforcement of the current national efforts in this field. These are daring decisions which may be viewed as being the actual gate through which Tunisia will join the intelligence and knowledge producing nations who are in control of the technology of this era.

Following are the most significant of these decisions:

- Approval of new reductions of Internet services tariffs to make Tunisia one of the countries which provide the best tariffs in this sphere.
- Reduction in the rate of the added value payment invested in subscriptions to Internet from 18% at present to 10%.
- Providing a family computer whose value does not exceed one thousand Tunisian dinars and insuring easy term payments to enable Tunisian families utilize the numerous advantages for development of sciences, knowledge and remote activities.
- Owing to the numerous and consecutive successes achieved by the Tunisian institutions centered at the communications technological complex in Tunisian, the President authorized the start of a ten-year plan which aims at the installment of a new technological major point every year in various parts of the country.
- Approval of special tariffs for media people to subscribe to the Internet owing to the special character of their profession and the important sensitizing and awareness fostering task entrusted to them so that they will take the initiative in spreading digital culture.

**Ladies and Gentlemen:**

In sum, Tunisia, this small country in terms of limited natural resources and modest, but at the same time, distinguished geographical size, is still a large country, thanks to its united people rallying around the wise future options of President Bin Ali and thanks also to the Tunisians intelligence, creativity and ability to contribute and add new things.

Over and about, Tunisia is a country which has proved successful, proficient and outstanding in steadfastly moving forward on the road of the future while keeping firm control of modern mechanisms of development and building up a bright future for its later generations.

Yet despite all these huge efforts and endeavors which Tunisia of the change movement has succeeded in incarnating on the ground, we are still fully aware of the gravity of future challenges and numerous stakes that face us as they face other Muslim countries and the rest of the international community as a whole.

What is staked today is how far nations can exist within the network economy and then move to the stage of active production in a manner that secures for Muslim and Arab identity and the national distinctive qualities of each state, their full opportunity for survival, radiation and distinction. It is not an easily attainable goal as some may believe. In fact it demands a great deal of planning in advance and much collective work within one single team. This is the equation which has been hit upon by President of the Republic Zaynul-Abidin Bin Ali and which has become a deeply significant and meaningful lesson which some of those who are interested describe as the Tunisian Model.

# Managing IT Assimilation in GCC Countries: Meeting the Challenges

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## 1 ABSTRACT

Information technologies, in general, and computer based information technologies (CBIS), in particular, play a central role in all directed and purposive efforts to bring about real development in the Gulf Co-operation Council Countries (GCCC). Many people, however, mistakenly fail to realize that technical issues of CBIS are only one of several essential components to ensure CBIS assimilation, and therefore, real development. The most important factors are the economic, sociopolitical, and cultural conditions that set the limits within which development can occur. Based on an understanding of these contextual factors in GCCC, this paper derives several challenges that may hinder CBIS assimilation. After assessing their relative importance, the paper provides practical recommendations on how to help assimilate CBIS in the GCCC. The guiding motivation for the effort is the concern to present a closer and more realistic vision as to how CBIS ought to be managed in the GCCC.

## 2 INTRODUCTION

Established in May 1981, the Gulf Co-operation Council consists of six Arab states - Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates. The council strives to foster the integration of economies, societies, and political standing of the six-member states. In spite of certain slight divergence between individual member countries, significant similarities do exist among the GCCC. They share many common characteristics, such as language, religion, culture and geography. Furthermore, they face identical challenges in the political, social, economic, and cultural arenas. Such common heritage, identical characteristics, and even environmental challenges justify treating them as one homogeneous bloc in this paper.

Economic and social development always entices and intrigues policy makers in the Gulf Co-operation Council countries (GCCC). Like many countries, GCCC have realized that indigenous technology and expertise are major ingredients of modern economic development. The Organization for Economic Cooperation and Development has reported that the total global expenditure on computer hardware, computer software, and computer services in 1989 was around 272.6 billion US dollars (Organization for Economic Cooperation and Development, 1992). In 1990, the figure rose to 351 billion. The alarming fact, however, is that only six countries together spent 80% of this amount: US (34%), Japan (19%), Germany (7%), France (6%), UK (6%), and Italy (4%). The remaining 20% is spread over the rest of the world.

The capability to develop technology, the scope to acquire it, and the existence of infrastructure for its application to important economic activities constitute some of the characteristics of a developed economy. In this context, computer based information technology (CBIS) is a factor of obvious importance to the development process. Although other factors such as capital growth, management know-how, and economic self-sufficiency are of much greater importance, no real development can be achieved without effective utilization of CBIS. It is not, therefore, difficult to understand that CBIS has been given considerable attention in the GCCC where socioeconomic improvements assume extreme urgency (Abdul-Gader, 1988; Abdul-Gader, 1990; Abdul-Gader, 2000; Abdul-Gader and Alangari, 1996; Rahman and Abdul-Gader, 1993).

As the GCCC are expanding industrially and commercially, the volume of domestic consumption, export and import is growing at a very high rate. This new phenomenon has created and enhanced the demand for the supply and use of information. It is not, therefore, surprising that CBIS has emerged as an essential element to support the need for regular, timely, and dependable information in business and industry in the GCCC. This may explain the increasing rate of growth in CBIS investment in the GCCC (Abdul-Gader, 1990; Abdul-Ghani and Al-Sakran, 1988; Khan, 1991; Nabali, 1991; Rahman and Abdul-Gader 1993; Yavas and Yasin, 1993). With favorable financial resources, the CBIS market in the GCCC has witnessed phenomenal growth rates since the mid fifties (Abdul-Gader, 2000).

Accelerating economic productivity through CBIS is considered to be the key to national development. In particular CBIS contribution to productivity enhancement in service industries is of paramount importance since service industries constitute the most important sector in the GCCC. According to the World Bank publications (World Bank, 1995), the service sector of the GCCC absorbs more than 65% of the work force. The report also attests to the increasing rate of the service sector of GCCC economies. The service sector absorbs approximately 44% of GCCC economies, while agriculture and industry absorb 4% and 55% respectively. It seems that services are becoming an increasingly important component of GCCC economies.

From an administrative point of view, CBIS can prove instrumental in facilitating innovative development in the internal functions of service organizations. In service industries, information processing is crucial not at the management level alone but also at the production level. Besides supporting the internal functions, CBIS can also enhance and consolidate the outward relations of the organization (i.e., relations with other organizations). More importantly, CBIS can improve the market position of the organization.

Unlike manufacturing technology, service industries are characterized by intangibility, inseparability of production and consumption, heterogeneity, and perishability. There are at least five independent dimensions that constitute service technologies:

1. Production Processes of services: Movement of service personnel, type and mix of necessary inputs, the interaction between the personnel and consumers, degree of automation and computer hardware, and managing supply (capacity) and demand;

2. Service/Process Design: Planning software to assist in service and process design;

3. Management Technology: Managerial and administrative dimensions;

4. Service quality evaluation and control technology: The most difficult type of technology because of the involvement of service providers and customer in assembling the service on a real time basis; and

5. CBIS: Communication, integration and coordination, and intelligence.

There is a need for appropriate harmony and coordination between the five technologies. Competing in a global market requires a good blend or balance of the five technologies with a major role for CBIS. CBIS, in particular, is important because of its pervasive role in the processes leading to advances in other technologies. All technologies create, transmit, disseminate, process, and use information. Therefore, CBIS exerts a remarkably profound impact on other technologies and hence ultimately contributes to the competitiveness of nations.

The five technologies must be viewed and managed (at least at the implementation level) as one computer based information system. There is a need for an enormous amount of physical interconnection that increasingly must take place among the five technologies on a real time basis. Let us take an example from the airline industry. As service providers, airlines face many challenges, one of which is the need to synchronize supply with demand. Since unused seats at any given point in time cannot be inventoried and used in time of peak demand, flight scheduling systems, management control systems, and reservation systems need to be physically integrated. Of course other strategies can be used for synchronization including the use of peak load pricing and stimulating non-peak demand through price discounting.

It is interesting to note that physical interconnection denotes the gluing capability of CBIS not only within the organization but also between organizations (Scott Morton, 1991). CBIS enables the integration of business functions within and between organizations provided the necessary infrastructure is available (e.g., communication network). CBIS can cause shifts in the competitive environment in many industries by defining the degree of inter-dependence among rivals and collaborators. It could be added that the level of competition and collaboration among nations can also be affected by CBIS. For example, some GCCC organizations are linked electronically both with local and international spare part suppliers.

Based on innovation literature, several models have been developed to define and predict the growth of CBIS in organizations. These models are widely known as "stages of growth models" (Benbasat et al., 1984). The strategies of managing CBIS in the GCCC that are presented in this paper are based on the hypothesis that CBIS technologies revolve around four stages of growth:

1. Initiation stage: This is the stage in which a particular CBIS is introduced in the organization or economic sector in the country.

2. Expansion stage: Users learn more about the new CBIS capabilities and the new CBIS spreads rapidly.

3. Formalization stage: management feels the need for enforcing an appropriate level of control manage the CBIS risks.

4. Maturity stage: At this stage use of the particular CBIS has matured.

## 2.1 OBJECTIVES OF THE STUDY

We have seen above the central role of CBIS in modern economic development for GCCC. Bringing in productivity enhancement to the growing service industries in the GCCC, CBIS is present in all directed and purposive efforts to bring about real development. Many people, however, mistakenly fail to realize that CBIS is only one of several components. The most important factors are the economic, sociopolitical, and cultural conditions that set the limits within which development can occur. Many policy makers and managers tend to stress the role of technology. A prime fault in this stance is precisely its overestimation of what this factor means in the transformation process. One might put it the other way around; too little importance has been given to other conditions, and to the interaction between them and the technology. A new perspective on managing CBIS has to begin with the realization that development in a society and in an organization involves and is generated by a number of factors and their interactions.

Based on an understanding of the GCCC economic, sociopolitical, and cultural dimensions, this paper provides practical recommendations on how to help assimilate CBIS in the GCCC. In this sense, it may lead to a wider recognition of the importance of CBIS management in the context of the GCCC. The guiding motivation for the effort is the concern to present a more realistic overview as to how CBIS ought to be managed in the GCCC. The author joins an increasing number of scholars and professionals from developing countries who appear extremely critical about "dominant" ideas concerning the context gap. They emphasize the need for more realistic models better suited to their unique situation and problems as well as ones capable for enhancing possibilities to effectively manage investments in CBIS.

It is essential for GCCC policy makers, managers, and professionals to embark on an active assimilation of CBIS into their work culture. This demands their active response and positive approach as against a passive and indifferent outlook. The role-played, be it nominal or substantial by such groups are discussed in the ensuing chapters.

The main managerial implications that can be derived from a contextual perspective will be analyzed in this paper through questions such as: How is CBIS managed in the GCCC? Specifically, how can GCCC policy makers and managers enhance the introduction, expansion, and control of CBIS within the social, political, economic, and cultural constraints of the GCCC?

Although these questions are generally broad, many more specific ones can be considered. Nevertheless, they all share the same assumption that the impact of CBIS and the way to manage it could be fundamentally different in the GCCC. The overriding purpose of the paper, however, remains exploring means and methods for effective management of CBIS as well as its application on a wider scale in the GCCC.

The paper is divided into three sections. The following section presents a contextual analysis, describing the unique characteristics of GCCC business and CBIS environments. An analytical framework is developed as a basis for understanding CBIS assimilation in the GCCC considering the economic/sociopolitical and the cultural environments. It illustrates a number of variables that have been identified in the literature as important for CBIS assimilation.

The second section discusses some of the salient approaches of managing CBIS assimilation based on the understanding and insights arising from the first section. Eight major issues of CBIS assimilation are identified and solution strategies to deal with them are given in this part. Throughout this part, we can identify two aspects of CBIS management in the GCCC. The first is the approach in which the role of the state is the focus. Here, the politics and functions of the government (policy making body) in a general sense are the primary elements of study. Adopting a national IT policy (some refer to it as national informatics policy) is an example of the effort within this approach. The second approach concentrates on the role of management in organizations. The CBIS management aspects in such an approach are considered with reference to a question as to how organizations can promote widespread acceptance of CBIS -- so essential to the study of innovations.

The last section summarizes the discussions and presents concluding remarks.

## 3 UNDERSTANDING CBIS ENVIRONMENT IN GCCC

While technical factors are primary attributes of computer systems (and are therefore relevant across organizations and countries), economic, sociopolitical, and cultural factors are not. The experience of a multinational corporation in implementing a computer application in two Latin American countries illustrates the importance of organizational and cultural factors in systems development (Robey et al., 1990). The same application has failed in one country, while succeeding in the other. The difference in implementation outcomes between the two countries was attributed to several organizational and cultural factors, including users' perceived threats from the system, lack of users' involvement, lack of manuals in the local language, and lack of local management in the project team.

The emphasis on the contingency analysis is not of a recent origin. Pioneering works such as March and Simon (1958) and Thompson (1967) point to the importance of environmental conditions, technology, and cultural patterns among many other factors. They look at the organization as an open system that affects and is being affected by its environment. Any attempt to isolate the organization and treat it as a laboratory experiment can fail. Therefore, importing technical solutions that were tailored and designed under different contexts and conditions is a gainless effort to apply to solve local problems.

The GCCC environment has a distinctive character in contrast with other countries. GCCC policy makers and managers:

- are subject to more pervasive environmental factors such as economical and political influence and cultural constraints;

- have less market exposure, which reduces incentive for productivity and effectiveness (protection); and

- have internal structure and processes that are fundamentally different from their counterparts in developed world. GCCC managers have less decision making autonomy, and multiple, conflicting, and intangible goals.

These differences may lead to different CBIS assimilation management processes. On many fronts, it would not be appropriate to generalize research findings in the developed world to the GCCC. CBIS management issues are not expected to be totally equivalent in the two segments. Having fundamentally different contextual opportunities and constraints, decision makers in the GCCC and other countries face fundamentally different external and internal factors.

It follows that different environments have different types of CBIS management issues and hence need different types of CBIS assimilation methods. As shown in Figure 1, four broad environmental factors can have direct bearings upon CBIS assimilation: (1) economic, (2) social, (3) political, and (4) cultural factors. Insights can be gained by exploring the impact of these environmental factors on CBIS assimilation in the GCCC.

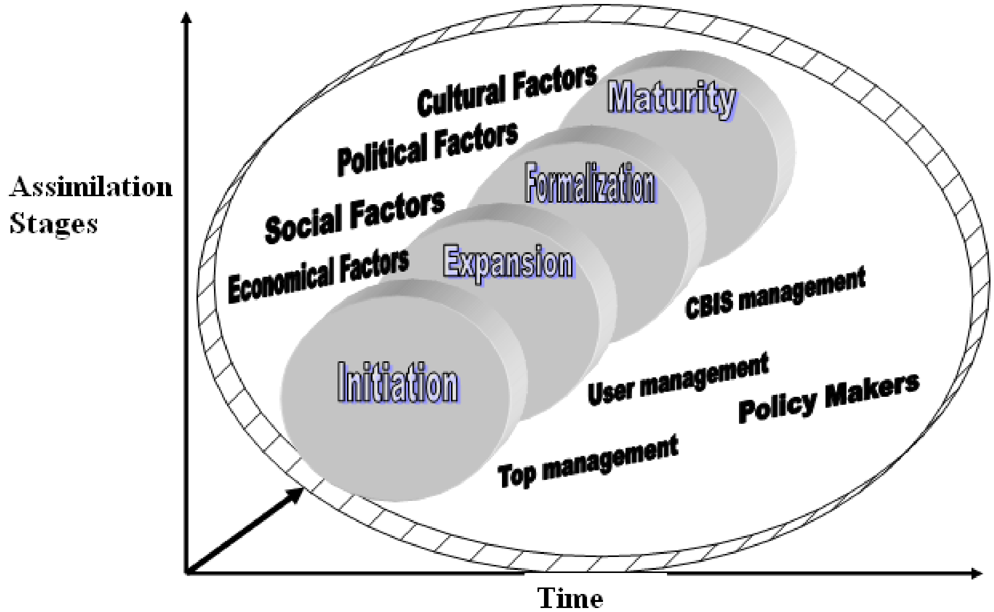


**Figure 1: CBIS Assimilation**

### 3.1 GCCC Economic and Sociopolitical Factors

The GCCC have increasingly become interdependent in the global economy. For the last three decades, the GCCC have been strategically and economically important to the world business community for many reasons: their current and future oil exporting capability, recycled petrodollars, and markets for consumer and capital goods. Strategically, the region produces more than one fifth of the world's oil production and holds the world's largest proven oil reserves. Most of the oil production is exported, making the GCC region the largest oil exporter in the world. Equally important, the gulf region is a major world source of natural gas. In turn, the GCCC import a significant volume of capital and consumer goods from the developed world. In addition, the GCCC economy is highly dependent on external sources for managerial and technical expertise.

The GCCC active and effective involvement in international trade is a fairly recent development. Its origin can be traced to two main factors: first, the oil boom, and second, the creation and development of other economic and production sectors sustained by oil revenue. Till 1973, GCCC international trade used to be fairly limited. However, with the advent of the oil boom and price escalation in 1973, the economies of the GCCC entered a new phase of modernization. This led to an unprecedented demand for massive capital and consumer goods imported from the industrial nations so as to create an infrastructure to meet the emerging requirements of industrialization.

The economies of the GCCC are heavily reliant on the outside world in terms of exporting oil and importing goods, services, modern technology, management, and raw materials. In 1992, oil revenues accounted for 64% of the total revenues in Bahrain and up to 95% of the total revenues in Qatar. Generally speaking, GCCC government budgets go up and down as they mirror world oil prices. Oil continues to have the lion's share of GCCC Gross Domestic Product (GDP) and GCCC exports.

Encouraged by its strong and fairly stable source of income, the GCCC adopt a free market economy system. However, the GCCC domestic market is relatively small, leading to a seller's market. The GCCC managed to translate the petrodollars into well-developed infrastructure facilities (utilities, transportation, and communication systems). With the help of foreign workers, the GCCC have progressed from a non-existent infrastructure phase before 1973 to an environmentally favorable business region. The achievements of GCCC development plans, for example, include a highly regarded communication network (telephone lines, mobile phones, packet switch system), international airports, ample seaports with large capacity berths, large networks of paved highways, and sufficient and uninterrupted electric power.

In spite of its strength, GCCC economy is characterized by a chronic scarcity of indigenous manual and skilled labor. Foreign manpower, therefore, constitutes a significant component of the GCCC population. It reached more than 61% of the labor force and almost 40% of GCCC population in 1985 (Atiyyah, 1996; Khawjakiah and Hisham, 1989). With an area of more than 3.0 million square kilometers, one-third of the size of the United States of America, the GCCC take up more than four-fifths of the Arabian Peninsula. Yet, the GCCC have only about 20 million inhabitants. Accordingly, their population density was about 7 persons per square kilometer in 1996. In addition to low population density, a lack of indigenous skilled workers to man the ambitious development projects has enhanced dependence on foreign manpower. According to the latest statistics, non-native inhabitants are more than 30% of all inhabitants. Such percentage reaches still higher levels in the UAE and Qatar.

In the longer term, the GCCC reliance on foreign manpower is likely to persist. Covering the period from 1990 to 2000, Table 1 depicts several population statistics. With a projected growth rate of 3.8%, the population of the GCCC would have reached 28.7 million in 2000 from 24.1 million in 1995. The ratio of the economically active citizens to total labor force ranged from 13.4% in UAE to 28.3% in Saudi Arabia. Most of these citizens, however, work in the service sector leaving technical occupations to the expatriates (GCC General Secretariat, 1995). The GCC Secretariat's study also shows that higher education and training are characterized by more emphasis on majors in arts and social sciences rather than in engineering and natural sciences.

Apparently, the dependence on foreign manpower stems not only from lower population density but also from the mismatch between various disciplines pursued in graduate and higher education and the job requirements of the labor market. For example, Saudi information systems education has not been able to cope with the increasing demand for computer professionals (Abdul-Gader, 2000). This points to the chronic deficiency of the Saudi education system in producing sufficient numbers with a computer education to assume positions in the information systems profession. Bahrain, Kuwait, Qatar, United Arab Emirates, and Oman exhibit even more alarming symptoms.

The presence and influence of multinational corporations (MNCs) are clearly evident in the GCCC. Encouraged by its lucrative markets, stable political systems, and liberal economic policies, a large number of MNCs have been participating in the region's economy (Ali and Al-Shakhis, 1990; Al-Jafari and Hollingsworth, 1983; Luqmani et al., 1989). To realize and implement their ambitious development plans, the GCCC have hosted a large number of MNCs and a considerable expatriate work force. Unfortunately, there are no exact statistics on the number of MNCs operating in the GCCC. However, indirect indicators of the ubiquity of foreign corporations do exist. In 1994, the Saudi Central Department of Statistics (1994) reported that almost 16% of the companies operating in the Kingdom were non-Saudi. These companies hold 18.1% of the available capital.

Politically, the GCCC governments are the most stable and openhanded ones in the region. With a highly centralized and dominant public administrative system, the GCCC business and information systems environments symbolize conditions in which information systems executives ought to closely evaluate government plans and priorities. Spirit and enthusiasm for development prevail over political differences and opinion, if any. However, regional conflicts and ethnic sensitivities do cast some shadows and pose certain risks for business practices in the region. High insurance rates for shipments, indications of adherence to religious customs and traditions for imports, quality control measures, and tight security procedures, could be considered as some of these sensitivities.

**TABLE 1: POPULATION STATISTICS AND LABOR MIX (1990-2000) IN GCC COUNTRIES**

| | Population ('000) | | | Active Citizens |
|---|---|---|---|---|
| | 1990 | 1995 | 2000 | |
| Bahrain | 515 | 601 | 682 | 0.087901 |
| Kuwait | 2090 | 2438 | 2782 | 0.150044 |
| Oman | 1468 | 1735 | 2057 | 0.252491 |
| Saudi Arabia | 14131 | 17118 | 20686 | 1.516078 |
| Qatar | 367 | 436 | 499 | 0.079905 |
| UAE | 1588 | 1776 | 1950 | 0.097201 |

Source: GCC General Secretariat (1995).

### 3.2 GCCC Cultural Factors

Culture assumes a critical dimension and is embedded in the GCCC business and CBIS environments. It can neither be escaped nor ignored. People of each nation have a national character drawn from their culture. They share a differentiating, enduring pattern of behavior and/or personality characteristics (Hofstede, 1980). According to Hofstede, through our experience we become "mentally programmed" to interpret new experiences in a certain way. Most countries' citizens share a national character, mutually and internally non-striking among themselves, but clearly differentiating and alien to foreigners.

The Islamic and Arabic tribal cultures dominate business and CBIS scenes in the GCCC. This section seeks to highlight the major relevant cultural issues that can affect CBIS environment and management in the GCCC. It is not to suggest localization of CBIS management applicable to the GCCC. Rather, the idea is to promote the development of CBIS management strategies and policies that are relevant and effective in addressing the distinctive and particularly Islamic and tribal cultures.

Management scholars have recognized religion's effect on individuals and their work. Islam advocates not only a simple, direct and comprehensive central core of beliefs, but also an extensive and totally comprehensive doctrine to guide a "believer" in almost every facet of his daily life, including his thoughts, mutual and social relations, trade and commerce, and every other act and deed. The often-heard description of Islam as a way of life is literally true. Islam presents itself as a single unit of norms, tenets, authentic traditions and customs which all lead to preaching the worship of One God (Allah).

By virtue of being the birthplace of Islam, the GCCC inherit the basic characteristics of early Islamic civilization. In this context, even its most modern economic development and technological inclinations, symbolizing a modern state, are unmistakably mingled with an Islamic spirit and culture. All GCCC inhabitants are Moslems. The people of the GCCC adopt Islam as a way of life. Actually, the influence of Islam and its myriad social prescriptions in everyday life seems to be spreading rather than waning (Abdul-Gader and Al-Buraey, 1993; Al-Ashker, 1987). Among other factors, Ali (1996) attributes the centrality of Islam in the Arab world to fact that “Islam is a comprehensive religion that regulates not only the ascetic but also the worldly tendencies. Almost all social, political, and military precepts are covered in the Quran along with the piety of the soul and moral aspects of individual behavior (p. 6).

Although an understanding of Islam is crucial to understand Islam-dominated societies such as the GCCC, it is beyond the scope of this paper to provide an exhaustive list of Islamic principles, teachings and guidelines that may affect CBIS management. Yet, several relevant Islamic principles are discussed below so that cultural lapses could be avoided while managing CBIS.

As regards the impact of Islam on modernization efforts and scientific development, some writers portray the religion as a stumbling block to change and development. Zureik (1978) claims that any society in which religion dominates will suffer from rigidity and development stagnation. He implies that development and modernization of Arab society can only be brought about by changing the cognitive framework of Arabs through liberating or severing intellectual endeavor from Islamic values. Other writers of international management (e.g., Pezeshkpur, 1978) claim that Islam encourages economic stagnation and makes Muslims averse to planning of any sort because of their belief that the future belongs to the will of Allah. Pezeshkpur also blames Islam for Moslems’ low personal aspiration, helplessness, distrust, low personal status, and lack of expressions of opinion.

In reality, however, the practical implications of Islamic teaching and its application reveal experience quite contrary to the above notion. The actual observation and analytical study nullify the above negative perceptions and make them unacceptable. Islam has been a major force toward development and it is by no means the cause of anti-modernization opinions expressed or encouraged by some Muslims. In its comprehensive outlook on man, Islam attempts to strike a balance between the extent of man's material and rational needs on one hand and his spiritual and mental requirements and limitations on the other. Islam, in this manner, advocates and encourages moderation in every possible aspect of human life and endeavor. The Quranic verses and the Prophet's sayings are all found to be praising the pursuit of knowledge and learning. So, Islam does not condemn science and technology in principle. Indeed, Islam stands for progress, development, and "modernization" as it itself has defined them. In fact, the Quran calls upon man to reflect on and ponder nature, the earth and sky, the wind and rain, the sun and moon, and the constellations (Al-Buraey, 1990; Idris, 1977; Shariati 1979; Qutb, n.d)). Actually, human efforts in the modernization process are in themselves an act of worship from the Islamic perspective.

The Islamic influence on the legal front and business law is highly visible in the form of Islamic teaching or "Sharia." Sharia prohibits some of the things regarded as necessities from a Western perspective. Alcohol, interest (usury), pork, nightclubs and gambling casinos are proscribed as prohibitions. Consequently, enjoying a long tenured non-Moslem technical and managerial human resources position is very difficult. Sharia also imposes the timing of holidays. Unlike the Saturday/Sunday weekends in the Western countries, the GCCC weekends are observed on Thursdays and Fridays. Communication and coordination between business partners are hindered since only three working days out of seven coincide. This is further complicated by religious holidays both in the GCCC and in the West. MNCs' subsidiaries and local business will find it challenging to be in touch with their home offices and international vendors, respectively.

Perhaps the most noticeable facet of the Islamic culture is the Arabic language. Although the Arabic language predates Islam, Islam gave it an added spiritual and sacred significance. It is the language of the Holy Quran. To Moslems, the Arabic language is not just a symbol of a common heritage but also a holy language. Arabic language is only one aspect of the Arab tribal and social structure that characterizes the GCCC culture. The influence of this social structure's traditionalism has led many researchers to coin the term "Bedoaucracy" when describing Arab organizations (Abdul-Rahman, 1982; Al-Awaji, 1971; Al-Hashemi, 1988; Almaney, 1981). Derived from "Bedouin," the Bedoaucracy model highlights the importance of Bedouin culture in the GCCC organizational setting. Similar to Max Weber's western bureaucracy model, the Bedoaucracy model delineates several central tendencies within GCCC organizations.

The most widely accepted cultural framework is based on the research of Hofstede (1980). Studying the values and attitude of employees in multinational companies (MNC) in over forty countries, he identifies four distinct dimensions of national culture: power distance, uncertainty avoidance, masculinity, and individualism. The power distance dimension reflects the way society distributes, shares and enforces the power among its members. It measures centralization of authority. Uncertainty avoidance relates to the society's tendency towards formalism and willingness to take/avert risks. Masculinity refers to the way society assigns roles between sexes. Masculine societies rate such "masculine" values as aggressiveness and performance higher than such "feminine" values as quality of life and cooperation. Individuals from different cultures may view, appear and behave differently in relation to their allegiance towards their peers and organizations. An individual in highly individualistic cultures is more independent. He is less likely to view the organization he works in as his own family.

The fact that Saudi and American cultures are quite different is also borne out through the studies by Hofstede (1980) and Kassem and Al-Modaifer (1987). Compared to American society, Saudi society demonstrates more power distance, more uncertainty avoidance, less masculine values, and less individualism. In a more recent study of Hofstede's cultural dimensions, he further confirmed the cultural differences between the GCCC and the US. The individualism index reported in their study was very low, indicating that GCCC societies are collective rather than individualistic. They also confirmed previous findings that GCCC nationals are relatively less assertive on the masculinity dimension.

Two out of the above four dimensions are considered dominant in studying organizations within a particular culture: power distance and uncertainty avoidance (Hofstede, 1991; Venkatachalam and Shore, 1996). Hofstede asserts that "from the four dimensions of national culture described [earlier], power distance and uncertainty avoidance in particular affect our thinking about organizations ... The remaining two dimensions: individualism and masculinity, affect our thinking about people in organizations, rather than about organizations themselves." (Hofstede, 1991, p. 140). Bjerke and Al-Meer (1993) have concluded that the GCCC scored considerably higher than US on power distance (centralization) and uncertainty avoidance (formalization). The implications for CBIS management of these and other cultural factors as well as the economic and sociopolitical factors are shown in Table 2.

**TABLE 2: CONTEXTUAL FACTORS AFFECTING CBIS ASSIMILATION IN THE GCC COUNTRIES**

| Factor | Consequences | |
|---|---|---|
| 1. GCC countries economies are heavily reliant on the outside world to export oil and to import modern technology, labor, management, and raw materials | • High uncertainty; dependence on single money generating product-oil<br>• Built-in competitive disadvantage because of high cost factors of production | • CBIS planning is prone to be ad hoc.<br>• CBIS applications development and operations are costly.<br>• Local development and operations are not attractive; |
| 2. Strong and stable economy | • Lower exchange rate fluctuation risk | • Major hardware and software investment decisions are less prone to financial risk. |
| 3. Thin, small domestic market | • Domestic market is seller market. | • Limited number of competing vendors<br>• Hardware suppliers and external software developer are few.<br>• MNCs may have to change their preferred vendors if these vendors do not operate in the Saudi market. |
| 4. Well developed infrastructure (utilities, transportation, and | • Facilitate business operations and communication | • Ease of coordinating CBIS activities.<br>• Communication quality, availability and cost make it cost effective to implement on-line applications and distributed systems. |

| | | |
|---|---|---|
| communication systems) | | |
| 5. Scarcity of manual and skilled labor | • High dependence on foreign labor force | • Greater need for CBIS expatriates<br>• Possible conflict between local staff and expatriates (wage difference; nationalistic feelings)<br>• Greater need for staff planning<br>• Training and development programs are needed |
| 6. Presence of multinational companies | • Capital and technology transfer | • Higher competition for local CBIS resources |
| 7. Regional conflict and ethnic sensitivities | • Security consideration outweighs economic considerations<br>• High shipment insurance rates | • Limited options in recruiting certain nationalities (Visa restrictions)<br>• High freight costs |
| 8. Dominant government role in the economy | • High uncertainty<br>• Private sector plays minor role<br>• Strict accounting reporting disclosure<br>• Pressure to nationalize jobs | • Evaluate closely government plans and priorities<br>• Make careful evaluation of emerging technologies; Certain types of technology are not permitted (e.g., radio communication (CB) except in rare cases)<br>• Accelerate localization (e.g., Saudization) programs (recruiting training, ...etc.) |
| 9. Open minded and unsophisticated Legal environment | • No import/export restrictions<br>• No labor unions<br>• Favorable tax system<br>• Simple customs procedures | • Free cross national boundary transmission of data<br>• Opportunity to create an international database<br>• Ability to import hardware and software freely |

**TABLE 2: CONTEXTUAL FACTORS AFFECTING CBIS ASSIMILATION IN THE GCC COUNTRIES (Cont.)**

| Factor | Consequences | |
|---|---|---|
| 10. Strong Islamic influence and identity | • Active role attributed to the individual as a change agent.<br>• Modernization process in itself can be viewed as a worship act.<br>• Flexibility in incorporating new technologies.<br>• The individual's responsibility and accountability for his actions to Allah.<br>• Conscious and positive awareness of Allah's omnipotence (Taqua).<br>• Highly elaborated moral and ethical system that has to be observed and used as a yardstick.<br>• The separation between the legal and ethical system does not exist in an Islamic environment.<br>• Continuous contact with Allah through daily Salah (prayers)<br>• The balance between the material and the spiritual and psychological well-being of Muslims<br>• Human oriented rather than production oriented. | • There is a need to reinstate Islamic values in CBIS management. Management should relate its structure, process, and objectives to Islamic principles.<br>• Augment professionalism spirit among local professionals with Islamic ethical teaching (e.g., copy write observation)<br>• Motivating local CBIS professionals through culturally rooted messages. |
| 11. Islamic "Sharia" | • A ban on "usury", pork, gambling, alcohol, and certain types of entertainment (e.g., casinos, nightclubs)<br>• Different timing of holidays | • It is harder to retain non-Moslem CBIS professionals.<br>• External financing sources are limited.<br>• Harder to coordinate MNCs' local and satellite operations; Saudi weekends are Thursdays and Fridays not Saturdays and Sundays. |
| 12. Religiously motivated pride in Arabic language | • Strong demand for Arabic CBIS applications and technologies | • Applications development software and documentation are basically in English; Local CBIS professionals must be proficient in English |
| 13. Power distance (high centralization) | • Centralization and autocratic leadership | • Management policies should be culturally congruent (e.g., motivating CBIS local professionals is different than MNCs' home country professionals) |
| 14. Formalization (uncertainty avoidance). | • Low tolerance to ambiguity | • Management policies should be culturally congruent (e.g., more attention to role ambiguity is needed in the GCC countries than Western countries) |

### 3.3 GCCC Challenges of CBIS Assimilation

Many studies have been conducted to explain the causes for failure and success of CBIS assimilation and the extent of both of these realities and their impact. To study this important issue, vast research projects have been based on qualitatively interpretative case studies (Markus, 1983; Walsham and Han, 1992). The majority of research, however, has centered on statistically investigating potential individual and organizational success variables which can determine the degree of success or failure of CBIS (Abdul-Gader, 1990; Abdul-Gader, 1996; Kwon and Zmud, 1987; Lucas, 1975; Lyytinen, 1987). This is referred to as the antecedent factor approach.

Abdul-Gader and Alangari (1994) conducted a major study in 1994 to investigate the computing sense in Saudi Arabia. After reviewing a number of studies that highlight information systems assimilation challenges, they pointed to the uniqueness of the challenges within the Saudi computing context. While extending their review to more studies, Abdul-Gader (2000) pointed to the abundance, multiple characteristics and dimensions, and complexity of the literature dealing with CBIS assimilation challenges. Such extensive literature review has resulted in identifying forty-thirty challenges that can impede CBIS assimilation within organizations in GCCC. To assess the relative impact of these challenges, they were aggregated and rephrased so that their relevancy to the GCCC is further enhanced and ensured. Local CBIS experts (academicians, computer vendors, and managers of computer departments) were asked to assign relative importance value to each challenge using the Delphi technique. A more elaborate description of the Delphi technique and the starting list of CBIS challenges is available elsewhere[1].

Table 3 depicts the results of the final round of experts' importance rating. By far, lack of appropriate CBIS planning topped the challenges list and it was, therefore, viewed as the most significant stumbling block toward successful CBIS assimilation. Furthermore, also the lack of organizational strategic planning was considered to be the third most significant challenge responsible for limiting CBIS assimilation.

Quite equally, the experts assigned high rating to several CBIS human resources management issues (e.g., professional competence, availability of qualified manpower and/or career opportunities, training, and management knowledge). The factors having a significant impact on, and directly related to human resources were clustered at the top of the ranking list: ranks 2, 4, 5, 6, 8, 11, 13, 16, 18, 21, 22, 23, 26, and 28. These reflect the dimensions of the relative components of human resources management. In order to augment inadequate and under-trained indigenous skilled human resources, the GCCC rely heavily on imported technology and a foreign work force. This has created its own cyclic problems led by ever-increasing demand for CBIS know-how and thereby enlarging the circle on and on.

Because of their importance, we will concentrate on planning and human resources issues in the following section.

[1] See Abdul-Gader and Alanagari (1994) and Abdul-Gader (2000).

**TABLE 3: EXPERTS' IMPORTANCE RATING OF CBIS ASSIMILATION CHALLENGES**

| Rank | CHALLENGE | Class |
|---|---|---|
| 1. | Lack of appropriate IT planning. | √ Planning |
| 2. | Insufficient training and career development for IT professionals. | √ Human resources |
| 3. | Lack of organizational strategic plan | √ Planning |
| 4. | Lack of sufficient computer knowledge among middle and top management. | √ Human resources |
| 5. | Scarcity of a qualified work force. | √ Human resources |
| 6. | Low top management involvement in IT projects. | √ Human resources |
| 7. | The IT department has low organizational power. | |
| 8. | Insufficient user training. | √ Human resources |
| 9. | Insufficient financial support to meet the needs. | |
| 10. | Problems with government budgeting process. | |
| 11. | Weak relation between top management and IT management. | √ Human resources |
| 12. | Rigidity of organizational procedures. | |
| 13. | Insufficient IT management skills and experience | √ Human resources |
| 14. | Poor coordination among different branches and divisions | |
| 15. | Lack of specialized consulting organizations | |
| 16. | Low users' motivation to use IT. | √ Human resources |
| 17. | Lack of standards and specifications (e.g., hardware purchase). | |
| 18. | Low management motivation to use IT. | √ Human resources |
| 19. | Weakness of the technology to support Arabic use. | |
| 20. | Inappropriate procedures to define user requirements | √ Planning |
| 21. | User perceived threats from IT. | √ Human resources |
| 22. | Lack of management confidence in the feasibility of IT. | √ Human resources |
| 23. | Non conducive organizational culture. | √ Human resources |
| 24. | Inappropriate vendor after-sale support. | |
| 25. | Costly IT application development. | |
| 26. | Lack of need for IT among users. | √ Human resources |
| 27. | Difficulty of software maintenance. | |
| 28. | User negative attitude toward IT. | √ Human resources |
| 29. | Hardware operation and maintenance problems. | |
| 30. | Too much centralization | |

## 4. MANAGING CBIS IN THE GCCC

In the previous section, specific problem areas for embedding CBIS assimilation in the GCCC were discussed. The purpose of this section is to propose a response framework to foster the discussion of possible solution strategies. The framework is neither exhaustive nor exclusive. It is illustrative, designed to point at the level of response group to these challenges. Some CBIS challenges have to be addressed not only on an organizational level but also on a regional or national level. In other words, they need to be tackled at the policy-making level along with the internal organizational level. King et al. (1994) list nine different institutions that may influence or regulate CBIS assimilations. These are:

1- Government authorities;
2- International agencies;
3- Professional and trade and industry associations;
4- Research-oriented higher education institutions;
5- Trend-setting corporations;
6- Multinational corporations;
7- Financial institutions;
8- Labor organizations; and
9- Religious institutions.

