

## **PAKISTAN: SELF-RELIANCE THROUGH SCIENCE & TECHNOLOGY – AN ESSAY**

*By: Athar Osama, Doctoral Fellow, RAND*

### **AN EXECUTIVE SUMMARY**

Ever Since our independence, some five decades ago, Science & Technology has been a “*Neglected Child*” of the Pakistani people. Despite a number of intermittent efforts by various political and bureaucratic leaders to put our “*Science House*” in order, things have gone from bad to worse with the passage of time. Lack of political stability, a clear vision of the opportunities and challenges, adhocism in the planning circles, bureaucratic red-tapism, absence of a work-culture and an attitude of criminal negligence are among the major factors responsible for the terrible state of Science and Technology.

Today as we prepare ourselves to step into the next millennium, we find ourselves at the brink of a major economic collapse that threaten our very identity as a nation. The loss of the “*Cotton Advantage*” through the hands of the New International Economic Order (NIEO) and trade globalization, and the “*Agricultural Advantage*” through the hands of *Malthusian Prophecies* has caught us unawares. The idea that Science and Technology has now become a must for our economic survival comes as a shock to most of us. But, that is indeed the true reality.

The longer and deeper economic recessions, growing unemployment and joblessness, crashing stock exchanges and capital markets, an ever widening trade deficit and the sky rocketing debt-burden have revealed shocking structural weaknesses in our economic policy. Today, we find ourselves left with no other option but to adopt the high tech. road to self-reliance and subsequently economic progress and prosperity as has been demonstrated by a host of newly industrializing economies (NIEs) of the modern age.

We must chalk out a comprehensive strategy for our economic revival and then implement it to the letter. The most appropriate strategy in this regard would be the traditional consumption industry approach tailored to develop a technology-driven competitive advantage in the field of textile, garments and other agricultural sectors of the economy.

*“Building Competitive Advantages”* in the age of cut throat economic competition and trade globalization is a logical approach to follow. The pace with which Science & Technology is progressing makes it imperative to concentrate on a group or cluster of industries and its scientific and technological infrastructure, besides developing indigenous capability in critical technologies and technology areas. This would not only result in the achievement of Self-Reliance through a lessening of our technological dependence on foreign sources but would also result in an appreciable expansion and diversification of our export base resulting in a sustain pattern of economic growth and continued prosperity.

A major factor that determines the success of a strategy is the Plan of Action. This forms the next step of our *Science & Technology Movement*. A carefully designed Plan of Action that caters to our limitations in a realistic manner while encompassing all important aspects of the strategy plays a critical role in our scheme of things.

Together, these two can be integrated into a comprehensive system that would provide the results of required quality and magnitude. The paper discusses each of these elements in greater details, drawing up a clear picture of the recommended Strategy and its Action Plan.

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*“We are faced today with a crucial decision. In one direction are going those countries that use the knowledge and power that **Science and Technology** provides to bend nature to their will. The other way is going a sorry crowd, forever scanning the sky to see if the rain will fall , or looking at the ground to see if the grain will grow, or glancing back in fear to see which fresh calamity is going to overtake them this time. We cannot delay the choice; we must take one of these roads. If we take the wrong one, we may never be able to retrace our steps.”*

----Report on Management of Technology (1966)

The above quote which forms the concluding remarks of a National Commission’s report on Management of Technology in Pakistan provides a befitting beginning to an article titled as above. Reality couldn’t have been expressed in a fashion better than the writers of the above report managed to do. Unfortunately, thirty-one years and a crippling division later, we still find ourselves at the same deciding moment in our history. Though fortunately, thanks to our incredible capacity of indecision and subsequent procrastination, we have not yet chosen the wrong path, about which the report so clearly warns. Even today the road to self reliance and hence progress and prosperity lies only *a few small steps* away; provided we muster up the courage to take *one big decision*.

Science and Technology in Pakistan, as we know it, has so far had a checkered history, with negligible or little role in national reconstruction. The learned Dr. Abdus Salam

terms science as a *marginal activity* in Pakistan. People who know lament the fateful morning of September 6, 1965 as a day when science was laid to rest in Pakistan. The war that was thrust upon us came only a day after the Scientific Commission headed by Prof. Salimuzzaman Siddiqi presented its recommendations to the then President Gen. Ayub Khan at Swat. With the other traumatic after effects of the war, these recommendations also got shelved and with this went the will to go scientific.

Pakistan joined the community of independent states as a **“Land of Promise”** blessed with a lion’s share of one of the most fertile lands in the world. Although we lacked the necessary infrastructure to capitalize on this immense potential, we thought we had the will to do it. As years went by and our economic situation worsened, a harsh reality struck us in the face. **“The Will”** was probably the only plausible missing ingredient. Science and Technology remained a popular slogan in our political and bureaucratic boardrooms. Till date, it has completely failed to become a serious business.

