

# SCIENCE AND TECHNOLOGY IN ISLAM

KHALID AL-KHATEEB



BP  
190.5  
S3  
K45

NATIONAL ISLAMIC UNIVERSITY MALAYSIA

# **Science and Technology in Islam**

**Khalid A.S. Al-Khateeb**

Department of Electrical and Computer Engineering

## **Summary**

Islamic epistemology is based on a central doctrine, Allah (swt) is the source of all knowledge. Three main sources arise therefrom viz. God's teaching to Adam, Revelation (Qur'an and Sunnah), and Fitrah. The knowledge of Adam was transmitted to his sons, and continues to flow down from one generation to another. Revelation being the word of God holds the truth, nothing but. The words of the Qur'an and their contexts contain the absolute and infinite knowledge. The Quran contains verses, which instigate the human mind to ponder on the wonders of the Universe from atoms to galaxies. It is a prime motive for scientific research. God taught man all what man knows, including science and technology. It is He who taught Adam the names of all things. It is He who taught Noah how to build ships, and taught Dawood how to use Iron to make shields and war equipment. It is He who facilitates the powers and contents of nature for human benefit. Fitrah is an inborn faculty and a great gift bestowed upon man. It is a formidable natural force. When its powers are released, the mind opens up to inspiration, whence great feats are accomplished. In the West it is left unleashed, in contrast with Islam which refines and controls it. Pure Fitrah leads to (Iman) and guides the soul towards good.

Islamic moral values developed under guidance of the Qur'an, and teachings of Prophet Mohammad (pbuh), produced generations of scholars, whose contributions had the greatest impact on modern science and technology, and the inventions that followed. The first flying machine ever, was designed by Abbas Ibn Firnas, neither by Roger Bacon nor by Leonardo Da Vinci. It was al-Hasan Ibn al-Haytham who studied light phenomena, long before Newton and Galileo. It was al-Biruni who discovered the law of "conservation of mass" 700 years before Lavoisier. Reference should be made to Jabir Ibn Hayyan not Boyle, and to al-



Khawarizmi and Thabit Ibn Qurrah, who were mathematicians of the greatest caliber, not to Descartes and Napier. History as taught in the West, is aimed at presenting the Europeans as the master race. Muslim names are Latinized and their contributions are attributed to others. Facts are falsified and made obscure. There is terrible negligence on the part of our educators, who have followed in the footsteps of the colonizers, by omitting a glorious Millenium in the history of Islam. Basic curricula should be revised and corrected. Pride and self-belief must be restored to the new generation of the Ummah.

Twentieth century science began by posing a simple question. What is matter, and why do materials have different properties? Investigations produced the new theories of nuclear physics and quantum mechanics. The first lead to the development of nuclear bomb, and the second to semiconductors and lasers. Semiconductors are the basic materials in electronic technology, hence computers, which are the most outstanding product of our time. Electronics has developed by 1000 000 times in speed and capacity over the last 50 years, and still developing. New ideas and applications appear every week. They are used in industry, medicine, robotics etc. to an extent that will change our life style radically. Information technology is at the center of the globalization process.

The concept of globalization is very old, as old as the first states and empires. As an expression it has been implied in politics, economics, etc. Globalization in science and technology started after World War II. It became more noticeable after the Gulf War, and the later collapse of the Soviet Union. From an Islamic point of view; if the aim is to build a world civilization based on moral values, such that globalization is "human oriented", it is a good thing. But if it is "profit oriented" aimed at propagating Western values, which are based on the supremacy of the European race, the Muslim Ummah must proceed carefully. Concerted efforts and calculated steps should be taken towards the development of human resources in science and technology. The available means can be put to advantage. Restoration of self-confidence and self-belief as part of the education system is a priority. The Islamic culture can stand up to the challenges of the West, with confidence and integrity. To achieve this many questions may be raised to the leaders as well as to the populous.

# العلم و التقنية في الإسلام

من المحاضرات الافتتاحية للأساتذة

الأستاذ الدكتور خالد عبد الحميد الخطيب

رئيس قسم الهندسة الكهربائية و الحاسوب

كلية الهندسة

الجامعة الإسلامية العالمية ماليزيا

## الملخص

تقوم نظرية المعرفة في الإسلام على عقيدة مركزية هي أن الله (سبحانه و تعالى) باسمه العليم هو مصدر العلم و منبع المعرفة. يتفرع عن ذلك ثلاثة مرتكزات أساسية. المرتكز الأول هو أن الله علم آدم و المرتكز الثاني الوحي أي القرآن الكريم و السنة النبوية الشريفة بجانبها القول و الفعلي و أما المرتكز الثالث فانه الفطرة. لقد علم الله آدم الأسماء كلها و مما تعلم آدم من ربه انتقل إلى أبنائه و مرى في الأجيال المتلاحقة. أما الوحي فيما أنه كلام الله إذن هو الحقيقة المطلقة و لا شيء غيرها و كذلك تكون كلمات القرآن. فكلمات القرآن و ما تشتمل عليه من معاني ما هي إلا كمال المعرفة و العلم اللامتناهي. يشتمل القرآن الكريم على آيات تستثير العقل البشري نحو التأمل و التفكير في عجائب الكون فالفطرة الإلهية تتجلى في الذرات كما تتجلى في المجرات و في ذلك دعوة و دافع للبحث العلمي و التقصي الفكري. لقد علم الله الإنسان كل شيء يعرفه بما في ذلك العلوم و التقنيات. فقد أعطى لأدم معرفة كل الأسماء و علم نوحا صناعة السفن كما علم داود صناعة الحديد و آلات الحرب. و هو الذي سخر قوى الطبيعة و محتوياتها لمنفعة البشر. و أما الفطرة فتأهيا الملكة التي أودعها الله عند البشر و تولد معه فهي موهبة إلهية و قدرة طبيعية هائلة. فالفطرة على سجيته قوة جبارة إذا ما تحررت تفتح العقل و أصبحت مناطا للإلهام و عند ذلك تأتي بإنجازات عظيمة كما حصل عند علماء المسلمين الأفاضل. لقد تعلم الغرب المعاصر من الإسلام تحرير الفطرة و لكنها تركت دون قياد بل عملت عليها قوى المادية و التهويد. ذلك أن الفطرة السليمة تقود إلى الإيمان و ترشد إلى الخير.

لقد تطورت القيم الأخلاقية في ظل التوجيهات القرآنية و تعليمات الرسول الكريم صلى الله عليه و سلم فنشأت بموجها أجيال من العلماء الذين كان لنتاجهم العلمي أبلغ الأثر على تقدم العلوم و التقنيات الحديثة و ما أعقبها من اكتشافات و اختراعات. إن أول آلة طائرة كانت من تصميم عباس بن فرناس و لم تكن من قبل روجر بيكن و لا من قبل ليوناردو دا فنشي و قد كان الحصن بن الهيثم أول من بحث في ظواهر الضوء رحا من الزمن قبل نيوتن و غاليليو. أما البتاني فقد



اكتشف "قانون حفظ الكتلة" الشهير 700 سنة قبل لافوازييه. ولا بد من الإشارة إلى مرجعية جابر بن حيان و ليس إلى بويل و إلى محمد الخوارزمي و ثابت بن قرّة و اللذين كتبا من المع رجال الرياضيات و ليس إلى ديكار و نابيير. إن التاريخ الذي يدرس في الغرب ما هو إلا تحن كبير على الحقيقة و الواقع يقصد من ورائه إظهار الجنس الأوربي بمظهر الأسيد ليسهل عليهم استعباد الآخرين. و أما أسماء الأعلام من المسلمين فقد حورت إلى لاتينية أو نسب نتاجهم الفكري إلى غيرهم و زورت الحقائق و طمست المعالم. هناك تقصير كبير من قبل مربينا الذين ساروا على خطى المستعمرين إما جهلا أو خيانة فساهموا في طمس ألفية من تاريخ الإسلام المشرق. و لذلك فإننا ندعوا إلى تصحيح المناهج الدراسية و إعادة صياغتها بما يكفل لأجيال الأمة استعادة الثقة بالذات و الفخر بالأجداد.