Institution analysis can become quite complicated as one reflects on the range of potential groupings that can impact a given organization. Outside of the supplier -- distributor -- consumer chain of a commercial concern, they could include environmental pressure groups, watchdog bodies, local and central government agencies, major debtors and creditors, and so on. Yet one can argue that the role of some of these institutions is limited in the GCCC. Labor organizations (number 8) do not exist in the GCCC while professional and trade and industry associations (number 3) have low or no influence. At the same time, regional institutions such as GCC General Secretariats can play a vital role in influencing assimilation in the GCCC. In our discussion, we will concentrate the discussion on governments' authority role. This encompasses the central government of each individual country (national level) and the GCC (regional level).

At the organizational level, the analysis is centered on the role of three levels of management: Top management, middle management of user departments, and middle management computer departments. Internal to the organizations, the level of response can be either strategic or administrative. While strategic challenges are those requiring the attention of top management, administrative challenges can be addressed at middle management level. Middle management, in turn, can be either the user department management or the CBIS department management.

As shown in Figure 1, four stakeholders can take part in responding to the CBIS problem areas: governments at the national level, top management, user management, and CBIS management. The selection of the appropriate level of response depends on the scope, seriousness, and impact of the problem areas.

### 4.1 Assimilation Challenger I: Planning

Planning is defined as the process of determining in advance the optimum direction of organizational efforts by establishing goals, budgeting for achievement, and analyzing the actions taken. This process may be considered to have four basic activities: strategic, operational, financial, and personnel planning. CBIS assimilation into GCCC organizations is a multifaceted, complex, and challenging process that cannot be dealt with at the organizational level alone. In order for GCCC organizations to properly utilize CBIS, a national approach to plan, organize, manage, and control such technology is to be followed. Proper coupling of CBIS planning at the national and organizational levels will impact (improve and enhance) many other areas of concern (e.g., recruitment and development of human resources, user and management involvement). If carefully implemented, CBIS planning can also make a positive impact on organizational culture and attitude towards CBIS.

Furthermore, planning for CBIS can help in at least three areas. Governmental and managerial thinking can be stimulated and sharpened as a result of planning interviews and analysis of current practices. Planning can also help in increasing management awareness of CBIS and in developing more correct expectations. Besides contributing to management understanding, CBIS planning can facilitate communication between levels of management across functional and regional areas. Thus, national and organizational cohesion and integration goals can be more attainable.

It is evident from the analysis that GCCC CBIS planning issues are:

1. Lack of appropriate CBIS planning (national);
2. Lack of organizational strategic plan; and
3. Inappropriate procedures to define user requirements.

The responses of individual state governments and the stakeholders at the organizational level are shown in Table 4.

## TABLE 4: NATIONAL AND ORGANIZATIONAL RESPONSES TO CBIS ASSIMILATION CHALLENGES

| | Response Level | | | |
|---|---|---|---|---|
| ***Planning Issues*** | ***National Response*** | ***Top Management*** | ***User Management*** | ***CBIS Management*** |
| 1. Lack of appropriate CBIS planning (national) | Establish an apex organization that would undertake policy planning and implementation in the area of utilizing CBIS for national development | -- Not applicable -- | -- Not applicable -- | -- Not applicable -- |
| 2. Lack of organizational strategic plan | -- Not applicable -- | Establish organizational goals for CBIS | Identify and seek departmental uses for CBIS<br><br>Support the planning process and provide relevant inputs | Lead CBIS planning process<br><br>Update plans annually |
| 3. Inappropriate procedures to define user requirements | -- Not applicable -- | Endorse an application development policy mandating appropriate level of user departments involvement in CBIS projects that affect them | Seek and negotiate the appropriate level of involvement in CBIS projects that affect the department<br><br>Nominate the right person(s) to represent the department in CBIS project teams | Develop an application development policy mandating user involvement<br><br>Involve user department in CBIS projects |

TABLE 4: NATIONAL AND ORGANIZATIONAL RESPONSES TO CBIS ASSIMILATION CHALLENGES (CONT.)

| | Response Level | | | |
|---|---|---|---|---|
| Human Resources Issues | ***National Response*** | ***Top Management*** | ***User Management*** | ***CBIS Management*** |
| 1. Scarcity of a qualified work force<br>2. Insufficient training and career development for CBIS professionals<br>3. Low user management CBIS knowledge<br>4. Insufficient user training<br>5. Low user motivation to use CBIS<br>6. Low management motivation to use CBIS<br>7. Insufficient CBIS management skills and experience | Adopt a national CBIS human resources development strategy<br><br>Develop or adopt CBIS curriculum recommendations that match national demand for CBIS professionals<br><br>Coordinate national CBIS training programs<br><br>Forecast CBIS manpower requirements and make sure that the educational system is geared to it | Adopt an organizational CBIS human resources development program (upskilling and acquiring)<br><br>Adopt an organizational CBIS training policy<br><br>Adopt policy statements addressing organizational behavior issues that enhance productivity: motivation, ethics, and work stress | Identify training needs for department members<br><br>Develop and implement productivity enhancement policies | Develop an organizational CBIS human resources development program (upskilling and acquiring)<br><br>Identify organizational CBIS training needs and develop a training policy<br><br>Develop and implement productivity enhancement policies |

*4.1.1 National Response to Planning Challenges*

One of the major characteristics of GCCC economies is the central role of governments in the economic development process. Hence, the appropriate role of the governments is a blend of providing central guidance and encouraging local initiatives. A trend of government intervention in CBIS across countries seems to be accelerating. Following the footsteps of Japan, which adopted a national plan in 1972, a number of countries around the world have adopted a national CBIS strategy. France (in 1978), Taiwan (in 1980), Singapore (in 1980), United Kingdom (in 1982), and India (in 1984) among many others countries adopted informatics plans. In most cases, these plans strive to develop the local computer manufacturing industry and to nourish a software development industry. The experience of these countries can be a good reference. The Indian experience in setting up and implementing a national information technology policy is an example of an appropriate mix of government intervention and private sector contribution. In 1984, the Indian government adopted an informatics policy and two years later a software export policy was announced (Joshi and Sauter, 1991). The CBIS policy laid down specific programs that have reshaped import and export tariffs and many protective measures for the local computer industry.

Many GCCC scholars have called for similar efforts in the GCCC (Abdul-Gader and Alangari, 1994; Al-Wakeel, 1987; Khayyat, 1990; Mandurah, 1996; and Mandurah and Bakri, 1990). There were calls for adopting a CBIS policy that should strive to achieve two fundamental goals -- maximizing the potential of CBIS to improve the quality of life, and improving GCCC competitiveness. A major ingredient of the policy is to have a strong and effective sponsor. It is recommended that an administrative body, at a high level, needs to be established. Such an organization can be an apex agency that would undertake policy planning and implementation in the area of utilizing CBIS for national development. Some of the responsibilities of the organization are the followings:

1. Formulating and reviewing a national CBIS plan;
2. Evaluating and controlling the execution of the national CBIS plan;
3. Coordinating all professional, technological and educational CBIS activities, so as to ensure the success of the national policy. Special attention needs to be given to the organizational CBIS plans of public organizations because of their size and level of CBIS maturity;
4. Encouraging collaboration among regional and international organizations that are engaged in CBIS development, operation, or use;
5. Adopting a national CBIS human resources development plan (see the following chapter for more discussion);
6. Analyzing laws of politics that affect CBIS use in organizations;

7. Helping in setting CBIS standards. A joint workforce can be formed with the Standards setting organizations such as the Saudi Arabian Standards Organization (SASO) and other professional organizations. An example would be participating in setting auditing standards of CBIS applications in collaboration with the accounting and auditing standard setting organizations such as the Saudi Organization of Certified Public Accountants (SOCPA);
8. Promoting CBIS benefits and guarding against set-backs;
9. Collecting and disseminating information that relates to CBIS development, operation, and use. The information can take different forms including published reports, periodicals, and papers;
10. Promoting the use of Arabic in CBIS applications, education, and other activities. This would encourage the assimilation of CBIS into all sectors of the economy;
11. Encouraging technology transfer initiatives - financial incentives to promote greater collaboration and the transfer of technology from local research and development (R&D) groups and industry;
12. Encourage MNC to establish local operations and training programs; and
13. Assisting and collaborating with CBIS professional associations so that professional standards are maintained.

Probably, the best administrative position for the national CBIS authority is an independent ministerial level entity. Sufficient manpower and other organizational resources should be allocated to this unit so that it can carry out its responsibility. It is advisable to institute a coordinating body within the GCC General Secretariat to synchronize the CBIS plans of the GCCC. Needless to say, without ensuring strict adherence to, and implementation of, the national policy the goals and objectives will not be attained.

### *4.1.2 Organizational Response to Planning Challenges*

Within GCCC organizations, CBIS planning is challenged by the fast rate of growth of a young technology, scarcity of qualified human resources, and the mixed experience of successes and failures of CBIS usage, among other factors (Cash et al., 1992). Rate of growth of CBIS makes planners wonder where and when to invest. Some “planners” tend to stick with the posture of "wait and see" and thus avoid a serious investment in CBIS. Those planners that reject the posture of "wait and see" and invest in CBIS are for sure taking a risk. They provide more cases for CBIS usage that are successful than otherwise.

Like any other type of planning, organizational CBIS planning is difficult and rarely done in GCCC organizations. Even if plans exist, various obstacles usually prevent their implementation. Among many others, Abdul-Gader (1990) has provided empirical evidence that plans for CBIS requirements are almost non-existent. Without serious efforts, the CBIS planning scene will not change.

Another factor restraining CBIS planning in GCCC organizations is the limited experience of those organizations. Field observations have indicated that CBIS utilization in many organizations has a short and/or a well-noticed under-utilization history (Abdul-Gader, 1990; Abdul-Gader and Alangari, 1994). Even in organizations with a relatively long history in CBIS introduction, the level of growth and impact are inconsiderable. Several CBIS applications in a number of organizations have been developed but few are implemented. Some of the implemented applications are not fully functional. The survey of GCCC CBIS experts and managers has shown that no (or poor) planning was the rule rather than the exception in many organization (Abdul-Gader and Alangari, 1994). The growth of computer resources appeared out of control and there was inadequate management involvement. Most of the expenditure was in the least cost-effective computer resources where expensive hardware was acquired and underutilized. Financial resources were inappropriately placed. Short-term costs were considered rather than long-term implications.

Another important restraining force to planning is the misconception among some Muslims about the Islamic view of the future. Islam does not make Muslims averse to planning of any sort. Although Muslims believe that the future belongs to the will of Allah, they are encouraged to be proactive and be ready for the future. Management should advocate CBIS planning among organizational members. They should design training programs or other promotional channels to eliminate any misconception such as the one discussed here.

Organizational response to CBIS planning ought to match the seriousness of this management issue. The literature is rich with materials that describe the importance, impact, benefits, and limitations of CBIS planning. The response of GCCC organizational stakeholders, namely, top management, user management, and CBIS management to CBIS planning is discussed below.

Top management confidence in the feasibility of CBIS projects and proper levels of involvement in these projects are necessary ingredients to CBIS assimilation. Top management ought not to stop at adopting a broad vision and leadership but required to allocate organizational resources (fund and manpower) to support its vision and to demonstrate its commitment

These are what we would like to refer to as "the cultural context of CBIS." Proper management of CBIS assimilation is not only achieved by writing CBIS plans, buying state-of-the art equipment, and even hiring the most technically competent work force. In spite of their importance, planning and resources procurement can be additional overhead cost items if top management vision, leadership, and commitment are not there. Without top management's political clout, a cultural acceptance of CBIS in GCCC organizations cannot be attained. In a nutshell, clear signals of top management vision, leadership, and commitment must be communicated to all members of the organization.

Top management has to make clear that promotions and other rewards will go to the employees who accept, use, and assimilate CBIS in their work. This means that organizations will have to invest in efforts to alter their dominant culture to fit the introduction and use of CBIS. Top management's use of CBIS applications, participation in training, and even involvement in relevant CBIS projects are examples of the signals that need to be heard.

Top management, in particular, has the responsibility to provide a broad vision of CBIS that recognizes the importance and value of CBIS to different locales of the organization. By identifying CBIS opportunities, top management can set the course for user and CBIS management. Top management is not responsible for directly developing the CBIS plan. CBIS management is. However, CBIS management will not be able to deliver relevant and quality plans without guidance from top management.

The ultimate product of CBIS planning exercises is computer applications serving user needs. The appropriate level of user department involvement in CBIS projects that affect them is instrumental for CBIS success (Abdul-Gader and Alangari, 1994; Kraemer and King 1986; Madon, 1992; Montazemi, 1988; Robey et al., 1990; Sideridis, 1988; Walsham and Han, 1992,). Top management is required to endorse a CBIS application development policy mandating the appropriate level of user involvement.

The second organizational stakeholder is user management. User department managers make decisions about CBIS issues in their departments. They ought to participate in implementing top management's directions regarding CBIS planning. By providing relevant inputs to the CBIS planning process, user management can ensure its success. Well thought-out computing requirements forecasts, a seriousness in filling planning forms, and a careful search for CBIS use opportunities in their departments are examples of healthy CBIS planning participation.

The role of CBIS department management is also significant in spearheading CBIS planning efforts in the organization. Working as a change agent, CBIS management needs to generate ideas for CBIS use in the organization, convince top management, and adopt a planning methodology for CBIS planning.

Planning issues are of great importance; they mandate organization's collective efforts through the responses of top management, user management, and CBIS management.

Abdul-Gader (2000) has recommended a CBIS planning implementation method for developing effective CBIS plans for various organizations in the GCCC.

### 4.2 Assimilation Challenger II: Human Resources

4.3

Worldwide current and future shortages of qualified CBIS personnel threaten the ability of many organizations to make effective use of CBIS. Evidence suggests that recruitment and development of CBIS human resources is one of the most important issues in both developed countries (Ball and Harris, 1982; Brancheau and Wetherbe, 1987; Brancheau et al., 1996; Dickson et al., 1984) and developing countries (Abdul-Gader, 1990; Avgerou, 1990; Lu et al., 1988; Madon, 1992; Perez, 1980; Sideridis, 1988; Woherem, 1992).

The GCCC computing scene exhibits more serious symptoms of this shortage. It has been shown that human resources issues in the GCCC are the most prominent among several CBIS challenges. The panel of CBIS experts and users has assigned high importance scores to a number of human resources issues. Among those issues are: Scarcity of a qualified work force, insufficient training and career development for CBIS professionals, lack of sufficient computer knowledge among middle and top management, insufficient user training, low user motivation to use CBIS, low management motivation to use CBIS, and insufficient CBIS management skills and experience.

Continuing emphasis needs to be put on studying IS human resources issues and on developing managerial intervention strategies to recruit and develop CBIS personnel. The effects of human resources factors are so immense that a national response is urgently needed to guide, promote, and complement organizational response. The responses of the three stakeholders at the organizational level and the response of individual state governments are shown in Table 4.

Given the size of the need for CBIS human resources, one of the responsibilities of the CBIS authority that was recommended earlier was to "adopt a national CBIS human resources development strategy." It must be clear that although the CBIS authority plans and follows up such human resources direction, it does not execute or implement those plans itself. If the CBIS training policy was to be implemented by a central entity, it would be difficult to make timely decisions and it would be difficult to keep up with technology development and select the most appropriate training programs. Therefore, the CBIS authority performs important macro level roles; the most important of which is coordination. The GCCC have the necessary training infrastructure in the forms of universities, technical colleges, and private training centers. What is needed is a national effort for fostering coordinated programs that match the GCCC requirements. A national CBIS planning authority can fulfill this role.

Another important part of the national human resources plan (HRP) is to forecast CBIS manpower requirements and to make sure that the educational system is geared to it. Looking at the number of CBIS professionals who will be entering the work force in the coming five years, one cannot help worrying. Like other educational systems around the world, the educational systems in the areas of computer and information systems in the gulf is not coping with the increasing demand for computer professionals. There is a chronic incapacity of the GCCC education systems to produce CBIS graduates.

An example of issues that can be addressed by the national CBIS HRP is the GCCC college education system's undue emphasis on technical programs (computer science and engineering). Without down-grading their importance, computer science and engineering programs are certainly neither designed nor capable of producing CBIS professionals for CBIS application development within an organizational context. Since CBIS applications are not developed in a vacuum, knowledge of organizational issues and the human side is an important success factor for them. CBIS professionals should be able to perform a number of activities (Lee et al., 1995):

The national HRP can help GCCC educational institutions to satisfy the GCCC organizations' needs for CBIS professionals by identifying the critical knowledge and skills for these professionals. To bridge the gap between educational institutions and industry, HRP can adopt a number of approaches as far as measuring different types of critical CBIS activities and skills from CBIS professionals (Lee et al., 1995).

Technical capability alone will not and cannot equip the graduate with the necessary knowledge and skills to carry out the above activities. Therefore, It is strongly recommended that undergraduate information systems programs are developed that incorporate organizational and behavioral knowledge clusters. Educational planners can consult recommended information systems curriculum models of international professional computer societies such as the American Computing Machinery (ACM) and Data Processing Management Association models (Couger et al., 1995; Data Processing Management Association, 1990; Nunamaker et al., 1982).

Within organizational boundaries, both top and middle management in user as well as CBIS departments play a crucial role in solving CBIS human resources problems. The response can vary from strategic to tactical, reflecting the level of management.

The key factor of top management response is adopting an organizational CBIS human resources development (HRD) program that aims at increasing the pool of CBIS skills in the organization. Targeted at both users and CBIS professionals, the program needs positive participation from the user and CBIS management. The HRD program needs to cover three major areas:

1. Recruitment: To ensure a sufficient pool of expertise is recruited;
2. Training: To secure continuous development of CBIS human resources and promote user CBIS knowledge and skills;
3. Management: To enhance CBIS human resources productivity.

Much has been said about CBIS human resources planning at the national level. Organizations ought to concentrate on identifying the needed expertise and make sure that sufficient resources are devoted to acquiring it. Hiring a sufficient number of CBIS professionals with the necessary mix of expertise is the first step in the right direction. Proper training and management are the main factors toward successful utilization of CBIS human resources.

CBIS management should develop a CBIS human resources plan that will focus on upgrading the existing skill pool and on acquiring new skills in both user and CBIS departments. Training should be coupled with needs of work and training potentials of trainees.

User management participation in CBIS training programs is an important success factor. First, user management should understand the need to advance computer knowledge among its members. Hence, CBIS training programs are looked at as significant skill development mechanisms. Second, user management needs to exert due care in choosing who to nominate for training. Only those employees who can benefit from the programs and bring back the acquired knowledge to their jobs are chosen for participation. The training programs should not be a spot for favoritism or a means to bypass promotion rules. The nomination process for training courses should be governed by work mandate.

There needs to be conscious user management involvement in CBIS projects that serve them directly or indirectly. Top management's established policy on user involvement should be implemented. Negotiating the right level of involvement with CBIS management and choosing the most suitable person to represent the department in development teams are important actions.

User management can also help in developing its human resources by participating in CBIS training programs and choosing the right employees for those programs. What is needed is an active participation in organizational human resources development program.

Besides training, productivity of CBIS human resources and users can be enhanced by addressing several organizational behavioral issues that have been identified in the literature as significant contributors to better management. Many have emphasized the importance of the analysis of the individual psychology and the logical progression to his relations with other individuals, small groups, and finally large groups.

## 5 CONCLUSION

It is our deepest belief that CBIS assimilation in GCCC has already come a long way. The assimilation process may have a way to go, but the GCCC have made considerable achievements in record time in many respects including CBIS utilization. Throughout this paper, much has been said about CBIS assimilation in the GCCC with particular emphasis on:

- the role of GCCC contextual factors in promoting and hindering CBIS assimilation; and
- the "*desired*" response from GCCC policy makers and managers.

Yet, much remains to be covered to do justice to an important dimension of economic development (i.e., computer based information system). It can be predicted that the GCCC will continue their strive to use more and more CBIS in the future. This makes the challenge confronting policy makers and managers even greater. It is no longer sufficient to adopt a "fire fighting" approach and the only way to take a proactive stance is to call in another breed of stakeholders. Besides policy makers and managers, researchers can lend a hand in understanding contemporary CBIS challenges and help building a bridge to the future.

As has been indicated throughout this paper, CBIS assimilation in the GCCC is in dire need of an appreciation of contextual factors and their management implications. Development on theoretical grounds is not possible without the help of researchers. A good theoretical model, however, cannot be expected to win acceptance simply by virtue of its scientific superiority. The best way a theoretical model can become accepted is by showing its superiority in practice. This requires continuous cooperation between researchers on the one hand and policy makers and managers on the other. Clearly, cooperation is needed to exchange experiences and to collaborate in rendering existing theories more valid. Only through such joint efforts can the new perspectives on the role of contextual factors in CBIS assimilation be better understood.

In this final section possible areas for relevant research are identified to improve the chances of cooperation between researchers and administrators. It is mostly a problem of setting priorities, since it is not at all a difficult task to identify problems. The idea here is to make an inventory of issues that fall into the category of relevant research.

The study of CBIS assimilation in the GCCC reveals that more can be done in policy making, organizational decision making, and research. There is indeed more to CBIS assimilation in the GCCC than has been presented here however it can be reaffirmed.

That to understand CBIS assimilation, it must be viewed in the economic, sociopolitical, and cultural context in which it occurs.

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# Creativity & innovation in Education For the Challenges of 2000+: Capacity Building of Entrepreneurship

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If you implement principles in your creative work, you won't be able to start anything" (Leonardo da Vinci).

## 1 INTRODUCTION

We are just about to enter an era of fast-moving knowledge-driven information technologies and networks which have the potential change of every classroom practice. The impact of the use of computers and communication technology will not be limited to the learning process (teachers and students), but will change the whole institutional infrastructure and pattern of behavior within the education system. We are passing through a transformation era in building human capital unparalleled in human history. Education faces the daunting challenge of preparing individuals for the information-age society. Answers to the following questions have to be provided:

- How to manage an avalanche of information?
- How to prepare the most efficient human capital for the brain-intensive market-place?
- How to prepare flexible human resources to meet the uncertainties of a global economy?
- How to innovate to keep up with a high-speed, knowledge-driven, competitive economy at the workplace?

In addition, education has (react/interact/address):

- to respond to social needs to "rights to education;"
- to "education for all;"
- to limited resources (physical and financial);
- to development of citizenship;
- and to maintaining ethical and cultural value system.

Languages and science and mathematics have to be taught at early childhood to build the microchip of the brain as "acquiring" and not "learning." The old concept of "we're over-loading the poor child" is no longer valid. Injecting technology to make the educational model more efficient, equitable and cost-effective, for strengthening "mode of inquiry" and "problem-solving."

Curriculum reform is needed with full participation of policy planners, teachers, and civil society to determine what education at various stages should deliver. Modular education is a suitable formula to respond to challenges of the future, and accommodate individual differences. In addition, bridges should be built between modules to allow flexibility and mobility according to emerging trends, and market forces.

Multimedia software is becoming creative and it is possible for users to navigate in a broad spectrum of topics as well as in depth into these topics. The possibilities which computers offer as a tool to help students to learn, to construct knowledge and to comprehend, constitute a true revolution of the learning process and an opportunity to transform schools. Teachers become facilitators for the knowledge construction.

Traditional teaching is based on transmission of knowledge, and students are the recipients of the information. The result is a passive student who has little chance to survive in the knowledge-based society we are about to enter. This society requires creative, critical thinking to learn about learning, working in groups to advance potentials, to have a wide vision about economical, social, ecological problems encountered by today's society, and keep knowledge in specific domains.

Certainly, this requires an educational process to create the learning environment in which students can develop - one in which students can build and develop knowledge. This means that schooling of today has to be transformed. This transformation goes much deeper than simply installing a computer as a new educational tool. So computers must be inserted into the learning environment to allow "construction of knowledge,"

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comprehension and development of capabilities that are necessary to function in the knowledge society. Learning becomes the product of a knowledge-constructing process through projects done by students using the computer network as a source of information. Through the process of solving problems, students can learn how to get and select the right information to incorporate into the solution – to learn about how to learn – to be critical of results obtained, to develop strategies, and to understand that debugging is the engine that drives learning. In this way, students can acquire capabilities and values necessary for the knowledge society instead of them being transmitted by the teachers.

Digitalization has revolutionized our daily life, and given rise to new concepts and a new world of virtual realities of dealing with data representing business, financial markets, transaction, trade, industry, services, and other socio-cultural activities. It is moving now rapidly into interactive media of higher education, where the "virtual university" becomes a simple computer screen; and through that screen, students will have access to every type of education for life. Higher education could be provided at home with "virtual laboratories" and workshops; and the campus of the "university of tomorrow" may become the planet itself.

Schools must have ethics at the core of their education for all. Globalization requires norms and ethical standards to be attained by all, for humanism and a united integrated world.

## 2 FOR CREATIVITY

### 2.1 Man: Security seeker or risk taker

By nature, man seems torn between two concepts: security and adventure. Because of the first, he seeks shelter. Because of the second he takes risks; all forms of risks – being wrong or being discovered. There is a price to be paid for each contrasting outcome. The price of being creative is admittedly higher. However, creativity does not mean leaving the field free for exercising every expression of human thinking. The ways of inventions and discovery also, follow the course of accepted disciplines, a scientific method, imitating chosen models or opposing contradictory models. Rejecting the rules of the game is out of the question. This creative, nonconformist, is apparent nowadays among young people who have revolted against paternalistic attitudes and self-preservation instinct in dominating societies. Youth are seeking new values for a new world free of the "culture of silence" and oppression. No long-term educational policy can do without an analysis of the profound reasons for the challenge young people are flinging down.

Education is increasingly called on to liberate all the creative potentialities of human mind. Young people for the first time in history are becoming the real entrepreneurs of the universe. Many are passing their business capitalization of $1 million before the age of thirty….

Education has the dual power and to stifle creativity. Recognition of its complex tasks in this domain is one of the most fruitful intellectual achievements of modern psychopedagogical research. These tasks may be described as preserving each individual's originality and creative ingenuity without giving up the need to place him in real life; transmitting culture without overwhelming him with ready-made models; encouraging him to make use of his gifts, aptitudes and personal forms of expression without cultivating his egotism; paying keen attention to each person's specific traits without overlooking the fact that creation is also a collective activity.

"So, ideas without risks are useless, while risks without ideas are stupid[1]."

### 2.2 Intellectual Entrepreneurs

To understand the nature of a new product, one has to discover the secret: who creates the product and how it originates? That could be in two ways:

1. Created by people who are not conscious of the product or service they create: by entrepreneurs; and
2. Created by intellectual entrepreneurs as a result of problem-solving to a challenge through systematic R&D, tests and experiments.

Entrepreneurs are characterized by: the ability to think, create and make decisions. They think independently and they reflect, dream, and make their dreams become a reality. They have the sense of inquiry and do not believe in inhibitions, limitations and they can do the impossible. In short, they are creators of events. They read fast and have the technique to analyze and predict. They are self-reliant individuals who know how to have access to information and how to make use of it, and how to construct new knowledge. They are scientists in the sense that they can look at matters as others look at, but **they can see what others cannot see.**

Entrepreneurs must have a sense of humor. They laugh, relax, and take vacation to meditate. They are able to choose partners and create new jobs employing intellectuals who are knowledgeable, creative, and

[1] F.Mayor – UNESCO - Paris

action-oriented. They can cause intellectual revolution and destroy all the myths and other limitations to human brain. They create their own company in order to function as independent thinkers away from bureaucracy and redtape. They watch and identify opportunities that no one else could find in the market place. They take risks and ignore boundaries and limitations. They release their potentials without limits. But they have information about markets, consumers, and forecasts.

First, the intellectual product is created in the brain of an intellectual. The vision of a product, its ideal picture the prognosis by creating a reality, sketches, designs, experiments, pilot projects take place. Feasibility studies of markets and promotions to develop the critical mass of consumption. Knowledge is the key to success, and cannot be achieved except by building the human capital through education. Then as in the genetic code, the entrepreneur constructs the sequence of elements in a perfect configuration to yield the product. It is an operational research with a systematic approach a vision. Intellectual capital may be summarized in the following scheme:

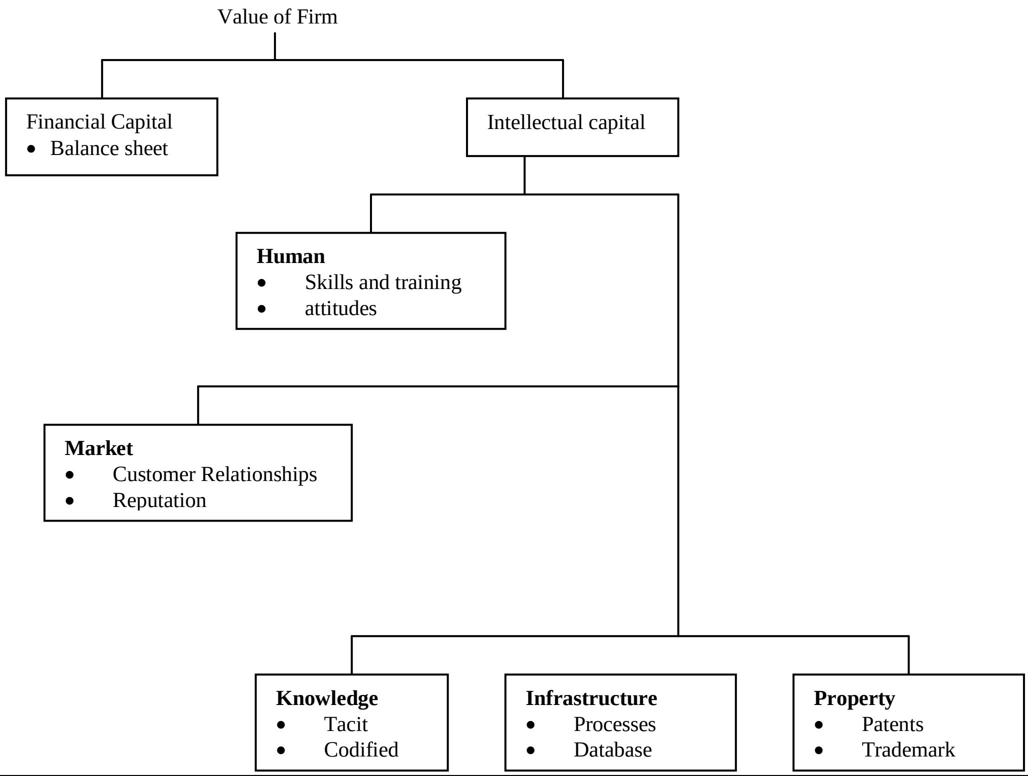


**Figure 1. How the entrepreneur creates? How is the product created?**

### 2.3 The link of creativity to knowledge

Do entrepreneurs read the academic journals to acquire the knowledge? One may wonder whether the entrepreneurial work is really guided by scientific findings; or simply guided by other knowledge acquiring via routes other than textbooks and journals.

To uncover this puzzle, wealth creation has triggered set of fundamental questions:

- What is knowledge?
- What constitutes entrepreneurial knowledge?
- How we make it visible so it could be subjected to empirical exploration?

To answer these questions, we have to construct new conceptual lenses. One of the procedures employed to make sense of the data is the comparative method. The evolutionary partner in the biological world has been drawn upon for comparison. Our inter-specie comparison has taken on a path quite different from species described in the Darwinian tradition. A comparison, say between tribal community and that of a metropolitan city, will suggest the latter’s increasing detachment from the impact of natural causation, and deepening reliance on artificial habitat composed of endless instrumentation, artifacts and system of human construction. Recent global trend has placed the entrepreneur into the leading role of transactional order, and the generation of endless variety of artifacts to respond to the power of the market mechanisms. The entrepreneurial work is seen here as transformational. Thinking along these lines, might give us a model for structuring the entrepreneurial observations for success or failures scenario as those of Hong Kong or Singapore, or for this matter, Dubai. In pursuing this approach to creativity the entrepreneurial knowledge of transaction and transformation depended upon:

1. Industry exhibitions, trade fairs shows, embodied in artifacts. In academic conferences, knowledge is codified.
2. Joint venture of services and factories, show rooms, R&D labs, etc.
3. Market events, product launches, product demonstration, prototype construction, networks, acquisitions, tenders, travel, etc.
4. Licensing of production and services, access to information, mass media, etc.

With time, this leads to adaptation and transformation and it will fall on the shoulder of the entrepreneur to be the prime generator of variation.

## 2.4 The link of creating wealth to creating knowledge

The empirical successful types are based on:

- Product innovation route;
- Process innovation route;
- Sourcing innovation route;
- Distribution innovation route;
- Establishing symbiosis route;
- Resource re-deployment and re-configuration route; and
- Leveraging state-market difference route.

Wealth creation knowledge architecture are built on:

- Know how
- Know what
- Know who
- Know why
- Know when
- Know which
- Know between
- Know where

If we place the above categories, we could then match the success type with the knowledge:

- Product innovation route (know what could be offered instead);
- Process innovation route (know how to do it better);
- Sourcing innovation route (know which lines of products for which areas);
- Leverage market forces route (know when to buy and when to sell);
- Establishment symbiosis route (know who could affect decision outcome and who to influence);
- Leveraging state-market difference route (know between state and market); and
- Resource redevelopment and reconfiguration route (know why the company gets into trouble and why it cannot be done otherwise).

This way of re-conceiving relationship between wealth creation and knowledge creation capture creativity and entrepreneurial success. It provides systematic framework to understand how entrepreneurs perceive, interpret, intervene in environment and how to create intellectual human capital. **Education in terms of quality and relevance is the foundation of this operation.**

## 2.5 Creativity of education for challenges ahead

### *2.5.1 Education is the tool*

In confronting the challenges of the unknown world, education provides the real basic needs to empower people to be able to manoeuvre and take action in "problem solving." Education provides a wealth of "brain knowledge and skills" capital which is so powerful in turning the wheels of development, to generate wealth and alleviate poverty; it produces the entrepreneurs, and provides employment opportunity. Education also is indispensable for an overall human development towards a democratic knowledgeable society based on freedom, social justice, so as to minimise exclusion and marginalization, oppression and ignorance.

But what type of education are we envisaging in the our countries for the complexity of the 21st century? Education is an on-going process of improving knowledge and skills, but it is also, an evolutionary process which should always be "flexible" to meet the "emerging needs" in the society and should be able to mutate according to circumstances.

But of which society are we speaking? Is it the local society – whether rural or urban or is it the regional society or the global society?

Emerging future trends of globalisation show clearly that we are moving into a world of "interdependence" where the "corporate" has no "distinctive" nationality and with a business "outreach" for every country in the world, anywhere, where comparative advantage gives an edge in competitive markets.

Afterall, the competitive edge will be the determining factor for staying alive in the global market economy. So the rule of the new game is to be efficient and innovative. Indeed, these requirements cannot be achieved except through new approaches by preparing competitive human resources to meet the emerging needs of globality. Education is the key to producing quality and diversity of well-prepared human resources at all levels for all the levels of global economy.

### *2.5.2 Capacity building*

Endogenous sustainable development is possible only when capacity building is achieved at the national Emirate level. An adequate infrastructure for education, including life education – training and research for industrial production, and adequate indigenous trained capacity (teachers, researchers, technicians, engineers, bureaucrats, managers) are a prerequisite for the future of endogenous development of the Emirate. Through education and training, challenges of the pattern of total dependence on expatriates may evolve. At the same time, it is important to prevent the emergence of a "North" and "South" divergence within the country, which ultimately produces inequity and unequal opportunity. This in turn would result in widening the gap within the same society and leads to social instability, violence and apartheid poverty.

### *2.5.3 Uncertainties brought by Globalization*

Worldwide economic, scientific, cultural and political interdependence dictated by free trade of economical and financial markets, and by the global information and communication revolution, is taking its roots at all corners of our planet. The emergence of this new world phenomenon is, without any doubt, going to shape our life style, behaviour, concepts and deep-rooted traditions. It is difficult to apprehend or predict and will create many <u>uncertainties</u> for future generations.

This means that the terms of <u>national economic policies</u> will be dedicated be <u>external forces</u>, as characterised by a steadily shifting mass capitals from one financial centre to another at high speed, in accordance with interest rate and speculative forecasts. World growth will be export-driven where exports of goods and services account for 20 percent of all economies in the world (1991) and this volume is growing steadily.

This new <u>world economic order</u> will put more pressure on education reforms. However, too many reforms one after another, can be detrimental to the educational process, because it does not allow the system, the time needed to absorb changes, and to deliver accordingly. Education is a long-term investment, and its results cannot be obtained instantly. Otherwise, disorientation of the system will lead to a delivery of confused graduates.

Another stress of globalisation may lead to a conflict between the <u>preservation of local roots</u> while at the same time becoming <u>universal</u>. Education again has a major role to play in the preservation of the diversity of culture, language, traditions and values. Otherwise, a <u>mono-culture</u> and <u>mono-language</u> may prevail and become predominant and destroy the rich <u>diversity of local</u> cultures.

The instrument of globalisation, which is brought largely through communication, may leave a large proportion isolated. Again, a conflict would rise among <u>info-rich and info-poor</u>, not only among countries but even inside the country. This will pose another challenge on equality of education among various social groups of the population. Those who have access to multimedia and networks and innovative education, and others who will be blacked-out. Disparity within the same society may result in polarisation.

With the speed of globalisation, <u>short-term planning</u> and gains may become predominant policy which could overtax the <u>long-term planning</u> in education. That could lead to a lot of education being done privately by the "corporate," or through commercial "virtual" university, or social well-tailored sandwich courses for career development. Continuous education ("life-long") will be carried out privately to accommodate what dose of training is required for a specific job or for a shift in assignment of a job. Public universities with rigid curricula may lose ground in this race for short-term policies dictated by the ever-changing market forces.

With globalisation, the phenomenon of "<u>brain-drain</u>" and "<u>brain-gain</u>" will not exist any more. The delivery of education in terms of quality of human resources, who are trained locally, will compete for employment in the global market. So planners of education at the local level have to act locally and think globally to seize the greatest portion of the global human capital. Human capital will cross borders, follow business opportunity anywhere in the world, and citizenship will give away to excellence and efficiency. The mobility of mass capital resources will follow global forces of competition for efficiency. The most important criteria for transitional corporations to consider a country or a region for investment will likely be determined by a developed economic infrastructure and by high quality human capital for high-tech industries; and by low-cost human capital of skilled vocational human resources.

With new communication technologies, distance and space are shrinking. Sites of manufacturing are increasingly independent of geographic distance, and have no nationality. Capital will not only search for fresh market but also to incorporate new groups, for part of the "global assembly lines." One part of the manufactured package may be manufactured in Dubai, another in Singapore, a third in Japan and the assembly is done in India. Cost-benefit analysis will determine, who does what, locally and regionally for the "global assembly lines." Also, labour-intensive manufacturing will shift for profit-gains from the industrialised world, into the third world, for competition in the global economy; for example: textiles, leathers, where women will become the larger portion of the workforce. While brain-intensive high-tech industries require a minimum of labour force, they will be promoted in the industrialised countries, where the capacity and infrastructure of producing the knowledge and technology though scientific research and development exists, and where frontier areas of science and technology are evolved through strong infrastructure of: **critical mass of scientists, highly equipped laboratories, strong backstopping of technical services, ideal environment for research, good incubation and business park facilities for conversion of applied knowledge to technologies, strong financing facilities, and adequate patent and intellectual rights protection.**

## 2.6 Human capital for the information age

### *2.6.1 Some imperatives*

Schools and universities must change to meet the challenges of a knowledge-based economy in the information age. New skills are needed for the emerging information-age workplace. If students are to become intelligent users of technology and information, they should also learn how to be creative and innovative. They should be involved in problem-solving and research and should be able to tackle case studies and understand how to analyse data and draw an intelligent conclusion. Students and researchers should know how to use new technologies and information from new resources and effectively disseminate their ideas, derived from knowledge. Equity and excellence should stay as priorities in any new policy of education.

