



# Higher Education in Bangladesh : Prospects of Industries-Academia Interactions

**Mala Khan  
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**The University of Asia Pacific  
PROTIPALOCK Society for Culture & Science PSCS**

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### Mala Khan

Born on 12 July 1977 Mala Khan is the first woman in Bangladesh working in the field of Laboratory Information Management System (LIMS), Laboratory Instrumentation and their applications. Mala Khan earned her B.Sc. Engg. (Hons.) in Computer Science & Engineering degree from the University of Asia Pacific and she is the recipient of the Chancellors Gold Medal from the Honorable President of the Peoples Republic of Bangladesh & Chancellor of the University as she scored the highest CGPA 3.90 out of 4.00 among all the students from all the department of the University of Asia Pacific in Spring 2000. As Application Engineer Instrumentation & Information Technology (I&IT) and Assistant Laboratory Manager Mala Khan served Plasma Plus Application & Research Laboratory & AQ Chowdhury & Co. (Pvt.) Ltd. from January 1998 to December 2003. From 2003 to 2006 she worked as a Scientific Consultant for WAGTECH International UK. In 2006 she received Prof. Dr. Nurul Absar Khan Post-Graduate Fellowship from BCSIR. Her present areas of interest are metrology in chemistry, analytical instrumentation, Laboratory Quality Management System as per ISO17025, LIMS and information technology (I&IT) with applications in water analytical environmental, industrial QAQC, science education and research. In 2006 she joined Bangladesh Council of Scientific & Industrial Research BCSIR within Ministry of Science, Information & Communication Technology. From 2008 being the initiator of a Government funded development project "Development of ISO/IEC 17025 Accredited Instrumentation & Calibration Service Laboratory for Chemical Measurements", Mala Khan Scientific Officer is serving BCSIR as the founding head of the Instrumentation & Calibration Service Laboratory ICSL as Project Director. Mrs. Khan is a certified EOQ Laboratory Manager & EOQ Laboratory Assessor for ISO/IEC 17025.



### KM Mostafa Anwar

Born on 02 December 1967 KM Mostafa Anwar received his degree M. Sc. in Physics with First Class First from the University of Dhaka in 1989 and from then he served a number of public and private institutes including UN Agency e.g. The Monthly Computer Jagat, Dhaka University of Engineering & Technology (DUET), Bangladesh Council of Scientific & Industrial Research under the Ministry of Science, Information & Communication Ministry and Plasma Plus Application & Research Laboratory a private run national laboratory, Shimadzu Japan, WAGTECH International UK and UNIDO. As one of the Director lastly he held the position of Laboratory Manager of Plasma Plus+ and served as the Product Manager of AQ Chowdhury & Co. (Pvt.) Ltd. Being the team leader of an expert team in SMTQ, at present Anwar is serving UNIDO as National Project Coordinator (QMS Component) of Bangladesh Quality Support Programme BQSP working to strengthening Bangladesh national quality and conformity assessment infrastructure: Standards, Accreditation, Metrology, Testing, Quality. Anwar's present areas of interest are analytical instrumentation and sciences, laboratory quality management systems LQMS accreditation, chemical metrology with applications in pharmaceutical, water, analytical, environmental, industrial QAQC, science education and research. Anwar is also a musician, actor, poet & journalist traveled many countries and received extensive training and working experience in the area of science and performing arts. Anwar is a certified EOQ Laboratory Manager & EOQ Laboratory Assessor for ISO/IEC 17025

This book has been uncovered by  
**Nobel Laureate Prof. Dr. Richard R. Ernst**  
on Friday 19 December 2008 at  
Swiss Federal Institute of Technology ETH,  
Hönggerberg, Wolfgang Pauli Strasse 10,  
8093 Zürich, Building HCN, Room D217,  
Switzerland in presence of authors & their  
two daughters Sahiba Tasnia Tanushree  
&  
Saraf Tasnim Tatinee

# FOREWORD



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The paper of Mala Khan and K.M. Mostafa Anwar, titled "Bridging the Gap Between the Higher Education in Bangladesh & Real world Applications: Prospects of Interactions Between Industries & Academia" very rightly emphasizes the relations between Academia and Industries. Their analysis makes it very evident that the interaction between Academia and Industries does in fact benefit both. The absence of the interaction may keep the industries unaware of the last words in their relevant science and technologies while such an absence would make the Academia confined only to their intellectual world divorced from the stark realities in the industries.

Though the authors have highlighted this interaction for the greater interest of generation of s&t manpower in the context of pharmaceutical and chemical industries, their observations are nonetheless valid for all kinds of industries which make use of the New and Emerging Sciences and Technologies.

I wish the authors success in spreading their message to the people in the industries and in the Academic world. Governments in the region would do well to integrate the observations of this paper in their industrial and educational policies.

Prof. Dr. M. Shamsher Ali  
President, Bangladesh Academy of Sciences  
&  
Vice Chancellor, Southeast University

Date: 02 September 2007

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## **ABBREVIATIONS AND ACRONYMS**

ASTM American Society for Testing and Materials

BAS Bangladesh Academy of Sciences

BDS Bangladesh Standard

BSTI Bangladesh Standards & Testing Institution

C Degrees Celsius

CAB Consumers' Association of Bangladesh

CC Consumer Council

CFR Code of Federal Register

cGMP Current Good Manufacturing Practice

CI Confidence Interval

EEC European Economic Communities

EPA U.S. Environmental Protection Agency

EU European Union

FAAS Flame Atomic Absorption Spectroscopy

FAO UN Food and Agriculture Organization

FDA US Food and Drug Administration

GATT General Agreement on Tariffs and Trade

GFAAS Graphite Furnace Atomic Absorption Spectroscopy

GOB Government of Peoples Republic of Bangladesh

IDL Instrument Detection Limit

ISO International Standard Organization

LOD Limit of detection

g/L microgram(s) per liter (ppb)

S/cm micro-Siemens per centimeter

MAC Maximum Admissible Concentration

MCL Maximum Contaminant Level

MCLG Maximum Contaminant Level Goal

MDL Method Detection Limit

mg/L milligram(s) per liter (ppm)

mL Milliliter(s)

NIST National Institute of Standards and Technology

OECD Organization for Economic Cooperation and Development

ppb Parts per billion ( g/L)

ppm Parts per million (mg/L)

PQL Practical Quantitation Limit

PSCS PROTIPAALOCK Society for Culture & Science

QA Quality assurance

QC Quality control

SPS WTO Agreement on Sanitary and Phytosanitary Measures

TBT Technical Barriers to Trade

TQM Total Quality Management

UV-VIS Ultraviolet - visible

WHO World Health Organization

WTO World Trade Organization

Dedicated  
to our  
respected mentors  
Prof. Dr. MR Kabir  
Prof. Dr. M. Shamsheer Ali  
Nobel Laureate Prof. Dr. Richard R. Ernst  
&  
to our  
beloved daughters  
Sahiba Tasnia Tanushree  
Saraf Tasnim Tatinee



## **BRIDGING THE GAP BETWEEN HIGHER EDUCATION IN BANGLADESH & ITS REAL WORLD APPLICATIONS: PROSPECTS OF INTERACTIONS BETWEEN INDUSTRIES & ACADEMIA**

### **ABSTRACT**

A number of crises in the industries, societies are affecting the welfare of millions of people and threatening the country's export economy at the dawn of a new economic globalization system under WTO in 2005. To become a manufacturing and exporting nation in this coming era of fierce competition, Bangladesh is not yet prepared to overcome two major unaddressed challenges namely the Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary Measures (SPS) mentioned in the old GATT, 1947 XX (b) agreement and onward agreements during Tokyo round and other.

We assume, the crux of the problem is the lack of proper knowledge and ignorance to technology as well as management to introduce applicable industrial Quality Assurance and Quality Control (QAQC) under the framework of Total Quality Management (TQM) system. The country is far behind these practices to be introduced and followed strictly.

In this era of science and technology we hereby assumed that the problems in development of knowledge based and technology intensive water industries and water-analytical-environmental education, pharmaceutical industries and pharmacy education, as well as software industries and computer science education etc. are not isolated from our overall problems inherent to the systems of higher education in sciences along with the problems in the technological and industrial development in Bangladesh.

To keep pace with the rapid technological advancement in the industrial sectors there is no alternative but to establish a complete industrial QAQC and other applications oriented laboratory based science education system so as to produce skilled professionals to meet the current demand. Hence reforms in the course curricula, as well as pedagogic processes and introduction of state-of-the-art instrumentation laboratory based education system in universities and higher educational institutions with effective QAQC or accredited education service management systems are must.

To achieve the above goal the importance of close and consistent interactions between academia, private and or public application and research laboratories and industries have been recognized.