لقد بدأ العلم في القرن العشرين بسؤال بسيط عن ماهية المادة و لماذا تختلف المواد في خواصها؟ فكان للإجابة على هذا السؤال ما أنتجت الأبحاث من نظريات تتعلق بالفيزياء النووية و ميكانيك الكم. أما الأولى فتنتجت عنها القنبلة الذرية و أما الثانية فأنتجت أشباه الموصلات و الليزرات. تكمن أهمية أشباه الموصلات في أنها المواد الأساس للتقنيات الإلكترونية و من ثم الحواسيب التي تعد أبرز منتج في عصرنا الحاضر. لقد حققت الإلكترونيات تطورا من حيث السعة و السرعة ما يزيد على مليون مرة خلال خمسين سنة فقط و ما زالت التطويرات تتوالى. لا يكاد يمر أسبوع دون ظهور فكرة أو تطبيق جديد فقد دخلت مجالات الصناعة و الطب و الروبوت و غيرها كثير إلى الحد الذي أثرت به على أسلوب الحياة بشكل جوهري. كما أن لتقنية المعلومات دور مركزي في عملية العولمة.

إن مفهوم العولمة قديم قدم تأسيس أولى الدول و الإمبراطوريات ولكنه كمصطلح حديث صار يتردد في المضامين السياسية و الاقتصادية و غير ذلك. أم في العلوم و التقنية فقد بدأ بعد الحرب العالمية الثانية و أصبح أكثر وضوحا بعد حرب الخليج (أم المعارك) و انهيار الاتحاد السوفيتي. في المنظور الإسلامي إذا كان القصد ببناء حضارة عالمية رائدها القيم العليا تقوم العولمة فيها على "توجه إنساني" فخير على خير و أما إذا كان رائدها "توجه ربحي" و تعميم القيم الغربية التي تقوم على أساس عنصري يدعوا إلى تفوق الجنس الأوربي فإن الأمة الإسلامية أن تتوخى الحذر و لا بد من خطوات محسوبة بعناية تقوم فيها بتنسيق جهودها لبناء الموارد البشرية علميا و تقنيا لنلا يأخذها الطوفان مستفيدة من الوسائل المتاحة. إن استعادة الثقة بالنفس و الإيمان بالذات من أهم الأولويات. إن الثقافة الإسلامية قادرة على مواجهة الغرب و تحدياته بقة و ثبات. ولكن ذلك ليس بالأمر الهين. فانه يتطلب الإجابة بوضوح على كثير من الأسئلة من قبل الرعاة و الرعية. والله ولي التوفيق.

# بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

الحمد لله رب العالمين والصلاة والسلام على أشرف الأنبياء والمرسلين  
سيدنا محمد وعلى آله وصحبه أجمعين.

## SCIENCE AND TECHNOLOGY IN ISLAM

**Khalid Al-Khateeb**

Kulliyyah of Engineering

International Islamic University Malaysia

### Introduction

The advent of Islam has no doubt, marked a major transformation on the epistemology, history, activity, and all other aspects of human life. When the level of intellectual development reached maturity, humanity became ready to receive the final message, Islam. The most central doctrine is God's unity, and belief that Mohammed (pbuh) is God's last messenger.

شهادة أن لاإله إلا الله وأن محمدا رسول الله وخاتم النبيين

The Qur'an is the constitution of the whole message of Islam. The first verse of Revelation starts with a command. (al-Alaq 96: 1-5):

اقرأ باسم ربك الذي خلق. خلق الإنسان من علق.  
اقرأ وربك الأكرم. الذي علم بالقلم. علم الإنسان ما لم يعلم.

Read! "Read in the Name of Thy Lord, Who created. Created man from a hanging clot. Read! Thy Lord is the most Gracious Who taught with the pen. Taught man that which he knew not". A close



look at these verses gives an over view of the Islamic attitude towards learning. Reading and writing are the basis of the learning process, and the source of all knowledge is Allah (swt). This is the foundation upon which the Muslim quest for knowledge and scientific learning rests. "The One who created" is a general statement. It does not specify. The generality means, He created everything. The ambiguity is to stimulate the inquisitive human mind, to seek answers. It is a sign for man to contemplate, to ponder on the universe and the wonders therein, and to explore the secrets of the creation. There is as much wonder in an atom as in a galaxy. What are the forces and the laws that govern the universe? One could feel the gravity of God's command to man to pursue research. "Who created" He is the Creator. No one has created but He. "Created man from a hanging clot" is incitement to look into the origin of ones own self, hence into the origin of all things. Let's further look into the following two verses. The wonders therein draw attention to the marvels of God's wisdom in the variety of creation. (Fatir 35:27, 28):

ألم تر أن الله أنزل من السماء ماء فأخرجنا به ثمرات مختلفا ألوانها  
و من الجبال جدد بيض وحمر مختلف ألوانها و غرابيب سود. و من  
الناس و الدواب و الأنعام مختلف ألوانه كذلك، إنما يخشى الله من  
عباده العلماء، إن الله عزيز غفور.

The verses call upon thinkers, invite and incite them to research. A most eloquent start "Seest thou not! that Allah sent down from the sky water with which We produced fruits with a variety of colors .." In a few sentences Allah (swt) calls upon scientists to look into such fields as atmospheric science, botany and agriculture, geology and mineralogy, sociology, and zoology. The call is then concluded

“Verily, it is scientists who are the most God fearing of His worshippers, for He is Exalted in Might, Oft-forgiving”.

### **Islamic Epistemology**

It is thus, that Islamic science and quest for knowledge originates. A Muslim seeks God’s wisdom in the wisdom of His creation. Therefore, it is an act of worship, and obedience to God’s command. This is radically different from the materialistic thinking, which characterizes most of the secular scientists. Islamic epistemology is based on three main sources of knowledge viz. God’s teaching, Revelation, and Fitrah. God is the prime source of knowledge. First, He taught Adam. Then, knowledge was handed down from one generation to the next. (al-Baqarah 2: 31):

و علم آدم الأسماء كلها ثم عرضهم على الملائكة فقال أنبئوني بأسماء هؤلاء إن كنتم صادقين. قالوا سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

“and, He taught Adam the names of all things, and presented them to the Angels..., be Exalted! said they; we know naught, save that which You have taught us”. Second, the Revelation, i.e. the Qur’an being the word of God, it holds all the truth, nothing but. (Fussilat 41:42):

**لا يأتیه الباطل من بین یدیه و لا من خلفه تنزیل من حکیم حمید**

“No falsehood can approach it from before or from behind it. It is sent down from the Wise, the Worthy of praise”. The Qur’an also, holds all knowledge. It is the words of God, and the inexhaustible meanings contained therein constitute infinite knowledge. (al-Kahf 18:109):



**قل لو كان البحر مدادا لكلمات ربي لنفد البحر قبل أن تنفذ كلمات ربي  
و لو جننا بمثله مددا**

“Say! If the ocean were ink wherewith to write the words of my Lord, sooner it would be exhausted than would the words of my Lord, even if we added one like it”. Third, Fitrah is God’s great gift of insight given to man. The unspoiled Fitrah means belief, faith, and inspiration. By Fitrah, man can discover the hidden secrets of the Universe. This inborn faculty has been bestowed upon man as part of his being. (Al-Rum 30: 30):