### *2.6.2 Learning in the 21st Century*

- New curricula integrated with strong component of interactive multimedia
- Interactive multimedia to be written by best scholars, and produced by the best publishing houses
- Level of communication and computing technology suited for every level of student to energise creativity, inquiry, research and new skills.
- Complete change of textbooks, to be replaced by a Mix of hard cover and wide version of instructional software, pcs, laptops, cd-rom, educational tv, video, interactive radio, cable and satellite educational communication.
- New role of the teacher; new training (in-service and out-service) to build and Share knowledge. Teachers should change from lecturing, to technology users, mentor, researchers, knowledge producers, and life-long learners.
- Strong involvement of the "home" schools with the help of parents and multimedia of learning
- Involvement of the community and the neighbourhood environment
- Involvement of the business community, in offering opportunity for training, in a business-like environment, so it becomes involved in preparing future human capital for the competitive workplace
- New Version of students evaluation, assessment and aptitudes for the information age
- Diversity of education away from the current traditional lines which were born after the industrial revolution. Innovative approach, to interdisciplinarity, to develop new Abilities and intelligence.
- Ability to explore and represent knowledge, dynamically, in various forms.

**Figure 2. Learning requirements in the 21st Century.**

Networking at the schools level to provide connectivity and interactivity is crucial in the new learning process. User-groups and collaboration to search for information will open new venues of thinking-ahead and become independent in self-learning. New setting-up of the classroom and the school, its materials and teaching aids dictated by learning for the information-age.

## 2.7 Reforms in education: Restructuring and rationalisation

### *2.7.1 The need for change*

Rapid changes are taking roots for the next millennium. These changes in economic interdependence, and communication and information technology require different education delivery. Such changes call for restructuring educational systems; first to become competitive and, just as important, to respond more to complexity and emerging needs of the society.

### *2.7.2 Streamlining Education*

To streamline the educational system, to cut down waste and dropouts, and allow vertical and horizontal movement of students according to their capabilities and potentials, the followings are recommended for action:

1. To institutionalise the two year KG system (3-5 age group) to become compulsory as part of the education system by inviting the private sector to become more active partner in education. It should develop creative thinking, innovative inquiry, knowledge construction and numeracy and logic through games using simple software and computers for motivation toward science and math, and toward self-reading, writing skills and others.

2. Children at home, should not be left totally to traditional parental care which may contradict building a self-reliance of the child. Programmes of "words and images" on TV should be provided for children at home on daily bases and on weekends.

   Recent Carnegie publication[2] emphasised the education of children aged 3 to 10 explicitly in the following:
   "During these seven years, children make great leaps in cognition, language acquisition and reasoning, corresponding with dramatic neurological changes. Educational attainment could be increased through better skills, enthusiasm of teacher's formal education. Schools may have the primary responsibility for children's formal education, but their success is influenced by other pre-schooling, religious and community institutions, family, neighbours and friends, and the mass media. From the age of 3 to 5, when brain activity is high, parental involvement is important to foster the love of learning to become a habit, a concrete block of life-long learning."
   The report goes on to say that parents who work long hours outside "home" in this demanding and pressing consumer-driven economy, leave very little time for their children. This vacuum has been replaced, to a large extent, by the TV set. A few TV programmes are suitably educational however; others are simply trash. It mentions that there are now 20-25 violent acts on TV per hour. By the time they reach 18, children in North America, on average, have watched 15,000 hours of TV which is more time spent than in the classroom! These TV watchers tend to put little effort into school work and have weaker educational skills. This will lead to deterioration not only to the educational system, but in the long term to the economy, the report concludes.

### *2.7.3 Restructuring for Efficiency: New Scheme*

1. The current system of elementary (six years) and preparatory (three years) should be abolished. It is obvious, it should be replaced by 10 years basic education (6-16 age groups) as a compulsory education, followed by 2 years secondary education (16-18 age group).

2. The following figure shows the current educational scheme and the recommended new scheme:

[2] Year of Promise: A comprehensive Learning Strategy for America's Children, September 1996.

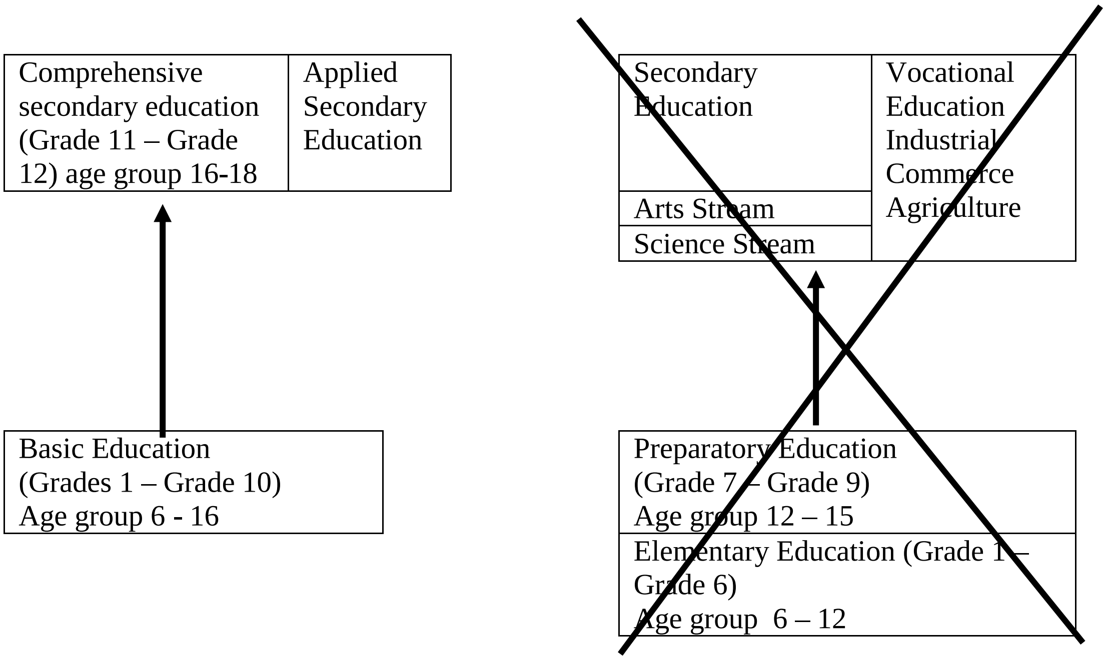


**Figure 3. Current educational scheme and recommended new scheme.**

3. The suggested new scheme is capable of dealing with all problems, constraints and failures of current scheme. It releases the individual potential to be creative, entrepreneur, and forward looking. It develops the human brain-intensive potential to a new horizon. It offers the followings:

- It provides a compulsory free cycle for all citizens in governmental schools, to give them the passport for life.
- It provides strength in acquiring skills, languages, science and math and develop citizenship strong with ethics, humanistic and cultural values, positive attitudes toward self-learning and work.
- It responds to social needs, education for all, and prepares flexible citizens to meet uncertainties.
- It provides a good working level of communication and information technology to energise inquiry and, new skills and construction of knowledge.
- It goes hand in hand with the new brain discoveries about neurophysiology in acquiring knowledge, operational search, concept behaviour and life long education.
- It reduces waste and financial costs.
- It allows students to move vertically and horizontally according to each one's ability.
- It develops citizens to new information age.
- It makes full use of females in abundance to feminize teacher-citizens for basic education. So investment in out-service and in-service training will be there to stay.
- It streamlines management of: curricula, students, teachers, and schools.

4. At the secondary cycle (2 years), the programme becomes competitive to prepare students to continue for:

- Tertiary education; or
- Applied technical education

The system of comprehensive secondary education will be based on units (modules) similar to International Baccalaureate (IB) or somewhat to IGCSE in Britain. Student will pick up units (courses) according to his capability and desire to prepare himself to higher education or to life. Measurement (examinations) will be done for each unit at the end of each semester and there will be three dates during the year to give the student a chance to set for the exams. It is no more essential to have one general examination for all disciplines (subjects) at once. The student has unlimited options to repeat the exam if he failed or to give him more chances to raise his marks to meet the requirement of pursuing higher education (better grades) so there is flexibility and no inhibition, for improving the student's quality and achievement. Accumulation of these units will finally give the student the final module (6-8 subjects) similar to IB or IGCSE.

The student may shift to technical secondary education if he does not desire an academic stream leading to higher academic education. Still, the technical stream may lead him finally to higher colleges of technology (HCT). The output of the system in short: a quality and reliable student.

5. The recommended secondary education scheme, is comprised of the following:

   1. Comprehensive secondary education stream that covers academic and vocational foundation courses as a base (core) in addition to subject matters of advanced subjects in academic or technical subjects.
   2. Secondary applied education stream that covers a foundation to advanced courses (core). In addition to advanced technical education.
   3. Full freedom to transfer from one stream to another; because the matter lies in the number and quality of courses the student picks up for the exam. He chooses the courses that qualify him for tertiary education or the life of work.

# 3 CREATIVITY IN EDUCATION: POLICIES FOR PREPARING FOR THE FUTURE:

## 3.1 Policy One - Literacy in Science

### *3.1.1 Public at Large*

Science is a successful mode of inquiry, and also of problem solving. Science has brought the technology that we enjoy and has changed our life styles: communication, highways, electricity, water, computers, agricultural crops, medicine, pharmaceuticals etc. so literacy in science is becoming so necessary as reading and writing for a living in a healthy society. Scientific literacy implies "the ability to respond to technical issues in our daily life.[3]"

Science fuels technology; and "technology" is the engine of economic growth: creates jobs, builds new industries and improves our standards and quality of life.

The productive sector of the economy demands a labour force that is scientifically literate. Workers are required to understand complex instructions in order to operate equipment, and to understand the vast information disseminated by the mass media about technological matters. It is needed at home to operate electrical appliances and to enjoy the fruits and appreciation of science discoveries.

### *3.1.2 Role of schools*

The goals of science literacy require meaningful **science education** to be imparted in schools. Three points will be discussed:

1. That science education should reach all students and start in early stages of child education and continue through all years of compulsory basic education (10 years).

   Also, it must train students in the secondary cycle, to study science and engineering, in technical schools and universities to become the scientists and engineers who occupy critical positions in industrial and economic development. Schools must also prepare the workforce demanded by science-based industries requiring technically skilled workforce.

2. The second point is that science in schools is largely taught as a reading subject from textbooks. However, science is much better learned, when is taught by illustrating principles with practical observations and experiments, which through schooling may simply be derived from the daily experience and local environment.

3. The last point, is that dedication of teachers as "constructors of knowledge" is crucial to motivation of students toward science education. The mass media, Radio and TV can play an important role here.

## 3.2 Policy Two - Strengthening Science and Mathematics and Languages in Schools

### *3.2.1 Basic requirement*

Strengthening science, math, and languages (English) in schooling, requires working on three fronts:

1. Curriculum;
2. Teachers;

[3] Ayala, F. World Science Report. UNESCO,1996.

3. Educational technology.

### *4.2.2 Curriculum Development*

Citizens population in the developing countries has a young age structure. Those under 15 represent 46% of the citizens population. As a result of this age structure, the entrants of citizen students at the KG and basic levels are increasing. In this demographic setting, the effect of education quality in science, math and language is magnified into the quality of workforce in science and technology and the latter potential to compete globally. Standard international tests have shown that performance of even 'advanced' developing countries in science and math is at the lower end of countries around the World (TIMSS 1996).

Textbooks, and learning packages and teacher's guide books should be published freely by publishing houses where competition for best textbooks will be evolved and updated regularly. So ministries of education in third world countries should abolish the policy of publishing their own textbooks in the traditional way as used currently. They should develop a new policy of setting the best curriculum and let schools to choose the best textbooks published by private enterprises, where the curriculum is translated to textbooks.

Bilingualism in support reading reference materials in science and math should be encouraged as a policy to give the student a chance to acquire new vocabularies in science.

### *3.2.3 Teachers for Science and Math*

Teachers need to be trained extensively.

### *3.2.4 Educational Technology*

Learning packages and interactive computer aided instruction need to be secured in science and math, and teachers are need to be trained on how to use them for accelerating the learning process. Also, video, CD-ROMs, visual aids and distant educational material via satellite for complementing the classroom learning and improving the "construction of knowledge" by both teachers and students to strengthen science, math and English. Modern language labs, video and interactive computer learning material centres may be established in every school as an extension of its library for "learning what to learn."

## **3.3 Policy Three - Creating Science, Math Educational Development Centre (SMED)**

To overcome the negative symptoms of out-dated teaching of science, math and English in Schools, SMED centre is recommended to be created. This centre will deal with the development of curricula, teaching materials, learning interactive media, other educational technologies and teachers training in science, math and English and other needed languages. It will be composed of workshops laboratories and language labs, seminar rooms and highly equipped labs staffed with high level professionals to undertake the task of overall development of science, math and English in schools from KG until the end of the secondary education. The centre may be organised around three pillars (departments) as shown in Figure 4.

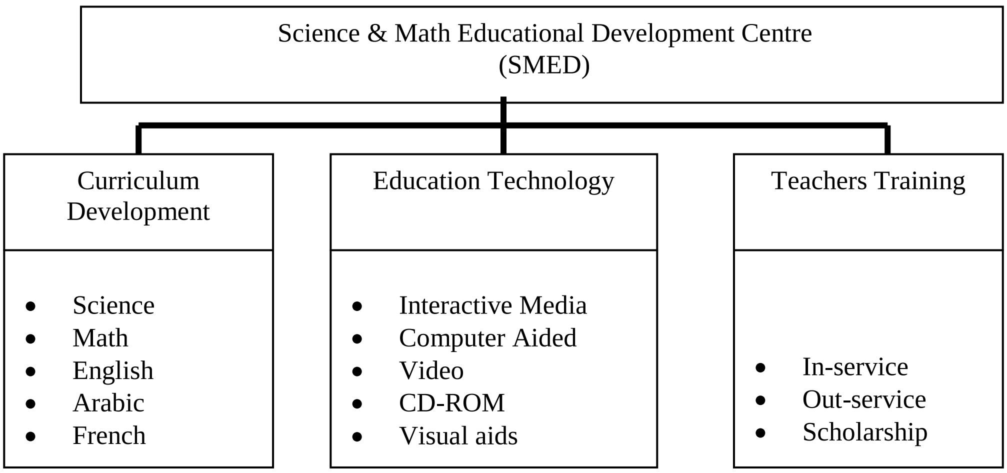


**Figure 4 . Suggested new Science and Math Educational Development Centre (SMED).**

### 3.4 Policy Four - Restructuring Education

For science and technology policy, it is extremely important to streamline the educational system for effective delivery. First it has to be competitive in a global economy for quality of human capital and, just as important, to be relevant and flexible to respond quickly to complexity and diversity of emerging needs in the country. It has been proven that the economic success stories of emerging countries in Asia were due to aggressive policies and strategies in human resource development. Huge investments were put in building the human capital in science and technology through education and have paid off. In order to build up technological capability, there must be people in place that can utilise and apply imported technology to achieve industrialisation and service economy. The current structure of the educational system is too rigid and compartmentalised to allow transdisciplinarity/interdisciplinarity and choices for nationals to develop their potential in science and technology. 10 years basic education and 2 years secondary is recommended.

### 3.5 Policy Five - Relevance of Teaching and Research

*3.5.1 General*

The economic contribution of higher education and research is both direct and indirect. First, there is a direct impact whenever university-based research leads to industrial innovations. Second, there are indirect, though no less important, effects through the training of qualified managers, scientists, engineers and technicians who participate in the development, adaptation or diffusion of innovations in the productive sectors. It is recommended that investment in education (all education) be in the range of 6% of GNP, by both public and private sectors in third world countries.

*3.5.2 Relevance and quality of teaching and training*

1. Improving the quality of instruction and the relevance of the curriculum can be achieved through a variety of complementary actions: establishment of efficient selection mechanisms, improved quality of teaching staff, curricular and pedagogical innovation, adequate provision of pedagogical inputs, development of more relevant programmes, and strengthening of evaluation procedures (see last figure).

2. Enhancing the quality of students and increasing the internal efficiency in higher education institutions will often require <u>tightening admission standards</u>. Many developing countries screen students either at the entry point, through examinations and secondary school grades, or during their course of studies. Perhaps the most effective selection mechanism is one which allows individual institutions to establish their own admission criteria in conformity with minimum standards established by accrediting bodies.

3. <u>Improving the Relevance of Higher Education Programmes</u>. The pattern of enrolment and the curricula should more closely reflect the skill requirements of the productive sectors. One way of achieving this goal is to promote the development of professional programmes, either by creating new courses or by transforming existing programmes. A variety of relevant short programmes (1-2 years) and long courses (3-5 years) as well as continuing education courses can be designed to respond to the economy's requirements for different levels of trained manpower.

### 3.6 Policy Six - Investment in Science

1. All developing countries taken together are responsible for a mere 10 percent of the total gross expenditure on research and development, whilst the member countries of the OECD can claim 85%. The industrialised countries commit between 2% and 3% of GDP to R&D, whereas the countries of the South only manage a fraction of this. In Latin America and Africa, for example, the investment ratio is 0.4% or below. Even countries with important scientific communities in certain disciplines, like India, Brazil or China, are not able to devote more than 0.7%.

2. The pattern is repeated if we take the numbers of active scientists and engineers. Although some 25% of scientists are found in the Third World, the regional figures again show a striking imbalance. Whilst the European Union support two scientists per thousand population, the USA 3.7 and Japan 4.1, the developing countries have much more modest levels – for example – Sub Saharan Africa has less than one tenth of the Japanese value.

3. For many parts of the worlds two things are needed: firstly, a clearer commitment towards science by governments and politicians; and secondly, a broad investment in capacity building – the strengthening of scientific infrastructure and the development of human resources.

4. Therefore, a clear commitment of the third world countries in investment in science is needed. It is recommended that 1% of GDP be invested in R&D.

### 3.7 Policy Seven - Link with Industry

1. Postgraduate links to research and to industry are very weak. To foster links with industry, the university professor is to have a matching role in conducting **contractual research** with industry or public business sector, to that of teaching. R&D should be fused to departmental research and graduate thesis to build bridges with the production and service sectors.

2. Research in the university is mostly funded by government, and it is geared towards academic promotion and publication in accredited journals. A new approach is needed where private funding is **lured** to create a partnership between the university and industry. UNESCO university –science–industry–partnership (UNISPAR) has been launched for developing linkage for R&D between the university and industry in Africa. It funds the **bridging** of the transfer of research outcome to production. The programme has reinvigorated researchers to advance their research towards application and it has invited the private enterprises to become a partner in this venture.

3. R&D units, where researchers in the university are mobilised for problem-solving have been created modestly in some Arab universities. Funding instruments by the state are established in some countries (i.e. KEFAS in Kuwait, KAAST in Saudi Arabia, HCST in Jordan), to create a contractual research on priority projects done at the research facilities in the universities; and in addition, to promote a competitive research among researchers.

### 3.8 Policy Eight - Business Parks – S&T Incubators

1. University should encourage the R&D of their staff by making contractual research with industry.

2. The application of their research should be transformed to technology through incubators in the business park surrounding the university.

3. Incentives should be given in term of promotion, and percentage of commercialisation of their R&D to innovations.

4. Business parks have been successful and been implemented by most universities in the West. Knowledge-based industry, small and medium enterprises (SME), are developing quickly around universities by utilising brain-incentive universities for problem-solving and “high-tech” industries.

5. It could begin by the transfer of technology from abroad. But to absorb technology, strong science and scientists are needed locally. With time, many components of this technology could be value-added by R&D workers in the university. At a later stage, a whole new technology will be developed locally to compete with imported technology.

6. In some Arab universities, R&D marketing centres, offices were established. Very few universities created incubation park to establish links between the researcher and industry. Project budget has been created to allow an important tool in this direction. However, there are still difficulties in ever-matching the western universities in this domain. Bureaucracy and heavy-load of teaching are counter-productive to make a success story of incubation.

## 4 CONCLUSION

In confronting the challenges of the next century, education provides the basic skills to adapt to “emerging needs” and to a “new environment” of globalization. In a fast developing society, there is no room for “rigidity” or for a traditional “slow-responding” education. Education has to be flexible and quick in delivery. Education provides the “value-added” human capital in terms of “brain-knowledge bank”. This is translated into skills, which are so powerful in bringing innovations into new technologies and efficient management; management of both material and human resources.

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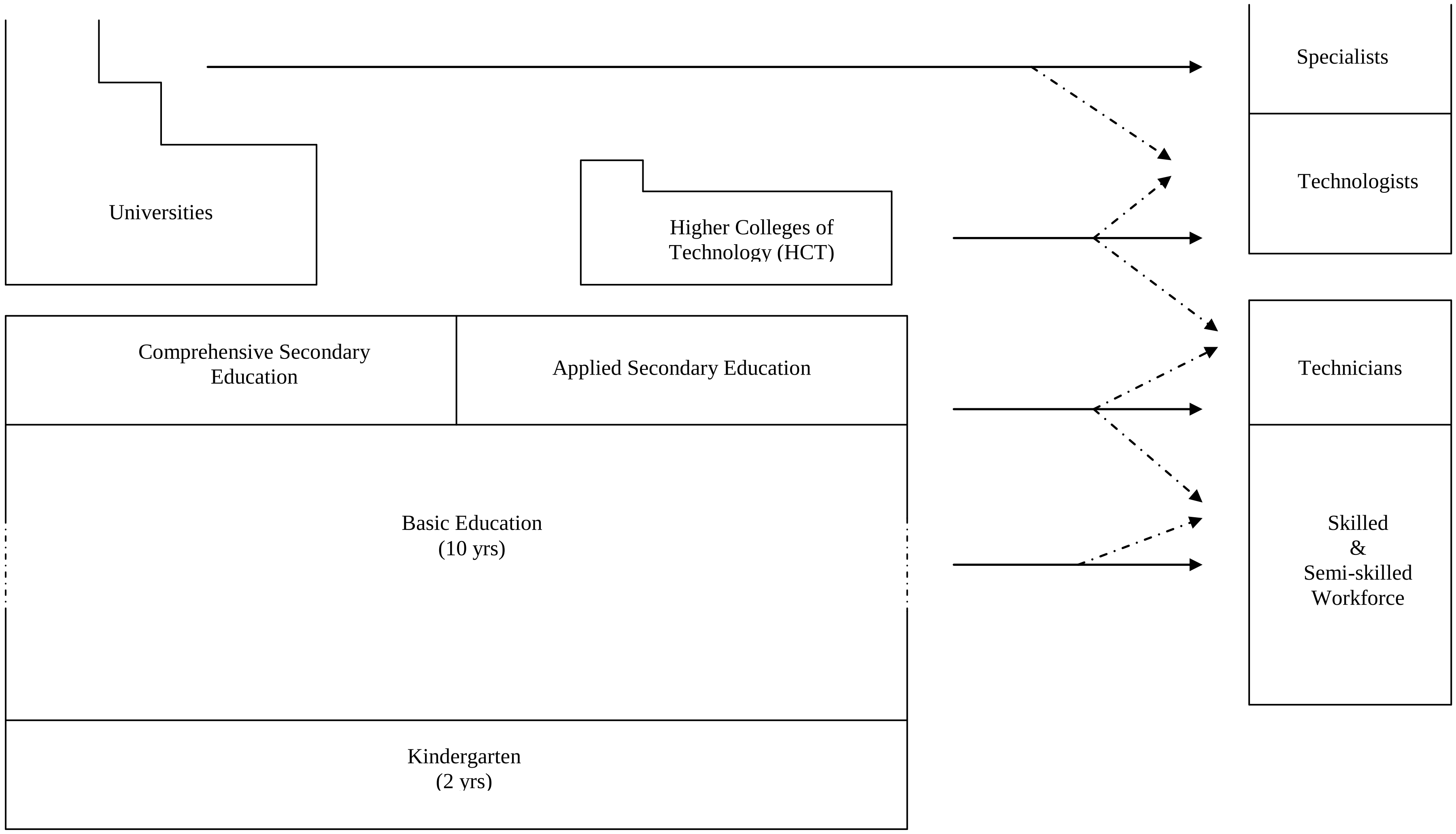


**Education System outputs for the workforce**

# Integrating Information Technology Policy Elements into National Science and Technology Policies: A Proposed Methodology

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## 1 ABSTRACT

This paper emphasizes the most basic requirement for today's lively interaction with the all-pervading global market economy, namely the competitiveness founded on a developed state of science and technology (S and T). There is dire need, therefore, for a change in the state of affairs in many of the Muslim countries. Of all the R and D - based technologies that influence the destiny of nations in the contemporary world, the information and communications technology stands now and more than ever before as particularly critical. The paper discusses the underlying national information infrastructure (NII) and the need for adopting an explicit strategy (and a supporting policy) for its creation, strengthening or further development. Being thus a pivotal component of any national S and T strategy, the discussion also attempts to cover the ingredients that go into the construction of the NII strategy and the need for providing guarantees for its continuity and sustainability.

### 2 THE NEED FOR ACQUIRING COMPETITIVENESS

Probably nothing else in our contemporary world has become as valid a phenomenon and as vivid a reality as technology being a sine qua non for real and sustained economic growth and prowess - and this is not in the least an over-statement. As a corollary, technology-based competitiveness is now as feverishly sought and has become as rewarding as never before in human history. The incomparably viable pursuit for achieving such competitiveness is immersing the national research and development (R and D) institution in new and highly demanding levels of performance while being guided by a sharply targeted science and technology (S and T) policy which, in turn, is master-minded by a pragmatic framework of thinking. Another tried-and-proven instrumentality is closely associating oneself with those who are forefront winners in S and T policies and R and D operations while ensuring that both are popularly appreciated and staunchly supported by enlightened political leadership. We have here a clear reference to the importance of forging strategic alliances which have become a prominent paradigm for achieving accelerated growth and market competitiveness.

The fundamental drive behind these endeavors is learning, which becomes all by itself the single most important morality among the whole gamut of motivations that influence S and T institutions and individuals alike. The traditional roles of R and D - among the more comprehensive S and T policies - need to give way to novel, cost-effective and candid practices that clearly help in quickening the pace of technological development, and hence overall socio-economic development. Significant among these practices are those conceived to support local high technology-based production and applications, forward looking reverse engineering that respect intellectual property rights of other parties. Achieving high levels of proficiency in these technological pursuits, predominantly pursuits with catch-up orientations, creates the most favorable environment for promotion to the higher status of more aggressive R and D that is necessary for joining those societies in the first world which depend for their prosperity on leading-edge R and D.

## 3 THE S AND T- RELATED POLICY PROBLEMS IN MUSLIM COUNTRIES: THE NEED FOR CHANGE

Seen in a broad perspective, the problems of the economy in most Muslim countries must be directly connected with the condition of inadequate production and productivity, which - in any analysis - are attributable to technological underdevelopment which, in turn, is perniciously connected with the state of technological dependence. There are of course several exogenously determined factors which aggravated this condititon, but at the domestic level its causes and symptoms can be seen as linked to its results in a vicious circular relationship. Chief among the roots of this problem is the fact that the professional R and D establishment, if it existed and even where it is sizeable, has a relatively marginal role in meeting the technological needs of the national economy, and that these needs are furnished principally form foreign sources in purely commercial transactions.

What is to be dismayed further, is that on several occasions, and quite unjustifiably, conglomerates of these technology-embodying inputs are supplied in packaged form for the implementation of turnkey projects. This state of affairs has produced, inevitably, a state of technological dependence which has aggravated with time and causes further marginalization (and sometimes alienation) of local R and D, which resulted in further tightening of the vicious circle.

What is particularly disturbing is fact that the crucial R and D indications in the majority of the Muslim countries are dismal. The capacities of the local R and D establishment to produce technologically viable results, therefore, are severely impaired and - whether a cause or a consequence or both - there is persistent lack of serious demand on its services. A central constraint in this context is indeed the absence of a stable and long-term science and technology plan which is master-minded by a well thought-out visionary strategy of technological transformation, lying at the heart of the overall strategy for socio-economic transformation.

Closely associated with this constraint is the absence of the fathering effect and patronizing role of the political leadership which is so vital in the particular situation of developing Muslim countries. As actually experienced, this role can be instrumental, in fact crucial, not only for the conception of technology-oriented plans and policies but chiefly for their implementation through removing many obstacles, mobilizing resources and enlisting the cooperation of all parties involved. Let it also never be forgotten that even in the most developed of first world countries, as seen in recent history, political leadership played in crucial moments of technological challenge the role of a saviour.

## 4 INFORMATION TECHNOLOGIES AND DEVELOPING COUNTRIES

### 4.1 General

The basic premise in the present discussion is that information technology (IT) must be acquired and efficiently utilized in any aspiring developing country. Not being generators of technology in their majority, Muslim countries can afford a more-or-less effective national information infrastructure that can be supplied and put together by world leading companies. Such acquisition must be seen as part of a general technological leapfrogging effort. In the area of IT, many development thinkers and planners are of the opinion that it is more prudent an approach to attach oneself to the bandwagon of the rapidly advancing IT by first being an efficient user of the technology than to attempt first to be among the generators of such technology. This in effect is a next-best choice (perhaps also the only choice) for the late comers. It can be complemented by higher levels of catch-up endeavours of learning through using, in a deliberate effort subsequently to contribute incremental improvements that hopefully lead, with time, to market-worthy contributions…all conceived within an ascending spiral scenario of technological growth and development.

Seen as such, within an ambitious, enlightened environment, IT policies will be conceived and implemented as an integral part of overall broader-ranged national S and T policies. Moreover, what makes this approach particularly attractive, is the fact that highly advanced IT, albeit not the most advanced or the latest IT, are now commercially available, as hardware and software and as complete systems which major global suppliers compete to deliver, at constant diminishing prices, as packages that include extensive training components.

A profoundly impacting quality of the information and communication technologies resides in the reality that in combination they have become the one product of research and development that changed radically the face of civilization more than any previous S and T achievement of mankind. So, starting with and/or capitalizing on the potential of IT, as a pivotal component of any national S and T endeavours, would be a most sensible undertaking in the drive for technological transformation of the society.

Needless to say, a prerequisite for any catch-up effort in the area of IT is the existence of a viable and effectively performing national information infrastructure (NII). Although the significance of the fundamental scientific and technological contents per se of the IT are never to be overlooked, the direct and sometimes immediate benefits of impacting the society will be the first to be sought in the direly needed socio-economic development. The impacts that are more pronounced are to be found, inter alia, in the areas of fight against poverty, malnutrition, infant mortality, illeteracy, gross social and income disparities, poor administration of justice, inefficient government, and environmental degradation. Because of this broader (more horizontal) socio-economic impact, IT policies can be seen as distinguishable from the conventional S and T policies which address the acquisition of knowledge (more vertical) for the production of goods and services. The fact that information and communication technologies owe their existence to R and D results generated under S and T policies does not diminish the validity of this statement.

The NII comprises basically the telecommunications networks and the strategic information systems necessary for sustainable economic development. Complementary to these pillar-ingredients are the invaluable human resources associated with the use of the infrastructure and the equipment they use on daily basis, e.g. telephones and computers.

### 4.2 Strategic Information Systems

The term "strategic information systems" refers to the whole gamut of information systems, of central importance to the nation's economic activity, that are necessary for sound macro-economic management and decision-making. Naturally, different countries differ in what they determine as strategically important among the information systems. However, the following is assumed to be a core group of strategic information systems, on which all countries would need to base their continued economic development, that are serviceable for:

1. Management of the macro-economy and the government's central activities of planning, budgeting, civil service payroll, debt management, tax administration and expenditure management systems at local and national levels;
2. Facilitating general economic activities, such as national statistics, demographic and geographic information, and judicial administration systems;
3. Improving the delivery of infrastructural services, such as air transport control, vehicle registration, port operations, and public utility management;
4. Enabling the functioning of financial markets and the development of the private sector operations, including land, property and business registration, payment clearance and settlement systems, and banking institutions and oversight systems;
5. Promotion of trading activities and enhancing global competitiveness, including customs operation systems;
6. Fight against poverty, including e.g. social security, basic education and primary health care systems;
7. Building human capital, through school and university systems, research networks, and provision of sectoral information systems that serve, inter alia, education and health institutions;
8. Preserving the environment through natural resource inventories, geographic information, environmental monitoring, industrial and commercial licensing and regional planning systems.

It is now a reality that all developing countries are acutely conscious of the necessity, not the choice, for developing strategic information systems to serve their national economic development. They realize that an opportunity now exists to design NII policies that serve their NII strategies. Perhaps the most serious constraints in their way reside in human resources and institutional capacity that are likely to slow down their progress, particularly in the poorest countries of Africa.

# 5 NATIONAL IT POLICIES AND STRATEGIES

## 5.1 Means and Goals

Among the dictates of the contemporary revolutionary advances in information and communications technologies are the opening of extraordinary opportunities for accelerating socio-economic development and, concomitantly, the creation of a pressing need for policy reform and capital investment for making use of the new opportunities. The new orientation, inevitably, involves moving towards a different kind of economy - the information economy - in which information is the dominant factor of production, trade and investment, and where firms must compete globally on the basis of knowledge, networking and agility.

At the same time, and as corollary, the same agenda leads countries into a new type of society - the information society - that is profoundly different from any societal setup that we have hitherto known. The information society is better informed than a conventional industrial society, more competitive, less stable, and more able to address individual needs. It can also be less centralized, more democratic and friendlier to the environment.

The very nature of the process of development of the information economy and society necessitates the involvement and participation of the governments, the private sector (now assuming far greater importance than ever before), and non-governmental organizations. We need to emphasize here that, as seen in the more developed countries, the private sector will expectedly be the primary engine of the information economy. At the same time, the government's role will be more crucial as a catalyst for change, as a policymaker, and as a guarantor of fair play in the entire field. Public sector-private sector partnerships, in such a setup, will be necessary both for formulating the NII policies and strategies, as well as for their implementation and then in reaping the fruits.

### 5.2 Developing the IT policy

For the development of the NII strategies and relevant policies, there will probably be a need to address at least the following fundamental components. It will be noted that these components are similar to those that will usually be addressed when embarking on the broader and more-encompassing exercise of formulating a S and T strategy-policy:

1. *Setting the strategic goods and target dates around which to rally the energies and resources of the society.*

Dependent on these dates, and given the rallying of sufficient political will, it will not be difficult to set the strategic time horizon for achieving the individual project targets and perhaps also the cumulative results of the entire strategy. There is obvious need for founding these estimates on a realistic and candid assessment of the current strategic information systems projects in the country, their scope and importance, their budget and status, and the common constraints their encounter.

This exercise will necessarily lead to the identification of the strategic opportunities and needs for information and communications in the economy, as well as revealing the real challenges that lay ahead before the time horizons are reached. In the process, there will be a need to examine the existing macroeconomic development plans and sectoral assessments to identity the priorities or to re-arrange these priorities. Of the opportunities that cannot be overlooked are:

(a) Trade performance levels achievable, in the contemporary world of the Internet and electronic commerce, after removing such barriers as customs and slow port operations;

(b) The profound socio-economic gains achievable from the expansion of telephone services nationwide and after penetration of the remotest rural areas;

(c) Boosting of the municipal development as a result of modern planning and advanced management systems;

(d) The immeasurable gains in educational and literacy levels resulting from distance education and computer-aided instruction; and

(e) The socio-economic gains in the industrial sector resulting from the provision of the much-needed support to small and medium enterprises through modernization of the administrative and production systems, all contributing to solving the unemployment problems.

2. *Defining the strategic investments needed to achieve the stated goals and objectives at the set target dates.*

This refers to the portfolio of investment projects specifically aiming at the expansion and modernization of telecommunications networks and utilization of the strategic information systems in the most efficient manner according to national priorities. Reference is also made here to all the components of the telecommunications infrastructure with respect to the levels and types of service, and the broad governing institutional setup such as the ownership, operations and regulations, and order-of-magnitude investment cost, and financing strategy. Prudent consideration needs to be given in all these facets to the potential of cooperating with foreign partners.

3. *Introducing all requisite legal reforms that can help in the policy implementation and accelerate achieving the set targets, while creating an information friendly environment and removing constraints.*

The reform must necessarily include public policy, regulatory and institutional elements in order to assure widespread access to information and telecommunications services. Typically, such reform will result in restructuring the entire information-telecommunications sector to allow increasing forms of market discipline in service provision, and the introduction of intellectual property legislation.

The reform must lead to liberalization of the relevant technology markets with sufficient transparency in the public information and contracting policies. It will also affect the regulatory practices that guarantee fair competition in all communications and information services, subsidy or exclusivity policies adopted to foster private investment, particularly in rural telecommunications, and the incentives available to encourage transfer and adaptation of technology.

4. *Designing a strategy for human resources development to suit the opportunities and challenges of the information age.*

This is an ambitious endeavor that starts with assessing the knowledge and skills the nation requires in the workforce to implement the NII strategy. In practice, this should involve the formulation and implementation of education policies to meet the sophisticated needs of the information age that go hand-in-hand with the corresponding institutional reforms.

The target here is the general population which will be required to be capable of operating electronic equipment and computers and able to consume information products intelligently, while utilizing the limitless potential of the national telecommunications networks. Another target group of the population includes researchers and technicians in the R and D establishment who should absorb and assimilate the scientific and technological contents of the new NII technologies, and make first attempts to contribute even marginally to the existing stock of knowledge.

5. *Reaching consensual agreement on the division of responsibilities for implementation, at the executive and oversight levels, of the overall NII strategy and attending policies.*

The importance of widespread participation cannot be overemphasized in the phase of actual implementation, just as it is in the phase of formulation, to assure visibility and accountability and benefit from the accumulation of achieved results. A vitally important reinforcement will be received from the committed sources of financing, both national and foreign.

### 5.3 Continuity and Sustainability

It would not be superfluous to state that an indispensable condition for the success of the entire exercise is the provision of sufficient guarantees for the consistency and continuity of implementation actions. The latter, under many developing country circumstances, needs to be immune against the effects of changes of political administration. It is assumed that such immunity could be secured if, ab initio, the strategy-policy formulation is founded as a sound democratic process with popular participation from all stakeholders, and if it is essentially demand-driven. The following criteria are suggested to be the most important that must be involved in the process of formulation of the NII strategy-policy:

*1. Relevant government bodies*

These are able to mobilize other stakeholders to participate, to organize and even lead the preparatory work. They will also be expected to play a central role, not just catalytic role, in the formulation of the strategy, both as a policymaker and regulator, while receiving signals from the stories of confirmed success in other countries.

2. *Demand side of the NII*

   This includes the productive and service sectors as well as specialized government and public-sector institutions, which are the primary users of the NII and should therefore be the major stakeholder in the formulation of the strategy.

3. *The national and international private sector*

   The national private sector would include entrepreneurs, particularly from among ambitions information-enthusiasts and microelectronics-alert young people who are conscious of the prospects of e-business in the new world economy. The international private sector would include key suppliers of investment and technical services (sometimes in packaged forms) for the NII.

4. *The telecommunications industry*

   This industry has a natural interest in the sectoral policy reform, investment, and service objectives likely to be part of the NII strategy. The prospects of diversified activities, horizontal expansion and deepening of its technological operations all carry the promise of vastly increasing profits and involvement in overseas operations.

5. *Non-governmental organizations*

   These have in our times increasingly important roles as providers of services in society, particularly to the poor. In their daily operations and in the delivery of their services they stand to benefit from the sophistication of the national information and telecommunications networks, and can therefore contribute an important perspective on how the NII can help solve social problems.

6. *Scientists and educators*

   While these groups are primary beneficiaries of a developed NII, they are able to contribute to furthering its utilization methodologies and even to the improvement of the design of its systems and components. Their views must be sought and given the highest level of respect.