From our point of view the system of higher education in Bangladesh is fully aligned towards a wrong target and not fit-for-the-intended-purpose at all. If a revolutionary change is not brought into operation, the existing higher educational system will not be able to transform the country to be a knowledge based manufacturing country rather it will help remaining the country to be a trading one. At this critical point the country is badly in need of a revolutionary and drastic change in direction not an evolutionary and steady modification to create loop within the loop.

## INTRODUCTION

A number of crises in the industries, societies are affecting the welfare of millions of people and threatening the country's export economy at the dawn of a new economic globalization system under WTO from the year 2005. To become a manufacturing and exporting nation in this coming era of fierce competition, Bangladesh is not yet prepared to overcome two major unaddressed challenges: the Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary Measures (SPS) mentioned in the old GATT, 1947 XX (b) agreement and onward agreements during Tokyo round and other.

BANGLADESH : FACT SHEET					
	2000-01	2001-02	2002-03	2003-04	2004-05
Population (in million)	128.1	131.60	133.40	136.2	137
GDP (in USD billion)	42.25	45.53	50.09	55.49	61.78
Sectoral Shares of GDP from Agriculture (%)	24.60	21.90	21.00	20.20	19.30
Sectoral Shares of GDP from Industry (%)	24.40	25.90	25.30	25.80	26.10
Sectoral Shares of GDP from Services (%)	51.00	52.80	53.70	54.30	54.60
National Annual Growth Rate of GDP	5.41	4.42	5.29	6.27	6.95
Annual Industrial Growth Rate Overall (%) (1996-98 prices)	6.88	5.48	5.75	7.1	8.19
Large (%)	6.55	4.5	5.56	6.95	8.3
SME (%)	7.02	7.69	7.21	7.45	7.83

Fig - 01: Fact sheet of Bangladesh (up to 2006) Sources: BBS, ADB & EPB Reports

EXPORT SCENARIO OF BANGLADESH INTERMS OF PRINCIPLE GOODS (1994-2005) (in USD million)											
Principle Goods	1994-97	1995-98	1999-02	2002-05	2006-09	2008-11	2011-12	2012-15	2016-19	2020-23	
RMG, Knives & Hosiery	1873.2	2193.3	2086.4	2013.7	2079.1	4792.4	4966.1	4793.86	4912.76	5086.89	5477.67
Shrimp & Fisheries	347.2	323.7	397	395.1	214.3	343.9	363.2	325.71	321.81	366.20	426.74
Raw Jute	79.1	72.7	101.7	83	111.83	72.1	67.16	61.12	62.46	79.7	96.10
Jute Goods	205.4	212.4	213.5	203.2	181.6	215.5	211.6	161.2	157.16	165.3	166.33
Leather	201.4	169.4	125.7	186	166.2	165.1	203.83	207.23	191.21	211.41	209.93
Tea	32.1	39.7	32.3	27.4	13.6	15.9	21.58	17.38	15.47	15.81	15.84
Others	293.3	438.4	479.1	501.4	545.4	522.9	572.15	599.72	586.15	614.22	1175.02
Total Export (in USD million)	2897.66	3335.08	2917.79	3094.40	3438.22	5716.10	6071.74	5997.26	6388.41	7001.09	8054.52
Total Export (in BOT million)	136079	144524	171036	229416	349226	241420	384480	392120	327896	427100	516271.2
YTD Conversion Rate with BOT	48	41	42	46	25	42	31	36	32	37	36

Fig - 02: Export from Bangladesh in terms of principle goods. Sources: BBS & EPB

We assume, the crux of the problem is the lack of proper knowledge and ignorance to technology as well as management to introduce applicable industrial Quality Assurance and Quality Control (QAQC) under the framework of Total Quality Management (TQM) system. The country is far behind these practices to be introduced and followed strictly in all the industrial as well as service sectors.

In this era of science and technology we hereby assumed that the problems in development of knowledge based and technology intensive water industries and water-analytical-environmental education, pharmaceutical industries and pharmacy education, as well as software industries and computer science education etc. are not isolated from our overall problems inherent to the systems of higher education in sciences along with the problems in the technological and industrial development in Bangladesh.

To keep pace with the rapid technological advancement in the industrial sectors globally there is no alternative but to establish a complete industrial QAQC and other applications oriented laboratory based science education system so as to produce skilled professionals to meet the current demand. Hence reforms in the course curricula, as well as pedagogic processes and introduction of state-of-the-art instrumentation laboratory based education system in universities and higher educational institutions with effective QAQC or accredited education service management systems are must. To achieve the above goal the importance of close and consistent interactions between academia, private and or public application and research laboratories and industries have been recognized.

Although the expressed idea here depends a great deal upon research, but to make reading easier we have deliberately not flooded the text with data, numerical and graphical expressions and or references to the original reports etc.

## **TRANSFER OF TECHNOLOGY: MYTH & REALITY**

Without development of technologically sound human resources, sustainable development for the country is impossible and hence the word 'transfer of technology' carries no meaning but a myth. During the last three and half decades in the name of 'technology transfer' we have experienced the expansion of market of foreign technical products following the hardware import only and not the development of humanware with 'soft' quality of higher intellect and expertise. We have seen mostly the transfer of some kind of operators' knowledge through short-time training at site or foreign manufacturers venues, but NOT the expansion of knowledge of TECHNOLOGIST. Thus the 'technology' had appeared to be double-edged sword to make us excessive dependent on the so-called

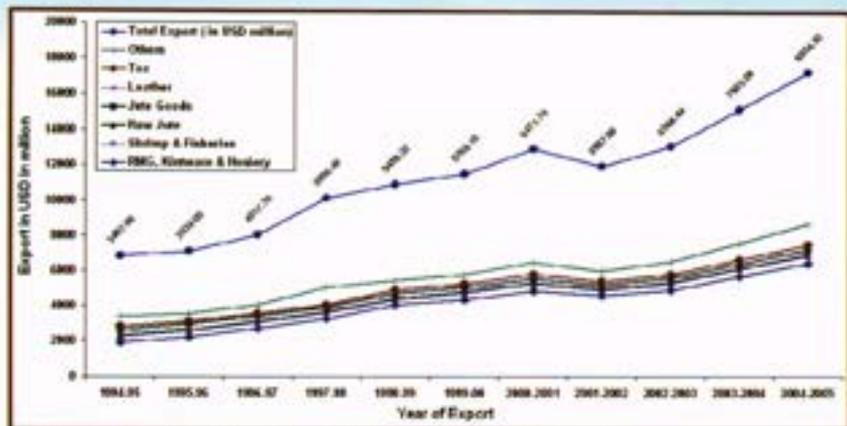


Fig - 03: Export from Bangladesh in graphical representation.



Fig - 04: Sector wise contributions to Export changing over time.



Fig - 05: Media publishing problems in export

foreign experts/consultants (!) and to buy the spares and consumables to run the technologies. The dilemma is: we do not but adopt the machines and we cannot use the machines effectively to its full capacity to have a development consistent and sustainable. From numerous examples we hereby mention one instance in the case of adaptation of computer and information technology in our country and the expansion of education in this IT sector. In the last decade along with the revolutionary development of computer and internet technology throughout the world we have also seen widespread expansion of market of computer and information appliances in Bangladesh. We have also seen mushroom growth of computer training centers and institutes, colleges, universities both in private and public sectors for awarding Diploma, Certificates and B.Sc.(Hons) in IT degree. People of the almost all walks of life started talking terms in "computer world". Flow of students to peruse the higher degrees in IT increased dramatically and the number of enrollment of students in this field reached peak at the end of the last decade. But we missed to understand and setting the actual goal of higher education in computer science and failed to realize the needs of meaningful computerization for the country. With a decade-long debate on the issue and with the expanse of ratepayers money we have just introduced 'computer in education' but NOT the 'computer based education' at all. We know that present day's Pentium - IV PC is hundred thousand times powerful than one supercomputer produced in the early or in the mid seventies. Yet we could not realize and utilize this immense capacity of the technology for the betterment of the society through utilizing it in the technological, science and engineering education and research. We could not start learning sciences, arts, law, social, agricultural, analytical, environmental, engineering and business disciplines based on computers and Internet. Rather we restricted ourselves to the computer technology just for usage like sophisticated type writing, sending emails and applying the minimum of networking and unfortunately maximizing PC use for playing games and browsing porno through cyber café. Our parents are proud of having children capable of running the latest memory hungry games demanding continuous upgrading of computers to keep the market stronger. In the name of software engineers, programmers and computer graduate we have actually created some certificate holding operators who move from institutions to institutions to install email-internet applications and browsers and managing some Internet Service Providers' business ISPs only at their maximum capacities. Our higher education system in computer science indeed following the course curricula not developed from the understanding the actual industrial - business demands and technological application. And the system is targeted to prepare a few students just to attend some programming contests and to award certificates ultimately leaving the graduates within the dark realm of not having orientation on industrial and practical problem solving practices. Job seekers cannot communicate effectively to provide an IT based solutions to the real time problems