**فطرت الله التي فطر الناس عليها لا تبديل لخلق الله  
ذلك الدين القيم و لكن أكثر الناس لا يعلمون**

Fitrah is an inborn faculty, a formidable natural force provided to all humans. When Islam released the power of Fitrah and allowed it to flourish, tremendous achievements were made. New sciences were founded. Discoveries were made in all fields. Muslim scholars elaborated and explained obscure facts. In obedience to Allah, they were true academics honest and just. They were inspired by their faith and guided by their Lord. However, God’s gift of knowledge by Fitrah is not limited to Muslims. God has bestowed this inborn gift upon all human beings, so that they may believe by intuition. (al-Isra’ 17: 20):

**كلا نمد هؤلاء و هؤلاء من عطاء ربك و ما كان عطاء ربك محظورا**

“We provide these and those from the bounty of thy Lord, Whose provisions are not sanctioned”. Therefore, it should not be tempting to attribute every scientific finding to Muslims. Credit should be

attributed to whoever deserves it. Justice should be done even to those malicious 'scientists', who do not credit the Muslim scholars for their scientific achievements. (al-Ma'idah 5:8):

ولا يجرمنكم شنآن قوم على أن لا تعدلوا اعدلوا هو أقرب للتقوى

"Let not the hatred of others to you make you swerve from justice. Be just, that is next to piety". The technological advance of the West should be recognized and put to good human benefit, but not to be overwhelmed by it, as to belittle our Islamic scientific heritage. Confidence in our ability to become masters of innovation and creativity must be restored. The West has benefited from Islamic wisdom of allowing the forces of Fitrah to be released. Fitrah in the West however, is wild and unleashed. Everything has become permissible under the pretext of freedom. Freedom of the individual is considered so sacred that man has become his own god. This is precisely how Islam comes into the clash of civilizations with the West. Islam refines and controls the forces of Fitrah. Islam has built a humane God fearing civilization. In this clash some naïve Muslims may think it right to oppose anything related to the Western culture. Whereas, science and technology with economic development mean wealth and strength, without which the Ummah cannot regain its leading role in the world. It is wise to take advantage of all scientific findings, while upholding our moral values. Wisdom is sought, wherever it shines. The Prophet (pbuh) says:

الحكمة ضالة المؤمن حيث وجدها التقطها

"Wisdom is a quest for the believer, he picks it wherever he finds it". Not forgetting that the principal wisdom is God fearing. This is the grand rule, which was taught and followed by all the great



Muslim scholars, in their quest for knowledge. They adhered to academic integrity and objectivity. For example, al-Hassan Ibn al-Haytham, who is considered by many as the father of modern optics. However, he could also be considered the father of all modern science. He defined scientific method (objectivity) in a beautifully precise and concise manner:

### هي اتباع الحقيقة لا الميل مع الهوى

"It is to follow the truth, not to be inclined towards one's own whims ". With this attitude, Muslim scientists went about researching and seeking the truth in every aspect in life. Baghdad, Kufah, Basrah, Cairo, Granada and Cordoba, were world scientific centers. Islamic civilization although original, i.e. founded on new principles, it was not rigid. It interacted dynamically with all existing and ancient cultures, Greek, Chinese, Indian, and Persian. Darul-Hikmah (House of Wisdom) in Baghdad was a center of scientific excellence. Any work of scientific value was rewarded with its own weight in gold, be it original or translated from another language. There were no complexes and no extremes. Agreement and disagreement may be, all argued over politely, proving or disproving with logic and authenticated facts. Moral values ranked high. Then they fell into oblivion. (Aal 'Imran 3: 140):

### و تلك الأيام نداولها بين الناس

"Such days (of fortune) We give to peoples by turn". Muslims today are in a state of misery. For many years, they have been blinded by foreign domination ignorance, and poverty. They will continue to be dominated, unless the whole Ummah wakes up and stands up for their beliefs and their rights. A malicious strategy has been set

forth and nurtured by the European colonizers. The strategy is a build up of psychological, moral, and spiritual defeat, gradually instilled in successive generations. One tactic of this strategy attempts at discrediting history systematically, by falsifying facts and events. This is especially noticeable with respect to Islamic science and technology (see next section). Aim! is to deprive the subdued nations from any sense of pride. Much effort has been devoted to present the Greeks, then the Romans as the only builders of civilization, and the Europeans today as their heirs. Therefore, it is 'fate' that the Europeans are the unquestionable masters, who must be accepted as the superior race. This deep-rooted racist rancor can only be exposed by an extremely strong sense of justice, which can only be upheld by Islam. The doctrines of Islam are clear enough even for simple people to discern the difference between right and wrong, however subtle it may be! The colonizers have come to recognize this fact. Orientalists and scholars through intensive studies devised subtle methods to combat the power of Islamic faith, but all went with limited success. Liberation movements scored one victory after another. The Islamic message in the conflict was short and sweet "I am Muslim, he is Kafir, he must leave my country". Failure has caused the colonizers to change tactics. Two lines of attack are adopted. The first is to use the Muslims themselves in the conflict, by luring the 'elite' into adopting Western culture. The second is less subtle and more aggressive, which is to wipeout all antagonism by physical elimination. Both tactics were employed in the Gulf War (Mother of Battles). Also, live events testify to this fact, from Iraq, Palestine, Afghanistan, Bosnia, Chechnya, Kosovo, Sudan, and wherever there are Muslims, who seek justice. These facts are brought to our attention daily even via the West's own media. The aim of this frivolous attack is to make us lose confidence in our ability to become masters, and



to lose our Faith, which is the driving force behind our ability of innovation and creativity. Faith must be restored, otherwise, exploitation of the Ummah will continue.

### **Islamic Excellence in Science and Technology**

Let's shed some light on the roots of modern science and technology. Let's look at the glorious past, because history is the collective consciousness of people. Ignorance of history is a state of amnesia, and forgotten identity, which is catastrophic to any nation. Therefore, it is imperative for the present and future generations of the Muslim Ummah to be well aware of the great achievements accomplished by their ancestors. Those men, whose multi-disciplinary scholarship enlightened the world. Without their research and ingenuity, modern science and technology would not have begun. Their outstanding contributions to our basic understanding of, mathematics, medicine, science, technology, sociology, and philosophy are enormous. Much use has been made of their contributions, without giving them due credit. Their names have been omitted from formal education in Western based systems of learning. If at all mentioned (in historical references), they are Latinized or changed so that their identity, origin and association with Islamic civilization, remain obscure.

Western civilization has made some invaluable contributions to the development of the sciences, but so have numerous other cultures. Most texts give little or no mention of the advancements made by the indian, the chinese and, particularly the muslim scholars. Westerners have long been credited with discoveries made many centuries before. The holy qur'an describes such people as (aal 'imran 3: 188):

و يحبون أن يحمدا بما لم يفعلوا فلا تحسبنهم بمفازة من العذاب

“Those who love to be praised for what they have not done, think not that they can escape torment”. In fairness to facts and history, some of the names and achievements will be cited here. By no means is the list complete. It represents no more than a tiny fraction of the hundreds who held the torch with esteem and integrity. The contributions they made had the greatest impact on the inventions and discoveries of modern age.

### **Engineering and Science**

Abbas Ibn Firnas invented, constructed and tested a flying machine in the 800's A.D. Roger Bacon may have learned of flying from Arabic references to Ibn Firnas' machine. The latter antedates Bacon by 500 years and Da Vinci by 700 years.

Mechanical Clocks were produced by Muslim engineers, both large and small, and this knowledge was transmitted to Europe through Latin translations of Islamic books on mechanics. Some of these clocks were weight-driven. Designs and illustrations of epi-cyclic and segmental gears were provided. It was not until the 14<sup>th</sup> century, that the only type of clock available in Europe was the water clock. It was 1335, when a large mechanical clock was erected in Milan, Italy. One such clock included a mercury escapement, which was directly copied by Europeans during the 15<sup>th</sup> century. In addition, during the 9<sup>th</sup> century, Ibn Firnas invented a watch-like device, which kept accurate time. The Muslims also constructed a variety of highly accurate astronomical clocks for use in their observations.