7. *International experts*

   Whether these come from foreign private sector or from international financial organizations, they can contribute a global perspective and, hopefully, an objective, nonpolitical point of view that can help in the shaping of a world-class NII. They can also facilitate financing of the requisite follow-up investments.

## 6 INFORMATION TECHNOLOGY AS A VEHICLE AND A TARGET IN THE DEVELOPMENT PROCESS

It must be conceded, given the realities of contemporary life, that it would not be superfluous to say that possession of, and mastery over, information technology now makes most if not all the difference between the have's and the have-not's of today. We live both with the driving forces that propel the emerging multimedia communications revolution, and with the evolution of the Internet, the information superhighway, the horizons of which have not yet been envisaged even by the most arduous futurists. The incalculable advances the revolution and evolution give birth to are already changing the way people work, play, travel, communicate, and make war. The work and home environments are changing dramatically. It is another reality, that must also be noted, that we are very far from any end or climax in the endeavors of S and T in this seemingly boundless domain of information technology. Need, indeed, continues to be the mother of invention. But in this very area of human endeavour, the more information technologists do and produce in terms of new products and services, the more the customers want. It has become a wonderful and virtuous circle or, in fact, an upward spiral that has been with us for the past three decades and will last another two or three decades more, well in the 21st century.

The underlying information technologies we refer to have been until now - and Allah knows what will emerge next - mediated predominantly by silicon chips, computing, photonics or light waves, and software. The remarkable reality about them all is that their capabilities are doubling every 12-to-18 months. Another remarkable reality, particularly important for us in the developing world, is that the actors in all these developments are not necessarily or always persons or institutions located in the industrially developed countries. We must note with some relief that in the field of software - once a bottleneck technology because of quality and programmer productivity problems - advances are being realized by technologists belonging both to the North and to the South. The message here is that there is substantial latitude for contributions that can be made by hard-working scientists and technologists from the developing world.

It is clear that public policy makers, including S and T and R and D policy makers, must be guided by the most visionary strategists in our countries. Because only the tip of the iceberg is all what we can see today, the impact of advanced information technologies on developing countries in years to come cannot be calculated in range or in quantum. However, the estimates of social workers tend to point to the following, according to J.S. Mayo, President of AT&T Bell Laboratories, USA, as likely benefits cited only as examples:

1. Advanced information technology-based communications could help in strengthening the ties that hold a nation's people together. Just think of large countries, like China, Brazil, India, Pakistan, and Nigeria, where huge distances between cities and regions and the complexity of regional dialects and ethnic considerations have made intranational communication quite difficult.

2. Indeed, peoples and countries would be able to retain their ethnic and cultural identities, a debatable issue as we know, but at the same they would be able to communicate (through speaking and seeing), transact and interact seamlessly across geographic and political boundaries - think of e-commerce as a case in point.

3. Advances in information technology are stitching together what could become a global society and a global economy - an opportunity for developing nations to participate with lesser inhibitions.

4. Advanced communications could help in slowing the migration of rural people to urban areas - a common problem in many developing countries.

5. Access to jobs and services, first by knowing about their availability, is already a tangible benefit of the Internet today. People living in rural areas would be less inclined to move to the cities if communications and information thereby transmitted gave them access to jobs and sophisticated social services where they already live.

6. Information-providing Internet services could alleviate congestion and commuter-traffic pollution in cities by telecommuting, possible by brining good jobs and services to people wherever they are.

7. Information-providing networks could also revolutionize education and make tele-learning a living reality. This development's essential benefit is that it will

eliminate differences in quality of education between rural and urban education systems.

8. Information-providing networks, national and international, will certainly be instrumental in revolutionizing medical care in all disciplines, including surgery (so-called tele-surgery), diagnosis, drug prescription, and professional consultation among medical practitioners. Virtual classrooms are already bringing profound changes in medical education.

In addition to the social impacts of information technologies, there are broad public-policy impacts, which will bring another category of benefits to alert developing countries, including the following:

1. Investing in communications infrastructure contributes greatly to a nation's overall economic development. The new technologies that developing countries could benefit from are becoming more and more cost-effective.

2. There is some opportunity to choose a technology path that would move a developing country into the information age most directly. The opportunity is to leapfrog most of the older technologies that preceded today's advanced network systems, e.g. to install glass fiber in local distribution networks.

3. There is also technology to "jump-start" a developing nation. The commonest example is cellular radio that provides "instant" telephony anywhere and serves large markets while the fiber-optic infrastructure is put in place.

4. There is also the need, and also immense benefit, for the development of the human infrastructure, not just the physical infrastructure. The return on investment in this area, regardless of the cost, is profound and immensely beneficial.

5. Information technology is vital to economic reform and development, not only as regards the domestic activities of the economy, but equally important for attracting foreign investment and participation in the global marketplace.

6. Information technology also enhances, and to an extent hitherto unappreciated, financial management. The commonest example cited here (perhaps of lesser importance comparatively) is enabling a country to move into a cashless economy.

The electronic transactions are incomparably faster, and there is the possibility of providing for much greater visibility into overall economic activity.

7. Information technology would both facilitate and complicate the job of governing: facilitate by making available to decision–makers vastly expanded resources of timely information; complicate by vastly expanding the numbers of people who would be informed about important issues and who would inevitably want to play a role in deciding them.

Any national effort for achieving a real participation in the global developments and benefits of information technologies must aspire to contributing to the advancement of these technologies. The role of the R and D establishment must not be confined to the improved utilization of what is being imported ready-made, but also oriented towards the generation of new science and technology in this fast-moving area of human activity. The role of basic science in these endeavors cannot be overemphasized: solid-state physics and chemistry, micro-electronics, electromagnetic radiation, etc. Contemporary experience in several developing countries, particularly where cost of labour might be a comparative advantage, points to the considerable opportunities open in the field of software development, both for the domestic market and for export. These activities call for the development, according to set policies, of world-class education and professional training programmes and the creation of first-rate R and D facilities which draw strength from adhering to sound S and T policies. Joining forces with large foreign corporate bodies in addition to academic institutions, within strategic alliances, to serve these activities and objectives is a well tried-and-proven formula.

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# New Technologies and Reform Strategies of the Educational System: The Strategy of Tunisia


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## 1 ABSTRACT

The Tunisian reform strategy of the educational system is based on an analysis of the efforts made in the country, in the long run, to enhance the competence level of human resources; on an analysis of the global and positive performance trends to develop a prospective vision of the future, and more particularly the disturbances rising from the development of new technologies; and, finally, on the premise of a voluntary commitment to the New World Order.


## 2 BACKGROUND OF THE TUNISIAN STRATEGY

The main axes, around which the strategy being implemented at the Ministry of Higher Education is being centred, are:

### 2.1 Development of the global training system

We are required to master the necessary material and immaterial infrastructures in order to be able to face the rapid growth in the number of students expected to be enrolled at the Tunisian Universities in the five years to come. This move should occur within a context that takes into account the upheavals engendered both at the level of subsidiaries allocated for training and learning pedagogical and methodological syllabi. In this respect, it is expected that the number of students, which is about 200,000 students now, will have reached 300,000 by the year 2004. It is also expected that the overall number of school- goers, at all levels, estimated to represent 8% of the overall population now, will catch up with those figures available in the OECD countries. In other words, about 12% by the end of the 2000/2010 decade.

Since these new technologies do allow the advent of new methods to help acquire knowledge, these methods which are characterised by the advantage of being economical in resources[1], become all the more necessary within the endogenization of the coverage strategy related to the needs of the training programs in Tunisia.

[1] The data currently available about distance learning costs set on the basis of some experiences conducted in some countries have proven that distance learning is not more cost-effective than attendance learning. Although face-to-face learning remains necessary and should accompany distance learning, the overall cost of a training program, encompassing some distance-learning modules, remains highly competitive. For Tunisia, it is envisaged to introduce these new methods linking some form of distance learning, accounting for 20% of global training.

## 2.2 Institutionalisation of lifelong learning

The training of individual living in a society based on the principle of liberty cannot be envisaged any longer within the sole framework of a temporal sequence occurring at an early stage of life. This process should rather be considered as a lifelong process to allow people enjoy themselves and put up all the time with a constantly changing economic context. Within this rapidly changing economic context, the individual is bound to acquire, at more or less regular intervals, the ancillary tools for adequate training and an upgrading of his expertise and know-how. Furthermore, he is required to receive another form of training that is totally different form the one he had joined to guarantee a job most of all.

According to the Tunisian approach, lifelong learning is considered as an extra asset and should be used as an enhancing tool towards the acquisition of more freedom and the highlighting of Tunisian citizens' right for a decent training and education. This is a new form of development that entitles all Tunisians, regardless of their age, to resume their academic career, upgrade their educational background, enjoy a decent job and raise their standard of living. It is a political project that aims at calling on everybody's services and new information technology resources with a view to multiplying promotion opportunities and human development occasions offered to all Tunisians. Obviously, it is a right for education that should be extended to reach all walks of life as emphasised by the new Tunisian education strategy. It is also considered as a second prerequisite in order for all Tunisians to boast a more decent and prosperous life. For Tunisian women, it is yet another opportunity to reach a higher status and achieve more equity between male and female citizens. Finally, it is a crucial factor on which hinges the right to a decent job and which, in turn, can only be guaranteed through an open and sound education system, a system capable of keeping abreast of the new technological breakthroughs and economic mutations.

Finally, learning is examined within the overall context of a project aiming at re-designing the educational and training system to make it reminiscent of the one adopted immediately after independence. The Tunisian educational system has been devised to be tailored to one particular need: to enhance the process of dissemination and democratisation of knowledge. At the beginning of the XXI century, we are all called upon to help popularise this concept of democratisation. Our task also consists in taking into consideration the New World Economic Order and make of the Tunisian school a shrine for the dissemination of know-how, a site open onto the economic world, able to put up with all new technology prerequisites and meet the demands of all Tunisians regardless of their age and motivated by the sole purpose of helping them upgrade their skills. The introduction of the new information and communication technologies within the educational and training system aims at helping the university achieve its ambitious programmes and making it meet the expectations of Tunisian nationals by rendering the educational system more cost-effective and productive. More particularly, it aims at achieving the following objectives:

- To enhance the capacity of the higher education and vocational training system;
- To avail the university to all students who are keen on resuming their studies regardless of their age;
- To provide the necessary human resources that could foster the Tunisian sector of cultural industry and multimedia;
- To help establish more synergy between the production system and the training system;
- To use the university as an appropriate site for private initiative enhancing and promotion as well as opportunities boosting;

### 2.3 New Technologies: Investment and development opportunities for Tunisia

Before dealing with the training sector within its restructuring framework, its means and objectives, the new technologies (and not simply the new technologies of information and communication), embody a change that is qualified not only as an economic paradigm, but also as social, political and cultural.

Up to some extent, and from a Tunisian point of view, the new information and communication technologies represent as many new investment opportunities for the reallocation of the country's resources and their orientation toward new future sectors; an industrial development project that is likely to generate more job opportunities, a new opportunity to give boost to the private initiative and gear it towards setting up more enterprises and the establishment of one's own enterprise. Being more than simple means of apprenticeship and training, these new technologies do provide renewed business opportunities and, by the same token, new development strategies and represent the genuine objective of a real policy that geared toward job opportunities.

As regard the training sectors which have been able up to now to keep abreast of a context which is relatively disconnected from the economic realities due to the lengthy technological and industrial procedures, the new technologies dictate the need to take into account organically (congenitally?) the needs of the newly emerging economy. From this point of view, the university is not to be considered as an aspect of the productive system (the training industry) which is able to grow in the future only within the framework of inter-industrial exchanges and in symbiosis with the rest of the economic sectors.

### 2.4 New technologies: Cost-effectiveness factor of the efforts made by Tunisia in education field

Beyond the highly scientific and technological aspect of the industrial activities which have led to the emergence of new products (micro-processor, new materials, transmission techniques, satellites, etc.), the main part provided by the added value which is to be generated by the new economy consists in the content production as well as upgrading of new channels of distribution. These are all domains where Tunisia has invested heavily for the last years, and more particularly in the field of training of human resources.

## 3 THE MINISTRY OF HIGHER EDUCATION'S CONTENT PRODUCTION PROGRAMME

### 3.1 General

At the level of the Ministry of Higher Education, a certain number of structural reforms and mechanisms, devised for the practical implementation of this strategy, have been well underway. It is within this spirit that a new student card has been designed for the year 2000-2001. The same applies for the measures which have been made operational as soon as the new academic year 2000-2001 and which all represent many cornerstones aiming at institutionalising of a lifelong learning process, the opening of the university up onto its economic environment and the introduction of new technological methods both in the pedagogical field and in the training curricula.

The same applies to the mechanisms implemented by the Ministry of Higher Education within the framework of the endeavour being undertaken to help promote a genuine Tunisian content industry which aims at the following:

- To engage a capacity-building process by the Tunisian skills with a view to giving them more leeway both intellectually and materially;
- Prepare the basic infrastructure of an increasingly-required training system and whose future relies (up to a certain extent) for obvious financial reasons, on distance learning;
- To indicate to the training bodies the best ways to arrive at a future integration, within the framework of their objectives and curricula, the sine qua non equation of taking into account the employability of the young and the need to bolster the training programmes of the less young; and
- To lay the bases of a genuine enterprise and co-operation culture to be jointly set with the industrial world the future development of which is highly contingent upon the new bonds to be experienced in the world of research and training.

Yet, the aspects related to the content-industry promotion will be displayed as follows:

The sector of Higher Education is required to claim some content needs in accordance with its training programmes such as they are prevailing currently and they are required to grow in the future in compliance with the overall programme of the governmental action. In the main, these needs could be summarised as follows:

1. Course modules devised for first and second-cycle university students in forms of modules to be provided by servers devised for training and accessible via networks or CD accompanying traditional courses (hand-outs) ;
2. Documentaries geared toward the trainers and students to be made available in videotapes, DVD or CD. These could be used as back-up or illustration documents and to be used in attendance or distance-learning courses: lab experiments, report-documents, archives documents or sites images, Atlas, summaries of filmed scientific events, etc.
3. Products geared towards public information about the Higher Education System, the training programmes it offers to all age groups, the transfer from one department to another, training-endorsement systems etc. This information system to be hosted by an ad hoc site is also required to be up-graded in order to allow the initiation of administrative contact remote-processing with the institutions of higher education.
4. Access services and university documentation to be made available. Thus, the BIRUNI[2] project is to be considered as a basic platform that is likely to trigger development processes relating to content industry and whose promotion could be entrusted to private stakeholders.
5. By-products of the supra-indicated activities and that are likely to involve the mass media (Television, press, magazines, etc.)

This programme takes into account the availability, at the level of the sector of Higher Education, of all the basic ingredients that are required for the promotion of a content-industry.

[2] The BIRUNI proposes the digitalisation of the university scientific documents currently available at the Tunisian Higher Education institutions.

### 3.2 Stakeholders

To judge by the production of goods and services, listed above, it is envisaged to involve university lecturers. They represent the pillar of the programme. As producers and providers of training modules, they are to be solicited by the programme to help invest in the digitalisation process of their lectures and other goods and services expected to emerge in order to accompany the distance learning modules and self-teaching programmes. Within the framework of their new activities, the university lecturers will be encouraged to involve their research teams, the post-graduate students whose work they are supervising as well as the young trainees or those who have just graduated.

From this point of view, the content industry seems as a new viaticum for research programmes (a pedagogical tool) conducted by university lecturers and a reservoir of new job-opportunities for university graduates.

### 3.3 Production framework

The availability of top-quality basic resources is a sine qua non to foster an activity of content production involving the sector of higher education. Yet, it is not sufficient.

As a matter of fact, and in order to bear fruit, this new activity requires infra-structural means and relatively important equipment to be made available. More particularly, that production workshops be made available (studios for production and pictures, sound editing) along with equipment such as computers, scanners, cameras, digital cameras, recorders, editing and mixing boards, picture and sound treatment software, etc. Finally, it requires the mobilisation of technical crews specialising in broadcasting arts.

The enhancement of the university map project has already spelled out, within the framework of the new Manouba University, the construction of a multimedia centre near to another new institution which is envisaged to be established: The Multimedia Arts and Techniques Institute. Prior to the finalising stage of these projects, it is envisaged to use the embryos of these facilities and equipment which are currently available in some higher education institutions.

### 3.4 Financing

At the initiation stages of this programme the financial resources are envisaged as follows:

- The National Employment Fund (21-21) offers financial opportunities to young graduates who are keen on setting up their own business and promote their own enterprise. Since the content-production activities envisaged are invited and (motivated) to focus most of all on young graduates, it requires a considerable source of financing; a primary source well capable of entailing a financing scheme on sound bases and promising future for the university graduates who might be interested;
- The funds are allocated for scientific research and run by the Secretariat of State for Computer Sciences **(SEI).** Since the content-production activities envisaged are closely related to the field of scientific and technological research programmes that the **SEI** attempts to encourage, these funds represent extra financing sources for the conducting of some financial operations;
- In many cases, the contents programme whose production is envisaged could yield some by-products which are likely to be widely disseminated via the mass-media: television, newspapers and other means. In this case, a personal pre-financing scheme can also been envisaged beforehand and as long as its usefulness has been proven. The benefit of such an approach is twofold: it is a source of financing that

could help complete the missing project funding and it also encourages the university lecturers to have an extra source of income since they are entitled to set up their own business and produce content programme;

- Finally, one can mention a fourth source of financing made available by banks.

### 3.5 Legal context

The development of the content-production activities to be undertaken by the university lecturers, within the framework of micro-projects that are likely to help set up some private enterprises, have entailed two kinds of problems:

- First, there is a problem of compatibility between the job of the university lecturer and that of a private businessman. The combining of both positions: the status of a civil servant, on the one hand, and that of a private businessman, an issue which should be disambiguated legally in the official documents. Although some punctual and limited activities enjoy some legal flexibility, many university lecturers, nevertheless, are still reluctant to embark on a private-business adventure without having official guarantees in this domain;
- Second, there is the issue of the nature, and if necessary, the legal status of the team which accepts to embark on such a project. In this context, the question of identifying the new legal framework for such an enterprise is still posed.

### 3.6 Practical implementation of the programme

The practical implementation of this programme has been envisaged in a sequential manner. According to the step to be taken, the introduction degree of new technologies in the higher education training system, the degree of preparation and availability of the institutions and structures to be allocated to the multimedia, some specific actions have already been envisaged.

## 4 CONCLUSION

The Tunisian strategy in the field of training aims at giving impetus to a new dynamic and global strategy that concerns not only the Tunisian economy but also the society and its cultural heritage within a sustainable and future perspective.

# Information Technology:
# Aspects related to Internet Use

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## 1 ABSTRACT

In developing countries to which most of the Islamic countries belong, Internet users seem not to realize that it is not the computer language or tool, or even the machine that is important. What is important is whether a problem has been solved using a combination of hardware, software, and the user.

Trade and commerce linked with IT should be a standard part of IT courses. Learning business concepts yields practical benefits to the users. When equipped with business knowledge, they should be capable of applying this knowledge to real life business situations.

## 2 INTRODUCTION

There has been a phenomenal and unprecedented development in the sector of Information Technology following easy Internet access. Search engines are like fairy tale monsters; almost instantaneously, a large volume of information appears on the computer screen after one types the subject of his choice in the space provided in a search engine and press the button, marked "go" by its side.

The big question is how much of this information is utilized in a meaningful way? How much of it is turned into knowledge in a real life situation? How many of the educated class relate or link pieces of information they see in the browser to generate knowledge? The situation is more dismal in most of the Islamic countries. Since many users do not convert it into a learning experience, huge network of information goes wasted.

## 3 IT AS A TOOL

It must be emphasized that IT is a tool. Well-known IT companies such as IBM-ACE, Aptech, NIIT teach details of packages. For instance, a particular lesson from IBM-ACE teaches four ways to "cut and paste" instead of teaching students how to 'cut and paste.'

It is more important to understand how to identify the need for cutting and pasting, i.e. when to cut and paste rather than how many ways one can cut and paste. The latter teaching methods confuse the learner, who is unable to apply his knowledge of the package to real life situations. It is like saying to a learner; today, we will learn in how many ways a calculator can add 6 and 4. IT companies of the latter kind are doing huge business in Islamic countries, producing confused students and at the **same time not allowing local IT companies to develop.**

# 4 EDUCATION IN ISLAMIC COUNTRIES

## 4.1 General

Unfortunately, in Islamic countries teaching is mostly abstract and not linked to real situations requiring application of a concept at the right time and at the right situation. Teaching should link to 'why we need to learn a certain concept', and apply the concept, when the class is in session to a practical example. Students should be taught how to suggest solution alternatives and then solve the problem using the most feasible option.

We are passing through an age of interactive multimedia software, and unfortunately we seriously lack good teachers. At this critical juncture, what we could think of is the use of interactive teaching software which takes a student step-by-step into a learning situation. In other words, in Islamic countries, we desperately need interactive learning software, which walks a student through a set of logically linked exercises, thereby helping him to thoroughly comprehend concepts.

## 4.2 Education software

Companies such as Soft-Ed in Bangladesh has developed a structured teaching method divided into the following order as: link-need, demo, concept, task and assignment. As an example of such software, Soft-Ed has developed a demonstration program to teach the fundamentals of spreadsheets. It has been demonstrated that by the use of this software, students can learn spreadsheet fundamentals in a matter of 10 to15 minutes.

Companies such as Soft-Ed should multiply throughout the Islamic countries under the patronage of the Islamic Academy of Sciences in order to derive maximum benefit of IT for economic emancipation of the Islamic world.

## 4.3 Education Taskforce

It is proposed to set up an Education Development Task Force under the management of IAS with the following tasks:

- Identify appropriate educational needs of the Islamic countries
- Prepare outlines for multimedia software to fulfill these educational needs
- Give software development jobs to software companies in Islamic countries; if necessary organize appropriate training and/or links with universities, such as the Multimedia University in Malaysia
- Help implement the software in various institutes across the Muslim world.

# 5 MAKING THE BEST USE OF THE INTERNET

## 5.1 Internet Search

There are no two opinions about the advantages of the Internet over other communication media in retrieving relevant information on the subject of one's choice. If the information is in the database, for sure it will appear in the browser's monitor, once he enters the relevant word in the blank space provided by search engines.

However, finding the information one really needs, is sometimes not as easy as it sounds! The problems, that one may be faced with, are:

a) The information found is not relevant;
b) The hits are too many, it is almost impossible to go through all the web sites;
c) The selected search engine fails to retrieve the information if the key words entered are not well-thought-out or not properly worded; one sees web sites not related to the subject which the browser seeks.

### 5.2 Software with Subject Specific Browsers

To help users, many companies are coming up with subject specific browsers. It would therefore help immensely, if one could find a browser that deals with a specific subject. The steps, one needs to take before selection of a specific browser, are:

- Identification of key areas of interest and research;
- For each area, identification of all possible keywords relevant to the area of interest or research;
- Looking for names of browsers (in magazines, advertising, research magazines, etc);
- Testing specific areas of a browser, studying indices and matching the list with one's own areas of interest or research;
- Further testing the browser, entering keywords and examining retrieval of information in the browser;
- Copying the name of the web-site into the address book or bookmark them once a particular web site covers one's area(s) of interest.

### 5.3 Popular Web Sites

Some of the popular web-sites are: Yahoo, Lycos, Google, Altavista, Look smart, Netscape, Hotbot. It will be a good idea to study these browsers, take a detailed look at the index in each and to understand how the browsers work (Please see http://www.arabidopsis.com for a list of search engines).

### 5.4 Cost of Accessing Internet

Unfortunately, in most of the Islamic countries the cost of accessing Internet for literature search is prohibitive and certainly not within the means of an MSc or a PhD student. What is urgently needed in Islamic countries is allocation of sufficient funds so that cyber cafés, that can be used by students, is available at nominal charges.

To minimize the cost, one must be ready with minimum possible words to retrieve the correct information; in the absence of such choice of words, the Internet bill will shoot up achieving nothing in the end in terms of relevant information. Therefore, as has been pointed out earlier, before starting the search engine, one has to make a list of all possible keywords with synonyms that could be relevant and appropriate to the search topic.

## 5.5 Free Access to Some sites or their contents

### *5.5.1 Journals and articles*

There are various ways to gain free-of-charge access to the abstracts/summaries of the most important journals such as *Nature*, *Science*, *Proceedings of the National Academy of Sciences, The Plant Cell* and many more. To access to abstracts, the user can register, free of charge, with the publisher of a number of journals of his choice. In fact, if requested, journals like *Nature* send via email their table of contents directly to the user free of charge. If a researcher is in quest of an abstract relevant to his research area, he may either request the author to send him a copy of his article or else can directly buy it from the publisher at a cost which is less than $10 per article.

**PubMed** is the National Library of Medicine's search service that provides access free of charge to over 11 million citations in MEDLINE, PreMEDLINE, and other related databases, with links to participating online journals.

Recently, PubCrawler located in Dublin University has opened up an alert service. After free registration with this company, one gets regularly in one's email a list of all recently published articles in the areas of his interest which he is required to specify at the time of registration. The titles are hyper-linked to the relevant online articles. It is recommended that students and staff members alike register with the currently available services. Such contacts would keep them abreast with the most recent publications in the areas of their research interest.

### *5.5.2 Gene Sequences*

Almost all gene sequencing data pertaining to model organisms and humans are now available in Public domain and the access is free. In order to collect relevant information relating to the DNA base composition of a particular gene or locus, conferring a particular trait to an organism, one needs to be properly trained to use such web sites. One needs to enter relevant information in the empty dialog box provided in the web site for this purpose. An example will illustrate this point. One of the powerful web sites of this kind is TIGR (The Institute for Genomic Research): (http://www.tigr.org/) which documents the DNA base sequences of *Arabidopsis thaliana*- the plant geneticists model plant. Before the year 2000 passes out, one would find, in its database, the DNA base sequences of all the five pairs of chromosomes that constitute the genome of *this model plant* together with the individual gene sizes and the traits implicated for each one of them. Two privately owned companies documenting DNA sequencing of Human genome and its systematic analysis in terms of protein expression of healthy and diseased tissues (proteomics) are Celera Genomics and Incyte Genomics. Proper training will enable our scientists to retrieve important information from these sources too.

The gene sequencing work is at a rudimentary stage in Islamic countries but there will soon come a time when we will see ourselves to be in desperate need of using the above data bases in order to keep abreast with the rest of the world and to utilize these data for our economic development. Suffice it to say, that without consulting such databases such as genomic research (which now covers 17 taxa; plant kingdom 7 and animal kingdom including human genome project 10) is well nigh impossible and genomic research is the key to future progress in agriculture, livestock, medicine and health.

### 5.6 Internet Access

In Bangladesh Internet connection in private homes, educational and research institutes is difficult because the connection is routed through Singapore and not direct. What IAS/COMSTECH can do is to encourage Islamic countries to make a number of regional groups/consortia based on geographical continuity. These groups will explore ways and means for creating and maintaining facilities for easy Internet access. It is expected that such groups will receive the support of OIC/Islamic Bank and ISESCO in working out a solution for an easy and affordable Internet access.

## 6 CONCLUDING REMARK

Time is running out. It is incumbent on the part of Islamic countries to do everything possible to develop IT in terms of equipment, facility, manpower development. In the area of manpower development, OIC organisations may play a catalytic role to arrange such courses with the help of UNESCO, ISESCO, EEC, World Bank as well as universities such as Manchester University in the UK which offers courseson Bioinformatics.

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# Internet Challenges Facing the Islamic World: A Working Paper by "Islam Online"

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## 1 INTRODUCTION

Current developments in online technology worldwide pose increasing challenges to major international political and economic powers. The World Wide Web has been on the agenda of high-level conferences like the G-7, European-American summits and EU summit meetings. Huge resources are being allocated to online development projects including a joint 45-item European programme, due June 2000, which has been described as a race to recruit specialists from around the world to work in highly technological environments in the United States and Germany under the Green Card system.

It must be realised that the developed countries which enjoy political and legal stability as well as material and technological progress have not been able to face online technological challenges without incurring serious damage on different social and cultural levels. They continue to devote enormous efforts to research projects related to the effects of progress which seem to have gone out of control. Islamic countries are thus faced with a serious question. What are the possible challenges that may be added by online technology to already existing challenges in various areas which may check the desired progress in the Islamic world?

In the Islamic world, two main approaches emerge in dealing with the new online technology as one of the main challenges to the desired progress:

1) A chaotic fragmentary approach, i.e. dealing with separate challenges without an overall vision that integrated the potential outputs of planning, programming, training or other supporting arrangements like the provision of the necessary phone connections, … etc. this approach is therefore rejected because it fails to lead to any positive move toward progress.

2) An integrated approach based on a comprehensive vision to harness concepts, research, planning and production to understanding the present challenges and their interrelations. This approach should provide the largest possible base of action. The early steps may be rather slow, but if properly maintained, they may lead to an effective, growing action mechanism to use the opportunities available in an ever-growing world.

3) A comprehensive view that is theoretically and behaviourally integrated does not accept the old traditional phased-out approach, i.e. the succession of conceptual, planning, executive, evaluative and development functions in a self-replicating cycle. This is an outdated strategy. Current developments dictate the integration and simultaneity of functions.

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# 2 DEALING WITH ONLINE TECHNOLOGY

## 2.1 Necessary requirements

To define the necessary requirements for dealing with online technology, the following two elements must be stressed:

1) The required action must be collective for the benefit of all the parties involved, since the existing challenges are universal. Collective action seems a necessity from the point of view of governments, individuals, the public sector, the private sector, the economic, technological, social and other sectors, the cultural elite, the general public, and various intellectual and political trends.

2) Collective action on such levels requires a common ground for practical efforts. This does not necessarily mean the existence of minimal agreement among the various trends involved. It stresses the importance of agreement on methodology in practical areas to achieve specific goals and consequently to agree on the highest common denominators.

In this regard, the paper identifies the challenges and opportunities for the Muslim world under the following headings:

a) Regulations for using online technology;

b) The effects of online technology;

c) Dealing with online technology;

d) Future prospects of dealing with online technology;

e) Online opportunities for the Muslim world;

f) Internet and technological challenges (under preparation);

## 2.2 IT challenges facing developing countries

A careful survey of the results of the worldwide use of online technology in the developed countries indicates that there are three main kinds of challenges which face Arab and Islamic countries in particular and the developing world in general:

1) Challenges related to purely material backwardness, e.g. the lack of local telephone networks and computer industry;

2) Challenges related to planning and the identification of aims, resources, methods, and controls related to the applied uses of technology;

3) Challenges directly related to online technology and its proper use to achieve the right aims;

## 2.3 What are the required regulations?

One important aspect in this regard is to define the “required regulations” or controls for the use of online technology. This is dictated by the specificity of the Islamic approach to various issues, including the use of modern technologies, and the experience of countries with advanced online technologies. In the course of providing online services, including knowledge, equipment and funding, the element of regulation and its effect on the use of online technology becomes one of the main decisive factors in the developed countries. This does not mean that regulations have come to dictate the use of online technology. In fact, it has become an important factor which could yield positive as well as negative results. The outcome of using the Internet in advanced countries ranges from positive benefit to serious damage depending on how far appropriate regulations are available and how far they are adhered to.

The concept of "regulations' involves several aspects, of which some may be more predominant. The following, are the traditional main sources of regulations:

a) The value system which includes religious beliefs, common notions and moral commitments;

b) The legal system which is shaped by different legislative structures in different countries;

c) The structure of social relations which forms customs, traditions and common practices regardless of whether they tend to be old-fashioned or innovative. The violation of established traditions may sometimes generate alternative relationships which in turn become as well-grounded as old customs and traditions. To evaluate the effect of regulations on the use of the Internet in this comprehensive sense, and to predict possible challenges for the present and future of the Muslim world, an essential point must be taken into account. The definition of basic terms like "benefit" and "damage" or "evil" differs from one society to another. In the developed countries in the West, "regulations" refer primarily to law and order, which are legislative formulations produced by material interests and balances. In most cases, this happens at the expense of social values and relations, as follows:

- *Setting laws is primarily dictated by material interests;*
- *The law decides the legitimacy of abandoning old values and replacing them by new legitimised values;*
- *Legislations made on this basis are the sources of the "regulations" which set the standards to use modern technology and estimate the resulting benefits or evils.*

The obfuscation of standards based on ethics, morality, religious beliefs and of criteria of social relations results primarily from the "legislation game" which corresponds steadily to the development of material interests and the decline of the residual value system and social relations.

### 2.4 IT and the value system

If we go back to the definition of "evils" in Western societies, we will see that what used to be considered "evil" until recently is no longer seen as such at present. The frequency of using this word to describe occurrences in social life has steeply declined with the accelerating technological progress, i.e. the appearance of technological applications accompanied by new marketing and legislation campaigns whenever necessary – genetic engineering technologies being a case in point. This entails a basic concept needed by the Islamic society to deal with technological challenges in general and online challenges in particular, namely that it is not the development of values in the society which generates new means of technology to automatically satisfy the need for new values. Instead, the production of new media tends to impose on and violate the established values and create alternatives by promoting and marketing new products.

This may be considered a flaw in the history of technological and material development which has disturbed the balance between value standards and the legitimacy of interests. On the other hand, it has led to a widening gap between the value systems of different societies. Naturally, this has nothing to do with the mere ability or inability to produce new technological products or develop new industrial machinery. What is seen as a grave social evil according to established Islamic criteria, like the promotion of illegitimate sex, may not be so considered in the developed countries in the West, whether on the Internet or elsewhere. It is not so considered even by those who adopt a Western-oriented perspective in the Islamic countries.

For example, the growing Internet mania may cause a Muslim user to run late in performing the daily prayers timely. In Islamic terms, this is considered an extreme form of evil, because Islam rates acts of faith above all other concerns. Thus religious belief takes precedence over life, reason, honour and material gain or property. Such a view has no place in the discussion of the negative results of the Internet in Western societies. The same applies to many things that are considered by modern Western legislation and social customs a form of pleasure, personal freedom or social progress. In Muslim societies, these things would be prohibited or rejected in accordance with such established principles as "No one shall harm oneself or others." "Whatever is harmful shall be prohibited, whatever is beneficial shall be sanctioned" or "Whatever is obnoxious shall be prohibited, whatever is good shall be sanctioned."

### 2.5 'Good' and 'Bad' IT

To understand the meaning of the "social evils" created or spread and aggravated by online technology in the West it should be noted that, by Western standards, this phrase is applied to what would be an extreme form of obscenity by Islamic standards.

The debate does not cease in the West about the evils that result from the use of online technology that spread as fast as the spread of the technology itself. Some of the evils may be seen and evaluated differently in different value systems. Others may be agreed to be an evil, but trigger a controversy on where to place them on the scale of value. These evils can be divided into the following categories by Western standards:

1) **Pornography**: The Internet may be used to abuse children and minors sexually to secure material gain, which is unacceptable by all standards. It has already been used for other pornographic purposes rejected by Islam;

2) **Politics:** The Internet may be used to serve extreme racism and organised terrorism, which is unacceptable. It has been used to achieve an international "political hegemony," which is unacceptable in Islamic terms;

3) **Official Level:** The Internet may be used as a tool of spying on individuals, institutions and countries. This is essentially unacceptable, and the relevant debate may only focus on possible justifications;

4) **Security:** The Internet may be used as a versatile financial or economic weapon in the form of notorious electronic viruses that filter through the electronic IT scanners of companies, institutions, government departments and other targets. Information related to arms production may be spread through the Web which may facilitate the use of weapons for terrorist or illegal purposes. Other "evils" as may be estimated differently by the parties concerned include arrangements for electronic attacks to paralyse an enemy or pave the way for launching military attacks;

5) **Economic Level:** Various illegal practices have spread through the Internet, including intellectual piracy, organised crime, and fraud. In Islamic terms, another form of economic evil may be added, namely the exploitation of online technology to foster pervert globalisation concepts in favour of giant corporations and banks at the expense of social justice all over the world;

6) **Society:** the Internet has had negative effects on social relations in general, most notably the "techno-philia" which is unacceptable by all standards. Little, however, has been said about the evils emerging from "intellectual, cultural and artistic hegemony" through online technology. In fact, users who exercise this kind of hegemony at present do not recognise it as an aggravating form of "evil."

Basically, it is important to realise that the "evils of the Internet" has become an issue in the Western societies which have advanced online facilities, and regulations for the use of the Internet are therefore being called for. This is the real situation which is totally different from what writers in the Arab and Islamic world tend to believe. That is to say that the West deals with online technology without any controls whatsoever. Judging by facts on the ground, it is more proper to suggest that regulations based on law and order in the West, in other words on the impact of material interests and balances, have not staved off some serious "evil." In addition, these regulations are not used at all in dealing with certain forms of evil which are not recognised as such by the changing value standards in the West.

Every society needs the appropriate criteria to define "evil" according to its own perspective and, accordingly, device means of precaution and remedy whenever necessary.

A final note remains to be made on the relationship between the "evils" of online facilities in advanced societies and the title of this paper. Backwardness may be an advantage in that it offers a perspective to identify threats and errors which may check the momentum of progress in spite of all efforts to control or correct them. This identification allows the avoidance of similar threats and errors, and accelerates the drive toward progress. In this sense, the identification of potential threats counts as one of the main challenges that we, as Muslims, have to deal with properly and timely.

## 3 EFFECTS OF ONLINE TECHNOLOGY: AREAS AND OPPORTUNITIES

### 3.1 Impact of the Internet

Since the first qualitative Internet leap in 1987, known as the "Net of the Nets," there have been continuous research efforts on the impact of the Internet and its use. Recently, there has been a second qualitative leap dubbed the Second Generation. But the relevant research and studies remain inadequate for the following reasons:

1) The speed of technological developments in the applied fields is too high for research to cope with;

2) Most of the relevant studies have been in the form of surveys. Estimates and raw figures without adopting a trustworthy analytical method. Surveys and estimates have been more of an additional rather than an independent component, and all the relevant possibilities in an attempt to reach relatively final results for all aspects under study.

For example, some surveys formulate questions on certain uses of online technology leaving out others, which makes the final resulting percentages questionable. Other surveys do not sufficiently take into account factors that lead to false answers, although the subject may mean otherwise. With respect to the speed of development, current studies tend to focus on the uses of email with professional and social communication considerations being predominant. Such studies may be able to offer future predictions. However, they overlook the possibility that before these predictions could be made use of, electronic trade may become so widespread that its share of email may be much greater than other categories.

This means that in dealing with online technological development no conclusive results should be formulated except when thorough specialised studies have been made, taking into account the speed of change.

The results of published research papers and studies should not be taken on their face value. They should be properly evaluated, while taking into consideration where they have been made, particularly if they proceed from specifically Western social, economic or cultural backgrounds.

One of the main conditions to face the current and expected challenges in the field of online technology is to try to understand fully the effects of this technology on various fields recently and the expected developments in the foreseeable future. This requires day–to–day updates and thorough research.

### 3.2 Impact of the Internet on Politics and Administration

The effect of online technology remains limited in this area although its size is relatively enormous. Transcending the barriers of communication and exchanging information, freeing information from formats whose circulation may be controlled by the authorities and the ability to promote online applications that have to do with the citizen–state relationship are only the first step in a long journey. Future positive and negative effects may be predicted from the actual experiences of different countries in the world.

In purely administrative terms, applications used by some Western countries do not only make things easier for people, but also curtail huge administrative systems and sometimes produce unemployment in a way that is unprecedented in traditional economic and administrative sectors.

There may be other negative sides to the potential conflict arising from such developments, including what may be described as “online hegemony” in a certain country or region and the use of the Web for racist or terrorist purposes.