by understanding and translating the employers demand in industrial-business areas. As a result no commendable industrial automation or computerization throughout the country has been seen in real sense and our graduates remained jobless and became frustrated. Now we are experiencing reverse trend with the decrease in the number of enrollment in the computer science courses for the last five years originated from frustrations among young. Indeed our tertiary level higher education systems are transferring "the operators knowledge" in the name of "the technologists' knowledge" and hence we could not create technologists but operators. As a result the Information Technology sector is still struggling to get its way into the global market with no significant achievement in fetching foreign currency. We did not have "problem solving society" from the universities to meet our industrial and social needs. In the last fifteen years we could not yet reach a simple solution with consensus to solve a single national problem in finalizing a standardized universal code for Bangla UNICODE and standardizing a single Keyboard layout. Rather we tried to put blame on each other among GoB, Bangla Academy, Universities, vendors and BSTI. With "this very quality of knowledge base" can we assume our expectation to earn a huge foreign exchange via exporting "software solutions" for "foreign problems"? Development, introduction and marketing a "new software" is somewhat similar to introduction of a "new culture" among the technology users in the advanced societies on the Globe and to push them towards further advanced practices. To develop, produce, market any software product in its life cycle it is necessary to set up software industries having rigorous and adaptive Quality Management Systems with applicable QAQC and R&D. Unfortunately most of the people in IT industries: software engineers, producers and vendors are not aware at all of these essential elements of management and sciences from a holistic approach. Why we have not addressed these vital issues in developing our course curricula and teaching process on producing computer technologists and professionals?

Similar examples can be noted from other industrial and social sectors on introducing voter identity cards (Voter Ids) for national and local government elections, managing automation in legal and judicial sector, providing "soft" solutions for Joint Stock & Registrar's office, managing problems in arsenic in water, environmental hazards, flood and irrigation management, RMG Leather, Tea, Shrimp, foods, agriculture and life sciences just to name a few. Whereas the global trend goes to the introduction of machine-readable passport or ID cards using bio-marking technologies we already know the status of the long pending Voter ID issue let alone the introduction of the electronic voting system.

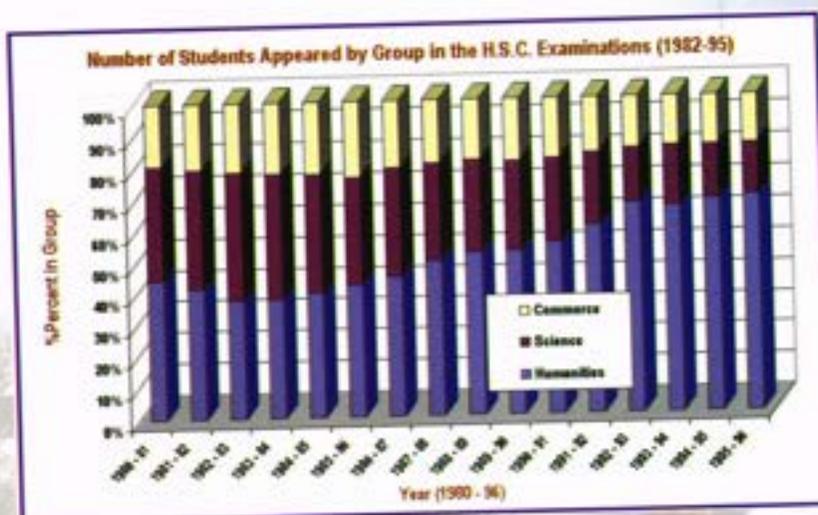
## **OPERATORS OR TECHNOLOGISTS?**

If I buy a camera from a store, the seller will teach me the basic operations of some buttons, but only pushing buttons is not the photography at all. That is the operator's knowledge seller transferred to me. But to be a professional photographer I must have to go to a university where photography is taught as a vast discipline. I have a camera, I know how to make a click but I am not Satyajit Roy or Zahir Raihan. Question is whether our existing university system of higher education is really 'GENERATING' and 'NURTURING' professional photographers' knowledge and genius or producing an occasional home user of a camera like me to have some photos for my daughter at her birthday party.

Question is: whether we are really growing within the existing university system as, say, pharmacists to be technologists in real sense or not. Are operating Fourier Transform Infrared FTIR spectroscopy machine with some 3-5 pages Standard Operating Procedures (SOPs) instructed by the suppliers' instrumentation or application engineers and understanding the spectroscopy with molecular applications same? One the way of developing new drug or natural/ herbal products how will we accumulate the valid information from that FTIR machine to elucidate the structure of the new unknown molecule extracted from our local plant or herbal resources (say Merrygold/ Gandha flower) and move towards the FDA approval to enter the US market? Why the active bio-compound(s) having medicinal importance extracted from our well known herb Neem could not be patented by ourselves? Why the credit went to US or India? In the university who is teaching me the fast moving and continuous evolving science of molecular spectroscopy with UV, FTIR, Atomic Absorption Spectrophotometer, Mass Spectrometer, NMR? Whereas in Bangladesh we have thousand years old tradition of treating diseases using natural plants and herbal crude drugs practicing Ayurvedic, Unani, Mogha and other indigenous schools, why we could not yet produce and promote some patented drugs with our own brand name in the global market in the last, say, thirty years? How many years we will produce only non-branded, generic prescription drugs following USP, BP, ISP, INN? When will we develop our own Bangladesh Pharmacopoeia? Whereas the prevailing systems in universities teach only bookish subjects more from memory than creative imagination, pursuing higher education like this will suffice the needs? Is the existing process within the higher science education system in university is Fit-for-the-Intended - Purpose? How the QUALITY of higher education in science is defined, controlled and assured via appropriate introduction of QAQC in accredited education system?

## EXISTING SYSTEM OF HIGHER EDUCATION IN SCIENCE

With plenty of meaningless political debates floating around us on issues like Bangladeshi or Bangalee nationality etc. and also in the midst of severe crises in political, social, water, environmental realms in Bangladesh, we have observed that science education is in decline nationally so as to show an alarming situation in the secondary and higher secondary level. Number of enrollment in science drastically went down in the recent years. Even someone who enters the science group in higher secondary stage he can pass H.S.C. or S.S.C. with first division or grade point A+ having full marks 25 for practical without doing any experiments in the laboratory at all. The picture is not different in the so-called university colleges where B.Sc. Honors degree is taught under the National University programmes without sufficient hands on practice in their laboratories. There the science students can even earn their graduation degrees without studying any "enabling sciences" namely physics, chemistry and mathematics! This trend silently crept in the nation to jeopardize all our achievement and development at this era of technology. Although a number of public (including the technology/engineering universities) and private (total of ~ 57 in number) universities have been established throughout the country, but with respect to the estimated goal and quality of education, the existing practices in delivering science lesson in these institutions, mind set on setting up laboratory based education, the higher education system is fully aligned towards an utter WRONG direction, bearing the same tradition. We named it to be a FULLY MISALIGNED HIGHER EDUCATION SYSTEM.



[Fig-06: Percentage of Students Appeared by Group in HSC Examinations (1982-95)]

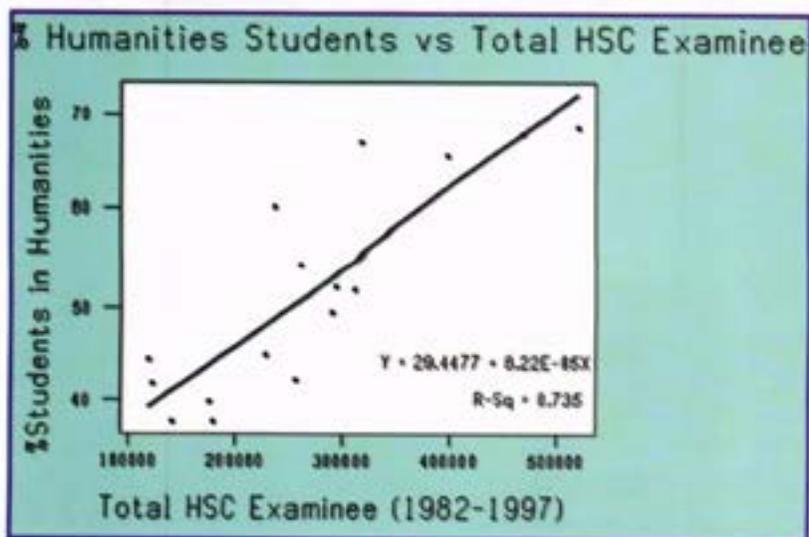


Fig -09: Linear Increasing Curve shows humanities group students are increasing: HSC Humanities VS Total HSC Examinee