An interesting little tale is told about a present sent by Harun Ar-Rshid to Charlmanne, king of the French. It was in the form of a chiming clock. When the people in the Court heard it, they were scared, thinking there were Jinn inside it. *جِنّ*

Ibn Yunus al-Masri discovered the pendulum in the 10<sup>th</sup> century. He was the first to study and document the oscillatory motion. Its



value for use in clocks was introduced by Muslim physicists during the 15<sup>th</sup> century. The Europeans in their formal education say that Galileo developed the pendulum in the 17<sup>th</sup> century during his teenage years. He noticed a chandelier swaying as it was blown by the wind. As a result he went home and invented the pendulum.

Syrian Artisans produced fine glass during the 9<sup>th</sup> and 10<sup>th</sup> centuries. Glass mirrors were in use in Islamic Spain as early as the 11<sup>th</sup> century. The Venetians learned of the art of fine glass production from the Syrians and first produced glass mirrors in 1291 in Venice.

Printing Press, a moving brass type was in use in Islamic Spain 100 years prior to Johannes Gutenberg, which was the first printing device in the West. It is told that in 1454, Gutenberg developed the most sophisticated printing press of the Middle Ages. It is probably worth mentioning that the press in its origin is a Chinese invention.

Al-Hassan Ibn al-Haytham, in the early 11<sup>th</sup> century, virtually discovered everything that Newton advanced regarding optics centuries prior, and is regarded by numerous authorities as the "founder of optics". It is claimed that Newton's 17<sup>th</sup> century study of lenses, light and prisms forms the foundation of the modern science of optics. There is little doubt that Newton was influenced by Ibn al-Haytham, who was the most quoted physicist of the Middle Ages. His works were utilized and quoted by a greater number of European scholars during the 16<sup>th</sup> and 17<sup>th</sup> centuries than those of Newton and Galileo combined. Did Newton discover that white light consists of various rays of colored light in the 17<sup>th</sup> century? This discovery was made in its entirety by Ibn al-Haytham (11<sup>th</sup> century) and Kamal ad-Din (14<sup>th</sup> century). Newton did make some original discoveries, but this was not one of them. Ibn Firnas invented eyeglasses during the 9<sup>th</sup> century, and they were manufactured and sold throughout Spain for over two centuries.

Any mention of eyeglasses by Roger Bacon (1292) was simply a regurgitation of the work of Ibn al-Haytham.

Abu-Raihan al-Biruni (died 1050) discovered the finite nature of matter. The concept is that matter may change its form or shape, but its mass always remains the same (Law of mass conservation). This discovery is unscrupulously attributed to Antoine Lavoisier (18<sup>th</sup> century), who himself admits that he was a disciple of the Muslim chemists and physicists and referred to their books frequently.

Al-Biruni was the world's first great experimenter. He wrote over 200 books, many of which discuss his precise experiments. His literary output in the sciences amounts to 13000 pages, far exceeding that of Galileo and Newton combined.

Chemistry was studied by a variety of Muslim chemists. The list is very long. Jabir Ibn Hayyan, is no doubt the father of chemistry. He is famous for writing more than 100 monumental treatises, of which 22 on chemistry. He performed many scientific experiments, some 700 years prior to Boyle. His contributions of fundamental importance include perfection of scientific techniques such as crystallization, distillation, calcination, sublimation and evaporation, and the development of several instruments. Jabir's major practical achievement was inventing alembic (Anbique), in which he prepared, for the first time, minerals and acids. Major scientific contributions to chemistry were also made by many other Muslim scientists, such as ar-Razi, al-Biruni, and al-Kindi. Humboldt and Durant regard the Muslims as the founders of chemistry. Muslims introduced the experimental method to this science.

Geology was studied by al-Biruni centuries before Da Vinci was born. He made the observation that fossils found on top of mountains indicate a watery origin of the earth and added much to it, including a huge book on geology. Ibn Sina also noted this. It is probable that Da Vinci learned of this concept from Islamic books.

He added nothing to their findings. The first mention of geological formation of valleys was made by Ibn Sina and al-Biruni 700 years before Nicolas Desmarest (1756).

## **Mathematics**

Muhammad al-Khawarizmi was one of the greatest mathematicians ever lived. He is recognized as the founder of Algebra. The name is derived from his famous book al-Jabr wal Muqabila. (الجبر و المقابلة) He also developed the Calculus of two errors, which lead him to the concept of Differentiation. Another valuable contribution is Analytical Geometry, in which he refined the representation of conical sections. He adopted the use of numerical Zero, leading to the Decimal System. He pioneered the work on the system of numerals known as Algorithm or Algorizm and introduced the Arabic Numerals. Several of his books were translated into Latin in early 12<sup>th</sup> century by Adelard of Bath and Gerard of Cremona. This book was the only books on mathematics in Europe for 400 years. It is a pity that many of his books are known only in Latin. Hisastronomical tables were translated into European languages and later into Chinese. To Geography he also made outstanding contributions.

Trigonometry remained largely a theoretical science among the Greeks. It was developed to a level of modern perfection by Muslim scholars. However, the weight of credit must be given to al-Battani. The words describing the basic functions of this science, sine, cosine and tangent are all derived from Arabic terms. Thus, original contributions by the Greeks were minimal. Even Pythagoras' theorem was known to the Babylonians, written and illustrated on a piece of clay, exhibited in the Iraqi Museum.

Al-Kashi's book Key to Arithmetic was written at the beginning of the 15<sup>th</sup> century and was the stimulus for the systematic application of decimals to whole numbers and fractions thereof.



It is highly probable that the Dutchman Simon Stevin imported the idea to Europe from al-Kashi's work around 1589. Muslim mathematicians were the first to utilize decimals instead of fractions on a large scale.

Algebra as invented by Muslim Mathematicians. They introduced the concept of using letters for unknown variables in equations. Though this system, they solved a variety of complex equations, including quadratic and cubic equations. They used symbols, as early the 9th century to develop the binomial theorem, which is a crucial component for the study of algebra. Hundreds of Muslim mathematicians utilized and perfected it. They initiated its use for the systematic solution of algebraic problems during the 10<sup>th</sup> century (or prior). Then it was said that Newton developed the binomial theorem in the 17<sup>th</sup> century. It is probable that Europe did not know algebra until Francois Vieta wrote algebra book (1591) describing equations with letters such as  $x$  and  $y$ 's.

The cubic equation was not solved in Europe until the 16<sup>th</sup> century by Niccolo Taraglia, whereas cubic equations as well as numerous equations of even higher degrees were solved with ease by Muslim scholars as early as the 10<sup>th</sup> century. Negative numbers were introduced by Muslim scholars 400 years prior to Cardano who was credited with the discovery. Thabit Ibn Qurrah in the 9<sup>th</sup> century was the first to utilize algebra to advance geometry, and he was followed by Abul Wafa in the 10<sup>th</sup> century, which is long before the 17<sup>th</sup> century Rene Descartes. Logarithms, also were invented by Muslim mathematicians and logarithmic tables were produced. Such tables were common in the Islamic world as early as the 13<sup>th</sup> century, several centuries prior to John Napier (1614).

Even some poets used logarithmic representation to commemorate historical events. They wrote indicative words from which the exact dates can be calculated.