### 3.3 Impact of the Internet on Economy and Finance

The e-trade, i.e. the economic sector related to online technology, has grown remarkably within a few years. Initial studies indicate that commercial and financial transactions between online corporate sites and commercial marketing sites will multiply within the coming few years creating completely new alternatives to current economic sectors. For example, a high rate of conferences, negotiations, and exchange of documents in the near future may take place online. Instead of traditional conferencing that requires costly travelling. Online banking is also expected to grow between individuals and institutions or between institutions. Early attempts in this sector – for example, co-operation between major auto manufacturers – indicate that costs may be cut by approximately 20%.

The main negative aspect of this development is that the gap between giant corporations and major financial institutions that are capable of using online technology worldwide on the one hand and others which are not will grow tremendously within a few years. This gap may become wider than the North-South gap and the rich–poor gaps within individual countries that existed over the last fifty years.

### 3.4 Impact on Society

So far, the exact social impact of the growing online technology cannot be precisely determined, and no other subject has been more debatable. The impact ranges from the situation of individuals who transcend their social isolation through the screen to those who turn into online addicts at the expense of normal social relations, and from the situation of families who have benefited from online services to the overflow of Internet pornography.

The more serious side of this effect is its tremendous speed. The social effects of earlier technologies that appeared before the World Wide Web like radio, television, cinema and satellite broadcasting took decades to spread. Certain precautionary or remedial measures could be adopted, at least partially, whenever necessary. But it is difficult to do the same thing with respect to the social effect of online technology. So far, precautionary and corrective reactions have not been able to keep up with the development of online technology and its proliferating social effects.

### 3.5 Technological life-cycle of IT

Most of the earlier technologies have proceeded along a proper course, so to speak, leading to the emergence of further new technologies. The invention of the steam engine, for instance, started a series of developments that led to the appearance of automatic means of transportation, and later radio and satellite communications. The important thing about the electronic revolution is that it has triggered developments on two simultaneous levels:

- The synchronic succession of achievements based on online technology at an ever-accelerating pace whose ultimate destination cannot yet be predicted.

- A proliferous web-like development based on the unprecedented possibilities for interrelatedness opened up by online technology. It is yet difficult to estimate, even tentatively, how things will be like a few years later. But the current networking of electronic means of communication with audio and video broadcasting multi media and the computerised online services that operate domestic appliances offer a glimpse of how the future may be like.

In the field of technology, more than any other field, it is difficult to speak about negative or positive effects. The effect of online technology is in fact evolutionary. It is innocent of the negative impact that may arise from the way technological products are utilised, although indirect negative effects can be seen on the social level in the form of specialization and unemployment problems.

### 3.5 Impact on Education and Training

This involves various cultural, intellectual, educational and media fields. It is one of the areas where online technology has been most effective in a short span of time. Unlike earlier technologies, online applications spread faster than any traditional method (research, planing, execution and modification along with ongoing development) could possibly cope with. For instance, the member states of the EU have decided to connect all their schools to the World Wide Web within the coming two years. Meanwhile, the argument persists that there is a severe lack of qualified teachers and instructors to do the required training.

Within a short span of time, the development of online services, information centres, and digital technology for information transfer have multiplied the cultural and intellectual effects of earlier technologies like the television in two simultaneous ways:

- Persons engaged in intellectual, cultural and media work have become more capable of multiplying output and reaching a wider base of "consumers," depending on their individual online access to trace sources and promote production on a wide scale.

- Consumers are growing more able to understand and accept new products on the one hand, and be better equipped to use modern technologies to access the information they need on the other.

In addition to intellectual piracy there are other relatively recognised negative side-effects of the above developments, including the possibility of the dissemination of material without proper discrimination between whatever is weighty or trivial. In addition, there had been an overflow of information that it has become impossible to use effectively without proper sorting out.

### 3.6 Tentative conclusion

The above discussion of the element of regulations in the field of online technological developments and their effects suggests that one of the main challenges for Muslims in dealing with online technology is to know how to proceed along the following lines of action simultaneously:

1) To overcome the present technological backwardness as well as the material backwardness which prevents the spread of online technology.

2) To achieve balance between the use of the Internet for consumer purposes and its use for creative, productive and service- providing purposes.

3) To benefit from the experience of the developed countries in using the Internet to educate new users in the Islamic countries and achieve a balance between the possible positive and negative effects.

# 4 DEALING WITH ONLINE TECHNOLOGY

## 4.1 Man's view of technology

Any man-made development must have limits and restrictions. In the case of dealing with online technology, the problem is not that its uses and positive or negative effects seem limitless. The problem consists in the following two points, which may throw light on the challenges facing the Islamic world with regard to the spread of online technologies, although they are basically drawn from the context of Western developed environments:

1) A philosophical aspect, i.e. basic assumptions and concepts related to dealing with online technology.

2) The nature of the method adopted in dealing with online technology, i.e. whether it is traditional in the sense of copying earlier models of dealing with technologies with different specifications, or innovative in the sense of coping with the unique specifications of the new technology.

## 4.2 Western concepts dealing with technology

### *4.2.1 General*

Western concepts and assumptions involved in dealing with most of the technologies developed along the history of the modern Western renaissance have always been problematic. Apart from the concept of "personal freedom" and how it fits in with "regulations," there are other areas of philosophically – based influences that bear on dealing with online technology in Western societies. The dialectic of conflict is characteristic of various aspects of the Western renaissance. It appears in the causal reference in Western literature to the use of natural resources within the framework of a "conflict with nature" in which man emerges triumphant. It also figures in intellectual writings and practical applications which refer to human rights standards and liberties as "gained" rights, secured through conflict over major issues like women's and workers' issues. The same thing applies to dealing with modern technologies, although the word often used here is "competition," while legislations on the protection of intellectual rights are taken advantage of.

### *4.2.2 Racism*

Racism appears in specific ideas and references like "the civilisation of the white man." In practice, it takes the form of arrangements that have rendered most technological achievements exclusively reserved for Western societies that have led the march of human progress in a certain historical phase. But, in fact, the West has built on earlier contributions without allowing others to benefit from its achievements to build their own future. Significant examples include the economic boycott measures and exportation bans, which are widely used against the non-Western "other" in international relations.

### *4.2.3 Materialism*

Materialism gives precedence to material profit over other considerations in the areas of economic and technological development, international relations and relations within individual societies – the so-called language of national and international interests.

The spread of online technology may have partially reinforced the above tendencies and placed them within a larger context that coincides with and complements globalisation drives. But at the same tine, it has destabilised these areas in applied terms by opening the door to the wide-scale use of technology to deconstruct the traditional barriers of technological monopoly, violate racist boycott measures, and challenge, at least partially, the overwhelming materialism in the distribution of existing or potential gains arising from the use of online technology in development and other areas.

**4.3 IT Challenges facing Islamic countries**

The challenges that face the countries which "import" modern online technologies like the Islamic countries can be considered primarily self-created. They may be divided into two kinds:

*4.3.1 Philosophical and Intellectual*

a) Purely political obstacles regardless of the relevant official justifications, such as the hesitation to open up to modern online technology. But these obstacles have been largely bypassed either voluntarily or as a result of the nature of the new technology.

b) Religious consideration related to the view that technology is only a means and, therefore, a religious opinion may be given on how to use it, not on whether or not is should exist in the first place. These considerations have initially blocked the spread of online technology, but soon the situation changed.

*4.3.2 Applied and practical*

a) Obstacles directly related to the nature of the new technology itself that requires a new approach to deal with its unique character.

b) Old persisting problems like material and technological backwardness which result in various procedural and practical complications, including planning, administration, individual training and public awareness.

**4.4 IT Challenges facing Islamic countries: The Macro view**

In the light of the above discussion, it appears that dealing properly with online technology must not be separated from the wider context of the urgent call for a renaissance in the Islamic countries. In this regard, the following are the main problems that seem to have a direct effect on dealing with online technology:

a) The lack or poor standard of infrastructural facilities like telephone networks, public and private sector computer networks, administrative, industrial or economic networks.

b) The serious disparity in the distribution of wealth between different countries and regions and within the same county across the Islamic world in a way that is unparalleled in the Western world. This problem appears to be particularly serious given the difference in the definitions of the line of poverty adopted by the North and those adopted by the South.

c) The severe inadequacy of planning, administrative services and applications in the areas of education and professional training in various basic sectors including the relatively new online technology.

d) The current status of the Islamic countries which may be described as potentially rising. The legacies of old conflicts, however, remain highly influential in such a way as to preclude the necessary mechanisms for directing the renaissance efforts through the proper means and technologies.

### 4.5 Transfer of IT

In dealing with online technology in particular, as well as several other areas, the Islamic countries tend to import and stockpile technological products including hardware, software and even management and maintenance systems for consumption purposes. This usually happens under the illusion that it is a valid alternative to real “progress.” Although there may be seeds of local software development, the prevailing consumerist patterns continues to be fostered by an inferiority complex with respect to foreign products. This smothers or places great hurdles before the local potentials in the field.

### 4.6 Other challenges

The contribution of online technology to the modern world, and to the drive of globalisation and the new technological vistas hitherto unopened to “all,” pose unprecedented challenges to the Arab and Islamic countries. These challenges require a special kind of treatment, and necessitate the availability of specific basic conditions. But even success in this confrontation is not enough. It has to be achieved within a relatively short period. In the past, the failure to cope with essential aspects of progress, whether in technology or other fields, led to a widening gap between developed and underdeveloped countries at our expense. By the end of the twentieth century, this gap was probably twice as much as it was in the beginning of the century. The gap could be doubled is the failure extends to the field of online technology, except that this time the span will be much shorter, perhaps no more than ten years.

### 4.7 Some strategic elements

To define the necessary requirements for dealing with online technology, the following two elements must be stressed:

1) The required action must be collective for the benefit of all the parties involved, since the existing challenges are universal. Collective action seems a necessity from the point of view of governments, individuals, the public sector, the private sector, the economic, technological, social and other sectors, the cultural elite, the general public, and various intellectual and political trends.

2) Collective action on such levels requires a common ground for practical efforts. This does not necessarily mean the existence of minimal agreement among the various trends involved. It stresses the importance of agreement on methodology in practical areas to achieve specific goals and consequently to agree on highest common denominators.

## 5 FUTURE PROSPECTS OF DEALING WITH ONLINE TECHNOLOGY

### 5.1 Proposed Approaches

Given the variety and interrelatedness of the possible areas of action in the Islamic world, two main approaches emerge in dealing with the new online technology as one of the main challenges to the desired progress:

1) A chaotic fragmentary approach, i.e. dealing with separate challenges without an overall vision that integrates the potential outputs of planning, programming, training or other supporting arrangements like the provision of the necessary phone connections, etc. This approach is therefore rejected because it fails to lead to any positive move toward progress.

2) An integrated approach based on a comprehensive vision to harness concepts, research, planning and productions to understanding the present challenges and their interrelations. This approach should provide the largest possible base of action. The early steps may be rather slow, but if properly maintained, they may lead to an effective, growing action mechanism to use the opportunities in an ever-growing world.

### 5.2 Evaluation of Approaches

A comprehensive view that is theoretically and behaviourally integrated does not accept the old traditional phased-out approach, i.e. the succession of conceptual, planning, executive, evaluative and development functions in a self-replicating cycle. This is an outdated strategy. Current developments dictate the integration and simultaneity of functions.

We need a qualitative breakthrough to change the pace of dealing with the issue of renaissance in general. It is not enough to move ahead at the same pace as others do if we ever want to keep up with technological progress. It is important here to note the positive advantages offered by online technology that may help in this regard. As noted above, online technology has led to the partial deconstruction of such stereotypes as the “monopolistic approach” and the “dialectic of conflict” in dealing with the technological achievements of the “white man’s civilisation.”

### 5.3 Moving ahead

The question thus arises of how to translate the above into practice? What can be done in the light of the available resources, whose real value materialises in proper utilisation based on the right decision? There are three main kinds of challenge that need to be addressed to “indigenize” online technology in the Islamic countries:

1) Challenges related to purely material backwardness, e.g. the lack of local telephone networks and computer industry.

2) Challenges related to planning and the identification of aims, resources, methods and controls related to the applied uses of technology.

3) Challenges directly related to online technology and its proper use to achieve the right aims.

In terms of who makes the decision and who implements it, the above challenges can be divided into two groups:

1) Challenges that require a political decision, either by individual countries, or by regional gatherings like the Gulf Co-operation Council and the Arab League or by a more comprehensive Islamic entity like the Organisation of Islamic Conference. Such decisions have to do with the indiginization of the computer hardware and software industry, co-operation in the fields of training and specialization, creating joint data storage and retrieval centres and online service providers, standardising legislations that have to do with online technology applications and all relevant issues that may be campaigned for by writers, the mass media, specialised leagues and forms that may possibly influence the public opinion and decision making. Although these stimulants will encourage the authorities to forge ahead in this direction, suggesting new ideas and highlighting the risks involved in lagging behind would be the main responsibility that rests with the authorities.

2) Challenges that require individual decision away from the official level as in the case of launching local training projects, communication between specialists, developing an original online service, spreading awareness of the practical aspects of using online technology and any such area where those who are capable of action should not wait for an ideal situation to obtain. Individual initiative itself may be one of the main factors necessary for inducing this situation and for influencing political decision-making.

Individual decisions related to online projects involve three different levels:

1) A technical and an industrial level, like establishing a production company or a technological training institute.

2) Online servicing level, which ranges from programming and maintenance sectors to scientific training and spreading cultural awareness.

3) An e-trade level, like securing banking transactions, online shopping and customer information services.

### 5.4 Advantages of Online Technology

The recurrent reference to the "enormous challenges" and the "wide gap" of backwardness may suggest that individual and collective projects are doomed to failure in such problematic environments. But Internet projects have in fact spread on a wide scale in many Islamic countries and other developing countries, which seem likely to be spared this fate by virtue of the advantages of online technology. Compared to many modern technologies already used to improve the quality of living, online technology appears to have the following advantages:

1) The degree of knowledge that is required to use online technology is relatively limited compared to the cognitive outcome – an advantage that makes the technology easy to use and spread.

2) The amount of costs required to use online technology is limited compared to the financial output, which allows the use of the technology even when available resources are limited.

3) Online technology may be used in various fields, which is considered a bonus when development is necessary in various areas at once.

4) Online technology is highly flexible. It can be used effectively either for simple or for highly complicated functions. It accommodates all user levels.

5) Online technology can be self-developing at a steadily accelerating pace, which may guarantee sustainability where development is online-based.

### 5.5 Necessary elements for launching online activities

Apart from projects of exceptional nature, the necessary elements for launching a small or major online project can be grouped under the following headings:

1) Sufficient knowledge on the online user level.

2) Technical knowledge to operate an online site and online communication devices.

3) Controls to guarantee the use of the available means to achieve a set target.

4) A telephone connection and computers.

5) Funding relevant to project size.

The lack of one or more of these elements should not block a project that seems viable and promising. Various alternatives may be explored. For example, the inadequacy of equipment or qualified instructors needed to provide online facilities to all school graders in a village or neighbourhood may be compensated for by providing fully-equipped vehicles and forming a joint team of school instructors who work on a shift-basis.

Another suggestion is that too much replication of the same type of project must be avoided in order not to waste available resources. Competition should be fostered in a conflict-free spirit. Sound and fair principles of co-operation must be laid out to boost projects like online bookselling. If the profits are gained by more than one participant, this may be an incentive to join other projects in different areas.

More examples may be cited here. Illiteracy in a certain region may be reduced by using audio-visuals intensively. Some political obstacles may be overcome by boosting communication between associations and NGOs. In short, we would be prevaricating if we waited for the ideal circumstances to obtain before became involved in online technology. What we should do is to embark on action using the available resources, which are by no means meagre, in a context of co-operation, coordination and integration. In this way, online technology could be used properly to achieve a qualitative breakthrough on the way toward improving life standards and other aims in this regard.

## 6 ONLINE OPPORTUNITIES FOR THE MUSLIM WORLD

Although the Internet poses various challenges to the Muslim world, it offers several opportunities, of which the following are only examples:

### 6.1 Reconnecting the Muslim world

The Muslim world has been divided into separate countries with disparate concerns and ambitions due to geographical barriers, political borders and the concept of the nation-state with its outgrowths of national independence and self-sufficiency. However, the current globalisation drive, in which the Internet is only on tool, may be harnessed to reconnect the Islamic world if this tool is used properly. The Internet transcends political barriers, financial obstacles and government censorship of ideas and work. It may become the nervous system that links the distant parts of the Muslim world through the following proposed lines of action

*6.1.1 Dialogue and discussion*

The Muslim peoples have long been preached to on how to adopt the "right path," and have therefore become eager to communicate with each other directly. Now in an atmosphere of sweeping international changes, it has become essential to hear every significant opinion, however odd it may seem to be. Formulating the right questions is the best means to unite the Islamic world, but if the right answers are dictated to it, this will soon cause division. Dialogue, however, is fraught by two main dangers; the sincere desire to find conclusive answers and the apparently alluring questions that have no real substance. Formulating questions properly must steer clear of superficiality and be motivated by a profound faith in Allah and His Messenger. Assumptions and ready answers must be questioned to formulate ultimate questions properly. In order to embark on the desired line of action, we must distinctly reject ready answers, alluring questions, and shallow learning.

*6.1.2 Tourism and Building Acquaintance*

Personal communication remains the more connective and influential element in any vital issue. Hence, the idea of posting personal data for chatting purposes through our Islamic sites. Getting acquainted in this way helps people transcend personal concerns to become interested in wider national issues. These postings may also offer information on Islamic countries, their customs and traditions, their important tourist attractions and the relevant travel information.

*6.1.3 Activism and Interests*

In a global environment, activists and academics in various fields who belong to different countries and races need to get together to share ideas, co-ordinate efforts and lend support to one another. Muslims are strongly urged to do this in the new age of technology. The Internet makes it possible for Muslim activists to share experience, integrate capacities and resources and co-ordinate stances internationally to support their action. It may also offer a window to present and promote these activities and invite potential contributors and interested parties to help. This involves scientific, research, cultural, artistic, development, social, sports or communal activities, and may cover specific issues like the environment, human rights, women issues and religious tolerance.

*6.1.4 Conceitedness and Integration*

With the obliteration of country borders and the decline of giant hierarchical organisations new horizontally expanding trans-border organisations emerged. Meanwhile, the importance of small discrete units was asserted because these units have a wide freedom of action and a far-reaching influence in various fields. They are all connected together by virtue of their common interests. These small units may be connected with other similar units or with international organisations ad individual activists involved in the same line of action. An organisation with four member states or more may be represented in the UN Social and Economic Organisations Union. UN conferences produce documents that will be binding in the next century, but Muslims tend to ignore these documents claming that they are either ineffectual. When Muslim participants attend such conferences they often fall into discord, and rarely agree on a unified discourse or position except when it is already too late.

Muslim users of the Internet should have a role in shedding light on such organisations and individuals and connecting them together. Information should be available on their present activities, future plans and funding needs. An issue like the of reconstruction of Kosova needs to be handled by development organisations, volunteering doctors, educational societies, newspapers, radio services and mass media. It needs a kind of dialogue among members of different religions, religious societies, political groups, businessmen, and corporations to carry out reconstruction efforts. It needs the reflection, opinions and predictions of politicians and jurists. The base line of the required coordination is to know whom to address, if one wants to be heard and helped.

In addition, integration between such units is now essential in the light of the absence of central government coordination. Small units must speak out and get to know others to complement their action. For example, businessmen who want to have a role in reconstruction efforts in Kosova, e.g. building new housing and factories, exporting products to the region, or investing in education and health, will not be able to do so unless the security situation is stable, the people are at peace with one another and the whole country is economically capable of accommodating reconstruction efforts with enough purchasing power to absorb the imported products. In this way, businessmen may be able to extend substantial support to NGOs engaged in relief efforts, dialogue between members of different religions, peace maintenance, social and health care or human rights action… etc.

Integration adds a new dimension to interconnectedness apart from building acquaintance and communication, namely the interrelatedness of interests. Politicians may soon have to depend on or be dictated to by private businesses, NGOs, research centres and local leaders.

#### *6.1.5 Finance and Economy*

The economy has become a matter of the utmost importance at present. It determines government policies, provides funding to NGOs and decides the fate of parliaments. Businessmen and multinationals have become more influential and perhaps tougher than governments and countries. In this context, earlier basic concepts like the independent national economy, the controlling national capital versus the intruding foreign capital and the self-sufficiency of the state are becoming obsolete. In this connection, Muslims should have an active Internet role to achieve two aims:

a) Presenting "proper" issues on the theoretical level.

b) Offering useful services on the practical level.

### 6.2 Breaking Muslim Isolation

#### *6.2.1 Nation statehood*

The modern nation-state concept has promoted a spirit of isolationism in spite of its universalism. It is based on the separation of a state from a mother kingdom to become an independent entity which has distinctive national and cultural characteristics and looks forward to self-sufficiency through a powerful central government and a strong army to protect its material borders against enemies/others. This spirit has been reinforced by resistance and antagonism to the West. The high nationalist sentiments have therefore promoted more search for a national self and more denial of every thing foreign or alien. A formidable army of intellectuals and researchers helped emphasize the principles of self-sufficiency and the protection of borders. Self-sufficiency has been particularly fostered by the strong emphasis on national culture and the identity of the people. The protection of the borders has been fortified by guarding moral, ethical and cognitive barriers against the alien, sneaking “other.” In other words, internal self-sufficiency and external protection have characterised the political/military, economic and intellectual aspects of life.

In this context, the other/world has been shrunk into the West in its unfair imperialist version. The remaining residual “other” has become the persecuted and the wronged that seeks freedom and emancipation. The question here is why do we communicate with the West in spite of its injustices? Why do we communicate with remaining residual if it is identical to us? Certainly it is not the need for communication and knowledge because ultimately everything is already well known to us!

## 7 CONCLUSION

The aim of this paper is to stress the necessity of opening up and removing the barriers between ourselves and the world. The Internet by it nature offers the opportunity for Muslims to communicate with all. This communication is not an end in itself, but rather a means to know the other and identify similarities and contrasts in accordance with the Qur’anic injunctions. This would be a step toward deconstructing stereotypes and understanding the other’s difference, depths, intricacies, interests, and aims.

One of the aims of such communication is to reformulate the image of the Old World instead of being passive audience who passes unsubstantiated judgements. It is not true that the image of the Old World has been decided in advance by Western countries. It is not true that any single country has a comprehensive world-view.

The future of the world is still being formulated at present, and the formulation requires specific tools (NGOs, multinationals, satellite media, electronic communication networks, … etc.). These tools are available to all. However, the formulation will not proceed from a totalistic ideology. It will proceed from specific practices and situations in which individuals and gatherings with different ideologies will participate.

The Muslim view of reconstruction should be based on the understanding that such a task has become an international process that requires us to know the others, co-ordinate and co-operate with them. The real problem for Muslims is not that others are plotting against them. It consists in their absence from the areas of action because they believe that UN documents are set in advance, that international NGOs aim at infiltrating Islamic societies, that international corporations want to undermine their economies, and that international human rights organisations are eager to exploit the current conditions to pounce on dedicated Islamic nationalist governments!!

Next to building acquaintance and reconstruction comes a third aim, namely communicating the Islamic message worldwide. Prophet Mohammad of Islam (peace be upon him) sought to communicate this message to all people everywhere, but not everybody embraced Islam. Our duty is to follow this course, to try to introduce a clear, unabridged and undistorted view of Islam. Whether people may respond positively or otherwise is totally up to them because it is a matter of personal belief. Our duty is only to communicate the essence of the Islamic faith in accordance with Qur’anic injunctions.

# Information Technology for Development: A Personal View

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## 1 ABSTRACT

This paper discusses the ways as to how the present and the future electronic Information Technology such as the multi-media Internet and the Information Highways along with the appropriate tools can be used as a multi-faceted and multi-professional **industry of services** that generates the capital needed for the development of a country via the setting up of appropriate infrastructures for basic scholarisation, education, health and professional training, and raising the public awareness towards this end. Moreover, this new technology as such is helpful in accomplishing these and other development tasks. Practical examples are given to back up the different points considered here.

## 2 INTRODUCTION

In the not distant past information technology consisted of local, national and international human networks composed of committees, institutions and academies that produced, collected and diffused information-knowledge in the widest possible sense. That was done at the rather leisurely pace via journals, books, conferences and personal contacts, in a society that used it to meet its needs and for its development. However, this process of information dissemination often suffered from lack of equity due to some inherent ethical, political and administrative problems that led to the exclusion of an important part of the society. Sometime, the information lost relevance because it did not reach the right person at the right time, because of the deficiencies in the operation of the human networks involved in its distribution. Another inhibiting factor that often came into play was the **cost** incurred to have this information.

An important aspect of information gathering and diffusion is that this activity is always elitist in nature; only those who manage to have the right educational and cultural background – the elite, benefit from it. The political leadership always make use of these elites as a driving force for the general development of the society (Mokhtar Ben Henda, 1991).

## 3. PRESENT SITUATION, FUTURE AND PERSPECTIVES FOR DEVELOPING COUNTRIES

The development of the electronic Information Technology in the recent past and its continuing exponential growth is a new way of collecting and disseminating the vast amount of all sorts of information. The network of tools of the technology such as radio, television, satellites, satellite-clusters, leading to the multimedia web of the

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Internet and not-far-in- the future the information highways will truly **globalise and make available** (almost) **free-of-cost** this information.

However, to receive, choose and exploit this information, one needs the relevant tools and properly qualified persons. Here again as in the 'old times' the elites of the society will be able to procure the required tools and will have the capacity to make use of them. However, now and even more in the future, these elites have to work in a highly competitive global environment by setting up and operating start-ups - new commercial enterprises such as dot com, tele com, and other types - based on real time interactive systems (Michel Alberganti, 2000) that will operate as **industry of services.** The term ‘services’ has to be understood in the widest possible sense of interfacing the global information system for all types of inputs and outputs including education, professional formation, electronic politics of democracy and governance such as voting via Internet during elections and referenda. This, as part of the new globalised digital economy for procurement, production and distribution of different sorts of service-products for the local market, and for export to earn the always needed foreign exchange for the development and progress of the country. The banks, the different financial institutions and the stock-exchange already use intensively information technology for their world-wide transactions carried out almost instantaneously. This activity is one of the most efficient capital-productive and profitable service industries.

Just one small example in this context: at present about 75% of the GNP of France comes form enterprises that provide and export a wide spectrum of services including those related to the Information Technology and the classical industry accounts for only about 25% of it (Matthieu Crossandeau, 2000).

Another important point to note is that the industry of services consumes very much less energy than the normal industrial machinery. Again if one takes the example of a developed country such as France, where now one uses only about 50% of energy to produce the same amount of wealth compared to that it would have used with the normal industrial machinery about 25 years back. Apart from an important gain in the economic use of energy during the last 25 years, the main reason for this is the one discussed just above – the energy consuming industrial apparatus no longer plays a significant part in producing the wealth for the country (Matthieu Crossandeau, 2000).

In this context, developing countries are again **penalised** because most of their existing industrial infrastructure is of the classical type that consumes a relatively large amount of energy.

Here it is worthwhile to speak about of the tendency in the developed countries to delocalise the energy-consuming industry to the developing countries. This delocalisation helps them to have the desired goods produced very cheaply, because of the very low wages they pay to workers. This ensures that they remain competitive in their markets. This is not negative in the short term, but it may not be desirable for the future, because it may operate as an **obstacle** for the entry into the new economy, unless the governments of the countries concerned use this opportunity as a stepping stone for their development as they have done for example in Singapore, Taiwan and the other so-called “Tigers” of the Pacific Rim.

It can be concluded that normal industrial apparatus run by workers or by robots would always be required to produce the needed goods, but the Information Technology can be helpful in providing access to new technologies that lead to the building up of new more efficient industrial tools and the improvement in the efficiency of the existing ones to produce goods of better quality and at a lower cost.

As Information Technology is evolving very fast, the development, for example, of the Internet-television-integrated mobile telephone (already in operation, for example, in Japan) may eliminate the need of having expensive and cumbersome infrastructures or other such routine systems (J L Shenker, 2000). In the new situation, one will be able to do the required job with small and even mobile entities dispersed in different parts of the country concerned and without creating heavy and centralised conglomerates. Of course, to operate in this environment, it is always indispensable to have the corresponding properly trained personnel able to retrieve and use the needed information from the system and who has the necessary physical and mental capacity and mobility to adjust to the evolving environment and its tools of operation.

In short, it is clear from what we see around us that we are evolving into a **new civilisation of economy of knowledge**, where **grey matter-intelligence**, will be the decisive factor for creating working opportunities for education, a continuous multi-faceted and multi-purpose professional formation, and the production of material and cultural wealth for the society as a part of its overall development.

The way and the speed with which the things are moving, the task for the developing countries will not be easy, because the gap between the developed and the developing countries is widening – for example, at present there are more than 300 million Internet users (Internauts) in the world, but only about 5% of them are in the developing countries. Of the 42 countries investigated recently by a team of CNN according to certain criteria: local skills, efficiency, government support…, Pakistan and Saudi Arabia were among the five countries at the bottom of the scale for the use of new technologies. However, with a concerted effort, it can be bridged as the example of the South East Asian countries show. Another pertinent example is of India. This country is moving forward very fast in this domain. In the next few years, its exports of services (creating software systems for managing the operation of enterprises such as air-lines …, at present installed principally in and around the city of Banglore) are projected to bring in up to **50 billion dollars** per year in foreign exchange. For a petroleum exporting country, this is equivalent to the production and exporting of about 5.5 million barrels of petrol per day, when one barrel of petrol is sold for 25 dollars.

It is absolutely necessary for the **developing countries** (most of the Muslim countries, at some different levels, are in this category) that they use their existing qualified personnel (elites) to create and exploit the relevant capital-productive enterprises of services to generate revenues. It is important to invest a part of these revenues for an overall development: the elimination of illiteracy – the real handicap for any society from whichever point of view one looks at it and which rises up to 60 to 70 % in some countries, higher education, appropriate and up-to-date formation for all sorts of professional activities, the improvement of health and breaking off the feudal and vicious circle of insidious poverty through the raising of the living standard of the society as a whole.

In other words, the number of well-qualified persons – the elites, must not remain limited to the very thin **upper layer** of the society, but it must become substantial and filter down to its depths, i.e., one has to have a dynamic, innovative and productive middle class that strongly aspires for a better material and richer cultural life for the society as whole.

In this enterprise of basic development, all the tools available via the Information Technology have to be used in a well-thought-out and rational manner. These means should be used and not end up as mere ephemeral gadgetry.

## 4. PROPOSED TRACKS IN IT DEVELOPMENT

### 4.1 Enterprise of teaching and learning

To achieve the aim of an overall development of a country and its people, one has to build schools, colleges, specialised institutes, inter-disciplinary centres, universities, …; to set up up-to-date and finely tuned-up educational programmes that make use of all the means that are available via the new technologies of information through the use of Internet such as the dot edu domain or others that will be set up in the future, to produce well-trained persons (teachers, engineers, specialists in different branches and trained to adapt to the fast evolving international environment) who are able not only to do their jobs, but will be able to stand up and compete in the digital-economy-driven globalised and open market. The market of services, that not only produces and provides what is needed and demanded, but is innovative and able to tailor the existing tools to its needs and create new systems, new products and new ways of providing different types of services.

As always, but particularly in the future, the overall quality of development of a society will be determined by the **quality of its school** – the fundamental structure, where a child begins the initiation for entry in the real productive - both mental and physical - world. This is the reason that so much thought and effort by different organisations such as the International Labour Organisation (ILD) and the European Co-operation and Economic Development Organisation (Lucas Delattre, 2000), is being encouraged to improve this basic institution. In developed countries, specific criteria are being defined and tested so that a child starts and follows through the school period under optimal conditions of learning and continuous adaptability. Of course, the post school institutions have to be improved and kept in tune with the demands of the school.

Developing countries have not only to work hard to build up the needed schools to eliminate the prevailing degrading and costly illiteracy, but they have to make particular efforts for including these ideas – **human capital**, in their basic educational systems.

## 4.2 Setting up of hardware-technology facilities and international collaboration

To exploit the Information Technology, one has to have the appropriate tools. At present, most of them have to be imported and they are not cheap. Hence, one has to start to plan vigorously but realistically and invest in the appropriate electronic industry that should quite soon be capable of producing the requisite electronic components and assemble them to produce the required tools: receptors, consoles, PCs, sophisticated telephonic systems, …, that are and will be the components of the digital economy mosaic. In this context, it would be very helpful to initiate and promote international collaborations. One very pertinent example here is that, at present, the entrepreneurs from India and Pakistan control and manage a significant part of the enterprises of the Silicon valley in the US (it may be true also for other countries). They seem to be very keen to invest in different types of projects in their countries of origin. One must do every thing possible so that this collaboration is initiated immediately. Other countries such as Jordan are planing to set up their own silicon valleys. Malaysia is a good example of success story in this domain, because at present it is one of the most important computer-chip producers in the world.

The well-known aim of this country to become a fully developed country by the year 2020 is a commendable example of a sharp vision. It is necessary and worthwhile to share the expertise in hardware ventures that are being set up and operated in different Muslim countries.

In parallel to this hardware side, this collaboration should also be used for setting up up-to-date interdisciplinary technical/professional institutes and training centres and initiating appropriate and specific exchange programmes to help raise the general level of competence and to create a collective thrust for development.

There are other international financial and technical resources available such as the earmarking of around US$ 15 billion by Japan for the next five years to help the developing countries to progress and to reduce the existing technology gap relative to the developed world (announcement made at the recent G8 meeting in Japan). Furthermore, a substantial amount of financial aid is allocated annually by the European Community for developing countries, but, because of some incomprehensible reasons of *laisser-aller*, very few of these countries make use of it. There may be other financial resources available such as the UN’s recently launched “partnership” with the private sector and the “Global Compact” alliance with more than 50 multinational societies (Afsane Bassir Pour, 2000).

Interested countries have to wake up and shake off the present lethargy often coupled to a false conceit of knowledge

Rich Muslim countries have a particular obligation in this field towards the *Ummah*. They should contribute financially and by all the other possible means to well-defined and mutually beneficial projects so as to instill the necessary impulse for the general development of the countries of this collectivity. These countries should also share their expertise in setting up and operating the banks and financial institutions, and the telecommunication systems as they are doing in some of the Gulf states to prepare for the post-petrol future.

### 4.3 Possible risks of cultural incompatibility

One should note that the way the things are going, there is a certain risk of conflict between the cultural values (language, social behaviour, customs, traditions,…) being transmitted along with the multi-faceted information from outside and the local ones. As the "intruding" and dominant culture has always a tendency to normalise the surroundings to its norms, one has to think very carefully about this and find effective ways of avoiding the hindering impact of this possible mismatching. Other societies have been able to find harmonious ways of assimilating this technology, while maintaining and even enriching own cultural values. There is no reason that we should not be able to achieve this, too.

In this context, one point that comes up regularly for discussion is which is the most appropriate and efficient medium to teach and pass on the concepts and the contents of the Information Technology via the Internet. It is not a mystery for anyone that at present the English language is (almost) the exclusive medium of expression for this type of activity. Should one use this medium? Or would it be more efficient to use the local language? If the latter is the case, how should one go about translating and transposing this knowledge in the local language without getting overwhelmed, bogged down and lost on the way? Or is there some middle way of achieving this aim? One has to find out as to how the other successful countries whose local medium of expression is not English are coping with this problem. Let us take the example of a developed country such as France. In France, the vast majority of the population in their day-to-day activity is interested mostly in having access to different types of services that are limited to and concern the affairs of the country.

This information may deal with educational institutions and educational programmes, airlines and railway time-tables, tourism, post office, weather, traffic control centres, atmospheric pollution, enterprises that sell different sorts of goods, banks, stock-exchange, political institutions, television programmes, newspapers and magazines and their texts, themes of reflection for the society treated by individual persons or associations or institutions. Here the Internet tries to provide all this information in the French language. However, the persons looking for the information that is produced in and comes form the outside world, the medium of interaction via the Internet is exclusively the English language. Similarly for the benefit (commercial, cultural, …) of the persons and enterprises form other countries, the French enterprises and institutions create their own sites in English.

For non-English speaking countries, this is the only reasonable and practical way out.

### 4.4 Caution

The task for the developing countries to have access to and make use of the Information Technology for development, will be arduous, because of the existing and widening overall gap between them and the developed world. Moreover, in spite of all the public gestures of goodwill and the different programmes of financial aid discussed above, developed countries use and will use possible unfair and foul means so that the situation of underdeveloped world remains as it is to enable them to export their finished products including services, to have cheap raw materials and labour and to import, when needed, well-qualified persons (brain drain) for their enterprises.

For example, at present these countries are looking for thousands of experts from the developing countries to work for their information technology related activities.

To overcome these handicaps each developing country singly and the *Ummah* as such have to make a single-minded and relentless effort to enter the arena with a visionary zeal to find its rightful place in the new high-revenue generating and multi-faceted global information technology market.

## 5. CONCLUSION

Occupying an advanced position in the high revenue IT market is possible if one is clear in one's mind about the high stakes involved in a world subjected to an almost tempestuous information flux. For this, the intelligentsia-the-well-trained vanguard and the political leadership (enlightened and selfless) must have a clear **vision** of the aim, and the **will**-this methodic madness, to create the right dynamics for development and find the necessary financial and intellectual means to achieve it by setting up the appropriate educational, technological and professional institutions.

For this, these countries have to generate revenues through the setting up of capital-productive enterprises of services using the available elites and reinvest them for development.

In some countries, local resources are already available, but they are mishandled and wasted on misconceived and non-productive projects.

Important financial means are available from other countries, but one has to take the initiative along with well prepared dossiers of justification for concrete projects to benefit from these facilities and resources. This process should also help to limit the loss of qualified persons through the brain drain.

One may refer here to the dreadful and choking debts that are relatively easy to get but almost impossible to pay back. Most of the money thus obtained has been either badly invested or got lost in the marshes of endemic and institutionalised corruption.

There are recent good examples of success to ponder on, emulate and learn from. The future will not be merciful for a society that does not make up and make use, with a strong sense of responsibility and accountability on the part of the responsible persons concerned, of the fast moving and constantly transforming global knowledge machine for its development and well-being. One has to learn to fix precise objectives and do what is decided.

## ACKNOWLEDGEMENT

I am grateful to many colleagues and friends, particularly A. Hedroug, G. Kamarinos, D. Masson, J. A. Pinston and U. C. Tsan with whom I discussed this open-ended and fast developing theme for their suggestions. This helped me to tie up some of the loose ends.

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# Progress and Trends in
# Digital Image Applications

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***Keywords**:* Digital Image, Descriptors, Completeness, Invariant features, mathematics, Euclidean motion, Curve, surfaces, 3D images, Arc length, Shape distance.

## 1 ABSTRACT

Here, we show how a joint mathematical approach formulation for the extraction of shape descriptors digitally is efficient and could be adapted to each image application. The topology approach allows the rigorous definition of the notions of shape, shape space, the invariant features space, and a metric between shapes. Using Harmonic analysis, a unitary operator that is able to separate the shape information and the geometric transformation one, allows us to extract a relevant invariant shape descriptors under a given class of transformations. It also gives a robust method for the evaluation of the object motion. In the closed curves, some three-dimensional surfaces and planar grey level image cases, such an operator becomes the Fourier transform on a given group. Therefore, under some assumptions, a complete set of invariant features can be constructed. We derived from this a shape metric.