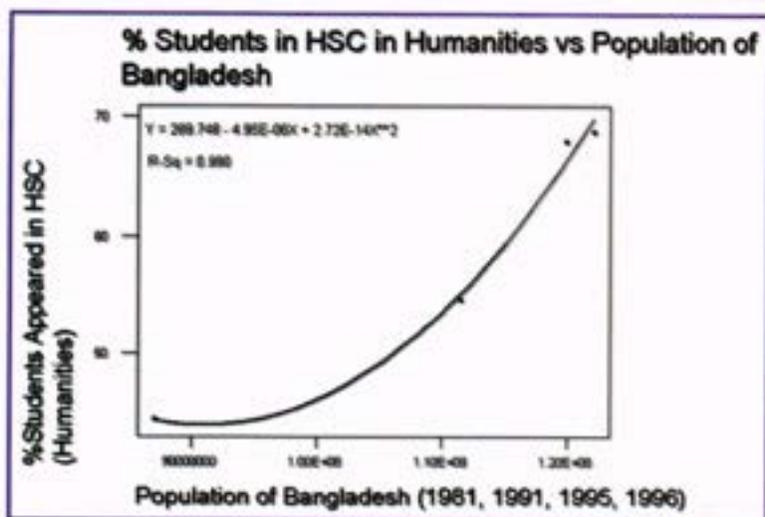


Fig-10: With population increase students increasing with a faster rate to study humanities

We may assume this kind of science teaching system inherited from colonial British ruling society and running by the people having only bookish knowledge to be the OXBRIDGE type general liberal science/art education introduced in the Middle Ages in UK aimed to produce mostly civil servants, bureaucrats, clerks, elites not to produce scientists and technologists and vocational workers. Unfortunately as an independent and sovereign nation we could not realized the future global trend and challenges in science, technology and economy and hence we failed to adapt the another science education gharana introduced in the second half of the nineteenth century by London University (Mechanics' Institute, Working Men's College, Imperial College), Manchester, Sheffield, Leeds, Durham and other Scottish Universities in UK. We had to adopt the WRONG gharana and became very happy with hearing and remembering the past glory like "Dhaka University, the Oxford of the East" where S. N. Bose worked in a quiet room of the present day Qurzon Hall. I repeat "Oxford", NOT "Manchester". But no body realized the fact that that was within 1926-1947 under British Rule and today is 21st century and that system of education was, still is, to be OXBDRIDGE type to produce civil servants. No body has asked the question instead of introducing the Manchester model why the British introduced that OXFORD model in setting up the Dhaka University. Within the British Empire in UK they have already established technology and knowledge based centers led the Industrial Revolution, and they would not need to develop technology aware society in this colonial India rather they were interested to create some elites, to form civil society who will learn their laws (becoming CSP, ICS, Bar-at-Law etc.) and follow their laws. Should we still keep the system alive with remembering past glory! To be honest, in operational term, the utterance of word like "Dhaka University the Oxford of the East" serves nothing to this present day's nation, sovereign Bangladesh, for future. What we see the most, if not all, of the science graduates (having B.Sc. Honors, M.Sc.) from Dhaka University (also from so-called university colleges) go for BCS (I) examination with full vigour (!) and spirit (!), that is the WRONG goal we have ever targeted and became complacent to achieve. Each and every time immediate upon publishing the BCS exam results, I hear from my colleagues in soil science department of Dhaka University mentioning with proud that "you know, our graduates from this soil science department always secure best positions in the BCS examination, a large number of Magistrates (!) we produce every year". That is surely the wastage of national/public money and resources collected from poor ratepayers and peasants, to create such kind of science graduates for running public administration. That is the irony, whereas Bangladesh is facing severe problems with soil, water, environment and agriculture and still lacking technocrats and experts in this area of business in soil sciences. No agro-based industrial developments have been seen in our country so far which we have seen in Thailand, Malaysia and recently in Vietnam even after their decade long

war. Our teachers, educationists, and bureaucrats those who are products of these misaligned systems are reluctant to change the whole processes of higher education and not in a position to pave the way of meaningful employment. Who will preserve our poor ratepayers money? The beneficiaries and members of the top civil and educated society must answer this question?

Are the concepts and propositions made above all some Utopian type? We have observed a different and relatively better scenario in another higher education sectors in Bangladesh namely the medical and the engineering education if we compare them in parallel with general and enabling science education. In Bangladesh we may easily visualize that the medical education system is definitely of second kind stated above. No medical student can have his or her final degree MBBS without completing an at least two years intensive INTERNSHIP practices. Medical colleges are inseparable from the hospital or diagnostic facilities. From the very beginning of his or her student life a medical student grows up within the environment of clinical applications to learn medicine, technology as well as hospital administrations from an integrated approach and receives a complete practical orientation on the whole service area where they will build their professional carrier in future. It is not a general trend that an MBBS passed doctor will appear before a public competitive examination like BCS, Banking Recruitment Examination to be a Civil Servant "Magistrate" or Banker respectively. Result is in Bangladesh we have seen a developing and wide spreading healthcare service industry and medical colleges both public and private sectors. And these medical institutions are attracting a good number of foreign students every year. Engineering education from BUET was also assumed initially to be the second type and a number of quality technologists were being produced from this institution and quality of education was quite good enough and the university earned considerable reputation from abroad until recent past, but unfortunately it is also loosing its original characters gradually with time. From the above we wanted to just sketch two education systems existing side by side. At this point we cannot but mention a very miserable picture/phenomenon from where one can easily visualize the overall quality of higher education in Bangladesh.

Before 1971 a huge number of foreign students get admitted themselves into the public universities and medical colleges in Bangladesh. Students from Singapore, Malaysia, and Thailand came here to pursue their higher degrees. But what is happening in the last three and half decades? In the Daily Ittefaq (on 16 July 2005 pp 3 & 5) the answer is published where the gradual decrease in the number of foreign students enrolled for higher studies in Bangladesh. That means our universities and our higher education institutes are not in a position to impart knowledge having quality globally accepted. Validity of our statement can be easily verified, every private and public universities are facing problems for not having

quality teachers (having a true nature of researcher/scientist/knowledge generator) in pharmacy, computer science and other. A "few number of known faces of teachers" are moving around one university to another JUST to deliver "lecture" as a part timer NOT TO GENERATE & DELIVER KNOWLEDGE AT ALL" keeping his/her original "job" as full timer in with a public university.

Just two weeks ago in the Daily Ittefaq on 3 November 2005 (Huq, 2005) an alarming report has been published to prove our above statement that according to a quality rating by the Institute of Higher Education, Xian Tau University of Shanghai, China there is no university from Bangladesh among the list of top 500 universalities of the world this year. Initially they have screened two thousand universities from the globe and finally calculated the rating for one thousand universities. Considering the quality of higher education and research, quality of the faculty members, size of the university, performance with respect to the student-teacher ratio, patent and publications in the internationally recognized journals, number of award recipients like Nobel Prize Winners etc. they have calculated the ranking scores to create the list of the universities. Unfortunately, there is no university from Bangladesh among the top 100 in the Asia Pacific Region. Rather we positioned ourselves at the top of the list as the most corrupted nation in the globe. Whereas our nearest neighbours Indian IIS positioned itself at the 301st, IIT Kharagpur and Kolkata University placed themselves jointly at 401st positions respectively to secure their positions among top 500 universities of the world.

**Table-01: Foreign Students Enrolled both in Public & Private Universities of Bangladesh in the Year 2002-2003 [based on data reported in the Daily Ittefaq (16 July 2005)]**

General University (26)		Technical University (151)				Medical (71)		
							Private Universities (14 nos.)	367
							Total Foreign Students in Public Universities (211)	290
						BSMMU	Medical Colleges & Agr. Colleges	52
							Total Engineering Venues	20
							KUET	76
							RUET	15
							CUET	6
							BUET	8
							Myersongh Agr. Varsity	47
							SUST, Sylhet	22
							Khulna University	13
							School of Fine General Venues	40
							Kutia Islamic Varsity	26
							Jahangirnagar Varsity	1
							Changang University	7
							Rajshahi University	5
							Dhaka University	1
								12

**Table-02: Dhaka University: No of Foreign Students Enrolled (1994-2005) [based on data reported in the Daily Ittefaq (16 July 2005)]**