Muslim astronomers made numerous improvements upon astronomy of the ancients. They were the first to dispute the archaic ideas of Ptolemy as early as the 9<sup>th</sup> century. In their critic of the Greeks, they synthesized proof that the sun is the center of the solar system and that the orbits of the earth and other planets might be elliptical. They produced hundreds of highly accurate astronomical tables and star charts. Many of their calculations are so precise that they are regarded as contemporary. Some biased authors, in contradiction to overwhelming evidence say, "No improvement had been made until the 13<sup>th</sup> century. Then, Alphonso 'the wise' invented the Alphonsine Tables. These tables were in fact, little more than copies of work on astronomy, i.e. the Toledo Tables, transmitted to Europe via Islamic Spain. -

## **Medicine**

Modern medicine, says Harvard's George Sarton, is entirely an Islamic development and that, Setting the Records Straight, the Muslim physicians of the 9<sup>th</sup> through 12<sup>th</sup> centuries were precise, scientific, rational and sound in their approach. Johann Wegger was among thousands of European physicians during the 15<sup>th</sup> through 17<sup>th</sup> centuries who were taught the medicine of ar-Razi and Ibn Sina. He contributed nothing original. Pathology was studied by Islam's Surgeons. They fully realized the nature of disease and described a variety of diseases to modern detail. Ibn Zuhr correctly described the nature of pleurisy, tuberculosis and pericarditis. az-Zahrawi accurately documented the pathology of hydrocephalus and other congenital diseases. Ibn al-Quff and Ibn an-Nafis gave perfect descriptions of the diseases of circulation. Other Muslim surgeons gave first accurate description of certain malignancies, including cancer of the stomach, bowel and esophagus. These surgeons were the originators of pathology not Giovanni Morgagni.

Chemotherapy is another field in which Muslim physicians

excelled. They used a variety of substances to destroy microbes. Sulfur was applied topically to specifically kill the scabies mites. Ar-Razi (10<sup>th</sup> century) used mercurial compounds as topical antiseptics. Numerous Muslim chemists produced medical grade alcohol through distillation as early as the 10<sup>th</sup> century and manufactured it on a large scale. They invented the first distillation devices for use in chemistry, and used alcohol as a solvent and an antiseptic. Therefore, neither Paul Ehrlich (19<sup>th</sup> century) was the originator of chemotherapy, nor was Arnau de Villanova (13<sup>th</sup> century) the first to purify alcohol.

Modern anesthesia was discovered, mastered and perfected by Muslim anesthetists 900 years before the advent of Humphrey Davy and Horace Wells (19<sup>th</sup> century). Az-Zahrawi and Ibn Zuhr among other Muslim surgeons performed hundreds of surgeries under inhalation anesthesia with the use of narcotic-soaked sponges, which were placed over the face, six hundred years before the American C.W. Long (1845).

Scientific Surgery was advanced by the illustrious surgeon az-Zahrawi, who began ligating arteries with fine sutures over 500 years before Ambrose Pare. He perfected the use of catgut that is the suture made from animal intestine. Additionally, he instituted the use of cotton plus wax to plug bleeding wounds. The full details of his work were made available to Europeans through Latin translations. Despite this, barbers and herdsmen continued to be the primary individuals practicing the 'art' of surgery for nearly six hundred years after az-Zahrawi's death. Pare himself was a barber, albeit more skilled and conscientious than the average ones. Included in az-Zahrawi's legacy are dozens of books. His most famous work is a 30-volume treatise on medicine and surgery. His books contain sections on preventive medicine, nutrition, cosmetics, drug therapy, surgical techniques, anesthesia, pre and post-operative care as well as drawings of some 200 surgical



devices, many of which he invented. The refined and scholarly az-Zahrawi must be regarded as the father and founder of rational surgery not the uneducated Pare. Ibn al-Baytar wrote a monumental pharmacopoeia during the 14<sup>th</sup> century, listing over 1400 different drugs. It is likely that the German work is an offshoot of that of Ibn al-Baytar, which was widely circulated in Europe. Ar-Razi, Ibn Sina, al-Kindi, Ibn Rushd, az-Zahrawi, Ibn Zuhr, Ibn al-Baytar, Ibn al-Jazzar, Ibn Juljul, Ibn al-Quff, Ibn an-Nafis, al-Biruni, Ibn Sahl and hundreds of other Muslim physicians mastered the science of drug therapy for the treatment of specific symptoms and diseases. In fact this concept was entirely their invention. The word 'drug' is derived from Arabic. Practical experience and careful observations were extensive.

### **Development of Weapons**

The historian Theophanes wrote about how the Byzantines, between the years 670-680 got a secret formula from a traitor who defected from the Umayyad navy. They called him Kallinikos. It was a petroleum mixture that would burn even on water, later was erroneously called 'Greek fire'.

Discoveries shed further light on a unique Arab manuscript brought to the Bibliotheque Nationale in Paris in the mid-19<sup>th</sup> century and titled "The Book of Horsemanship and the Art of War". Written in 1285 by Najm al-Din Ahdab, a Syrian officer, the book is packed with information on how to distill oil to make kerosene; how to prepare explosives from gunpowder; how to fit the multiple fuses into various kinds of "naphtha pots"; and even how to build (flying fire) rockets! The author includes sketches of the weapons he mentions, and one is a crude missile armed with a (naphtha pot) warhead.

In the 1940's, Maurice Mercier had several varieties of those bombs carefully examined, many are on display in Cairo Museum

and the Louvre. They were filled with a volatile jelly of kerosene, nitrates and sulfur, thrown by hand or mangonels. Clearly, the makers of the firebombs were technicians with a sophisticated knowledge not only of explosives and incendiaries, but also of soil sciences and ceramics. They must have known which clay to use with which kind of bomb and to what extent to harden and glaze it. The makers must also have known mechanics and some aerodynamics, too.

Abu Tahir al-Fayruzabadi wrote his monumental work, a condensed encyclopedia titled al-Qamus al-Muhit. To this day, it remains one of the best references ever written on the Arabic language and Arab culture. It contains a remarkable section that deals with Naft. Not only its origin, its uses as fuel in lamps, in flame-throwers, as a solvent, - he elaborates "The best grade of Naphta is water-white". This indicates that there were grades, which means that Muslims must have practiced some form of oil refining, must have been refiners and associated technicians. The term water-white naphta, however was first mentioned by Masarjawah a physician from Basrah in 683, in his book Kitab Qiwa al-Aqaqir.

Muslims developed the Astrolabe and were the first to use the compass in Navigation. Al-Idrisi made the first rational map of the known world. The list goes on and on.

### **Development of Science and Technology**

When, where and how did modern science and technology begin? There is argument amongst thinkers and historians as to which came first, science or technology. Some say that by necessity any intellectual activity signifies a scientific thought. Science in its turn would lead to an application. The variety of applications develops into technology. Others argue differently, they cite historical evidence to the opposite. Ancient man, they say, for his own defense and survival in a wild environment imitated the sharp teeth and strong claws of animals in their fight for survival. Hence, he

invented tools out of stone, wood and, minerals. That is how technology started. Then man managed to tame the wild animals with science and philosophy. With technology, he practiced agriculture.

### **Ancient Technology**

Some Western scholars consider the civilizations of Mesopotamia (Iraq) and the Nile Valley (Egypt) as technological. The Greeks then learned from them what they did, and developed their scientific philosophy.

Whatever the case may be, it is difficult nowadays to talk about technology without some reference to science and vice versa. The two terms are so inter-related that each constitutes a compliment to the other. It could be said that, science as a branch of knowledge, may be sought for its own sake, because it is a high value. In this case it may be termed "Pure Science". When it is used to produce things for human benefit, it is called "Applied Science" and, it becomes "Technology" when time and cost are taken into consideration, i.e. larger quantity and better quality for lower cost.

Science as an English word, originates from the Latin expression Scientia. Its general meaning comprises the organized knowledge in a certain field, as defined by scientific method. Scientific method, on the other hand, is a conventional style agreed upon by scientists, which must be followed before a scientific finding of a phenomenon, or a conclusion can be accepted by other scientists. Engineering defines professions concerned with scientific knowledge, especially mathematics and natural sciences (acquired by study, experience, training and, practice) to exploit materials, resources, and natural forces. It is the application of science in design, building, and use of tools. Technology nowadays, is an expression that refers to the methods developed by man to make the tools, machines,



equipment, and systems, which satisfy human and social needs. It is the science of development of human skills.