Recent developments in image coding domain, for moving pictures in indexing of digital image basis, offer new perspectives to the application of the image invariant representations of regions and contours. Therefore, we intend to illustrate the importance of our approach in several image applications (Telecommunications, Digital TV, medical imaging, multimedia, remote sensing, geo-science…

## 2 INTRODUCTION

The central goal of pattern recognition is to make the computer intelligent. The importance of invariance to pattern recognition systems has been recognised. Invariance is a property of geometric configurations which remains unchanged under an appropriate class of transformations. The fundamental difficulty in recognising objects from images is that the appearance of a shape depends on a viewpoint. Invariant parameters which can be measured directly from images, are used as shape descriptors. Many applications use invariant features such as robotic vision, shape classification in biological or medical imaging, speech recognition, radar signature and so on...

The main classes of geometrical transformations of interest for image analysis applications are Euclidean, Affine and projective. It is useful to recognise these classes of transformations into a hierarchy which is based on the generality of the transformation. For example, a projective transformation is more general than a Euclidean transformation because it applies to more situations and consequently there are fewer invariant properties. It is also important to precisely identify the type of function that represents the object, whether it is a curve, a surface, or grey level volume.

Numerous approaches in image analysis domain for constructing invariant features have been developed as the algebraic invariant theory [1],[2],[3], Fourier Descriptors [4],[5],[6], Fourier Mellin transform [7],[8], the M-transform [9], curvatures [10].

Invariant features extracted by the differential geometry are local (Euclidean or Affine curvature…) and serve to describe curves and surfaces independently of Euclidean, Affine and projective transformations [10] [11] [12]. Methods based on Harmonic analysis give global invariant descriptors. With such an approach, we can formulate invariance problems for new kind of objects such as planar grey level, three dimensional grey level objects or some kind of parametric three dimensional surfaces [7],[13],[14],[15]. Within the context of practical applications, the invariant descriptors should necessarily verify a number of criteria. The following is a non exhaustive list:

1. The *fast computation.*
2. The *powerful discrimination* useful for object classification.
3. The *completeness*: All geometric objects related by a transformation will have the same invariant values. However, the converse is not generally true. Namely, two geometric objects with the same values of invariant features need not be related by a transformation. Completeness means that the invariant descriptors characterise the shape uniquely up to a transformation.
4. The *stability:* It guaranties that small shape variations are traduced by a small difference in the values of invariant parameters.
5. The definition of a metric between shapes: It has to be a right physical mean.
6. The *invariance* of the used curves or surfaces algorithms with respect to the considered transformations (Euclidean motion, Affine motion, projective…) [19][20].

The existence of a set of invariant features verifying such criteria depends upon the complexity of the considered scene : Planar contours, grey level planar objects, three-dimensional surfaces, grey level three-dimensional volumes (useful in medical applications). It also depends on the considered class of geometric transformations, whether they are projectives, affines, Euclideans.

In this paper, we propose a unitary joint topology and Harmonic analysis formulation for the construction of global invariant descriptors verifying most of criteria cited above. The topology formulation is introduced to precise the shape notion, the invariant features, the shape space and the invariant features space. Therefore a rigorous definition of completeness, metric shape, stability, is given. By the Harmonic analysis, we intend to construct a unitary operator which is able to separate the shape information and the geometric transformation one. This property gives two main results. First, it allows us the extraction of invariant shape descriptors under a given group of transformations. Next, it gives a relevant robust method for the estimation of the global object movement. Under some assumptions, this operator corresponds exactly to the known Fourier transform on a group. This approach gives satisfaction results in some cases such as the closed curves (submitted to the planar Euclidean or planar affine transformations), three dimensional surfaces and the planar grey level images. Here, we intend to give some answers to the completeness in these cases since the Inverse Fourier transform exists. Therefore, a complete and convergent set of invariant features could be constructed. A shape metric can be derived as well.
Recently, pattern recognition offers new perspectives and new methodologies for the object oriented image coding. Then, we illustrate the application of the proposed approaches for invariant features constructions in this context.

The paper, we introduce the joint topology and Harmonic analysis approach for the mathematical formulation of the geometric invariance in imaging system. In Section II the cases of objects represented by a closed planar contour, are presented. The invariance with respect to Euclidean motions is considered. Such restriction allows us to illustrate Stability property by the construction of a complete and stable set of invariants [17]. We also show to estimate the rigid motion object in digital images with uniqueness. Afterwards, affine transformations are considered where a complete and convergent set of invariant features under planar affine motions is described. With the same approach, the invariant description of planar grey level object is studied. A complete and convergent set of invariant descriptors with regard to planar similarities is presented [7]. Shape invariant representations of three dimensional objects (spherical shaped form and Taurus-shaped form surfaces and a general grey level volumes) are constructed with the proposed approach. In this case, we underline that the obtained descriptors are relevant. However, completeness are not reached in spite of the existence of the Fourier transform.

Finally, we describe applications of the developed model. Object-based coding, for example, uses shape representations that should verify : completeness for the reconstruction, stability for the robustness under errors of transmission and a small shape change, real time computation for the moving pictures and the definition of distances for object matching and the estimation of global object rigid motions.

## 3 FORMULATION AND PROBLEM POSITION

This shape representations approach is very promising for the new coding techniques. Improvements are also for seen for more general formulation both for the type of object and the type of motion such as :

- *planar grey level images* animated with *planar rigid motion* (Euclidean transformations),
- *planar closed contours* moving in three dimensional with *rigid motion* (planar affine or projective transformations ).
- *Surfaces* animated with *3D rigid motion* (3D Euclidean transformations).
- *Planar closed contours* moving with three dimensional rigid motion (3D Euclidean motion). The application of this generalisation in coding

## 4 CODING APPLICATION

The CCITT has standardised a block-based hybrid coder for coding of moving images with low data rates between 64 kb/s and 2 Mb/s where each image of a sequence is subdivided into independently moving blocks. Each block is coded by 2D-motion compensated prediction and a transform coding (DCT). This corresponds to a source model of 2D square blocks moving translationally in the image plane, which fails at boundaries of natural moving objects. At low data rates, source model causes coding artefacts known as blocking and mosquito effects.

In order to avoid these coding distortions, the concept of object based analysis-synthesis coding aiming at a data rate of 64 kb/s, has been introduced [47],[48] . A coder based in this approach divides an image sequence into moving objects. We propose here to describe objects by the global rigid movement of exterior contour (a translation followed by a rotation and a scale factor), by its shape (invariant descriptors under similarities) and by its texture. The model developed in section II is available. We intend to apply such a tool to a videophone sequence.

The objet motion analysis is recognised as a key point for many applications in robotic vision and machine intelligence or, recently, in object oriented coding. It consists of the estimation of the geometric transformation parameters primitives existing between a given object extracted from two images at two (or more) consecutive different instants of an image sequence. It is usually based on primitives, according to the context, may be segments of straight lines or curves, characteristic points, pixels, blocks or regions. Matching the primitives is carried out by minimising a cost function, or maximising a correlation function, both based on these attributes. Therefore the estimation methods differ because of the primitives that are used and also depend on the used criterion. It could be the generalized correlation function or a given distance. A numerical optimisation method is generally required. In this work, we intend to use the exterior profile of the objects as features. We also intend to consider the Euclidean distance between respective parametrisation of each planar and closed boundary assumed moving with a planar and rigid motion. More general hypothesis can be done as :

- Planar objects submitted to three dimensional motions which can be described by affine transformations.
- Planar grey level objects submitted to rigid movements modelled by planar Euclidean motions.
- Three-dimensional objects (surfaces or volumes) which move in the 3D space.

The joint topology and Harmonic analysis proposed in this paper seems very suitable to give answers to object oriented coding since such a model can be adapted to the different cases which we classified above.
Later on, we show how the whole theoretical results in the contour-rigid motion case serve efficiently and are essential in oriented coding application.
For these experiments, the test sequences MISS CLAIRE have been used, they have been selected by international expert groups MPEG (The sequence MISS) Figure 1 shows some pictures of this test sequence. The first pre-processing consists in extracting the contours as shown in Figure 2.

**Figure 1: Original Claire sequence**

The main idea consists of the compensation and the coding of homogenous regions assumed to be animated with rigid movements between two consecutive images. However, we admit of small non linear shape deformations.

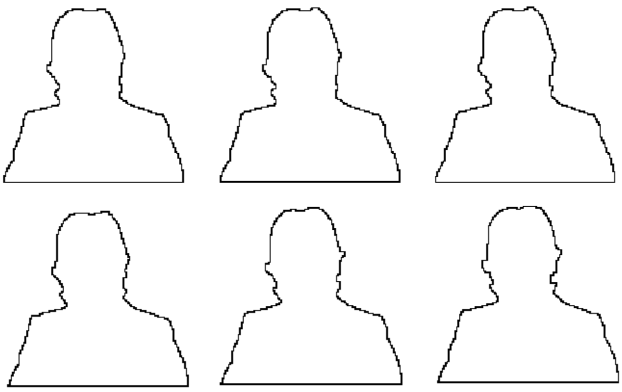


**Figure 2: Contour extraction**

The formulation seems suitable for the coding problems. Effectively, data reduction for very low bit rate image coding can be obtained for the following reasons :
1. All pixels of a region are assumed to have the same movement vector which is related directly to the parameters of the geometrical transformation. For planar similarities, we only have 4 real parameters.
2. The whole exterior boundary of a given region can be coded with a limited number of descriptors (about 20 features for a perimeter of nearly 400 points).
3. The texture of regions is also described with a limited number of features (this point will not be studied in this paper).
A prediction procedure will be applied to all of these primitives which generally change slowly along image sequences. The first type of features requires some properties such as :
1. robustness.
2. Uniqueness : Hausdorff distance which is a shape space metric as we have seen in section I, guarantees this fact.

3. Real time computation : only a limited number of the normalised points will be useful for the estimation of such primitives.
The second kind of features have to verify the following criteria :
1. Invariance : The descriptors must be independent of a rigid motion (a planar similarity).
2. Completeness allows the reconstruction of the objet up to a transformation in the receiver.
3. Stability gives robustness under small distortions caused by failures in transmission, quantization and non linear deformation of the object between two consecutive images.
4. Simplicity and real time computation (based on a monodimensional Fast Fourier Transform algorithm).
5. Generally, a given scene contains several objects . Therefore, we usually need testablish the correspondence between similar objects in the two consecutive images before the movement estimation step. This fact requires the computation of a shape distance. Such a distance presents algorithm simplicity, allowing the matching between objects in real time.

A curve is usually represented by a parametrisation. It is well known that there are different curve parametrisations to represent a given curve. Therefore, the normalised arclength parametrisation has to be used when the invariance under similarities is required and when the displacement of the object is assumed to be rigid and planar, such a parametrisation is also needed for the estimation of the motion (see Figure 3). An arclength parametrisation is obtained by a reparametrisation procedure which doest not have to depend on the location. We propose to use the truncated Fourier expansion of the original curve points.

where M is the number of the original contour points $r_m$. and n is the truncated number of the Fourier harmonics. It is easy to verify that this curve algorithm is periodic and independent of the orientation of axes in the mean of [19][20].
So, a discrete normalisation can be achieved by computing the length function defined by :

$$l(t) = \int_0^t \|f'(u)\|_2 \, du = \frac{2\pi}{M n^2} \int_0^t \left\| \sum_{m=0}^{n-1} \sum_{k=0}^{M-1} k \, r_m \, e^{-\frac{2i\pi k(m-u)}{n}} \right\| du$$

Then, a uniform sampling of the inverse function of the arclength one defined in the last formula can be derived numerically. In Figure 3, we illustrate the type of experimental result which we have obtained in a Claire contour with 128 normalised points.

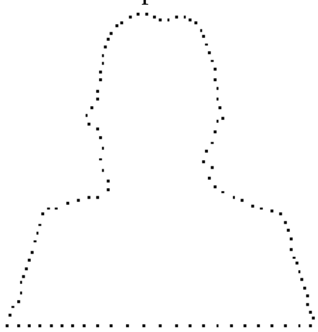


**Figure 3: A discrete arclength normalisation with 128 points**

It is important to note that this step of normalisation is obtained by using twice the FFT algorithm.

## 5 Invariant features extraction

The computation of invariants is obtained in real time, since the DFT is computed on the obtained normalised points of the contour. Then, the proposed set of invariants is computed in real time.
Figure (4.a. 4.b.) illustrate the relevance of these descriptors. Clearly, they converge to zero when indexes tend to infinite. Therefore, the shape information is located near the origin and it is contained in just a few invariants. So, a contour reconstruction from a limited number of Fourier coefficients was proved in [4],[6] to be without a lot of shape deformation.

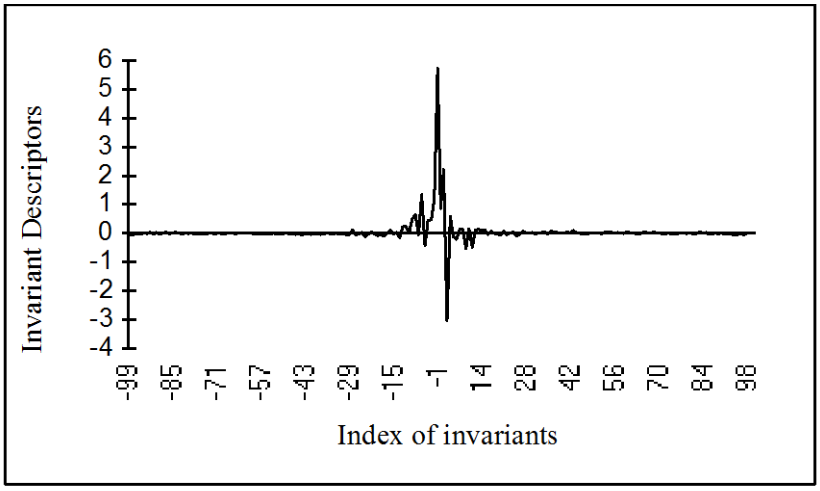



**Figure 4.a. : Real part of complete a stable Invariant Descriptors**

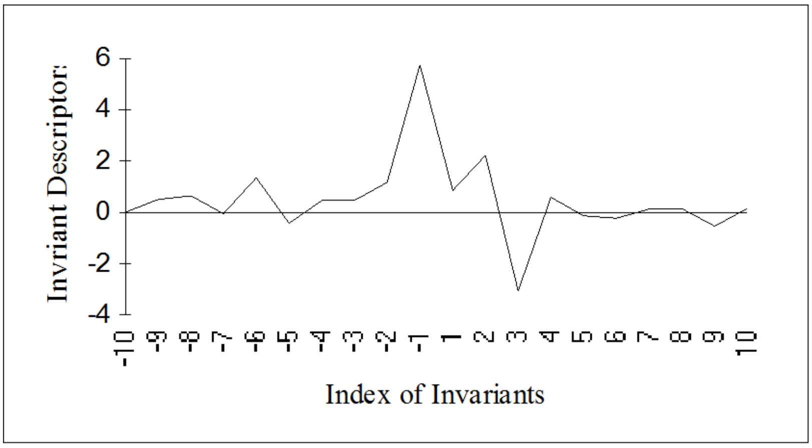



**Figure 4.b. : Zoom of the most dominant part of a real part of Invariant Descriptors**

## 6 Global Motion estimation of objects

The following step is the movement estimation between two objects having the same shape and extracted from two consecutive images

Pearson and Fu showed that there is a simple numerical solution to this problem. since it consists of the extraction of all the zeros of a function F

## 7 Motion estimation in videoconference

In order to illustrate the behaviour of this motion estimation algorithm, we consider the contour represented in Figure 5a. This contour was rotated artificially by 10 degrees in the inverse clockwise direction (Figure 5b.).

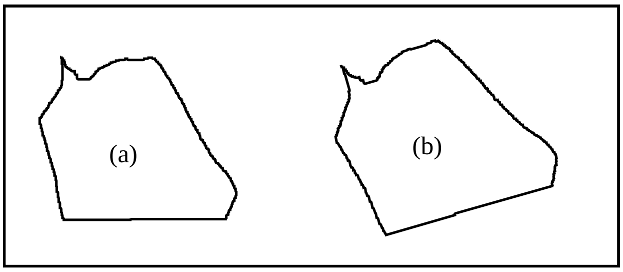



**Figure 5 : (a) Original contour 1, (b) Original contour 2**

$F(l_0)$ only contains a limited number of harmonics. So, it is possible to find all zeros of $F(l_0)$ by using numerical techniques. Here, we apply a bracketing method to solve this equation. The function $F(l_0)$ has more than one root in the interval $[0,2\pi]$ (for the two contours represented in Figure 5, the function $F(l_0)$ presents several roots, see figure 6 ).

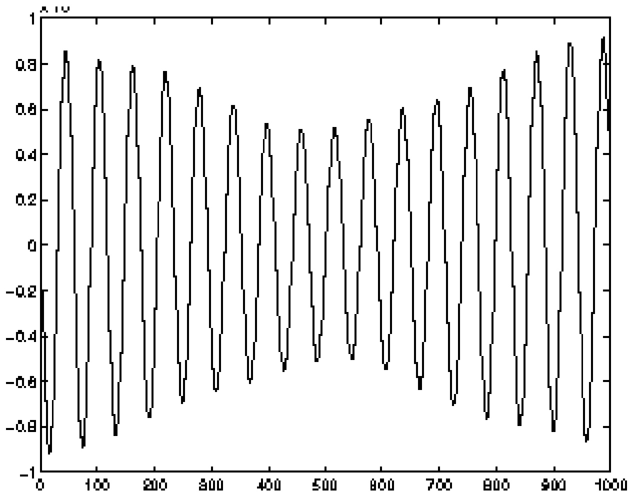


**Figure 6 :The function $F(l_0)$ computed with 64 values of normalised points**

As $F(l_0)$ exhibits several zeros, we compute the Hausdorff distance for each solution. Thus, the zero which presents the smallest value of Hausdorff is kept. The adjustment of the parameter v, which represents the number of normalised points, can be reduced significantly, as we can see in Figure 7.a and figure 7.b. This involves that a reduction in the computing times can be obtained by choosing the minimum number of the normalised points.

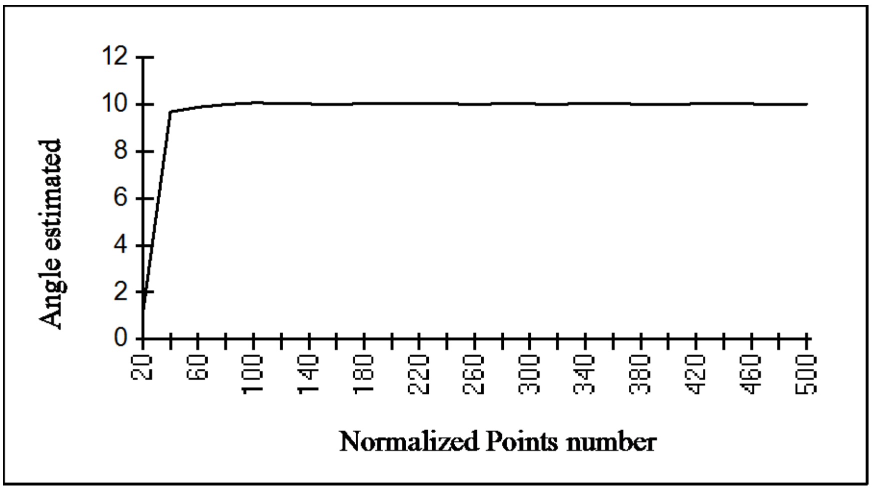



**Figure 7 a. : the rotation angle estimation with different number of normalised points**

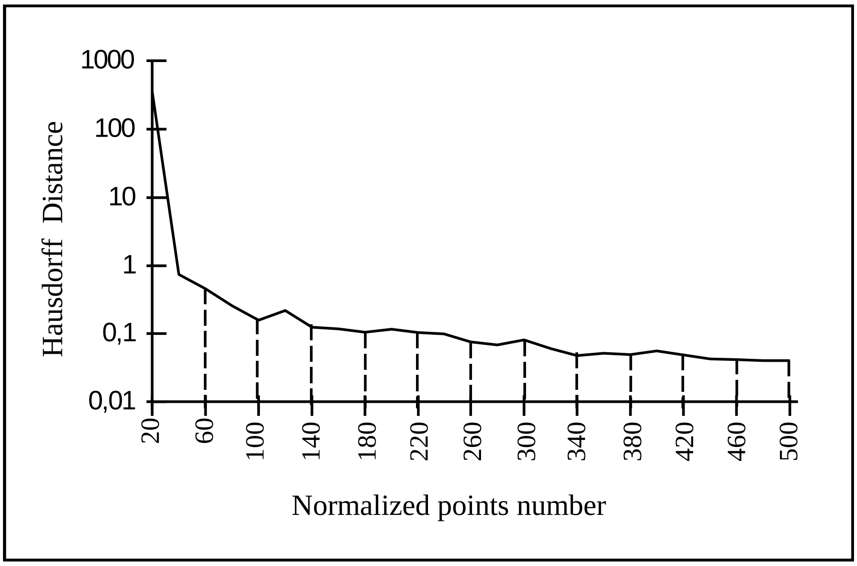
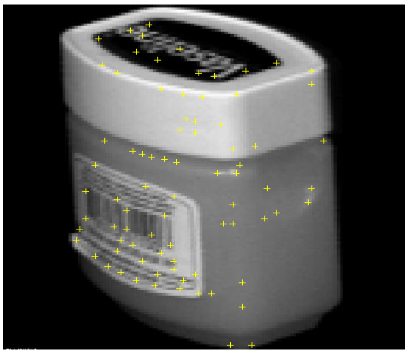


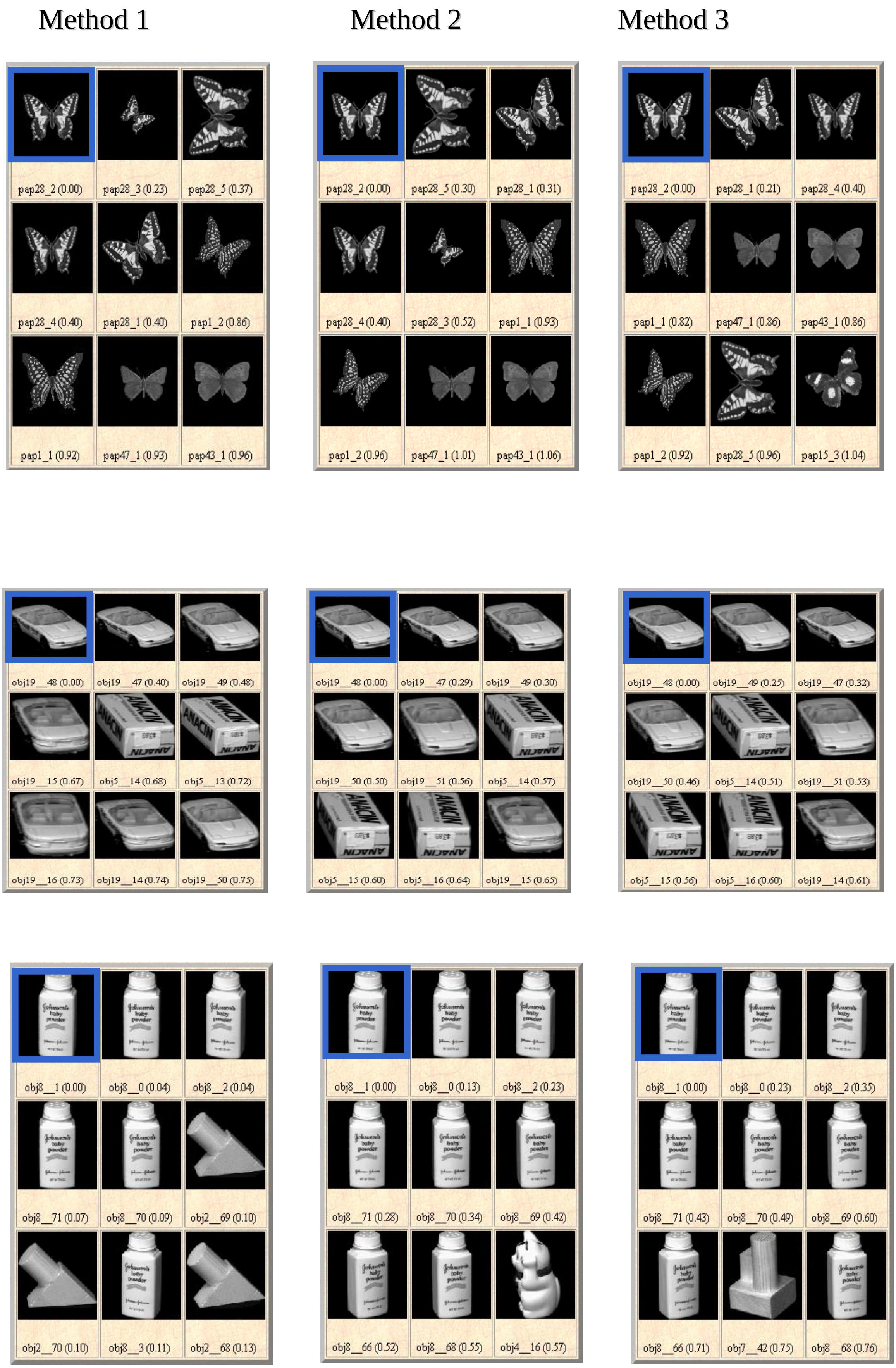

**Figure 7.b : Hausdorff distance according to the number of normalised points**

## 8 Indexing of image data basis Application

Here, the result in different images of the called invariant local descriptors



**Some Results for indexing image data basis with gray level descriptors under similarities**


Method 1
Method 2
Method 3
pap28_2 (0.00) pap28_3 (0.23) pap28_5 (0.37)
pap28_4 (0.40) pap28_1 (0.40) pap1_2 (0.86)
pap1_1 (0.92) pap47_1 (0.93) pap43_1 (0.96)
pap28_2 (0.00) pap28_5 (0.30) pap28_1 (0.31)
pap28_4 (0.40) pap28_3 (0.52) pap1_1 (0.93)
pap1_2 (0.96) pap47_1 (1.01) pap43_1 (1.06)
pap28_2 (0.00) pap28_1 (0.21) pap28_4 (0.40)
pap1_1 (0.82) pap47_1 (0.86) pap43_1 (0.86)
pap1_2 (0.92) pap28_5 (0.96) pap15_3 (1.04)
obj19__48 (0.00) obj19__47 (0.40) obj19__49 (0.48)
obj19__15 (0.67) obj5__14 (0.68) obj5__13 (0.72)
obj19__16 (0.73) obj19__14 (0.74) obj19__50 (0.75)
obj19__48 (0.00) obj19__47 (0.29) obj19__49 (0.30)
obj19__50 (0.50) obj19__51 (0.56) obj5__14 (0.57)
obj5__15 (0.60) obj5__16 (0.64) obj19__15 (0.65)
obj19__48 (0.00) obj19__49 (0.25) obj19__47 (0.32)
obj19__50 (0.46) obj5__14 (0.51) obj19__51 (0.53)
obj5__15 (0.56) obj5__16 (0.60) obj19__14 (0.61)
obj8__1 (0.00) obj8__0 (0.04) obj8__2 (0.04)
obj8__71 (0.07) obj8__70 (0.09) obj2__69 (0.10)
obj2__70 (0.10) obj8__3 (0.11) obj2__68 (0.13)
obj8__1 (0.00) obj8__0 (0.13) obj8__2 (0.23)
obj8__71 (0.28) obj8__70 (0.34) obj8__69 (0.42)
obj8__66 (0.52) obj8__68 (0.55) obj4__16 (0.57)
obj8__1 (0.00) obj8__0 (0.23) obj8__2 (0.35)
obj8__71 (0.43) obj8__70 (0.49) obj8__69 (0.60)
obj8__66 (0.71) obj7__42 (0.75) obj8__68 (0.76)

## 9 CONCLUSION

The mathematical formulation presented has been applied to coding, in the planar closed contour case, with a rigid motion (Euclidean motion). The generalisation to the affine case would be very useful for such an application and more efficient than Euclidean case. So, it is thought to be a good approximation for the 3D-dimensional rigid motion for planar objects. It can also offer a model of the 3D dimensional planar contour displacements. The disadvantage comes from the fact that the parameter estimation is not unique since SL(2,R) is not compact. The grey level case can be solved, too. The orientation of our future work will concern the planar grey level object compensation with a rigid movement assumption as well as the planar affine contours animated with a general rigid 3D motion. Three-dimensional grey level object movement estimation can also be treated with such an approach. However, Completeness is not verified at the moment, which is important for the coding applications since object reconstruction are not possible. 3D Surface object case is a complex problem because of the non existence of a general parametrization.
The more complex movement estimation problem remains the projective 3D grey level object one. In this case, the Harmonic analysis approach seems suitable to formulate the problem but the theoretical solution needs the determination of all the unitary and irreducible representations of the group SL(2,R).

Recent developments in digital image basis indexing which offer new perspectives to the image invariant representations application has been also described in our paper.

**Acknowledgements**

The author expresses his thanks to *Gérard Eude* for his encouragement and to *France Telecom Recherche et Développement* for having financially supported this work.

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# Minimal Representations: From Group Theory to Applications in Information Technology

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## 1 ABSTRACT

Increasing abundance in available information has brought together the problems of storing, analyzing, and transmitting exorbitant amount of data. Most often than not, the data under consideration is a digitized representation of a composition or a system. Since the same composition or system can be digitized through different representations, research on which representations yield the maximum amount of information in the least amount of storage has been eminent. On the other hand, efficient and effective representation of complex systems had also been a major problem faced by the particle physicists in the early twentieth century. These pioneers found tremendous help through the application and development of the Group Theory. Quite surprisingly, most of the recent algorithms for analyzing and compressing information pertaining to complex physical systems find very elegant interpretations when inspected through a group theoretical perspective. The most striking examples to this might be the implementation of the Fast Fourier Transform and the Fast Multipole Method.

The aim of this exposition is to highlight the key role played by contemporary applied mathematics education in gaining the upper hand in information technologies. Basic notions in group theory will be introduced very briefly in order to facilitate a common ground for the wide range of application examples that will be presented.

## 2 THE NEED FOR GOOD ALGORITHMS: COMPLEXITY

Almost all the information technology (IT) is based on storing, transmitting, and processing of data in various forms. All these processes are performed through the application of algorithms. Most of the times there exist many algorithms for performing the same task and a criterion for differentiating “good” algorithms from “bad” ones is necessary. Criteria such as “minimal processing time” or “minimal storage space” are at best short sighted since an algorithm that performs well for the current demand might perform poorly for an increased demand in the future. Considering the fast rate of development in the IT, “low complexity” has become the determining feature of a “good” algorithm. Here, complexity refers to the trend in resource (time or memory) usage as the amount of processed data tends to infinity. For example, consider two algorithms for processing $N$ units of data. The first algorithm uses $2N^2+3N$ units of computation time while the second one uses $50\,N \log N + 1000N$ units; hence the respective computational complexities of the algorithms are $O(N^2)$, i.e. “order $N^2$”, and $O(N \log N)$. Figure 1 shows how much time each of these algorithms use for different $N$ assuming a 1 ms unit computation time. Clearly, for $N < 1000$ the $O(N^2)$ algorithm seems more advantageous to use but for larger $N$ the $O(N \log N)$ algorithm outperforms the other one.

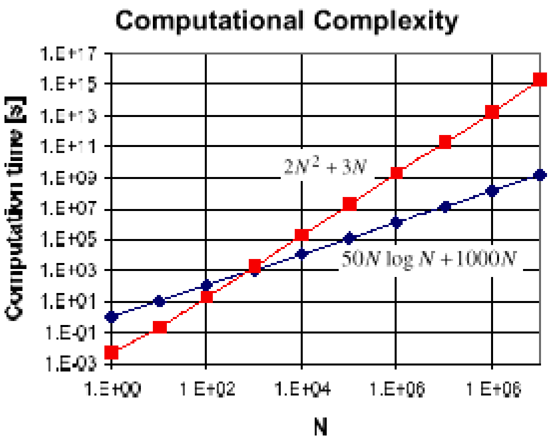


**Figure 1. Computational complexities of two algorithms.**

Although the previous example provides a notion of what a low complexity algorithm is, the question of how to obtain such algorithms still remains. A tremendous amount of research has produced low complexity algorithms in many areas encompassing image and signal processing, compression, simulation of physical phenomena, telecommunications, etc. However, most of these algorithms were produced by observing and eliminating redundancies in current algorithms and a systematic way of reducing the complexity of a given algorithm has not yet been formulated. On the other hand, the similarities between the low complexity algorithms—in terms of both the anatomy and efficiency—suggest the existence of an underlying theory. Some recent publications [1-5] indicate that the group theory provides a common ground where a formalism for developing fast algorithms can be established. Furthermore, since group theory is a well-developed branch of mathematics, if the function of an algorithm can be formulated within the framework of group theory it provides the tools to explore whether there exists a reduced complexity algorithm to accomplish the same task or not. And if there exists such an algorithm, group theory helps find it.

## 3 HOW GROUP THEORY HELPS

"Group theory can be considered the study of symmetry: the collection of symmetries of some object preserving some of its structure forms a group; in some sense all groups arise this way." [6] Since it deals with similarities, equivalences, and transformations, group theory might be viewed as the branch of mathematics that deals with classification, representations, and in a sense identification of redundancies. In this section a couple of examples that demonstrate how a group theoretic perspective helps in producing low complexity algorithms will be provided. In particular the first example can be viewed as a fast Fourier transform (FFT) algorithm that is an indispensable part of most algorithms used in IT today. This form of FFT which is also known as Walsh-Hadamard transform is due to statistician and design theorist Yates [7] and will be explained through a toy example similar to that of Maslen and Rockmore [8]. The second example is what is known as the fast multipole method (FMM) [9-11] that has become an integral part of many numerical simulation software in engineering and applied physics. The reasons for selecting these examples are (*i*) that they are the first of their kind in their respective fields, (*ii*) that they are amenable to simple group theoretical interpretation, and (*iii*) they relate to problems of practical value. Before going into more detail it should be emphasized once more that the aim of the present study is not to teach group theory or specific applications but to outline the group theoretical trend in efficient algorithm design.

**3.1 Efficient Analysis of Statistical Data**

Problems of $N = 2^{\kappa}$ -factorial designs are encountered in statistical analysis of data. For example if a system administrator wants to analyze the effects of day/night, holidays, and weather on the number of users connected to his server he has to first collect data for $2^3$ =8 sets of conditions. The data he collects may be summarized in Table 1, where the average number of users is reported for each set of conditions. In the first column (d), a (+) indicates "day" and a (-) indicates "night." In the second column (h), a (+) indicates a weekend or holiday, and in the third column (w), a (+) indicates "good weather."

**Table 1. Average number of users w.r.t. day/night, holiday, and weather conditions.**

| *d* | *h* | *w* | $u_{dhw}$ |
|---|---|---|---|
| + | + | + | 59 |
| - | + | + | 64 |
| + | - | + | 83 |
| - | - | + | 62 |
| + | + | - | 96 |
| - | + | - | 62 |
| + | - | - | 58 |
| - | - | - | 75 |

Certain figures of statistical value can be extracted from the data of Table 1. For example, what might be called as the zeroth order effect is the grand mean $\mu_{gr} \propto$ or the total average number of users. This is the expected number of users disregarding

$$\mu_{gr} = \frac{1}{8} \sum_{\{d,h,w\} \in \{+,-\}} u_{dhw} .$$

any effects of parameters considered, and it is calculated as

The next quantity of interest is the pure first order effect: the effect of a single parameter disregarding the variations in the other parameters. For example, the first

$$\mu_w = \frac{1}{4}[u_{+++} + u_{-++} + u_{+-+} + u_{--+}] - \frac{1}{4}[u_{++-} + u_{-+-} + u_{+--} + u_{---}].$$

order effect of good weather can be obtained as

Continuing in this fashion, the second and third order effects can also be defined and all effects can be computed by performing the following matrix-vector multiplication.

$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 & 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 & 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 & 1 & -1 & -1 & 1 \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 \\ 1 & -1 & 1 & -1 & -1 & 1 & -1 & 1 \\ 1 & 1 & -1 & -1 & -1 & -1 & 1 & 1 \\ 1 & -1 & -1 & 1 & -1 & 1 & 1 & -1 \end{bmatrix} \begin{bmatrix} u_{+++} \\ u_{-++} \\ u_{+-+} \\ u_{--+} \\ u_{++-} \\ u_{-+-} \\ u_{+--} \\ u_{---} \end{bmatrix} = \begin{bmatrix} 8\mu_{gr} \\ 4\mu_d \\ 4\mu_h \\ 4\mu_{dh} \\ 4\mu_w \\ 4\mu_{dw} \\ 4\mu_{hw} \\ 4\mu_{dhw} \end{bmatrix}.$$

Performing this multiplication directly requires $N^2 = (2^\kappa)^2 = 64$ operations. However, Yates [7] came up with a way to perform this multiplication in $3.2^k.k = 3N\log N$ operations. Let us provide the group theoretical perspective on his algorithm, derivation of which would be a mystery otherwise. The above matrix-vector multiplication can be interpreted as the projection of the data vector onto a set of orthogonal basis functions. In this case, each basis function formed by each row of the matrix on the left-hand side has a physical meaning. What is more special is that the bases in this case are the bases of characters (one-dimensional representations in this $k = 3$ dimensional problem). Hence, the right-hand side is the Fourier transform of the data vector. Let us denote the Fourier transform matrix for a $k$ dimensional problem as $H_k$ , e.g. the above matrix is $H_3$ and

$$H_1 = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}.$$

From group theory it is known that any character of a $k$ dimensional group can be written as the tensor products of the characters of the 1 dimensional group. Therefore, $H_3 = H_1 \otimes H_1 \otimes$ $H1$ and it has the following factorization

$$H_3 = [I_4 \otimes H_1] \cdot [I_2 \otimes H_1 \otimes I_2] \cdot [H_1 \otimes I_4],$$

where $1_k$ is the $k$ dimensional identity matrix and $\otimes$ is the usual tensor product. In long form the above formula reads

$$H_3 = \begin{bmatrix} 1 & 1 & & & & & & \\ 1 & -1 & & & & & & \\ & & 1 & 1 & & & & \\ & & 1 & -1 & & & & \\ & & & & 1 & 1 & & \\ & & & & 1 & -1 & & \\ & & & & & & 1 & 1 \\ & & & & & & 1 & -1 \end{bmatrix} \cdot \begin{bmatrix} 1 & & 1 & & & & & \\ & 1 & & 1 & & & & \\ 1 & & -1 & & & & & \\ & 1 & & -1 & & & & \\ & & & & 1 & & 1 & \\ & & & & & 1 & & 1 \\ & & & & 1 & & -1 & \\ & & & & & 1 & & -1 \end{bmatrix}$$

$$\cdot \begin{bmatrix} 1 & & & & 1 & & & \\ & 1 & & & & 1 & & \\ & & 1 & & & & 1 & \\ & & & 1 & & & & 1 \\ 1 & & & & 1 & & & \\ & 1 & & & & -1 & & \\ & & 1 & & & & 1 & \\ & & & 1 & & & & -1 \end{bmatrix}.$$

Note that in the above decomposition there are $k$ matrices each with $O(2^k)$ non-zero elements and that multiplication of these matrices with a given data vector can be performed in $O(2^k .k) = O(N \log N)$ operations. Note that without resorting to group theory, how to obtain the above sparse decomposition would be a mystery.

### 3.2 The Fast Multipole Method

It should be evident from the previous example that reducing the computational complexity of an algorithm can be accomplished in two steps in general. In the first step, the function of the algorithm must be represented in matrix form. The dimension of the matrix representation is arbitrary and group theory even supports infinite dimensional representations. In the second step, the matrix representation is expressed in a different set of bases through a similarity transform, which is found through a group theoretical analysis. The point of changing bases is to find the minimal representation for the mapping at hand. The new set of bases usually turns out to have a physical meaning in practical applications. In the previous example the new set of basis were the first, second, and third order statistical variances. In the present example the basis will turn out to be plane waves which are the fundamental solutions to the wave equation that the matrix represents. In any case, without proper group theoretical interpretation, one has to be armed with a deep understanding of the problem at hand together with good linear algebra skills to come up with a minimal representation. Let’s demonstrate this through the example of **FMM**.