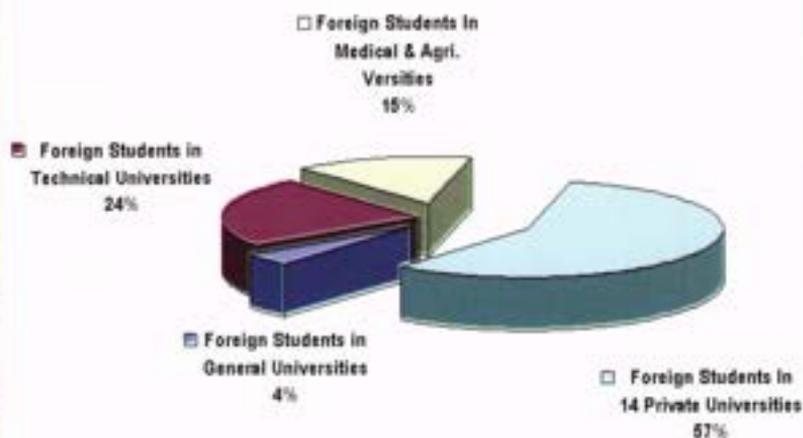
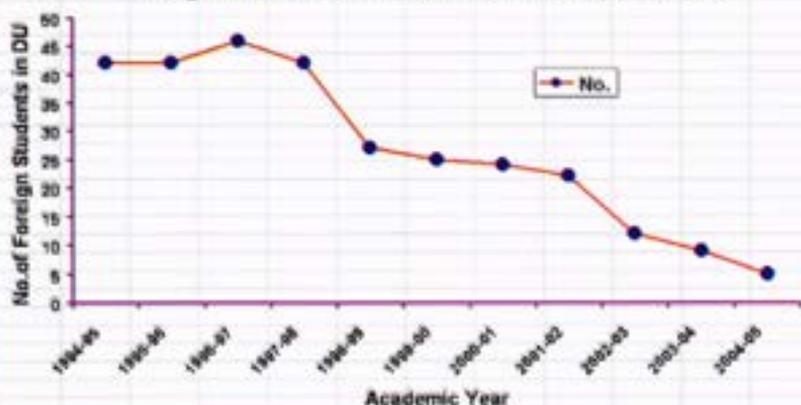
Year	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
No.	42	42	46	42	27	25	24	22	12	9	5

**Foreign Students Enrolled in the Dhaka University (1995-2005)**

Year	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
No.	42	42	46	42	27	25	24	22	12	9	5

Data Source: The Daily Ittefaq on 16 July 2005 pp3-4.

**Foreign Students Enrolled in the Dhaka University (1995-2005)**



**Fig-12: A snap shot : Presence of foreign students at different universities of Bangladesh in 2005**



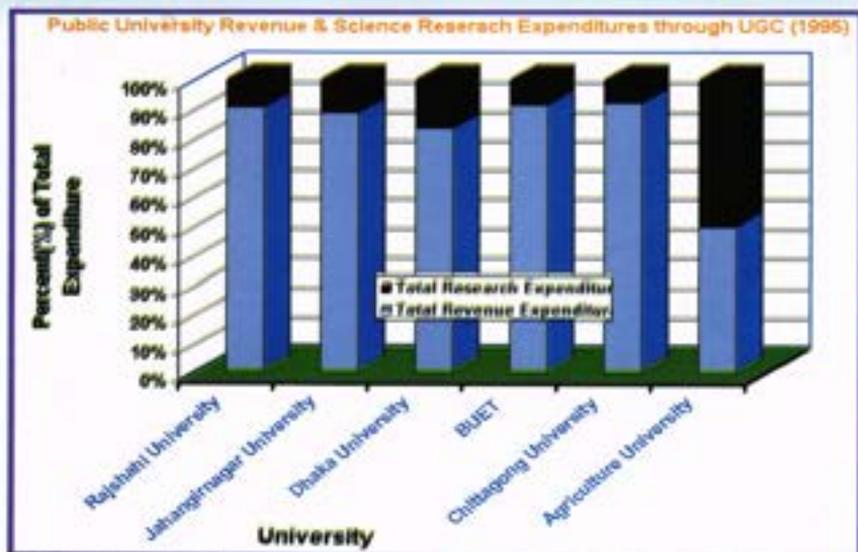


Fig-14: Flow of money for science: Public University Revenue & Science Expenditure through UGC (1995)

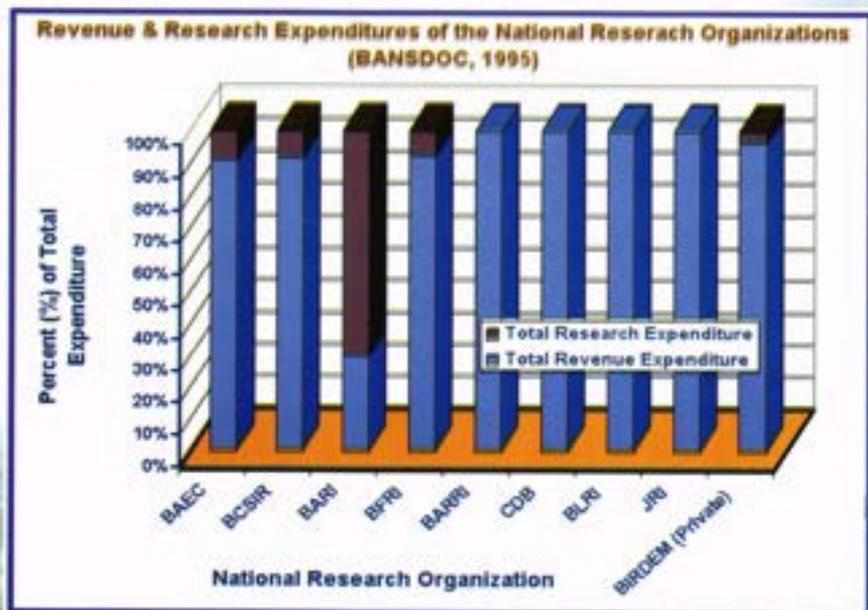


Fig-16: Flow of money for science: Revenue & Research Expenditures of National Research Organizations (BANSDOC, 1995)

## CHALLENGES UNDER WTO REGIME AFTER 2005

In addition to resolving various national-international trade issues like tariff and para-tariff barriers to trade in the era of globalization, the country is badly in need of change in institutional frameworks within universities and higher education centers and initiatives to increase the knowledge on overcoming the non-tariff barriers like Technical Barriers to Trade (TBT) and Sanitary & Phytosanitary Measures SPS via developing sufficient experts on science and technology for industrial requirement. In exporting products it has been evident that facing the challenges due to TBT and SPS measures by the importing countries and to achieve the competitive edge to survive in the "open market" in this era of science and technology there is no other way without developing sound technical and management knowledgebase for sustainable industrial development. Hence we envisioned that there is NO ALTERNATIVE WITHOUT BRIDGING BETWEEN ACADEMIA, INDUSTRIES and other commercial and or service sectors.

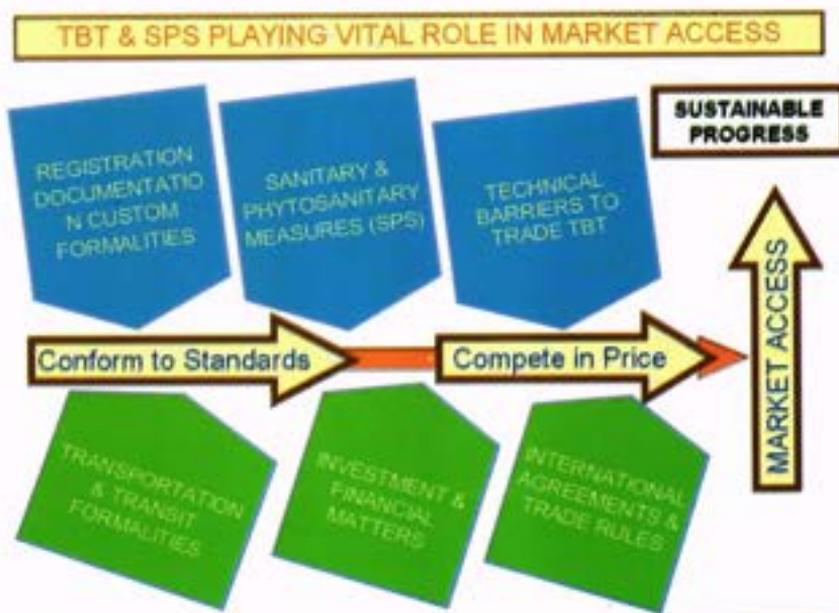


Fig-17: Gaining Sustainable Progress: Challenges to overcome all barriers to get market access

## REDEFINING THE GOAL OF HIGHER EDUCATION IN SCIENCE

Knowledge itself is inter-disciplinary in nature (Bligh, 1977) and industrial environment is also multi-disciplinary. Sphere of knowledgebase does not increase beyond its threshold to contribute to the society in a real sense to solve the problems of the fields without having sufficient internal pressure towards outside coming from insatiable thirst of knowing something repeatedly via searching again

and again. The way of SEARCHing again and again we named hereby it RESEARCH. Who will let the students know how to search and how to ask the right questions if the teacher herself/himself is in the world of not-knowing as she/he is the product of erroneous university systems. Just only securing the First Class First may not be the only criterion to join as a lecture in the department without having any exposure to the industries, commercial business, service, regulatory organizations, where the real world problems exist with their full gravity. In UK 'academics average about ten years' experience in industry, commerce or the professions before entering academia' (Bligh, 1977). Hence finding and appointing knowledgeable persons as faculty members having proven track records in his/her professional carrier will be effective on the way to transforming the university to be a real knowledge and idea generator and no doubt this action will be critical from the prevailing mind set.