### **Islamic View of Technology**

The Islamic point of view is quite different. The Qur'an generally, states that Allah (swt) created man, and the things he makes.

#### **خَلَقَكُمْ و ما تصنعون**

In the anal of Noah (pbuh), as narrated in the holy Qur'an, Allah (swt) commands him to make the Ark. (Hud 11: 37, 38);

واصنع الفلك بأعيننا و وحينا و لا تخاطبني في الذين ظلموا انهم مغرقون.  
ويصنع الفلك ...

“But construct the Ark under Our own eyes and Our Revelation, and plea not with Me regarding those who committed injustice, they will surely be drowned. And so, he proceeds to make the Ark ...”. Allah (swt) taught Dawood (pbuh) to manufacture battle equipment. (Anbiya' 21:80);

و علمناه صنعة لبوس لكم لتحصنكم من بأسكم فهل أنتم شاكرون

“We taught him the making of armor protection to shield you in your battle, will ye then be grateful”. In another verse Allah (swt) softens for him the Iron, indicating smelting and foundry work. (Saba' 34: 10, 11);

ولقد آتينا داود منا فضلا يا جبال أوبي معه و الطير و أنا له الحديد.

“We bestowed grace upon Dawood, O' mountains sing back praise of God with him, and ye birds too!, and We softened for him the Iron”. Again, a special reference is made to Iron in the Qur'an,

being the basic element for heavy industry, military hardware, and bears many benefits to mankind. (al-Hadid 57: 25):

و أنزلنا الحديد فيه بأس شديد و منافع للناس و ليعلم الله من ينصره  
و رسله بالغيب إن الله قوي عزيز

“We sent down Iron, in which is military might, as well as many benefits to mankind, that God may test those, who will stand forth in His cause, and for His messengers, in the Unseen”. The subject and verses that deal with God’s favors in teaching man how to manufacture and produce things for his benefit are much more than can be included in this text. Much was created by God for man’s benefit; the day and the night, the mountains and the rivers, the wind and the sea, water from the sky and buried treasures, and all what the earth contains. God’s blessings are many, both obvious and concealed. (16:14, 22:65, 31:20, 43:13, 45:12). Allah (swt) has honored man and favored him. (al-Isra’ 17: 70):

و لقد كرّمنا بني آدم و حملناهم في البر و البحر و رزقناهم من الطيبات  
و فضلناهم على كثير ممن خلقنا تفضيلا

“We have honored the sons of Adam; provided them with transport on land and on sea; given them pure provisions of good taste for sustenance, and favored them above many of Our creations.

### **Recent Developments in Technology**

The 19th and 20th centuries have witnessed some major leaps in science and technology. Wars as one of the main drives of social dynamics have especially instigated the revolutionary trends of mass production. Specifications and Standards played important roles in quality assurance. New materials, new industrial processes, and innovative manufacturing, techniques, are some of the results of

scientific research. Research was generously supported by the warring parties. All research was encouraged, theoretical, and applied. The most profound results, however, were those, which challenged existing laws of mechanics, and of elementary particle physics. The achievements that followed marked the 20<sup>th</sup> century as the age of Atomic bombs, Electronics, Lasers, Computers, and Robotics. Most of these inventions were based on new ideas in modern science such as relativity and quantum mechanics. In a simplified way, it all started from a basic question. What is matter, why do materials have different properties?

### **Development of Modern Theories**

The atom is the smallest indivisible building unit of matter. This was what Thomson took for granted when he conducted his experiment. He found that different metals when heated emit the same kind of negatively charged elementary particles. He advanced in 1898 the 'plum-pudding' theory of atomic structure, holding that the negative particles (electrons) were embedded in a pudding of positive matter. The different properties arise from the different spatial arrangements of those particles. Rutherford set out to measure the size of Thomson's particles. He bombarded gold foil with positive alpha particles emitted from a radioactive source. It was described as firing bullets on a haystack, which contains canon balls. If a bullet hits a canon ball, it is deflected sharply, and if it hits hay, it will go straight. Rutherford concluded that the atom is mostly empty space and its mass is concentrated in a very small positive nucleus in the center, with negative electrons orbiting it. By bombarding nitrogen gas with alpha particles, he was able to split the N atom into both O and H atoms, and in the process a great amount of energy was released. The experiment was an early stimulus to the development of the Atomic Bomb. He won the Nobel Prize in 1908. What he failed to explain however, is why do



electrons assume specific orbits, with certain levels of energy. Bohr set a model in which the angular momentum can have specific values only; integer numbers of Planck's constant. De Broglie made a hypothesis; any particle with mass and velocity (momentum) can be described as a wave. Therefore an electron orbiting the nucleus is a wave with a wavelength inversely proportional to its momentum. The path length is an integer number of wavelengths. The idea was refused point blank, because it contradicted normal experience. How can a particle be a wave!? Born suggested that, the wave is a probability function, which describes the distribution of a large population, not individual particles. Hence, statistical mechanics, and wave mechanics should be applied in the analysis. Schrodinger summed it up in an equation, which reconciles the dual nature of matter, particles and waves. The outcome was a new science called Quantum Mechanics. It played a major role in the development of nuclear physics and solid state electronics, and the inventions that followed.

## **Electronics**

The thermionic valves (vacuum tubes) were the first electronic devices invented. They served a variety of applications, most important of which was the Radio Receiver, followed by all sorts of devices, even early computers. Research on semiconductors lead to solid-state devices. Soon after World War II, the Transistor was introduced on December 23, 1947. The miniaturization that has resulted leaves us to wonder about its limits. In the 1960's Gordon Moore, an industry pioneer predicted that the number of transistors that could be manufactured on a chip would grow exponentially. His prediction known as Moore's Law was remarkably prescient. Moore's ultimate prediction was that transistor count would double every 18 months, an estimate that has held remarkably well. Complete systems now appear on wafers thousands of times smaller

than the single element of earlier works. New designs and systems surface weekly. The engineer becomes more and more limited in his knowledge of the broad range of advances. Miniaturization and electronic circuit design to many people seem like magic. Some electronic systems are familiar from everyday life. For example we encounter radios, televisions, telephones, and computers on daily basis. Other electronic systems are present in daily life, but are less obvious. Electronic systems control fuel mixture and ignition timing to maximize performance and minimize undesirable emissions from automobile engines. Electronics in weather satellites provide us with a continuous detailed picture of our planet. Other systems are even less familiar. For example, a system of satellites known as the Global Positioning System provides three-dimensional positional information for ships and aircraft anywhere on earth to a high accuracy. Other electronic systems include air-traffic control system, various radars, compact-disc recording and player equipment, two-way radios for police and military communications, satellites that relay television and other signals from geosynchronous orbit, electronic instrumentation, manufacturing control systems, computerized monitors for patients in intensive care units, and navigation systems. Electronic systems are composed of subsystems or functional blocks. These functional blocks can be characterized as amplifiers, filters, signal sources, wave-shaping circuits, digital logic functions, digital memories, power supplies, and converters.