The starting point for FMM is the discretized version of an integral equation that is intimately related to the wave equation. This discretized equation is written in matrix form as

$$\mathbf{V}_{N\times 1} = \mathbf{Z}_{N\times N} \cdot \mathbf{I}_{N\times 1},$$

where the $\mathbf{I}_{N\times 1}$ vector represents the sources of the wave field. Multiplying the source vector with the interaction matrix $\mathbf{Z}_{N\times N}$ yields the field values $\mathbf{V}_{N\times 1}$ at selected points in space. Due to the nature of the wave fields, the interaction matrix is a full matrix with $N^2$ nonzero elements and, again, performing the matrix-vector product in the above equation is an $O(N^2)$ process. This process is illustrated through the graph in Figure 2(a) where each node on the periphery of the circle represents both a source point and a field observation point and the lines represent the elements of the interaction matrix. For the sake of illustration only $4N$ interactions are shown in Figure 2(a).

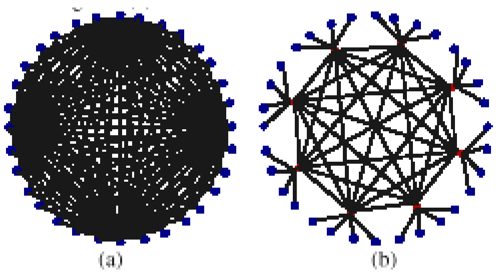

**Figure 2. Graphs of interactions for the discretized wave equation.**

The idea of the FMM is to divide the interaction matrix into two parts

$$\begin{aligned}\mathbf{Z} &= \mathbf{Z}_{nf} + \mathbf{Z}_{ff} \\ &= \mathbf{Z}_{nf} + \mathbf{T}^{-1}\overline{\mathbf{Z}}_{ff}\mathbf{T}.\end{aligned}$$

The first part $\mathbf{Z}_{nf}$ represents the interaction between only the nearby source-field points and has $O(N)$ nonzero elements and the rest of the interactions are represented as $\mathbf{Z}_{ff}$. This way of splitting the interaction matrix is tantamount to grouping nearby source and observation points together as illustrated in Figure 2(b). In this figure the interactions represented by $\mathbf{Z}_{nf}$ are those that belong to the same group. A change of bases represented by the transformation matrix $\mathbf{T}$ produces the required sparse minimal representation for the interactions between far away source and observation groups (the lines between the groups in Figure 2(b)). The interaction submatrix $\mathbf{Z}_{ff}$ that represents the interactions between two far away groups can be transformed into a diagonal matrix as illustrated in Figure 3(a) where nonzero matrix elements are denoted with an “x” mark. Although nothing seems to be gained at first glance, two points prove the contrary. First, the transformation matrix $\mathbf{T}'$ is nothing more than a discrete Fourier transform and therefore can be implemented efficiently as an **FFT**. Second, even if the multiplication of $\mathbf{T}'$ cannot be implemented efficiently, the structure of the whole $\mathbf{Z}_{ff}$ turns out to be as illustrated in Figure 3(b) where each shaded submatrix comes from decompositions as in Figure 3(a). Obviously a sparse representation of the interaction matrix has been obtained through this process. More specifically, a careful study shows that there are $O(N^{1.5})$ elements in the $\mathbf{Z}_{ff}$ matrix and $O(N)$ elements in the $\mathbf{T}$ matrices. Hence the cost of the matrix-vector multiplication has been reduced to $O(N^{1.5})$ through a change of bases. The idea of grouping may be taken further by agglomerating nearby groups to form larger groups at higher levels as illustrated in Figure 4. The complexity of the resulting algorithm can be shown to be $O(N \log N)$

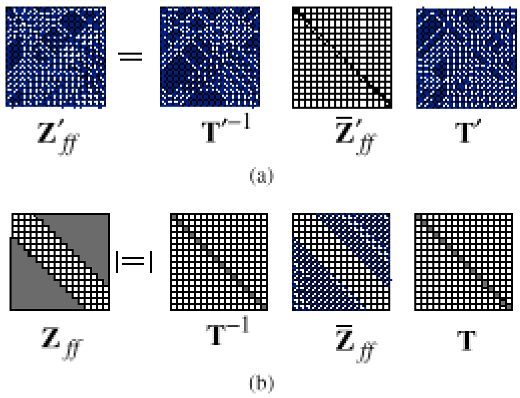


**Figure 3. Sparsity of the far interaction matrices (a) for two far interaction groups (b) for the whole interaction matrix.**

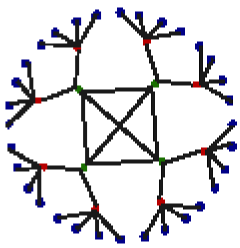

**Figure 4. Graph of interactions for the multilevel case.**

Coming back to the point of going through this exercise; the FMM method can be obtained in two ways. Either by studying the physical principles of wave propagation together with a good understanding of underlying algebra, or by approaching the problem from a group theoretical point of view and trying to find a minimal representation of the original interaction matrix. The second way seems to be more methodological with an added benefit of being able to come up with more than one sparse decomposition with the same complexities. Indeed, several researchers have arrived at different methods with similar complexities each of which might be classified as a different decomposition in group theory [12-15].

## 4 FACTS AND FUTURE TRENDS

The presented examples demonstrate several facts and trends, and suggest hints for stratigical planning to take place among the IT providers:

1) There is considerable amount of research focused on producing highly efficient low complexity algorithms to process (and store) data.
2) These algorithms have a direct impact on the IT market.

3) Low complexity algorithms used to be constructed by researchers that were very specialized in their respective fields, e.g. telecommunications, signal processing, computational and applied physics, etc. However, the current trend is to find a unifying theory, which seems to be converging towards the group (representation) theory.
4) The leading IT providers of the future will be those that incubate multidiciplinary pupils with a good grasp of contemporary mathematics.

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# Agents Technology and Applications

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## 1 ABSTRACT

This paper describes the new promising technology of agents its application. In the first half of this paper, we present a background about the history of agents technology. Then, we present all definitions of agents as described by the top researchers in this field. We end this half by describing Multiagent Systems (MAS) and its relevance to Distributed Artificial Intelligence (DAI) and comparing it to Distributed Problem Solving (DPS). In the second half, we present some current application of agents technology such as NASA's space probes (Deep Space-1) and other Internet applications. In addition, we suggest some future agents applications such as query agents and collective store database. Then, we describe the world of agents and all of its components that are needed in order to build more powerful agents systems. We conclude this paper by speculating about a more sociable Web as a result of the agents' behavior such as cooperation and benevolence.

## 2 BACKGROUND

Nwana and Ndumu stated that the history of agents goes back to the early days of Artificial Intelligence (AI). Hewitt's concurrent actor model [Hewitt 1977] was the first agent system. In his model, he proposed a "self-contained, interactive, and concurrentlyexecuting" object that he called "actor." Each actor had an internal state and was able to respond to messages received from other actors [Nwana and Ndumu 1997].

Research on agents can be divided into two eras: 1977 – 1990 and 1990 – present day. During the first period, study was focused on deliberative agents and macro level aspects of the agency. The macro level topics included interaction, communication, task distribution, coordination, and co-operation between agents. These macro issues focused on the society of agents rather than the individual agents. Gasser, Huhns, and Chaib-draa are some of the pioneers of this period [Nwana and Ndumu 1997]. The second period consists of two main areas of research. The first area is research and development of agent theories, architecture, and languages. Wooldridge and Jennings accomplished significant research in this area. The second area is extending the typology of agents [Nwana and Ndumu 1997].

## 3 DEFINITIONS OF AGENTS

Starting in the seventies, DAI researchers focused on agents as computational "entities" that interact with each other to solve distributed problems [Huhns and Singh 1998]. Wooldridge and Jennings defined AI as the sub-field of computer science that builds and maintains intelligent agents. In other words, agents are "central" to AI [Wooldridge and Jennings 1995].

Nwana and Wooldridge stated that agent technology is the most "rapidly" growing area in the world of computer science. But, there is no agreement among the researchers on what is an agent [Nwana and Wooldridge 1997]. The following are some definitions of agents:

Nwana and Ndumu defined agent as “a component of software and/or hardware which is capable of acting exactingly in order to accomplish tasks on behalf of its user” [Nwana and Ndumu 1997].

Huhns and Singh defined agents as “active, persistent (software) components that perceive, reason, act, and communicate” [Huhns and Singh 1998].

Wooldridge and Jennings presented two definitions of agents, weak and strong. The weak definition is “agent is a hardware or (more usually) software-based computer system that enjoys the following properties: autonomy, social ability, reactivity, and pro-activeness.” The stronger definition includes the properties of the weak definition plus concepts that are used in humans such as emotions [Wooldridge and Jennings 1995].

# 4 DISTRIBUTED ARTIFICIAL INTELLIGENCE AND MULTIAGENT SYSTEMS

Bond and Gasser defined Distributed Artificial Intelligence (DAI) as “the sub field of AI concerned with concurrency in AI computations.” The science of DAI is divided into two major strands, Distributed Problem Solving (DPS) and Multiagent systems (MAS). DPS deals with how to solve a problem using a number of “modules” that divide labor and share knowledge in order to solve the problem in hand. In MAS, autonomous agents co-ordinate their skills, knowledge, goals, and plans to solve a global problem. In addition to solving the global goal, the agents in MAS may work toward achieving their own individual goals. The main difference between DPS and MAS is that in MAS can be an open system where there is no global control. In other words, MAS can be either a centralised or decentralised system, where DPS can only be a centralised system [Bond and Gasser 1988].

Due to the rise of computer networks, agents' performance is better if agents operate as group than independently. The multiagent environment is usually open, decentralised, and contains autonomous agents [Huhns and Stephens 1999]. In addition, Huhns and Singh believe that agents are better "developed" in a multiagent system than in isolation [Huhns and Singh 1998]. Moreover, Huhns and Stephens believe that multiagent systems are the best way to build distributed computational systems [Huhns and Stephens 1999].

# 5 AGENTS APPLICATIONS

## 5.1 Space Probes' Agents (NASA)

NASA is adding autonomous agents aboard their space probes. Since the space probes travel long distances in the outer space, it is very costly to try to control every operation of these probes. In addition, in case of unexpected events, quick decisions are needed. Given the fact that these probes are so deep in space, it will take a crew on earth a long time to respond to those events. Thus, having autonomous agents will solve the cost and the speed problem. For example, Deep Space 1 (DS1) is carrying autonomous agents on board.

## 5.2 Operating System Agents

Software agents could play major roles in managing operating systems. For example, an agent could clean up stalled or failed transactions. Another agent could close sockets that were left open by a process that terminated early. Also, an agent could remove locks set by failed or former processes. When agents do not have either the authority or ability to take action, they can simply provide notifications to other agents or systems that do.

### 5.3 Query Agents

How long it takes you to find a specific piece of information on the Internet? For example, how long it takes to find all the florists in Dubai, United Arab Emirates, that sells roses bouquet for the less than AED 60. The answer is…. a long time! This is a very time consuming operation and expensive, especially if the user is on mobile unit. Thus, the need for an agent that surfs the net and comes back with an answer is very much in demand. Smart agents should take the user query and find all possible answers to it. Such an agent is called query agent. Thus, a query agent is an agent that searches the Web to find an answer to a user's request, and in so doing it may visit many sites and databases.

Moreover, when asked, a query agent, co-operative or benevolent agent, would freely share its query results with other agents on the Web, even though it may have consumed substantial resources to get this knowledge and might have to consume more to share it. Through one agent's benevolence, other agents charged with similar queries would not have to explore all the sites or databases the first explored: they can simply use its results. Thus, benevolent agents can help reduce Internet traffic, leading to faster Web processing for all [Huhns and Mohamed 1999].

### 5.4 Collective Store Database

Parisi, Pedone, and Cecconi discuss the ideas of individual survival strategies (ISS) and social survival strategies (SSS). Social survival strategy employs a collective store (CS) to which all individuals in a group contribute some of their resources. The collective store in turn redistributes the resources to group members by some allocation criteria or converts the resources into something new. Resources may include essential provisions, money, or knowledge—or CPU time and data storage space. Through simulations, the researchers concluded that a group using a collective store could survive severe environmental conditions, while individuals without a collective store would perish. In addition, the raw resources that individuals contributed could be transformed into new resources that no single individual could produce [Cecconi and Parisi 1998] [Parisi 1997] [Pedone and Parisi 1997].

The collective store could be implemented as a large database of query results and information, see Figure 1. Moreover, query agents, co-operative or benevolent agents, contribute their search result to this collective store database. When heavy Internet traffic degrades the search environment, the collective store database could help those agents seeking information on the Web. This is the basis for Internet search services such as Excite, Lycos, and AltaVista, except that users do not have to contribute anything in exchange for using these services. However, agents making greater contributions to a collective store might be given higher priorities in the subsequent use of the store. The collective store could refine the data submitted by different agents and derive new results through data mining techniques. Moreover, a collective store can gather data from agents that have better Web access capabilities and redistribute them to those with poorer capabilities, such as low-bandwidth PDAs [Huhns and Mohamed 1999].

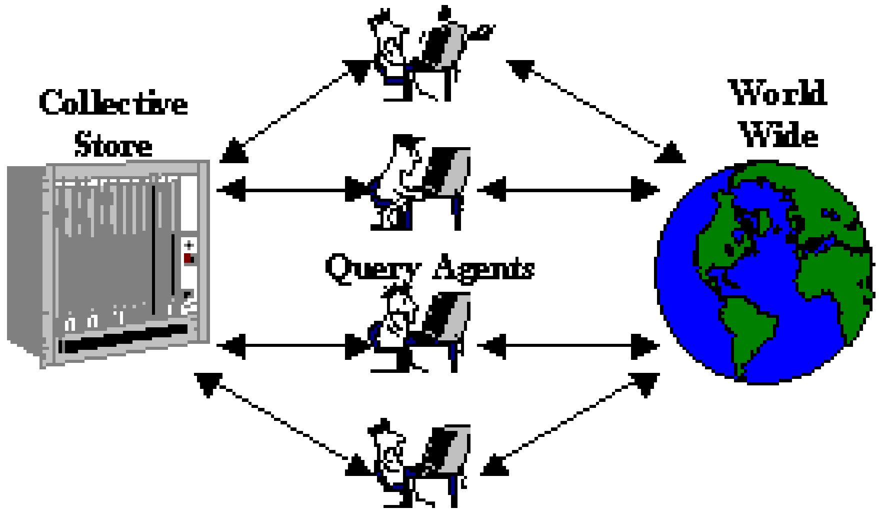


**Figure 1. Collective Store Database**

## 6 WORLDS OF AGENTS

In order to determine the usefulness agents in a given system, we need to study an analysis the following properties:

- The agent's domain type;
- The agent's structure;
- The agent's characteristics;
- The environment properties;
- The performance measures of the system;

### 6.1 Agents' Domains

Agents coexist in multiagent systems. They interact with each other in different manners and in different environments. Agents' encounters vary from one domain to another. Rosenschein and Zlotkin classified agents' domains into three different types: Task Oriented Domains, State Oriented Domains, and Worth Oriented Domains [Rosenschein and Zlotkin 1994].

### *6.1.1 Task Oriented Domains (TOD)*

*Task Oriented Domain* (TOD) is a domain in which agents have sets of tasks to perform, and they exchange some tasks that can benefit both agents. TOD does not consider the side effects of the actions. Postmen domain is one of the examples of TOD. In the Postmen domain, agents have to deliver letters, and after delivering all letters, they must return back to the post office. There is no limit on the number of letters the Postmen can carry or the number of letters that can fit in one mailbox. Also, there is no cost to exchange letters between agents while they are still at the post office. Thus, agents' actions have no effects on the common resources. For example, when an agent delivers its letters to mailboxes, it does not affect the other agents since it will not fill up the mailboxes [Rosenschein and Zlotkin 1994].

### *6.1.2 State Oriented Domains (SOD)*

*State Oriented Domain* (SOD) contains more multiagent interactions than TOD. In fact, TOD is a subset of SOD. In SOD, side effects are considered. One agent's action can have positive or negative effects on other agents' goals. An agent action may help others reach their goals or may prevent them [Rosenschein and Zlotkin 1994].

SOD contains agents that coexist in an environment, and where each individual agent has goals to reach. A goal is a state that the agent tries to reach from its current state by going through some sequence of states. For example, a person has a goal to reach his work on time. The initial state is to wakeup, followed by some sequence of states such as taking a shower, eating breakfast, getting dressed, driving the car or taking the bus, etc. The final state, which is to be at work on time, is the goal state. If the person arrives at work late, then he did not achieve his goal, he only achieved part of his goal, to be at work. Thus, any goal in SOD is described by a set of states that leads to the final state [Rosenschein and Zlotkin 1994].

Let us extend the above example to consider that both the man and his wife wants to get to work on time and they only have one car. If the only one of them exists, then that person will take the car, which will lead to the "optimal" plan to reach the goal. However, both exist, and they have to help each other to coexist. One solution is that the man drives his wife to work first, and then takes the car to his work. The man has to take extra effort to compensate for the existence of the wife, but he will still be able to reach his own goal. That extra effort is due to the commitment between the husband and wife [Rosenschein and Zlotkin 1994]. In multiagent systems, similar commitments exit such as social duty and group welfare. There is a cost associated with taking actions that benefit other agents, but how much the agent is willing to sacrifice determines the strength of its commitment to its multiagent system.

In SOD, the goal is "fixed, pre-determined, set of states." At the end, the agent either reaches its goal state or not. There is no such thing as "partially" accomplished goals in SOD. In the next sections, we will see that "partially" accomplished goals can exist in worth-oriented domains. In addition, all states in a SOD are finite. The set of states can be a finite set or an infinite set where the states can be determined by some formula in first-order logic [Rosenschein and Zlotkin 1994].

### *6.1.3 Worth Oriented Domains (WOD)*

Goals in both the TOD and SOD are "fixed," either reach the whole goal or not, "partial" goals do not exist. Where in *Worth Oriented Domain* (WOD), goals are "relaxed" and can "partially" accomplished. WOD is a generalisation of SOD where each state has a worth value associated with it. In SOD, goals are described by final states that agents like to reach. On the other hand, WOD describe goals as a worth function of all reachable final states. The final state with the highest worth value is the complete goal where the other states with the lower worth values are the partial goals. In addition to considering the worth values, agents also take into account the cost of reaching each final state and pick the best combination based on its preference of the state's worth and cost (agent's utility functions). The worth function depends mostly on the domain of the multiagent system. The multiagent system's designer chooses the appropriate worth function based on the environment where agents operate. The following are some methods for designing worth function [Rosenschein and Zlotkin 1994].

#### *6.1.3.1 Subgoals Set*

Values are assigned for each subgoal, and the state that includes the most subgoals is the one that gets the highest worth value. In other words, the less the number of subgoals a state has, the less the worth value for that state. An example of this type is the multiagent Tileworld. In the Tileworld, the goal for each agent is to fill as many holes as possible, which makes filling each hole a subgoal. Each hole has different values, and the worth of the goal for each agent is the sum of all the holes value that it can fill. The agent utility is the worth minus the cost to reach the final goal state [Rosenschein and Zlotkin 1994].

#### *6.1.3.2 Distance between States*

The goal state is the "ideal" state that agents try to reach, but not all agents reach that state. Some agents reach states that are close to the "ideal" goal state, which make them "partially" satisfied. The closer the final state to the "ideal" states is what determines how successful agents are in reaching their goals and vice versa. The satisfactory distance depends on the application and is usually set by the multiagent system designer. The truck delivery domain is a good example of this type of WOD [Rosenschein and Zlotkin 1994].

## 6.2 Agents' Structure

Russell and Norvig define an agent as anything that can perceive from its environment and act on that environment accordingly. The mapping between the perception and the action is what defines the agent's structure. They classified agent's structures into four types: simple reflex agent, reflex agent with internal state, goal-based agent, and utility-based agent structure [Russell and Norvig 1995].

### *6.2.1 Simple Reflex Agent Structure*

The simple reflex agent senses the environment and uses its perception to build a description of the current state of the world (environment). Then, the agent uses its rule-based knowledge to take the appropriate action to cope with the changes in the environment. The agent's rule-based knowledge consists of sets of simple condition-action rules from which the agent fires the first rule that matches the current description of the environment. Therefore, the reflex agent response to percepts is fast [Russell and Norvig 1995].

### *6.2.2 Reflex Agent with Internal State Structure*

The reflex agent with an internal state builds a description of the current state of the world by using both its perception of the environment and its previous internal state.

This agent updates its internal state continuously by using two methods. One method is by maintaining records of how the world evolves. The other method is by assessing the effects of the agent's action on the environment [Russell and Norvig 1995].

### *6.2.3 Goal-based Agent Structure*

The goal-based agent builds its description of the world using its perception of the environment and from its internal state. The main difference between this agent and the previous ones is the agent's goals. These goals are some states that the agent wants to reach. To reach these goals, the agent has to do some searching and planning. This decision-making mechanism is different than the condition-action rules mechanism that the reflex agent uses. In order to make the right decision on an action, the goal-based agent asks itself two questions: "What will happen if I do such-and-such?" and "Will that make me happy?" In addition, the goal-based agents are more flexible when facing new conditions than the reflex agent [Russell and Norvig 1995].

### *6.2.4 Utility-based Agent Structure*

The utility-based agent is a goal-based agent that uses a utility function to evaluate its goals. The utility-based agent is better than the goal-based agent in two cases. When there are conflicting goals and only some could be reached, the utility function of the agent helps to describe the trade-off of these goals. The second case is when there is more than one goal, and the agent is not sure that it can accomplish any of them; the utility function helps to weigh the likelihood of reaching a goal against its importance. In addition, the utility function helps the agent to make a rational decision. Thus, a rational agent is the agent that owns a utility function [Russell and Norvig 1995].

### 6.3 Characteristics of Agents

Agents can exist alone or in a society of agents (MAS). Each agent in MAS has a list of goals or tasks that it will attempt to accomplish. Similarly, a MAS has a list of global goals that it will strive to achieve where each member agent contributes some effort toward reaching the MAS's global goals. The agents' contribution to their MAS is controlled by their behaviour such as co-operation, altruism, friendliness, and benevolence. In addition, agents' interactions with each other are determined by their characteristics. Some of these behaviours and characteristics are:

- Autonomy;
- Independent: agent exercises control over its own actions;
- Controlled: agent exercises under external restraints or influences;
- Rationality: agent acts with well-directed intentions and does the right things;
- Sociability;
- Altruistic: agent acts regardful of others benefits, and is unselfish;
- Egoistic: agent acts with excessive thoughts of self and self-loving;
- Friendliness;
- Co-operative: agent operates jointly with the others to achieve the same goal;
- Competitive: agent competes against the other agents;
- Cognition;
- Reactive (sensing and acting): agent responds in a timely fashion to changes in the environment;
- Deliberative: agent examines and discusses reasons for and against taking actions responding to changes in the environment;

- Adaptability;
- Teachable: agent is capable of being taught;
- Self-learning: agent changes its behaviour based on its previous experience;
- Mobility;
- Stationary: agent does not move;
- Itinerant: agent travels from one place to another;
- Locality;
- Local: agent operates on local machines;
- Remote: agent operates on remote machines;

### *6.3.1 Example of Cooperative agents*

Lets take for example co-operative agents. Agents can be co-operative on the web and help each other search for information that will greatly reduce the traffic on the Internet, thereby benefiting everyone. The following situation might occur on the web. Agent *x* asks agent *z* about a piece of information, but agent *z* does not know the answer. Later, agent *y* asks agent *z* the same question, but agent *z* still does not know the answer. If agent *z* is a co-operative agent, then it will inform agent *y* that agent *x* was asking the same exact question, and agent *y* should go and ask agent *x*, because agent *x* most likely found the answer by now. This will save agent *y* a lot of time and reduce the traffic on the net. This example demonstrates the power of co-operation between agents.

## 6.4 Environment Properties

If an agent perceives the changes in its environment, then, it takes the appropriate actions in order to cope with these changes and the new environment. The design of an agent is highly dependant on the type of the environment that the agent will exist in. The following section will describe the different types of environments.

### *6.4.1 Accessible vs. Inaccessible*

An environment is accessible if the agent can sense everything in the environment. This is important for the agent in order to avoid keeping track of the world and having to keep an internal state for that purpose [Russell and Norvig 1995].

### *6.4.2 Deterministic vs. Nondeterministic*

A deterministic environment is the environment where the next state of the environment is fully determined by the current state of the environment and the actions taken by its agents [Russell and Norvig 1995].

### *6.4.3 Episodic vs. Nonepisodic*

In an episodic environment, the agent's precept and action forms one episode. Each of the agent's actions depends only on its current episode. The agent's actions taken in previous episodes do not influence its decision in taking actions in the subsequent episodes. One of the advantages of the episodic environment is that the agent does not have to think about its future actions. Thus, the episodic environment is "simpler" than the nonepisodic environment [Russell and Norvig 1995].

### *6.4.4 Static vs. Dynamic*

In the dynamic environment, the environment changes while the agent is deciding on an action to take. On the other hand, the static environment does not change while the agent is "deliberating." Therefore, the static environment is simpler for the agent, since the agent does not need to keep checking the environment while thinking about the right action to take. In the Semi-dynamic environment, there are no changes in the environment, but there is a change in the score of the agent's performance [Russell and Norvig 1995].

### *6.4.5 Discrete vs. Continuous*

In the discrete environment, the entire agent's perceptions and actions are clearly defined and fixed, where in the continuous environment they are not. An example of a discrete environment is the game of chess because all possible moves are clearly known [Russell and Norvig 1995].

## 6.5 Performance Measures

Performance measures are used to determine how and when an agent is successful. These performance measures differ from one agent to another. The designer of the multiagent system chooses the appropriate performance measure of the agent based on the agent's role in that environment. For example, an agent is role is to vacuum a dirty floor; a good and simple performance measure for how successful this agent is could be the amount of dirt it cleaned. More complicated measures could include the rate of the agent's cleaning operation or the amount of electricity the agent used. When this agent is successful is also important. We need to evaluate the agent success over long period of time, not just momentarily. Some agents perform well at some times and poorly at other times, and we need the agent that can perform well all the time [Russell and Norvig 1995].

# 7 CONCLUSION

The presence of agents is important and plays a major role in enhancing the performance of many systems. One of the main areas where agents is and will continue to play a major rule is Internet computing. More and more people are using the Web every day for many different reasons such as searching for information or buying goods and services. This can be time-consuming but is tolerable because it is still faster than traditional methods. However, as we begin spending more time on the Web, the demand will rise for agents that can perform our daily Web chores for us. Each agent will represent its owner, serving as the owner's surrogate for Web tasks and transactions. To be an effective surrogate, agents will have to be imbued with their owners' preferences and characteristics, such as co-operation, friendliness, sociability, and benevolence. Then the Web will be a friendlier and more productive environment for work, learning, and recreation. Research prototypes of such agents are operating now, and will soon be making their way onto the Web.

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# Maktoob.com: An Arabisation Catalyst in Today's Internet Revolution

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## 1 INTRODUCTION

### 1.1 The Internet

The Internet is a worldwide computer network that is composed of thousands of interconnected computers that all have the ability to communicate. The Internet market is the fastest growing in the world. At present there are approximately 378 million Internet users, and increasing at an aggressive rate. Organizations are now racing to have their information published on the World Wide Web, in order to reach a global audience with the lowest cost.

The growth of the Internet as an information source is coupled by the increasing use of the Internet for transactional and business purposes. This use of the Internet is also growing due to the rapid developments in the security aspects of applications, in order for mission critical information to be communicated over the Internet safely.

The main use of the Internet since its inception is email. Email remains today as the main Internet service where hundreds of millions of messages are sent on a daily basis. Email has created a communication revolution allowing people to communicate easily and instantly all over the world. The next challenge for email is to overtake the fax and mail in official dealings and transactions. This will become a reality as encryption, authentication and digital signature technologies develop and become more widely accepted in both the business and legal environments.

### 1.2 The Internet In the Arab World

The Arab world is roughly populated by 300 million people. According to recent studies by Dabbagh Information Technologies (www.dit.net) and NUA Internet Surveys (www.nua.ie), Internet users in the Arab world amount to a little more than 2 million users, accounting to less than 1% of the Arab world population, as well as under 1% of the total online users worldwide.

The number of Internet users in the Arab World is expected to grow exponentially reaching several million in the next few years. The fact that many Arab countries are among the leading countries in terms of the rate of increase of computers affirms positive Internet growth in our region.

The number of Internet users in the Arab world is doubling every year, according to the Internet Arab World magazine (IAW) and PC Magazine (Arabic edition).The magazine expects the Internet community in the Arab World to continue with a healthy growth and to reach about 12 million users by the end of 2002.

However, the magazine warned that demand on Internet access would probably exceed infrastructure development, leading to network bottlenecks and stunted growth in the number of users. After 2002 the growth rate could fall considerably since infrastructure development in most Arab countries is running at a very slow pace compared with the surging demand on Internet access and telephone lines. The infrastructure would not be able to cope with the pressure. The growth rate for the number of Internet users would then decline in most Arab countries, though some governments and telecommunications companies concerned might realize the coming problem and work to avert it.

In addition to the Internet users in the Arab World, it is estimated that there are several million Arab users who are resident in the United States, Europe and the rest of the world. These users have a direct effect in pushing our region to resort to the Internet as a medium for personal and business communication.

**Table 1. Arab World Internet Usage**

| **Breakdown of Internet Users in the Arab Word** | | | |
|---|---|---|---|
| **No.** | **Country** | **Date** | **Total Users** |
| 1. | Algeria | July 2000 | 20000 |
| 2. | Bahrain | March 2000 | 37500 |
| 3. | Djibouti | July 2000 | 1000 |
| 4. | Egypt | March 2000 | 440000 |
| 5. | Jordan | March 2000 | 87500 |
| 6. | Kuwait | March 2000 | 100000 |
| 7. | Lebanon | March 2000 | 227500 |
| 8. | Libya | March 2000 | 7500 |
| 9. | Mauritania | July 2000 | 2000 |
| 10. | Morocco | May 2000 | 120000 |
| 11. | Oman | March 2000 | 50000 |
| 12. | Palestine | October 2000 | 23520 |
| 13. | Qatar | March 2000 | 45000 |
| 14. | Saudi Arabia | March 2000 | 300000 |
| 15. | Somalia | July 2000 | 200 |
| 16. | Sudan | March 2000 | 10000 |
| 17. | Syria | March 2000 | 20000 |
| 18. | Tunisia | March 2000 | 110000 |
| 19. | UAE | March 2000 | 400000 |
| 20. | Yemen | March 2000 | 12000 |

***Source:***
*Dabbagh Information Technologies, http://www.dit.net*
*NUA Internet Surveys, http://www.nua.ie*

# 2 MAKTOOB.COM

## 2.1 The Opportunity

The Internet and email usage grew exponentially, with its origin and major growth in the western world, and predominantly using the English language, Maktoob.com Inc. felt an urge and a dire need to revive the Arabic language within the realm of the Internet World.

The idea of Maktoob was to help Arab people around the world use email in their own language. In October 1998 Maktoob founders decided to launch and Internet web site that allowed people to register for an email account free of charge, and to use it in both Arabic and English. The response to the idea was enormous and Maktoob turned from an experimental project to a full fledged operation and company.

As more and more Arabs worldwide are turning to the Internet as a source of information, Maktoob.com has become a leading brand and destination enabling users to communicate using the Arabic language. Today Maktoob has over 500,000 registered users and is growing at an exponential rate.

### *2.1.1 What does "Maktoob" mean?*

In addition to the simple meaning of 'letter' or 'mail', Maktoob in traditional Arabic has many other meanings; one of which is fate, or the simple word "written." The simple and easy to remember name of Maktoob has helped create a very strong brand and a memorable experience for the service users.

### *2.1.2 WebMail*

Web based email allows a user to get a free email address using a web site. The user is then able to send and receive emails from anywhere in the world by going to the web site. This service proved very popular with students and individuals who wished to have their own private free email address.

Worldwide interest in web based email solutions has been increasing at a high rate after the success of Hotmail. Hotmail has over 40 million accounts and an increase rate of 200,000 accounts per day. Many other companies such as Yahoo and Netscape have introduced web mail to their clients.

Web mail is considered to be an excellent virtual community tool as it creates repeated visits and loyalty by members who periodically check their inboxes. Different revenue streams can then be used to extract value from the community, such as advertising, premium services, content and e-commerce.

## 2.2 Maktoob Today

Maktoob.com is the World's First FREE Arabic/English Web Based Email on the Internet. Since its formal introduction in October 1998, Maktoob.com has grown to hundreds of thousands of users in a very short time. Maktoob's uniqueness and what sets it apart, is it's Arabic facilities. Maktoob.com users, regardless of their Windows operating system, can send and receive Arabic messages back and forth.

## 2.3 The Team

The team at Maktoob consists of 34 professional employees, who are constantly developing and introducing new and fresh ideas. All employees are Arab and the organizational strategy will continue to focus on local and regional talent. Maktoob is expected to grow to 55 people by the year 2001 and to 100 people by the year 2002. The Maktoob team is a young team with an average age of 27.

Maktoob employees are split into the following main teams:

**Management team :** Responsible for the strategic direction and the management and business development of the operation.

**Technical team :** This team is responsible for all the technology aspects of the system, including system design development and maintenance.

**Content and Community team :** Responsible for developing or outsourcing content to be broadcast through the Maktoob site.

**Production and Quality team :** Responsible for the production and quality testing of all services and content.

**Marketing team :** Responsible to market the Maktoob services and increase the number of Maktoob registrants.

**Customer Support team :** Responsible to support members who have technical and service inquiries.

**Sales team :** Responsible to sell Maktoob services and products.

**Administrative and Accounting team :** Responsible for all administrative and accounting tasks.

## 2.4 Vision

Maktoob's vision is to establish the largest online Arabic community around the world. This community will utilize Maktoob's free web based email solution, communication and content services. Maktoob.com's goal is to reach 4,000,000 members within 3 years.

To achieve the above vision Maktoob is continuously developing new services and content to meet the needs of its members and to make them feel that they are in an Arab community. Maktoob emphasizes a lot on the community aspect and promotes user submitted content and feedback.

In addition to existing services and products Maktoob is continuously seeking to enter into new areas such as e-commerce and e-business that will enhance its offering and value to its customers and in addition improve the Maktoob revenue and profitability.

# 3 BUSINESS MODEL

Maktoob business model is based on a multi stream revenue strategy. The actual and potential areas can be summarized as follows:

## 3.1 Business to Consumer (B2C) Services

### *3.1.1 Services and Content*

The following is a brief list of services, among others, available to site visitors and registrants:

a) Communication Services:
1. Arabic/English Email
2. Arabic/English Chat
3. Arabic/English Instant Messaging
4. Discussion forums
5. WAP email for accessing email through mobile devices

b) Entertainment and Leisure:
1. Electronic greeting cards
2. Melodies
3. Fun and Games
4. Maktoob TV and TV Guide
5. Maktoob Radio One, an internet radio station

c) Business Services:
1. Business directory and news
2. Bookstore for purchasing Arabic and English books
3. Online Voting
4. Secure File Zone for storing files online
5. Shopping Mall – coming soon
6. MazadMaktoob – coming soon

### *3.1.2 Advertising*

a) Advertising on the Net

Prior to the birth of the Internet, advertising was considered as a powerful means of transferring ones message to the general public. The Internet has been able to grasp this idea and begin to set forth its own rules.

According to estimates for Internet growth from Ovum (reported in GSM Data Today) the total Internet population from 1998 to the year 2005 will increase by 268%. In 1998, the total amount of advertising revenue generated on the Internet was about $2 billion according to Internet World. Projections from eStats indicate that Internet advertising revenue will reach $8 billion by 2002.

Internet advertising is still a new industry that is passing through a definition stage. Standards are being defined and technology is being developed to deliver advertising efficiently and cost effectively. Traditional companies have not yet moved large portions of their online advertising from traditional media to online media, but there are positive signs that Internet advertising is growing.

Internet advertising has several advantages over traditional advertising. The available technology allows for new dimensions in audience targeting, campaign distribution and measuring of campaign results. Targeting and measuring results using online advertising is much easier and accurate than traditional media.

b) Advertising on Maktoob

Keeping in mind Maktoob's vision as being the largest and leading online Arab community, advertisers now have the ultimate destination in reaching the largest Arab community and getting their message across.

Advertisers may now choose from a variety of programs to aid in escalating the sale of their products or services. Below are a few of the programs offered by the Maktoob.

### Banner Advertising

Maktoob offers Banner Advertising across the site. Advertising space is sold in the form of rotating banners. Maktoob banner ads are priced in units of 1,000 impressions (1,000 impressions = 1 CPM). Unlike other types of conventional media, you are only paying when people see your banner advertisement. An impression is defined as a view of the advertising banner.

There are two different methods that the client chooses from when advertising on Maktoob. The first is having your advertising message rotating in all the sections of Maktoob, through a Run of The Site (ROS).

The second method is more direct and considered a bit more effective for specific campaigns. Advertisers may choose to limit their exposure on Maktoob according to specific criteria such as country, gender and age targeting.

### Section Sponsorships

Unlike the above-mentioned banner advertising medium, certain advertisers wish to focus on specific sections that cater to distinct populations within Maktoob. This option enables advertisers to place their fixed button on the section of their choice for a specified period of time.

### Email Promotions

Advertisers may utilize Maktoob's extensive mailing addresses of subscribers to send out mail shots. Email shots may be targeted by country, gender, or age. To protect the privacy of Maktoob members, email shots can only be sent if the message carries a sales promotion or is of a special offer nature.

In addition Maktoob sends a monthly newsletter to all its members. Advertisers are given the opportunity to sponsor and advertise in this newsletter.

### 3.2 Business to Business (B2B) Services

*3.2.1 Technology Outsourcing Services*

Maktoob.com, the leading Arab online community, with well over half a million users, is now placing the technology that made it a success at the disposal of corporations and emerging sites globally interested offering email and other services.

Maktoob Outsourcing & Licensing solutions provide a wide range of leading edge Arabic/English web based services. Adding these services to any website attracts and retains customers. Maktoob takes care of virtually all the corporation's communications, community and content needs and let's them focus on growing their core business.

a) Email Outsourcing Solutions

<u>Email Licensing Service</u>

Maktoob provides corporations with a tool to offer site visitors with email addresses @companyname.com. Internet users send and receive email on average once per day – this is an invaluable way to get corporate branding and message across the globe.

<u>Anti-Virus Service</u>

This service is offered to protect incoming and outgoing emails from viruses. Our solution eliminates the virus threat completely, then notifies both the sender and recipient of the virus detected. Maktoob Anti-Virus is continuously updated for protection against new viruses.

<u>WAP (Wireless Access Protocol) Service</u>

The growth of mobile phones is growing rapidly in the world in general and in the Arab world in particular. Our WAP service provides email users and corporate employees and site visitors with the ability to check their mail on the move, with our outsourced WAP solution.

<u>Instant Messaging</u>

Instant Messaging (IM) provides business users with an excellent communication service. Arabic/English Instant Messaging is the best means for fast, concise communication especially for geographically dispersed employees or customers.

b) Content and Community Solutions

<u>Arabic/English Chat</u>

This service is provided for web sites wishing to retain site visitors with a service that enhances the community feel, and provides a platform for users to interact and spend more time on the web site.