In university education system teachers along with her/his students must involve in two activities simultaneously: research and teaching. From Bangladesh perspective we termed this 'research' not to be a fundamental type but to 'solve real time problems in industries and societies using effectively the existing knowledge' extended throughout the world. This needs to establish full-fledged laboratories with QAQC. The activities will in turn to earn money as service charges and upon accumulating some amount can be expend for basic research, if possible, in future. Because we must not forget the fact that industries will be much more interested to look forward to buy the services and to have a continuous source of skilled manpower from the universities rather than the research outputs. Building confidence among industries and societies is the mammoth task lying ahead for the university teachers and management.

University process should be designed in such a manner that it will function to acquire existing knowledge, solving problems of the industries and societies using existing knowledge repeatedly and periodically, generating new idea and knowledge and transferring the knowledge to the young scholars through teaching and building up team of peers above criticality around common areas of problems and moving in search of new frontiers of knowledge to push further ahead of the horizon of the knowledge circle. Efficient transferring of knowledge needs continuing research on education process adopted and thus to introduce adaptive science curriculum system to face the new challenges in teaching sciences. All that will be done with close interactions among academia, students, and industries, commercial, professional, service sectors and regulatory bodies.

Developing professionals, apart from help students achieving the key qualifications to work within the multi-disciplinary industrial and professional area of business, "a major purpose of science education is to have students construct a deep conceptual understanding of any scientific topic studied" (Keer et al, 1994). This cannot be achieved if students do not acquire higher order cognitive skills (HOCS) that include the ability of asking the right questions, solving problems, decision making and critical system thinking. In brief "understanding", "application"

and "exercising critical judgment" are important educational aims of higher education (Bligh, 1977). Universities and the centers involved in imparting higher education cannot disregard this goal of higher education on to generate the idea, address the problems of the society, push further the horizon of understanding and buildup the knowledgebase.

## **PROSPECTS OF INTERACTIONS BETWEEN ACADEMIA & INDUSTRIES**

We have just floated the conceptual framework of the idea of interactions between academia and industries. If it seems to be feasible and essential then other finer details of action plan and working out the avenues of proposed interactions may be possible upon more discussions with the stakeholders. As we are already late spending thirty-five years of sleeping or crawling (are we hair or tortoise!), we must not spend more time to find out the way of sketching tentative programme. Should we further check the validity of the wise words or proverb "slow and steady wins the race"? We are recommending hereby some proposals to be discussed and inviting more opinions from all of you. We must not forget taking opinions from our parents those who are paying the cost to have their children educated.

a. We hereby recognized that understanding technical barriers to trade (TBT) and SPS is nothing but understanding the integrated science, technology and management. Lurching laboratory based intensive science educational program immediately through out the country (from the high school level to higher educational levels) is recommended.

b. To develop human resources and to provide technical and scientific assistance to industries as well as to help establishing accredited private and or public laboratories in the country initiative can be taken to form a consortium (namely, say, National Industrial Sciences Roundtable NISR) to have a common platform among the government, academia and industries to increase interaction on industrial and laboratory QAQC. NISR will provide a science-oriented, apolitical forum for the leaders in the industrial sciences to discuss industrially related issues affecting government, industries and universities.

c. This consortium (NISR) may also help introducing countrywide Quality Circles among the people working in the industries at different levels. This Quality Circles concept originated in Japan worked in many developed as well as developing countries including India where it came at least twenty-five years ago having tremendous success with many instances (Rajasekaran et al., 1989, Murty et al.1989, Sundaram et al.1989, Venkataram et al.1989, Sharma, 1989, Bhargava, 1989, Setty, 1989, Ranganathan, 1989) in quality improvement and adapting quality culture in the industrial arena.

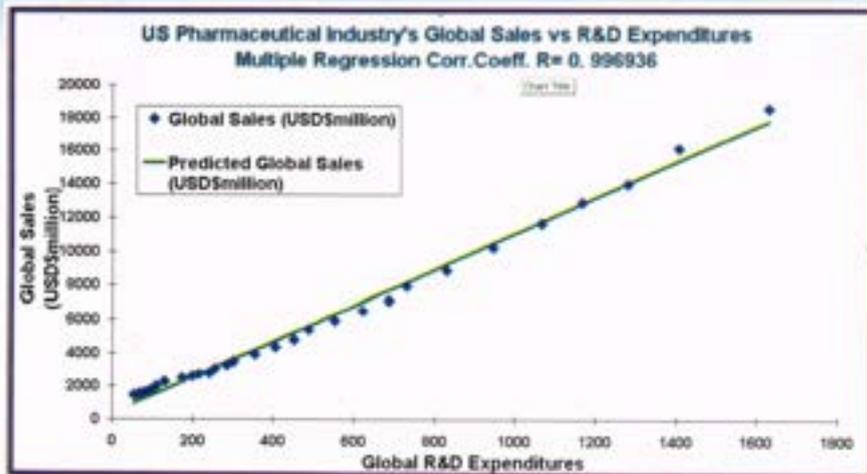


Fig-17: Gaining Sustainable Progress: Industrial growth goes up with R&D expenditure

**1982 Pharmaceutical Share of Total Sales of the World's Top Twenty Pharmaceutical Company (Figures are in USD\$billion)**

Company	Total Sales (USD\$billion)	Pharmaceutical Sales (USD\$billion)	Pharmaceutical as Percent (%) of Total Sales
Hoechst (FRG)	14.79	2.63	18
Bayer (FRG)	14.73	2.45	17
Merck & Co. (USA)	3.06	2.21	72
American Home Products (USA)	4.58	2.14	47
Ciba Geigy (SWITZ)	6.95	2.05	29
Pfizer (USA)	3.45	1.7	49
Eli Lilly (USA)	2.86	1.54	52
Roche (SWITZ)	3.57	1.51	42
Sandoz (SWITZ)	3.04	1.42	47
Bristol Myers (USA)	3.6	1.36	38
Smithkline (USA)	2.64	1.34	51
Abbott (USA)	2.6	1.3	50
Warner-Lambert (USA)	3.25	1.29	40
Takeda (JAPAN)	2.18	1.29	59
Upjohn (USA)	1.83	1.21	66
B. Ingelheim (FRG)	1.49	1.21	81
J&J (USA)	5.76	1.12	19
Squibb (USA)	1.66	1	60
Glaxo (UK)	1.66	0.98	59
Rhone-Poulenc (FRANCE)	5.55	0.9	16

Note: Among the 20 companies, 3 from West Germany, 11 from USA, 3 from Switzerland, 1 from France, 1 from UK and 1 from Japan.  
 Note: From 1982 sales figure, out of top 50 pharmaceuticals, 18 from USA and 13 from Japan

Source: Compiled from Company Reports, 1986.

Table-3: Global pharmaceutical industrial shares from top 20 (1982)

d. This body NISR may also work in collaboration with industries, GoB, UGC, private and public universities and research establishments and other foreign groups etc. to introduce academic programs and partnerships on physical, chemical, pharmaceutical, environmental, analytical, engineering and other industrial disciplines in undergraduate, graduate, postgraduate, vocational and or certificate course curricula. The body can work on introducing continuing education and university teachers' training, Certificate of Professional Development (CPD) programme and can host Proficiency Testing (PT) Program/Competition countrywide annually or biannually to help developing competency/proficiency in QC laboratory practices among teachers and students in sciences. Award and or other form of appreciation can be introduced to encourage the academic/laboratory bodies, teachers and students participating the program. Also the body may initiate R&D, organize workshops, round table discussions in this area. And definitely we have to start from the early stage of the science education so that the next generation must be tuned to adapt the Quality Culture. This very body may help developing a National Commission on Quality.

e. As human is the first and foremost resource on building up a knowledge center,  
universities may take initiative to appoint

(i) KNOWLEDGEABLE persons as faculty members having proven track records of selling expertise in the fields, having national and international reputation. Offering attractive packages with full academic, financial and management freedom is essential so that freedom can only be exercised by the professional judgment. Bangladeshi scholars staying abroad and working in the foreign industries, universities should be communicated so that they can contribute. Indian and Korean experience can easily be followed.