## **Lasers**

Another important offspring of Quantum Mechanics is the Laser (Light Amplification by Stimulated Emission of Radiation). Light is an electromagnetic radiation, i.e. it is an alternating electric field and an alternating magnetic field. The two fields oscillate perpendicular to each other. Their direction of propagation is perpendicular to both. In the interaction of radiation with matter,

electrons inside the atom can acquire energy (by absorption) from incident e/m waves. The atom, which attains a higher energy state (by pumping), becomes excited. Excited atoms (metastables) will relax back to their normal state, after a certain lifetime. The extra energy is emitted as e/m radiation of specific amounts of energy, called quanta, or photons. The process is spontaneous emission. If the number of atoms in the excited state is made more than the number of atoms in a lower energy state, it is called population inversion, and becomes a gain medium. When incident light of suitable wavelength enters such the gain medium, it polarizes the excited atoms and causes stimulated emission. The emitted light will have the same wavelength, the same phase and, the same direction. Normally, the gain medium is enclosed between two mirrors.(optical cavity), so that as light travels back and forth, its intensity increases to very high values. The result is light amplification by stimulated emission of radiation (laser). One of the mirrors is made such that part of the generated light is transmitted outside the cavity. Laser light is intense, monochromatic, coherent and highly directional. Active research has produced many types of lasers, depending on the type of gain medium and pumping mechanism. They cover now most of the spectrum. Initially, the laser was described by some skeptics as an invention looking for applications.

Laser applications, in recent years have become quite diverse. Each application relies on one or more of its properties (high intensity, directionality, monochromaticity, and coherence). Industrial usage of lasers utilizes its power in cutting and machining of hard materials like ceramics and diamonds, or welding of plastics. In medicine they are used instead of scalpels, and in dentistry instead of drills. They are used in a variety of scopes to look inside the human body. In military applications they were the main card played



by the Americans in the SDI, nicknamed the star-war bluff. Guided missiles and smart bombs use lasers in their homing devices. Long lists of many other applications can be drafted.

Optical Communications and Fiber Optics is another major area of laser applications. With a frequency bandwidth reaching 10 to the power 14 (i.e. 100 000 000 000 000), huge amounts of information can be transferred on a laser beam via optical fiber not much bigger than a hair. What a small bundle of such fibers can carry in terms of data channels, TV channels, sound and voice channels, control signals of all sorts etc., is beyond imagination.

### **Robotics**

Robot is a device to manipulate or transport parts through variable programmed motion for the performance of specific tasks.

It may sound far-fetched to say that Muslims were the first to invent Robots, but it is true. Al-Mutanabbi has written a few lines of poetry describing accurately the motion of a mechanical concubine, which hands flowers, and cups to the companions of a prince.

Development of robots will continue so as to replace people on dangerous jobs, or jobs they do not like to do. But, most important on jobs that robots do more economically, to reduce cost, improve quality, and provide better management control. Robots will have a profound impact on man's work style, and perhaps even his life style. In 1979 it took 109 men 6 days to unload a timber ship, then came containerization. Today it takes 8 men one day to do the same task, a reduction from 654 to 8 man-days.

### **Computers**

The greatest revolution of all time came with computers and modern communications. Although they started as an application of Electronics, soon the importance shifted so that Electronics became

the tools with which computers and communications are implemented. The importance of computers cannot be emphasized more. The question however is; what is the present status, and where is it heading? At present, computers are used mostly in an interactive dialog with people, who sit at their keyboards, facing screens, analyzing, storing, retrieving, processing, sending, and receiving information. Also, they are used in individual systems to operate a factory, to run an automatic flight control system, to move a robot, to guide a missile or even in home appliances like washing machines and microwave ovens. In spite of their diversity, these are all limited applications for what computers are capable of doing. The major transformation in computer application strategies is anticipated when computers become more independent and start talking to each other.

The following scenario may serve to demonstrate the idea: "A preoccupied businessman is driving a car. A certain malfunction develops in the car. The computer in the car immediately detects the fault, diagnoses it, checks the time schedule of the businessman, allocates a suitable free time, and sends a message to the computer at the service garage. At the service garage, the computer takes a note, checks store records for available spare parts, sends an order to the suppliers, checks work schedule, issues a work sheet and an estimate, and communicates them to the car computer. The businessman is informed, directed to the service garage, and a charge is made to his account, by the car computer".

This is just one little example of the way in which computers are going to run the lives of the next generation, and perhaps ours. Universities in the future may not be, as we know them today. They will probably be reduced to a small room with stacks of CD's, operated online by some computer expert. Students will not have to leave their living rooms to obtain the university degrees. This revolution may

bring about good, or may result in a total chaos. The big issue is linked with globalization.

### **Globalization**

Globalization as a concept is as ancient as the formation of the first states and empires. As an expression, it has been implied in many contexts, political, historical, cultural and economic. The latter is perhaps the most important. It is assumed that many are familiar with these contexts. Therefore, it shall be looked at from a different angle viz. science and technology.

### **Globalization of Science and Technology**

In this context, it did not start after the Gulf War and the collapse of the Soviet Union. However, it did become clearer, after these two major historical events. In science and technology the process has been going on for more than 50 years, since World War II. The symptoms were evidently there. Industrialized nations have, for a long time, dominated the seen in top meetings and conferences. They developed and managed joint projects whenever a reduction in cost was envisaged. Exchange of scientific information went on, even with some developing countries, under 'partnership' terms during the Eisenhower campaign; Atom for Peace [2]. The fall of the Berlin Wall brought about an open interaction between the West and Eastern Europe ensued by a wide exchange of information. The computers and the major technological achievements in information technology and communications opened the channels for the relations between people to grow and develop on international scale. This constituted a big step towards globalization. The wide spread of the Internet and the accompanying networks made possible the dialog on matters of common interest. Business people jumped at the opportunity to win untapped markets. Scientists discussed such matters as ecology, pollution, global



warming, the ozone layer, food production, energy, education, and last but not least, human cloning.

The advocates of globalization may summarize it as; freedom of expression, and open access to knowledge on unprecedented scale. This attractive proposition is quite an important advantage to the scientific community. It claims that globalization of science and technology will make knowledge available to everyone. Equal opportunities for scientists in a competitive market, governed by offer-and-demand, will not exclude the poor from attaining the level of riches enjoyed by their peers. Could this be true or is the sugar coating? What happens when conflict of interests arise? Will the very advocates of these claims be the first to renounce their principles?

## **Islam and Globalization**

“Globalization should be human oriented not profit oriented” Dr. Mahathier

If globalization is an inevitable fate, what are the principles upon which it should be based? Capitalism, which is promoted in globalization as a new force of control and power, will not necessarily work in Muslim countries because the Muslim mind and convictions are different. Of course Islam is a global religion. In any general address the Qur'an makes, is a declaration of its Universality. Perhaps the verse which is most quoted in this respect is; (al-Hujurat 49: 13):

يا أيها الناس انا خلقناكم من ذكر و أنثى و جعلناكم شعوبا و قبائل لتعارفوا ان اكرمكم عند الله اتقاكم ان الله عليم خبير

“O mankind We created you from a male and a female and made you into nations, that ye may know each other, verily the most gracious among you in the sight of God, is the most righteous of

you". Clearly, Islamic globalization is based on righteousness, which is not only the five duties but (ایمان و عمل) Faith and Work. In conclusion, A Muslim is driven by incentive, which does not totally agree with the capitalist objectives of globalization. Much more comes from a world vision that life on earth is a prelude to an everlasting life in the hereafter. Therefore, for a Muslim Ummah to revive and to have a new Science and Technology culture, an Islamic Paradigm would be essential [3]. Islamic leaderships have an enormous and vital role in starting this paradigm. Co-operation between scholars and leaders is essential. There is no hope if such co-operation did not exist. Internal conflict will lead to corruption and eventual weakness. Muslims never got anywhere in Science and Technology or Civilization except under the banner of Islam, whether in peace or at war.

### **Conclusion and More Questions**

Self-belief is a major factor in the drive towards excellence. There is terrible negligence in our schooling system, regarding the scientific and technological achievements made by the Muslim scholars at all levels of formal learning. Curricula of basic education in nearly all Muslim countries, were based on what the colonizers had planned. They are biased and should be revised. The development of the basic understanding of the scientific principles should be referred to their rightful contributors. Why refer to Newton and Galileo if al-Hassan Ibn al-Haytham has made the contributions centuries before. It was al-Biruni who discovered the law of "mass conservation" 700 years before Lavoisier. Reference should be made to Jabir Ibn Hayyan not Boyle and to al-Khawarizmi and Thabit Ibn Qurrah not to Descartes and Napier.