Discussion Forums

This service provides site users with an ability to discuss certain topics in both Arabic and English and using text and voice. This is another excellent tool for sites to retain users.

Content

Maktoob offers other content services such as melodies and e-cards, allowing people to send each other songs and cards.

### 3.3 E-Commerce Services

*3.3.1 Maktoob Shopping Mall*

Maktoob is in the process of introducing E-commerce to its members through the Shop@Maktoob English / Arabic mall. This mall will offer goods and services from the Middle East. Aramex International, a leading transportation company in the Middle East, will handle transportation and logistics.

Shop@Maktoob will enable merchants, in the Arab region, to market and sell their products and services online by easily setting up their own store within the mall, with credit card processing and order fulfillment.

The Maktoob E-commerce solution will be initially targeted to Maktoob members but can attract foreign shoppers from all over the world at later stages.

*3.3.2 MazadMaktoob*

The very first Arabic/English online auction. Visitors to MazadMaktoob can place items up for bid and sell to the highest bidder. This service will be launched soon and will allow individuals and businesses to post their items online and receive bids from potential buyers in the Arab world and worldwide.

## 4 TECHNOLOGY

### 4.1 Arabization

Maktoob has been a leader in the Arabization industry on the Internet. Maktoob was the first to develop Arabic email and communication services on the Internet. Our technical team continues to research and develop new tools that will help Arabic users utilize the Internet easily and efficiently.

### 4.2 Operating System Independence

Maktoob is based upon open Internet standards. The latest technologies, and use of the java programming language have been used, enabling users across the globe to access their email account and correspond using the Arabic language, regardless of their operating system.

This technical feature has given Maktoob a technology edge and has allowed users worldwide to send and receive Arabic email even if their operating system is English. Maktoob is now using this feature in chat, discussion boards and other communication technologies it offers.

### 4.3 Email Technology

In addition to the Arabic Internet applications developed by Maktoob, our systems use high end email servers (Mirapoint servers) to handle the hundreds of thousands of emails sent daily. Developed by leading e-mail experts, the Mirapoint Internet Message Server was designed to control the massive increase in message traffic and message volume that is occurring. Because it is built as an appliance, the Mirapoint Internet Message Server is optimized to deliver robust performance and reliability while keeping management costs exceptionally low. With Mirapoint, large fault-tolerant messaging systems can be designed and deployed with only a fraction of the e-mail expertise required by the alternatives. A messaging architecture based on Mirapoint appliances offers these benefits:

- Internet standards compliance (POP, IMAP, SMTP)
- High performance
- High system security
- High system availability
- Low management costs

Other Maktoob services such as chat are run on other servers. All servers are hosted in the USA to allow for best possible performance. The servers are remotely monitored and managed from our offices in Jordan.

* For more information about Mirapoint servers please visit http://www.mirapoint.com .

### 4.4 Security

In addition to the high system performance and reliability our systems and servers offer the highest security possible. No one can go into the system and read any email, not even the administrator of the system. This feature is rarely present with any of the email providers today.

## 5 MARKETING

### 5.1 Branding

The most important goal in achieving Maktoob vision is to build a very strong brand. Maktoob has been successfully introduced as a powerful brand. This brand will be able to overcome competition and become the largest web based virtual community for Arabs around the world.

Perhaps the hardest task when launching as service or product, is choosing the right name for the right product or service. The name Maktoob, gained rapid popularity in the region due to its Arabic connotation of "letter" or "message" and its simplicity.

Aggressive marketing to create ample awareness enabled Maktoob in becoming the leading online Arab community. Periodic press releases have been circulated and published in leading regional newspapers and magazines to familiarize the general public of the services and achievements of Maktoob.

Successful branding leads to the degree of stickiness a site fosters. The stickiness of a web site is the ability of a web site to attract repeat visitors to that site and to keep visitors on that site.

**5.2 Positioning**

**a) Brand Personality**

Spirited, young, up-to-date, outgoing, exciting, trendy, popular and friendly.

**b) Brand Behavior**

The above traits are associated with the following brand behavior:

-Advertises extensively
-Continuity of characters
-Friendly advertising, endorsers

**c) Brand Position**

Core Identity: Free Web-based Arabic Email and leading online community

Points of Leverage: Technology, Bilingual, Fast, Unique Content and services

Primary Target Audience: 15 – 35 years old individuals

**5.3 Retention**

The key factors that contribute to the stickiness of a web site and retention of site visitors are:

- Content – This is the most important factor in designing a sticky site. The site must either have a substantial amount of good content that the user returns for time and time again, or the site has a lot of fresh content, which changes frequently.
- Community – When a site attracts a large enough audience of people having similar interests, it can be a big win to provide ways for those people to interact. Interaction may be through bulletin boards, news groups, chat rooms, discussion areas, or games.
- Customizability – Providing a way for the user to customize his/her experience on the site, for example, building a page with a customized look and customized content which the user is interested in seeing,

helps to maintain repeat visitors. After customizing a site, the user is more likely to stick with that site over similar sites due to the effort needed to go through the customization process again with another site.

The reason people want to build sticky sites boils down to one thing - building brand loyalty. Those sites that can attract and retain a loyal following, by providing a good user experience are likely to do well in the new online world.

### 5.4 Online Marketing

As an Internet business that depends on online users, our marketing team utilizes online marketing techniques to market Maktoob services:

#### *5.4.1 Frictionless and Active Viral Marketing*

Viral Marketing is a term for describing the pattern in which Internet companies unfold their message via customer referrals. A customer passes information about a service to those close to them- friends, neighbors, and coworkers. Those people then pass the service on to their own friends, neighbors, and coworkers, and so on.

The most important concept in the marketing of Maktoob is called "Viral Marketing". There are two types of Viral Marketing that Maktoob utilizes; the first is "Frictionless Viral Marketing", while the second is called "Active Viral Marketing".

In frictionless viral marketing, each person that registers into Maktoob is required to tell at least one other friend by supplying an email address. Furthermore every message or greeting card that is sent from Maktoob is sent with a line at the bottom of the message saying "get your free Arabic/English email from Maktoob http://www.maktoob.com " . As the number of users increases, thousands of messages and cards are sent on a daily basis promoting Maktoob. This causes a spiral effect and is attributed as the best marketing tool that Hotmail used.

"Active Viral Marketing" requires the active participation of a customer in recruiting new customers. For example, Maktoob Friends, Forums and Instant Messaging allow people to communicate and voice opinions amongst each other only if they are already registered users with Maktoob. This means that a customer must actively convince his/her friends, relatives, or coworkers to also register with Maktoob in order to communicate with them.

Viral Marketing is an essential marketing method that companies need to be conscious of, to remain competitive in this Industry. Those that dismiss it will fall by the wayside as those that embrace flourish in the Internet Industry.

#### *5.4.2 Internal Affiliate Programs*

Affiliate or Associate programs have been used in member acquisition strategies. In these programs, people must actively participate in promoting the site by acting as a referral source. In exchange for directing customer to a site, the affiliate or associate is paid for the referral or given other incentives. Maktoob has created two affiliate programs, one geared toward companies, and the other targeted for individuals.

*5.4.3 Search Engines and Directories Listings*

Maktoob is registered and promoted in the major Internet search engines and directories.

*5.4.4 Yahoo, AltaVista and other International Sites Advertising*

Maktoob will continue to launch campaigns on major International sites targeted towards the countries and users of the region.

*5.4.5 Arabic Sites Advertising*

Maktoob purchases advertising banners on different high-traffic Arabic sites, especially ISP sites in the Middle East.

### 5.5 Offline Marketing

In addition to online marketing our team performs several offline marketing activities:

*5.5.1 Internet Cafes*

Most of the usage of Internet Café terminals is estimated to be for web based email. Maktoob has adopted a strategy of allying itself with Internet cafes all around the Arab World as a main marketing tool. These cafes are spreading at a high rate and many users start in Internet cafes before obtaining their own accounts.

*5.5.2 Print Advertising*

Maktoob is presently advertising in major print media in the Arab World, especially in the countries of Saudi Arabia, UAE, Egypt, Kuwait, Oman and Jordan. Other countries are being targeted through online marketing in the initial stages.

*5.5.3 TV Advertising*

Maktoob has utilized television advertising to build and strengthen its brand around the region. Ads are currently being placed on major satellite channels such as Al-Jazira, LBC, MBC, ART and Future Television. Long term sponsorship of targeted television programs are also being utilized.

*5.5.4 Exhibitions*

Maktoob's participation in the major IT exhibitions in the Middle East has aided in reaching a great number of people as well as spreading the familiarization of Maktoob throughout the region. Past exhibitions include GITEX Cairo, Comdex Cairo, GITEX Lebanon, METS Amman among others.

*5.5.5 Sponsorships*

Maktoob has and will continue to sponsor different events especially at universities, schools and public gatherings. Sports and cultural activities will also be targeted.

*5.5.6 Promotions and Giveaways:*

Mugs, T-shirts and other items are being used to promote Maktoob by way of different games, quizzes and contests. Alliances with companies such as Swatch, and other multi national companies for site prizes and competitions will further enhance member loyalty and will continue to attract new members.

**5.6 Member Demographics**

**a) Audience Profile**

-Total number of registered users :

529,846 as of Tuesday, 17 October 2000, and increasing at an average rate of more than 1,800 members per day.

**b) Total number of monthly Impressions (page views) that Maktoob receives:**

Maktoob is currently serving an excess of 20,000,000 page views per month.

**c) Distribution by Country**

**Table 2. Top 10 Countries making up Maktoob's audience**

| No. | Country | Percentage |
|---|---|---|
| 1 | Saudi Arabia | 18.82 |
| 2 | Egypt | 14.35 |
| 3 | Jordan | 11.55 |
| 4 | UAE | 7.49 |
| 5 | Kuwait | 7.46 |
| 6 | USA | 4.71 |
| 7 | Morocco | 4.34 |
| 8 | Lebanon | 3.06 |
| 9 | Palestine | 3.01 |
| 10 | Oman | 2.07 |

*Source: Maktoob Database.*
*The countries that rank 11-20 are as follows (in order): Canada, Sudan, Bahrain, Qatar, Libya, UK, Algeria, Syria, Australia and Yemen.*

**Table 3. Distribution of Maktoob audience by Occupation:**

| Occupation | Percentage |
|---|---|
| Student | 25.26 |
| College/Graduate Student | 9.81 |
| Computer Technical/Engineering | 8.71 |
| Professional (doctor/lawyer, etc.) | 6.77 |
| Executive/Managerial | 5.25 |
| Sales/Marketing | 4.78 |
| Academic / Educator | 4.56 |
| Other Technical/Engineering | 4.28 |
| Banking | 2.76 |
| Other / Not defined | 27.82 |

*Source: Maktoob Database.*

**Table 4. Distribution of Maktoob audience by Gender**

| Gender | Percent Users |
|---|---|
| Male | 76.92 |
| Female | 21.29 |
| Not yet defined | 1.79 |

*Source: Maktoob Database.*

**Table 5. Distribution of Maktoob audience by Age:**

| Age | Percent Users |
|---|---|
| Under 18 | 12.62 |
| 18-25 | 38.80 |
| 26-35 | 29.52 |
| 36-45 | 11.42 |
| 46-55 | 3.55 |
| 56 and Over | 3.01 |
| Not Defined | 1.08 |

*Source: Maktoob Database.*

**7. Distribution by User Interface:**

| Interface Language | Percent Users |
|---|---|
| Arabic | 60.02 |
| English | 39.98 |

*Source: Maktoob Database.*

Note: Subscribers using the Arabic Interface have a higher frequency of log-ins to Maktoob.

# 6 ALLIANCES AND PARTNERSHIPS

## 6.1 Financial

- EFG Hermes – a leading Egyptian and Arab investment bank. EFG-Hermes is currently the main financier of Maktoob.

## 6.2 Business

- Aramex International – A leading transportation and logistics company in the Middle East. With over 2090 employees working in 132 offices in 34 countries around the world, ARAMEX has created one of the most sophisticated global networks, offering total transportation solutions. In 1997 ARAMEX broke new grounds by becoming the first Arab based company to go public on NASDAQ (NASDAQ NM Symbol: ARMX). This alliance is crucial for Maktoob e-commerce services.

- MazadMaktoob – an alliance with a group of Arab investors and professionals to create Maktoob auction services; the First Arabic English Auction site on the Internet.

- Career Middle East – An alliance with this leading Internet career service to provide job career and employment services to Maktoob members. Career Middle East is the region's first and leading online recruiting service on the Internet.

## 6.3 Technology

- MediaRing - MediaRing is the global leader in Internet Voice Services. MediaRing offers Maktoob users free Internet voice tools to use from within the Maktoob site. Users can record, send and receive voice messages for free from their Maktoob account.

- Apptek is a leading provider of linguistics and translation software worldwide with offices in Washington, Taipei, Korea, Amman and Dubai.

## 6.4 Marketing and Content

- Ihilal.com – An alliance with a leading Internet Islamic Financial services site, in the technology and Marketing areas.

- RadioOne – Lebanon and Maktoob.com joined forces in introducing the very first Arabic Internet radio station, which broadcasts Arabic music 24 hours a day, 7 days a week. RadioOne is the leading FM radio station in Lebanon.

- AME Info - Middle East Business Information, a search engine and a business directory containing information, news, web sites and companies in the Middle East. Established in 1993, Arabian Modern Equipment is the leading Middle East Business resource site on the Internet.

- Moheet.com – A leading source for Arabic news, information and content on the Internet. Updated continuously, Moheet provides world news of current events in the Arabic Language.

## 7 CONCLUSION

Maktoob.com is the World's First FREE Arabic/English Web Based Email on the Internet. Since its formal introduction in October 1998, Maktoob.com has grown to hundreds of thousands of users in a very short time. Maktoob's uniqueness and what sets it apart, is it's Arabic facilities. Maktoob.com users, regardless of their Windows operating system, can send and receive Arabic messages back and forth. Similarly, the recipients, regardless of their operating system would be able to view and read the Arabic messages sent to them from a Maktoob.com user. Maktoob's rapid growth has made it the leading Arab virtual community on the Internet. New and innovative services are continuously being introduced to spread the use of the Arabic language on the Internet and to technically make it easier for Arabic users to communicate.

Since inception in 1998, Maktoob currently boasts to more than 550,000 online members and serving an excess of 20 Million monthly page views and is growing at an unprecedented rate daily. With a minimum advertising budget, Maktoob was able to achieve exceptionally high growth rates.

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# Information Technology: Impact on Biological Sciences

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## 1 ABSTRACT

The present manuscript attempts to review briefly the impact of Information Technology on the new and exciting developments in biological sciences. At the very outset it is crucial to emphasize that this correlation is best understood and appreciated by analyzing the historic evolution and current status of human genome project.

Genetic Engineering, Molecular Biology, Gene therapy, Cloning, Genetically Modified Foods, etc have all become household words during the last two decades. Life sciences which focus on the study of living systems including a very broad range of micro-organisms, plants, animals and human beings have always greatly benefited by the use of new tools and innovative techniques. The detailed structure of the basic unit of life, a cell, has largely been understood by use of microscope. The multidisciplinary science of biotechnology has extensively used computers as tools to gather, store and retrieve huge amounts of data that would not have been possible otherwise. Information Technology thus represents one of the most recent and an extremely powerful new tool that has greatly facilitated research in biological sciences.

## 2 INTRODUCTION

### 2.1 A Century of Biology

For the last several decades, there have been very significant and revolutionary breakthroughs, both in molecular biology, and the computer technology. For those who follow the historical development and growth of science, there is no parallel for such rapid advancements and of such far reaching importance. The obvious impact of all these discoveries, innovations and technological advances is the very close interaction between these two disciplines. Molecular biologist have thus benefited enormously by using super computers. This is especially true of data obtained by sequencing DNA of a number of lower organisms that eventually led to the complete sequencing of the human genome. This close co-operation between life sciences and information technology has resulted in the development of the hybrid discipline of bioinformatics. The economic potential and the new opportunities in such areas as human diseases, drug design and genetically modified foods have been very well documented and need to be both clearly understood and benefited from.

The subject is far too vast to be discussed in one article. The interested reader therefore, should refer to some of the books and review articles listed at the end. For the present write-up the sequencing of the human genome is discussed as an example of the study of a biological problem. A brief account of bioinformatics is also included to illustrate the impact of Information Technology on biological sciences. Needless to add that one can easily find a large number of other examples where the study of biology has greatly benefited from use of computers and other Information Technology devices.

In the midst of all the current excitement that surrounds the scientific progress of the last century and the progress that awaits us, the 21st century, has been appropriately called the "Century of Biology" or "Genome Century." The new discipline of "Genomics" which focuses on the analysis and sequencing of organisms including viruses, bacteria, yeast, Drosophila, plants like Arabiodopsis, rice, maize, and finally human beings, is clearly indicative of the pace at which progress is being made.

The completion of the DNA sequence of Human Genome is really a historic and revolutionary beginning, truly indicative of the exciting events and achievements yet to come. A brief account of this gigantic project is presented below.

## 2.2 Human Genome Project

The term genome refers to the total genetic material contained within the nucleus of any living system. The genetic material that controls the hereditary features essentially consists of DNA, which is a double helical structure (Figure 1) with four nitrogenous bases: Adenine, Thymine, Guanine and Cytosine (A,T,G,C). There are nearly three billion base pairs that constitute the human genome. This is the chemical basis of human body and if one takes this complex biological system of one hundred trillion cells and break it down to simpler units, the resulting picture is the one graphically shown in Figure2.

**Figure 1**

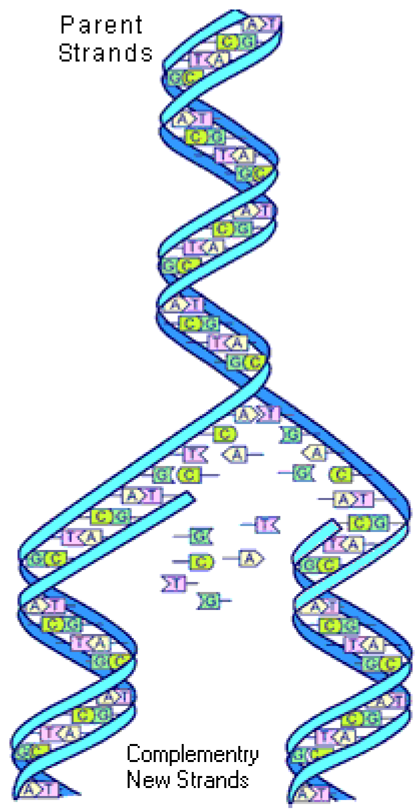
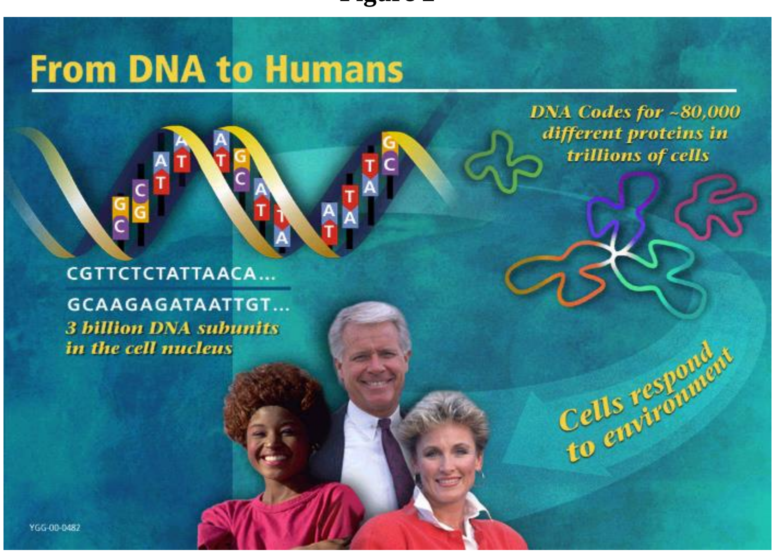



**Figure 2**




The efforts to sequence the human genome referred to as Human Genome Project were initially started as a government sponsored project at the department of Energy and National Institute of Health in 1990. The accomplishment is a superb example of international co-operation between 18 countries with leading roles played by USA, UK, France and Japan and thus represents a real global effort. Researchers are now generating gigantic databases containing the details of how various genes are turned on, the shapes of the proteins the genes encode, how the proteins interact with one another and the role those interactions play in disease.

The initial effort cost over two hundred billion dollars involving thousands of scientists, 16 research centres, and has now led to the complete decoding of the three billion base pairs that carry the genetic information for human beings. The availability of this information helps to illustrate the significance of the Human Genome Project which has been compared to man's landing on the moon, splitting of the atom and inventing the periodic table of elements. It is, however, really important to emphasize that whereas the landing on the moon was a one time achievement, the decoding of the book of life is going to lead to research in human biology focused on diseases for decades to come.

Human struggle in coping with the challenges posed by such diseases as cancer, Alzheimer, diabetes and cardiovascular disorders has been going on for centuries. The complete sequencing of the human genome will become a historic milestone in the history of science and will have a major impact on future medical research. The two brief quotations of June 2000 below attempt to capture the excitement:

> *"Scientists and statesmen yesterday hailed the breakthrough on the sequencing of the human genome as an achievement comparable with the invention of the wheel."*
>
> *"The completion of a first draft of the DNA blueprint is set to open up new frontiers in medical science, accelerate the commercial use of biotechnology and pave the way for new treatments for inherited disease."*

It is in this perspective that one should look at bioinformatics in an effort to appreciate the very strong correlation between biology and information technology.

## 2.3 Bioinformatics

The term bioinformatics best describes this truly interactive and exciting science which will remain a frontier science for decades to come. Bioinformatics itself like recombinant DNA is a Hybrid term. This new discipline is a marriage between computer science and biology and seeks to make sense of it all. In so doing, it is destined to change the face of biomedicine. The future applications of Genomics in molecular medicine have been well documented. The available information about the genetic make up of Humans will lead to designer drugs.

The initiation, development and evolution of human genome project is without doubt the best example to illustrate the extensive use and highly significant impact of the use of extremely sophisticated computers and other approaches that have become available through Information Technology for study of biological systems. The extensive coverage in print and electronic media that followed the announcement of June 26$^{th}$ of the 97% completion of the human genome sequence has documented all these facts.

A brief review of the historical development of bioinformatics would be of interest here. The field got its start in the early 1980s with a database called GenBank hosted by the U.S. Department of Energy to hold the short stretches of DNA sequence that scientists were just beginning to obtain from a range of organisms. In the early days of GenBank a roomful of technicians sat at keyboards consisting of only the four letters A, C, T and G, tediously entering the DNA-sequence information published in academic journals. As the years went by, new protocols enabled researchers to dial up GenBank and dump in their sequence data directly, and the administration of GenBank was transferred to the National Institutes of Health's National Centre for Biotechnology Information (NCBI). After the advent of the World Wide Web, researchers could access the data in GenBank for free from around the globe.

Once the Human Genome Project (HGP) officially got off the ground in 1990, the volume of DNA-sequence data in GenBank began to grow exponentially. With the introduction in the 1990s of high-throughput sequencing - an approach using robotics, automated DNA-sequencing machines and computers - additions to GenBank skyrocketed. GenBank holds the sequence data on more than seven billion units of DNA at present.

Around the time the HGP was taking off, private companies started parallel sequencing projects and established huge proprietary databases of their own. Today companies such as Incyte Genomics in Palo Alto, Calif., can determine the sequence of approximately 20 million DNA base pairs in just one day. Celera Genomics - the sequencing powerhouse that very actively participated in the completion of the human genome sequence, has enormous capability for storage and retrieval for sequence data with 50 terabytes of data storage. It translates in to roughly 80,000 compact discs, which in their plastic cases, would take up almost half a mile of shelf space. More comprehensive reviews on bioinformatics have discussed all these aspects in detail and a few of these have been listed in bibliography.

Another aspect of this discussion is the use of electronic devices in molecular biology. The increasing sophistication of electronic mechanisms to store, manipulate and communicate information has transformed the way we work. In particular, the opportunities and pitfalls for science opened by information technology are profound. Nowhere has this been more apparent than in molecular biology. The information of life — DNA coding for complex proteins involved in intricate biological processes - has become accessible during the last three decades; fortuitously an era when computer hardware and methodology has seen a comparable revolution. The way scientists deal with data has been completely transformed. It is possible to collect, analyse, communicate and share huge amounts of information rapidly and accurately. The benefits are fantastic. Electronic communication enables a kind of collaboration hitherto unthinkable - even simple email allows the collaborative authoring of documents by authors on opposite sides of the world in real time.

## 3 IMPACT ON DEVELOPING WORLD

### 3.1 General

It would be pertinent here to try and examine the impact of these scientific landmarks on developing world. It is only fair to put on record that man's landing on the moon in 1969 may have made some impact on our national policies in science or our attitude towards science. The real question is whether this recent astounding breakthrough will draw the attention of our decision-makers to the importance of biological sciences and the exciting discoveries that will be made in this field during the 21st Century. Dr James Watson, who discovered DNA structure in 1953, has described this as an inspirational experience which could act to create an excitement leading to our involvement with such disciplines as cell biology and human genetics. So will we wake up and be energised in a manner that will lead to the required emphasis on future research in biology?

The development of new techniques, innovative methodologies, and research tools have always been the major and most effective mechanism for scientific progress. From that point of view the use of computers, email, Internet and all other related devices have been of enormous help in elucidating the molecular mechanisms underlying biological systems. The fact is self-evident and hardly needs any illustration. From the point of view of the present discussion, however, the aspect that needs special emphasis is the need for appropriate initiatives in the OIC member states. I would like to outline some of the recent initiatives taken by COMSTECH which would enable us to benefit from the revolutionary breakthroughs in bioinformatics.

### 3.2 The role of COMSTECH

COMSTECH cosponsored a Workshop on Human Genome Diversity during which Human Genome Forum was established for follow up and to organize activities in this area. A number of member states have responded and identified national focal points to actively participate in the activities related to the human genome project and study of human genetic diseases.

COMSTECH has launched a Literature Search Service program free of charge for the research community of the OIC region. Searches are conducted on the basis of keywords supplied by the users. COMSTECH Literature Search Service has been initiated from current contents database which abstracts some 6000 journals on Agriculture, Biology and Environmental Sciences, Life Sciences, Physical, Chemical and Earth Sciences, Engineering and Computing Sciences. This vast database covers information from 1993 to 2000.

COMSTECH returns searched data by email within 24 hours. Those having no email access are required to provide floppies for transfer of data through ordinary mail.

Presently more than 1775 researchers/students from OIC member states have benefited.

Similarly realizing the importance of information technology in collaboration with COMSATS the following information technology centers have been established in different OIC member states.

COMSTECH-COMSATS-Syrian Arab Republic Information Technology Center in Damascus, Syria.

COMSTECH-COMSATS-MTM Information Technology Center in Karachi, Islamic Republic of Pakistan.

COMSTECH also helped to establish the following centers.

- Computer Center in Freetown, Sierra Leone.
- Computer Center in Cameroon.
- Computer Center in Khartoum, Sudan.

## 4 CONCLUSION

Molecular biology, driven by the need to deal with large volumes of information, was quick to embrace the electronic medium; particularly to build large collection of shared scientific information. Substantial international efforts now support databases of DNA sequences, protein sequences and protein structures. Genetic mapping information was captured in the Genome Database which evolved into an important resource in the early stages of the Human Genome Project.

Nowadays, access to and skill in exploiting electronic information repositories is crucial to biological research. This sharing of information is typical of electronic collaboration in molecular biology. Other exploitations of electronic methods by collaborating molecular biologists, such as the use of email, world-wide-web publication, all are immensely valuable.

For us the need collectively is to look to the future with a firm commitment and total dedication realizing fully the importance of Information Technology and life sciences for the future economic development of the Muslim world. One should also not ignore the reality that these two technologies of the future, Biotechnology and Information Technology, have merged and integrated into the hybrid discipline of “Bioinformatics”. From this very timely and important conference organized by Islamic Academy of Sciences it would certainly be appropriate if one of the take home messages is to seriously initiate research and academic activities in Bioinformatics

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## 5 ACKNOWLEDGEMENT

The author is thankful to Ikram Abbasi for his help in the preparation of this manuscript.

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# Information Technology Applications in Hospital Management

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## 1 ABSTRACT

This is a presentation on a Hospital Manageme[1]nt System, an implementation of actual data, built on top of the existing Healthcare Information System. The structure of the system, as well as possible improvements end extensions of the system, are presented. This system (TIPDATA) is used in social security hospitals, state hospitals, private hospitals and university hospitals in Turkey.

## 2 HOSPITAL INFORMATION SYSTEM

### 2.1 Inpatients

The Inpatients Module provides all the facilities to manage the admission, discharge and transfer functions. The process starts with a booking for admission or a waiting list entry and, if appropriate, an operation booking. This can be done from the consulting room, saving time and improving patient service by allowing necessary paperwork to be prepared in advance. All beds in the hospital can be recorded on the system and can be reserved for specific specialities. Beds may be flagged as unavailable due to housekeeping, maintenance, or other reasons. Bed allocation is done on admission or on arrival at the ward, taking current availability and reserved usage into account. The reason for admission and estimated discharge date are recorded when the patient arrives. Once a patient is admitted, services and pharmaceuticals can be ordered and results returned to the patient record, which may be accessed at the ward, clinic, or doctor's office. Costing data is generated as a result of this process. The patient's location is kept up to date throughout his stay using the 'patient transfer' function. The discharge function records the clinical, physical and contractual discharges of the patient; follow-up outpatient appointments can also be made from the ward.

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### 2.2 Outpatients

The flexibility of the Outpatients Module allows clinics to be set up in accordance with the hospital's and clinicians' requirements defining types of appointment, numbers of patients to be seen, full diary functions and flexible rescheduling. Workload may be controlled by setting limits on the number of patients who may be seen; multiple doctors may work in a single clinic and parallel appointments made at the doctors' discretion. Patients are booked into a

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clinic, from an outpatient waiting list, as a new referral or as a follow-up, directly or resulting from treatment elsewhere in the hospital - double booking and over booking can be eliminated. The clinic schedule is presented as a diary, making the selection of clinic, doctor, speciality, date and time easy. Outpatient appointments can also be booked as part of a care plan. If the patient does not have an appointment - and the clinic allows 'walk-in' consultations - the patient is allocated a time slot after patients with appointments. An estimate of waiting time will be produced to facilitate booking if appropriate. Also, all generated cost data is automatically transferred to the contracting modules for analysis.

### 2.3 Day Surgery

Hospital information system provides all the functionality for the management of day surgery clinics, wards and theatres. The system supplies the user with the facilities to quickly plan and book patient appointments for multiple resources on a single screen. This screen provides an effective and efficient approach to recognising bottlenecks or spare capacity within the day surgery process. With the minimum of keystrokes, patient appointments can quickly be scheduled for assessment clinics, bed space and theatre.

### 2.4 Clinical Workstation

The clinicians who use the computerised follow up system can access their patient records through a set of screens that have been designed together with doctors, nurses. This module presents the user with a 'problem oriented' view of the patient's medical record. Data can be recorded by any care-providing discipline and then viewed according to that discipline's specific needs, or a 'total care view' can be seen (subject to appropriate security within the system). This will allow the hospital to move towards 'integrated patient care management.' The functions available to clinicians include:

- Record 'problems' with symptoms, diagnoses, planned and actual procedures;
- Structured coding can be used with the hospital information system but the clinician is not restricted to recording data in an 'administrative coding' format. A coding links 'normal clinical text' to the chosen 'administrative coding structure;'
- Record and review the medical history;
- Record and review data in the system, a powerful, flexible structure that is user-configurable, solving the problem of setting up and recording patient data like assessments, care plans and clinical diagnostic tools;
- View the attendance history of the patient;
- Review laboratory test results;
- Review X-Ray reports;
- Dictate notes for transcription by medical secretaries;
- Review current drug therapy;
- Pharmacy prescribing;
- Book appointments;
- Add to waiting list;
- Manage the current inpatients, outpatients and waiting list; and
- Place 'requests' or 'orders' for lab, x-ray, physiotherapy, etc.

### 2.5 Clinical Checklist Modules

Checklist screens are configurable to the individual needs of clinicians and clinical specialities. Each healthcare professional can have his or her personal list of the items of patient information they wish to collect, review and report upon. A unique feature of checklists is the ability to share information between different professional groups. For example a blood pressure reading taken in a diabetic clinic is available to the consultant is cardiology who is treating the same patient. All specialities and therapies can use checklists for their own purposes.

## 2.6 Care Protocols

Care protocols are becoming key a standard feature within acute hospitals to ensure the provision of consistently high quality care. Oasis allows a hospital to define it's own care protocols. Protocols can be implemented for all aspects of patient care. Some examples are:

- Pre-operative 'work-up' protocols;
- Referral protocols;
- Protocols of clinical care for common diseases;

Care protocols will provide clinicians with the information they require to implement clinical governance.

## 2.7 Results Reporting

Results reporting is independent of Order Entry, allowing its rapid implementation. Lab reports are brought into the patient record via an HL7 conformant interface accessing the laboratory system. Lab reports are organised in reverse date order with high / low / abnormal results highlighted in red as a warning colour. Series of results can also be viewed graphically to better highlight trends. X-Ray reports that are dictated into the Radiology module can be immediately played back from the patients notes at PCs connected to the network that are fitted with sound card and speaker. Transcribed reports are available, as soon as the transcription process is completed, from any PC connected to the network. Results Reporting is accessed from within the clinicians workstation.

## 2.8 Order Entry

The software provides all the functionality for the hospital-wide placement of orders to laboratory, pharmacy, theatres, therapies, etc. Order Entry is a module that can be used to deal with orders as non stock orders, or integrated with stock and inventory functions. The user decides the level at which to implement Order Entry.

## 2.9 Patient Costing and Contract Management

An effective patient costing system needs to provide prompt as well as reliable patient cost information. Patient Costing ensures that the data is collected from the clinics and departments, creating comprehensive and accurate cost of care information. Together with the contract management modules, patient costing is a feature that makes an unique and very powerful management system.

Contract Management deals specifically with defining, controlling and monitoring purchaser contract details. The need to manage contracts effectively has become more and more critical, as service purchasers are now much more actively cost-conscious Failure to comply with the terms and conditions of a contract invariably results in lost revenue to the service provider. Contract Management functions include facilities to set up and maintain group and purchaser accounts, define the conditions and tariffs that apply to the contracts, monitor contract status by contract or patient, and even investigate 'what if?' scenarios regarding potential contract changes. This module is highly flexible with multiple tariffs and a variety of rules that may apply to patient cost allocation.

The software allows you to monitor costs down to the smallest item of care, e.g. an injection. The software will continually monitor new orders for duplicates within a predefined time limit. A warning will be given to ensure that unnecessary duplication is avoided. For prescribing, monitoring can be against a local formulary to prevent the use of certain drugs when a lower cost alternative is available

### 2.10 'Radiology,' the system

Radiology utilises the powerful technologies that are available principally Oracle and Microsoft products. Oracle provides a database that stores dictated voice records, images and other objects - not just text. Microsoft provides the environment that makes Radiology simple and obvious to use:

- Dictate your reports straight;
- Plan your procedures;
- Organise your department's staff and assets;
- Manage your appointments;
- Organise the X-Ray functions;
- Track your films and manage your files.

Radiology is a departmental system that is built up from the unique department requirements plus Program Objects.

### 2.11 The Maternity Module

The Maternity module provides the easiest method available of capturing clinical and administrative pregnancy and birth data. Designed for use by both administrative and clinical staff to:

- Record birth and register babies;
- Record and report delivery details;
- Plan and record the patients clinical obstetric record.

### 2.12 Therapies

Accessed directly as individual departments from patient search, ward management and clinicians' screens, the Therapies module provides the easiest method available of capturing both clinical and administrative data required to manage both inpatient and outpatient services, whether planned or emergency. Each therapy department can:

- Manage outpatient appointments;
- Manage inpatient services;
- Manage the utilisation of their resources;
- Report and record both clinical and administrative data.

### 2.13 Medical Records

This software allows the management of the medical records department either centrally or as a distributed function at ward or clinic level. This module is central to both hospital administration and clinicians providing care to patients. Functions include:

- Case note tracking;

- Patient master index management;
- Multiple patient Ids;
- Patient aliases;
- Permanent and temporary addresses with simple to manage contract addresses;
- Automatic post-coding;
- Multiple patient contacts;
- General practitioner record management;
- Flexible definition, review and management of patient care episodes;
- Patient's location management at ward or bed level;
- Patient category management;
- Flexible external interface providing mandatory data to the format required by your organisation.

### 2.14 Asset Management

Asset Management is designed to integrate fully with the Maintenance Management module. This allows the option for sites to have an unique asset database capable of supporting the functional requirements of finance and operations, which consequently delivers efficiently a total cost per asset.

Issues such as assets under construction, partially donated assets, collective (grouped) assets and assets belonging to multiple cost centres are dealt with comprehensively, yet simply and effectively.

The forecasting module allows for multiple forecasts to be held on the system simultaneously. Detailed examination of 'what if?' scenarios is simply a matter of comparing forecast results. Asset Management can be enhanced using barcode technology. Ease of stock checking, tracking of portable assets, maintenance control and an improved audit trail are the obvious advantages, but issues like insurance claims and theft prevention can also be helped with bar-coding.

### 2.15 Maintenance Management

The Maintenance function includes the possibility of total integration with financial accounting thus allowing the provision of a total cost per asset in terms of capital charges and maintenance costings. This 'life-cycle' approach allows informed decisions to be made in relation to future purchasing initiatives. The design of the system provides for the control of planned preventative (PPM) and reactive maintenance functions with associated links to supporting financial systems covering stock control, purchasing, staff scheduling and costings (labour management) and capital charging.

The Biomedical Maintenance and testing function is available as a part of Asset Management or Maintenance Management modules. It includes full facilities to deal with issues relating to maintenance and safety testing schedules, using handheld data capture units to maintain an up to date database and to minimise equipment down-time.

### 2.16 Executive and Management Reports

The software offers a cost-effective solution to accessing a large and complex information database. It achieves this via the Statistics module, which utilises a star schema data warehouse to optimise reporting. The Statistics module generates an aggregated database of management information on a regular basis. The aggregation process is usually run of a monthly basis (although any period can be selected) to provide managers with an accurate and consistent view of the month's activity. Most questions can be answered in seconds.

A daily snapshot of the live database is transferred to the Management Information server. This ensures that complex enquiries and management or clinical reports can be produced without affecting the operational activities of the Trust, such as ordering tests or viewing results. The snapshot includes all clinical information, allowing the Management Information server to also act as a powerful clinical audit tool hence, all relevant patient information is available for analysis from a single source.

A further benefit is that the Statistics module's operational management reporting screens provide full drill-down to the detailed patient information behind the management figures. This is ideal for reviewing unexpected trends and 'outliers.' Business Managers have the ability to spot issues as they happen an to react accordingly. Drill down gives the Business Managers the confidence to trust the information, as supporting patient information is available to them at the push of a button.

## CONCLUSION

The system is designed as a framework that works with workload measurement subsystems, which are defined as multidimensional arrays, and are observed through different units of time. Each of the axes has several hierarchical structures built on top of it. Setting up the system is a difficult task, because it requires a good knowledge of the organisational structure of a particular hospital. An incremental approach is used in defining the organisational structure.

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# Conference Committees

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*Passed away, 2001.

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| Prof. Ugur Dilmen | 1996 | Turkey. |

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Jordan Kuwait Bank, Jordan.
Rafia Industrial Company, Jordan.
Secretariat of State for Scientific Research and Technology, Tunisia.
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