(ii) KNOWLEDGABLE persons as faculty members from the FIELDS those who have already proved their merits and leaderships to work with success at various levels in Bangladesh with considerable experience in industrial, commercial and service sectors both in public and private.

In appointing faculty members we must not restrict ourselves within the present day practice of having a fresh graduate as a direct lecturer, on the basis of his final year exam result. They may be appointed as teaching Assistant first. Upon performing a commendable job with exposure to the industrial and real world problems and showing aptitude on handling problems they may be appointed to be a lecturer.

f. The university may invite regularly the professionals in industries to participate actively in the academic program to help building multidisciplinary teams of peers around the core areas of interest and also students and teacher can visit industries regularly maintaining confidentiality through instrument of non-disclosure agreements and other protocols to work collectively to solve problems in industries.



Fig-18: Pharmaceuticals sales are positively correlated with R&D expenditure

**Pharmaceutical R&D/Sales Ratio of Selected Pharmaceutical Companies 1982-83**

Company	R&D Expend (USD\$million)	Pharmaceutical Sales (USD\$million)	R&D/Sales Ratio (%)
Nippon Chemihar (JAPAN)	12.95	70.7	18.18
Astra (SWEDEN)	83.77	377.5	16.89
G.D. Searle (USA)	87.2	517.9	16.84
Synthelabo (FRANCE)	36.87	219.6	16.36
Reccentati (ITALY)	58.1	31.7	17.70
Pharmacia (SWEDEN)	13.91	88.2	15.77
B. Ingelheim (FRG)	194.26	1210.5	15.19
Delalande (FRANCE)	11.92	78.9	15.11
Alfa Farmaceutic (ITALY)	2.53	16.7	15.15
Upsamedica (BELGIUM)	9.38	66.2	14.40

Note: All 10 companies listed above spend between 14 to 18 percent of sales on R&D.

Source: National Academy of Engineering: The Competitive Status of the U.S. Pharmaceutical Industry 1983.

Table-4: Global pharmaceuticals sales with R&D expenditure

g. Introduction of adaptive curricula and extensive laboratory oriented courses is a must. The teacher-student contact hours should be increased through close and continuous interaction with fulltime involvement around industrial and other problems so that teacher can act as a core to aggregate scholars and students also from other disciplines to form peers. In designing and establishing laboratory the industries can help in various ways from donating old analytical or production machineries to providing financial supports.

h. Revenue budget (for salary, infrastructure and other recurrent expenditure) and research budget should be separated for universities and for research organizations both in private and in public sectors. Research budget must be increased to a sufficient amount and allocation should be

based on the regular income generated by the scientific teams and activities via selling services and solutions to the industries and other. In addition to their salaries the financial benefits, incentives, awards, promotions should be made based on the achievements/earning of the talent of the problem solving teams consist of people from multidisciplinary areas.

i. Establishing a full-fledged ISO17025 certified analytical and instrumentation laboratory to offer services to the industries and societies and to generate revenue for research activities.

j. It is essential immediately to form an accrediting body by the GoB (Ministry of Education), say, Bangladesh Accreditation Council for Education (BACE) to be quasi-judiciary in nature, similar to National Board of Accreditation (NBA) in India, US Accreditation Board for Engineering and Technology (ABET), The Engineering Council (EC) and Joint Board of Moderators (JBM) in UK etc. This body may include a sufficient number of renowned foreign professors, scholars and measures should be taken so that the body can work just not to produce rubber stamps. The body will introduce eventually the validation procedures, to evaluate a course work in order to certify the standard of students who complete it successfully.

Above all given the opportunity to the private entrepreneur to help building the country's young generation with knowledge and wisdom via setting up private universities, the people sitting behind in the foundation and or governing body must not consider it as a scope of earning or other. Indeed it should be realized that, by virtue of its nature university is a home of junior and senior learned scholars and knowledgeable mentors of the country and hence management of a university must not be considered to be similar to that of real estate business or commercial bank or insurance company. It is essential to monitor closely the management processes and quality of the academic programmes through a powerful independent regulatory body ( BAEC) from the government's end to protect the students' rights to have the quality education services from the system.

## CONCLUSION

While talking of 'PROBLEM SOLVING' or 'RESEARCH' there is always a peculiarity we observe in this country that we can not but mention through a story. The story came in our mind while we were working with the arsenic issue. We have seen holding a lot of discussions, seminars, workshops, news and views explosion in media and also have seen the 'RESEARCHES' by scientists, social workers from home and abroad with a huge amount of foreign and local currencies reaching the sky, but simple answers to the questions we could not yet reach to save our people in the

arsenic contaminated areas. We are also now talking of problems with interactions among industries and science education but what will happen in the coming day? There is a story that several pundits were considering the question of how many teeth a horse has. They looked at all the "DOCUMENTS" and sources of "REFERENCES" they could lay their hands on and debated long and hard all day and well into the night. With this question still unresolved and when it was getting very late, one young boy ventured to ask if he might be allowed to speak. On permission being granted, he suggested that right now they should take a lantern, go down to the stables, open the mouth of the horse, count its teeth and settle the matter. Whereupon the elders turned upon him, and chastised his impudence for supposing that his own observations could outweigh the opinions of all the scholars that had ever preceded him.

## REFERENCES

Bhargava, Lt Col D.K, Quality Circles, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 202-203.

Bligh, D., Higher Education, Education Matter Series, CASSELL, UK, 1977.

Esumi, S., Japanes Government Procedures for Approving the Manufacture or Importation of Pharmaceuticals, Comprehensive Biotechnology The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine., Vol.4, Pergamon Press, 1985, pp-587-608.

Goulet, D., The Uncertain Promise, IDOC/North America, NY, 1977.

Guidance for Industry, U.S. Department of Health and Human Services, Food and Drug Administration USFDA, Center for Drug Evaluation and Research (CDER), Center for Biologics Evaluation and Research (CBER), ICH, Revision ICH, Revision 1, June 2004.

Huq, S., Biswer Panchshaw' Biswabidyaloyeer Modhyee Bangladesher Thhanil Neil, No Bangladeshi University Got its Position among Top 500 Universities of the World, Daily Ittefaq, 53rd Year, Issue 306, pp1-2, 3 November 2005

Keer, A.V., Geerlings, P., Eisendrath, H., An Interactive Working Group in Chemistry used as a Diagnostic Tool for Problematic Study Styles, University Chemistry Education, The Higher Education chemistry journal of the Royal Society of Chemistry, May 2004 Volume 8, Issue No 1.

Khan, M., Anwar KM. M., Commercialized Bottled Water (Part-V), The Daily Bangladesh Today, 17 April 2003, p5.

McGarity, T.O., Bayer, K.O., Governmental Regulation of Recombinant DNA Research and Manufacturing Processes, Comprehensive Biotechnology The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine., Vol.4, Pergamon Press, 1985, pp 587-608

Nituch, N.E., Acceptance of New Drug Products in the United States and Canada, Comprehensive Biotechnology The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine., Vol.4, Pergamon Press, 1985, pp 645-657.

Rajasekaran, R., Rakesh, R., Introducing Quality Control Circles in An Indian Organization, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989, pp181-185.

Ranganathan, M.R. Quality Circles: From Introduction to Institutionalization, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 209-213.

Safiullah, S., Science In Bangladesh Past Present and Future, October, 1996.

Setty, C.A., Weaving Quality Circles Into Company - Wide Quality Control, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 204-208.

Sharma, S.K. Quality Circles - From Quality to Quality of Work Life, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 197-201.

Statistical Yearbook of Bangladesh, 12th Edition, Bangladesh Bureau of Statistics (BBS), 1999.

Sundaram, K., Krishan, A.V., Quality Circles - Our Experience, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 190-192.

U.S. Department of Commerce, A Competitive Assessment of the U.S. Pharmaceutical Industry, 1986.

Murty, T.S.N., Mohanty, R.K., Chakraborty, M., Shop Improvement Groups- A Version of Quality Circles in RSP, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 186-189.

Rajasekaran, R., Rakesh, R., Introducing Quality Control Circles in An Indian Organization, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989, pp181-185.

Ranganathan, M.R. Quality Circles: From Introduction to Institutionalization, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 209-213.

Setty, C.A., Weaving Quality Circles Into Company - Wide Quality Control, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 204-208.

Sharma, S.K. Quality Circles - From Quality to Quality of Work Life, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 197-201.

Sundaram, K., Krishan, A.V., Quality Circles - Our Experience, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 190-192.

Venkataram, H., Rao, B.S.R., Prakash, M.S. Quality Circles - NFC Experience, Quality for Progress and Development Papers presented at the First Asian Congress on Quality and Reliability, 30 October- 2 November, 1989, New Delhi, India, 1989. pp 193-196.