Children on school playgrounds should discuss the achievements of their ancestry with pride. University students should be well versed in these achievements. Even in the street, at home,

everywhere, people should know, and talk about their glorious scientific heritage.

It is agonizing to see the Muslim Ummah technologically backward, economically poor, and militarily weak. How can it stand on a globe that has no respect for the weak and the poor, and has no place for the backward?! The Muslim Ummah is now threatened in its very existence. It has lost its self-confidence, and even its self-respect. Respect is never begged for, it is always enforced upon others, by deserving it. This requires a level of excellence and achievement, which makes the Ummah a contributor to the human civilization, rather than a consumer thereof. What are the prospects under the 'new world order'?

Scientific achievements of recent times, good or ugly, are a collective effort of all world scientists. But, the banner of science flies high, in Washington, London, and Paris. How did this happen? Is it because the paths of learning and research are paved with prosperity and affluence? How much of the riches were derived from the exploitation of weaker nations? Does the West, who is in the lead now, uphold secular Machiavellian values? Will the world be dominated by the materialistic technological civilization? Will the rich become richer and the poor poorer? Is the technological development going to prevent the West's decadence in moral values and human behavior? Are the materialistic values characteristic to European based cultures? What is the Jewish and Zionist role in the Riba based financial establishments? How much interest is there in the Globalization process? Are the leaders of the Muslim countries aware of what is going on? Is it true that some are treated as fools by the big powers? Do they deserve to be treated as such? Do 'we' simple people deserve what we are getting? How much of the burden should fall upon 'us'? Who is to blame for our weakness? If the Ummah possess the world's richest material resources, why are we so poor? Do we lack human resources? Where should the priorities be placed? The answer to



these questions, and many more, requires some serious consideration by scholars and leaders alike.

A lesson from history tells us that Marwan Ibn Mohammed, the last of Umayyad Caliphs was a good leader. In fact he spent most of his time at Jihad, to an extent that he was called Marwan al-Himar (Marwan the donkey), because he was always in battle dress. This however, did not stop the collapse of the Umayyad State. The other example is also Umayyad. Yazid Ibn Mu'awiyah, according to history writers, who are not always fair, was a corrupt Caliph, but this did not stop the state from expanding, going from one victory to another. The people however, were unhappy and miserable living under tyranny and oppression. The third example is that of Omar Ibn Abdul Aziz, who was one of the most righteous and just leaders. In his time the state flourished, the people were prosperous, to the extent that a crier announces in all public places that the treasury of the state (Bait-ul-Maal) is prepared to bailout anyone in debt, any poor and needy, any bachelor who wants to get married, etc, etc. A traveler would go from Syria to Yemen fearing none, but God, and caring only for his sheep lest they are eaten by the wolf.

Clearly, the aims have to be well defined, the responsibility has to be shared by both the people and the leaders. These may be the necessary ingredients for progress and prosperity. The relations between globalization, science and technology are so interwoven that they cannot be discussed separately. Strategic planning is required to develop technology for the Muslim Ummah as a concerted effort between Muslim countries, with the aim of establishing an integrated industry that can face up to the challenges. Carefully calculated steps should be taken to provide the means with which the strategy could be implemented.

Wa Billah at-Tawfeeq

## References

1. The holy Qur'an.
2. Prof. Mazin A. Kadhim,  
A millenium passed, and a millenium started, A public lecture,  
Iraqi Scientific Council, Baghdad 2000.
3. Prof. Salim Al-Hasani,  
A lesson from Muslim civilization, Ifthihar International  
Conference, Jakarta, 2000.
4. Dr. K. Ajram,  
Setting the record straight, Excerpted from appendix B of 'The  
miracle of Islamic science'. 1992.
5. Dr. A. Zahoor,  
Cities of Muslim scientists and philosophers in the dark and  
middle ages, 700 to 1500 c.e., 1992, 1997.
6. Dr. Zayn Bilkadi,  
The oil weapons: Ancient oil industries, Aramco World,  
1995.

## BIODATA

- Full name: Khalid Abdul-Hamid Saeed Al-Khateeb.
- Born in the Karkh district in Baghdad in 1942.
- At school going age the family moved to Adhmiyah (named after al- Imam al- Adham) a district near the famous Mosque and school of the great scholar Abu- Hanifa. The district, known for its poets and scholars.
- He completed primary and secondary school education with distinction.
- Initially, he went to medical college in Baghdad, then decided to take up the scholarship, which was offered to him to study Electronics in the United Kingdom.
- In 1963 completed 3 'A' levels.
- In 1966 graduated with B.Sc. (Hon.) in Electronics.
- Started his academic career as lecturing assistant at the College of Engineering, Baghdad University for 4 years.
- During which time he took evening classes for 2 years to study Law.
- He was awarded a 2-year scholarship for a M.Sc. degree in Electronics.
- He completed the M.Sc. in one year, 1971.
- He joined a Ph.D. program in 1972 and completed it in 1975.
- Initially, he was appointed as a research officer at the Ministry of Higher Education, soon after that, a senior research officer.
- Promoted to research Director in 1976.
- Visiting Professor at the University of Arizona 1976-1978.  
During which he organized a joint study between Baghdad and Arizona.
- Deputy for academic affairs, School of Electrical Engineering, University of Technology, Baghdad, 1979-1984.
- Associate Professor, University of Technology Baghdad, 1984-1988.
- Head of Electronics and Communications Engineering Department, Saddam University for Engineering and Science, 1988-1991.
- Associate Professor, then Professor in 1993, at the University of Science and Technology, Oran, Algeria, 1991-1994.
- Professor at the Electrical Engineering Department, Mu'tah University, Karak, Jordan, 1994-2000.
- Professor then Head of Electrical and Computer Engineering Department, Kulliyyah of Engineering, International Islamic University Malaysia, 2000-to present.



## General Experience

- Chairman of Research Committee, (1996–1998)  
Faculty of Engineering, Mu'tah University, Karak, Jordan.
- Chairman of Postgraduate Studies, (1996–2000)  
Dept. of Elec. Eng., Mu'tah University, Karak, Jordan.
- Editor, (1996–1998), Mu'tah Lilbuhooth Wa Al-Dirasat, a refereed and indexed Journal, Jordan.
- Editor, (1988–1992), "al-Muhandis", Scientific Journal of Iraqi Engineering Society.
- Editor, (1996–1997), Rayat Mu'tah, Cultural Journal, Karak, Jordan.
- Organization of Link Programs between Universities:
  - a) University of Arizona, U.S.A. (1976–1978)
  - b) University of Nottingham U.K. (1992–1994)
- UNIDO Local Expert, (1988–1989), ICEQCS, Baghdad, Iraq.
- Chairman of Central National Committee, (1987–1988)  
Electrical Measurement Standards, ICEQCS, Baghdad, Iraq.
- University Research Awards Committee, (1980–1988)  
University of Technology, Baghdad, Iraq.
- Board of Directors, (1980–1983),  
Specialized Institute of Engineering Industry, Baghdad, Iraq.

## Research Interests

- Semiconductors and Thin Films
- Electronic Engineering Applications
- Computer Vision and Tracking

## Patents

- Tracking using live TV images
- Novel projection TV system

## Authorship

- Specialized Papers; 20
- Engineering Education; 3
- Text Books, in Arabic; 6

## Professional Affiliations

- M.I.E.E. (1975) U.K.
- C. Eng., (1975) U.K.
- M. Inst.P, (1974) U.K.
- M. Eng. Soc. (1972) Iraq.