**ANNEXURE-A**  
**COMMUNICATIONS BETWEEN PROF. DR. ERNST & AUTHORS**

Re: Inspired by your lecture on "My Pathway into Science and beyond" in Dhaka Bangladesh

Monday, November 24, 2008 2:51 AM

From: "Richard R. Ernst" <Richard.Ernst@nmr.phys.chem.ethz.ch>

To: mostafa\_anwar@yahoo.com

Dear Dr. Anwar,

Would it be possible to come to my office on Friday, December 19, at 14:00-15:00? My office is at ETH Hönggerberg, Wolfgang Pauli Strasse 10, 8093 Zürich, Building HCN, Room D217.

Best regards,  
Richard R. Ernst

Tel.: +41 44 632 4368  
Fax: +41 44 632 1257  
Tel.Priv.: +41 52 242 7807  
Email: ernst@nmr.phys.chem.ethz.ch

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K.M.Mostafa Anwar wrote:

Dear Prof. Ernst:

Many many thanks for your kind acceptance of our meeting with you during our visit to Zurich in December. We will be in Zurich from 14 December 2008 up to 20 December 2008. On 15 November 2008 we will be attending training on Energy Dispersive X-Ray Fluorescence Spectrometer by Thermo Fisher at their Zurich works. Would it be possible any day from 16 to 19 December 2008 to see you at your ETH Office even for a few minutes. Awaiting your kind consent. Hope to see you soon.

With best personal regards,

Mostafa Anwar  
&  
Mala Khan  
Dhaka, Bangladesh

--- On Tue, 11/4/08, Richard R. Ernst  
<Richard.Ernst@nmr.phys.chem.ethz.ch> wrote:

From: Richard R. Ernst <Richard.Ernst@nmr.phys.chem.ethz.ch>  
Subject: Re: Inspired by your lecture on "My Pathway into Science and

Beyond" in Dhaka Bangladesh  
To: mostafa\_anwar@yahoo.com

Date: Tuesday, November 4, 2008, 4:11 PM

Please just try! I will be partially there.

Best regards,

Richard R. Ernst

Tel.: +41 44 632 4368  
Fax: +41 44 632 1257  
Tel.Priv.: +41 52 242 7807  
Email: ernst@nmr.phys.chem.ethz.ch

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K.M.Mostafa Anwar wrote:

Dear Prof. Richard Ernst:  
That's ABSOLUTLY GREAT, receiving your "PULSE" to move forward!  
Thanks for your kind blessings towards us. Hope your safe and successful  
journey towards Latin America in the near future. All our good wishes  
with you.

By the by, it has primaly been planned that from 14 to 19  
December 2008 we will be travelling to Zurich and of course to visit Bruker  
works at Fallandan. Like earlier visit hope we will be to see ETH-Z. Will  
you be there at ETH-Z during that period? And if you please allow us it will  
be an immense pleasure for us to see you at ETH-Z, even if it is for a brief  
moment.

With regards,

Mala Khan  
&  
KM Mostafa Anwar  
National Project Coordinator  
QMS Component  
Bangladesh Quality Support Programme BQSP  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION  
UNIDO  
Maan Bhaban, 3rd Floor, 116-KA Tejgaon I/A  
Dhaka-1208, Bangladesh  
Tel: 880-1714389039 (Cell), 880-2-8962824(Home).  
Email: mostafa\_anwar@yahoo.com

--- On Mon, 11/3/08, Richard R. Ernst  
<Richard.Ernst@nmr.phys.chem.ethz.ch> wrote:

From: Richard R. Ernst <Richard.Ernst@nmr.phys.chem.ethz.ch>  
Subject: Re: Inspired by your lecture on "My Pathway into Science and Beyond" in Dhaka Bangladesh  
To: "K.M.Mostafa Anwar" <mostafa\_anwar@yahoo.com>  
Date: Monday, November 3, 2008, 5:28 PM

Dear Mr. Anwar, dear Ms. Khan.

Many thanks for the well-written, thoughtful article. I like your practical sense. While my lecturing remains relatively general, you have the knowledge to make specific recommendations. This is exactly what I hope that my audience will do. I wish you success in advancing the relation between academia and industry in Bangladesh.

I will depart in a few days to Peru and Colombia.

Best regards,

Richard R. Ernst

Tel.: +41 44 632 4368  
Fax: +41 44 632 1257  
Tel.Priv.: +41 52 242 7807  
Email: ernst@nmr.phys.chem.ethz.ch

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K.M.Mostafa Anwar wrote:

Dear Prof. Richard Ernst:

Hope this mail will find you in good health after a safe journey home from Bangladesh. We are not sure whether you may remember us among thousands of new faces in Bangladesh. This is KM Mostafa Anwar, student of Prof. M. Shamsheer Ali, working for Bruker in Bangladesh as well as EU-UNIDO Programme (to built national measurement and testing infrastructure) met you at Dhaka University while you were delivering speech: Man and Nature on 27 October 2008. You have signed an autograph on our favorite book on NMR written by you. We have also enjoyed your second lecture which was indeed interesting and you made it full of fun but not funny. It was full of wisdom and studded with wise words from your golden mouth.

Along with many other things what we really enjoyed that you were talking of "Industry Academia Interactions" and why teacher should start their journey from industrial problems. You are a great teacher and leading the world of knowledge. Being active passionate students and workers of

science in this small developing country, with our limited understanding and capacity, we had realized in more than ten years back that Bangladesh is lacking this essential element "Industry-Academia Interaction" leading the country's education far away from its track and in other hand the industries are struggling with numerous problems. I along with my wife Mala Khan was jointly working at the interface on industry-academia-scientific institutions from the very inception of our professional lives in 1991 onwards. Subsequently in the year 2004 our honorable teacher, mentor Prof. M. Shamsheer Ali invited us to deliver a Key Note Speech on this very topic at his Southeast University. Later in 2005, the University Asia Pacific also invited us to talk on the topic as keynote speaker. We received a huge appreciation from industrial and political as well as civil societies of Bangladesh. But unfortunately our academia laughed at us with only a few exceptions from Prof. Shamsheer Ali and other. This time you are talking of same thing and emphasizing the need for these essential interactions for building a nation with responsible economy and growth.

We are herewith attaching that article (2005) for your kind appraisal. We would be highly obliged if you please go through this article and make comment on the same. Please correct us if you find anything wrong with us. We are aware of the fact that you are passing extremely busy time with your great mission and obligations towards humanity. As your speeches inspired us here in Bangladesh, your small invaluable comment on our article would also be stimulating with immense magnitude. Your immense field of inspiration aligned us, your brief pulse will lead us to an excited state and as such we will be able to transfer our energies throughout the lattice of the society while we will be on the way to be relaxed to the aligned state again. During this relaxation process our nation will experience wide spectrum of colors and pathways towards development. We already became your students, fans and followers. Awaiting your kind and great response.

Hope to see you again in Bangladesh at your time convenience. Good wishes to you, your family and friends!

Live forever for the human civilization!!

Mala Khan

&

KM Mostafa Anwar

National Project Coordinator

QMS Component

Bangladesh Quality Support Programme BQSP

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Tel: 880-1714389039 (Cell), 880-2-8962824(Home).

Email: mostafa\_anwar@yahoo.com



## Comment From Nobel Laureate in Chemistry 1991 Prof. Dr. Richard Ernst

— On Mon, 11/3/08, Richard R. Ernst<Richard.Ernst@nmr.phys.chem.ethz.ch> wrote:

From: Richard R. Ernst  
<Richard.Ernst@nmr.phys.chem.ethz.ch>

Subject: Re: Inspired by your lecture on "My Pathway into Science and Beyond" in Dhaka Bangladesh

To: "K.M.Mostafa Anwar"  
<mostafa\_anwar@yahoo.com>  
Date: Monday, November 3, 2008, 5:28 PM

Dear Mr. Anwar, dear Ms. Khan,

*Many thanks for the well-written, thoughtful article. I like your practical sense. While my lecturing remains relatively general, you have the knowledge to make specific recommendations. This is exactly what I hope that my audience will do. I wish you success in advancing the relation between academia and industry in Bangladesh.*

I will depart in a few days to Peru and Colombia.

Best regards,

Richard R. Ernst

Tel.: +41 44 632 4368

Fax: +41 44 632 1257

Tel.Priv.: +41 52 242 7807

Email: ernst@nmr.phys.chem.ethz.ch

From top : (1) Prof. Dr. Richard Ernst, Prof. Dr. M. Shamsher Ali & KM Mostafa Anwar on 27 October 2008 at Dhaka University (2) Prof. Ernst signing autograph on a book written by him for the authors (3) Mala Khan talks on industrial QC & melamine testing in milk at BRAC University on 25 October 2008 (4) KM M Anwar, Prof. Ernst, Mala Khan & Prof. M. Shamsher Ali.