Our initial infrastructure at the time of inception was by all standards; poor. Three to four small laboratories, an agriculture-cum-research institute and only two fully functioning universities. The numbers have grown with time, but not with the required pace. In 1987, there were over 130 Research and Development organizations and 22 universities. Industry included a rich mixture of traditional and basic ones like Cotton and cotton-based textiles, agri-based products, cement, sugar, chemicals, paper, pharmaceuticals and metals etc. Although there has been an appreciable level of effort in developing the basic infrastructure to build the foundations of a typical third world technological leap-frog but unfortunately all this has lacked direction, a coherent strategy and a strong commitment.

#### **REASONS FOR A NEGLECTED S&T SECTOR**

The above phenomenon can be seen as an after-effect of two separate but, in this case, complementary set of observations. Firstly, ever since our independence we, the people of Pakistan have been fed with the belief that agriculture is the mainstay of our economic growth and if Pakistan has to claim its share in the world’s prosperity, it can do so only through the agricultural sector. High/low technologies, basic and applied sciences were

projected as an activity which was not meant for the so-called “*Agricultural Nations*”. No effort whatsoever, was made to diversify our industrial base to include engineering-based high/low tech. products. Consequently, for years our economy has shown an excessive dependence on Agri-based products, foodstuff, Cotton and cotton-based textiles with utter disregard to any effort of modernization, automation or diversification. Secondly, the lack of foresight and vision in our leaders, coupled with years of political instability and an infamous “*Public Sector*” has played havoc with whatever was left of our ambition to join the community of developed nations. We, as a nation, have become accustomed to living in “day-tight” compartments. Our policies represent a complete lack of vision, a high degree of ad-hocism and a total disregard of what lies in store for us in the future. All this, and much more has resulted in a terrible mess up as far as our *Science and Technology Establishment* is concerned.

#### **THE PARADIGM SHIFT OF THE 1990S**

Things have started to change now. The ongoing decade of the nineties has left some deep impressions on our economy, exposing some of the so far neglected structural weakness. The “*Cotton Shock*” of the early nineties that led to a sky-rocketing of the prices of cotton thus rendering our products internationally in-competitive was one eye opener for us. The crisis triggered steady erosion of our textile sector shutting down hundred of textile mills in just a couple of years time sending shock waves in our economic boardrooms. As nineties moved ahead we experienced yet another disaster that shook the very foundations of our decades long beliefs. The “*Wheat Crisis*” of the late nineties brought the nation to the brink of riots spurred by the shortage of wheat in the domestic market. Our image as a nation self-reliant in agricultural products and food stuff was irreparably damaged. The wheat crisis that created a grave situation back home, has raised serious concerns about our national security thus challenging our very identity as an agricultural nation. This was not all for the nightmarish nineties. There were at least two more events of great significance that were instrumental in bringing about the thought reversal that we experience today. “*Globalization of Trade*” as we know it, in the Post-GATT scenario provides our limited export-sector with a daunting challenge. The opening up of the international economic borders provide an opportunity to those

who have the courage and wisdom to take it. We have all the potential to take advantage of the situation provided we make the necessary structural changes required to make our products internationally competitive. **“International Quality Movement”** is yet another factor. In the recent years we have seen the ISO-set of quality standards gain immense popularity in the world in general and the west in particular. ISO-9000 and BS-5750 certifications have already become mandatory in much of the North America and developed Europe. This provides our exporters with yet another task of modernizing production, stepping up productivity and ensuring quality in their products. All this, cannot be achieved by continuing with our age-old traditional production techniques. Modernization is the name of the game. We must innovate if we want to claim our share in the world’s riches. Science and Technology would form a stepping stone for our industrial and economic renaissance.

Today as we stand at the crossroads with time running out, and look to the East and West for direction, we find ourselves caught up in a hopeless state of affairs. The idea that science and technology has now become a must for our economic survival comes as a shock to us.

#### **SCIENCE AND TECHNOLOGY – A RATIONALE**

The importance of Science and Technology for development cannot be undermined. Nobel Economist *Robert Solow*, in his pioneering work that won him the Nobel Prize in Economics claimed that technology and not capital or labor, is the key factor in economic growth of nations. The world around us is a testimony to this fact. From North America to Europe to NICs of East Asia, technology seems to play a major role in determining the winners of the international economic arena. As the industrialism subsides and new era of techno-electronics ushers in, science and technology assumes a central position in the development plans of nations aspiring to become economic leaders in the twenty-first century. The advancement in the state-of-the-art has led to a steady erosion in the profits of the nations that are still reluctant to play in the technology game. The traditional advantages of cheap labor, fertile lands and materials have become negligible in the age of industrial and agricultural mechanization, genetic engineering and new materials.

“*Going High Tech.*” is the buzz word for political and economic managers of the rapidly developing NICs. The effective utilization, indigenization and reproduction of Technology has marked East Asia’s march from producers of foot-wear to brain-ware. As Malaysia becomes a world leader in semiconductors, Singapore aspires to become a Bio-technology giant, India exports Software to the developed West and Philippines and Thailand go on to initiate their own car development programs; Pakistan sees its Textile advantage going down and with it a major portion of the trade. While the countries that started later, have now started to reap the fruits of investment in their S&T sector, we plan to buy wheat from America, sugar from India and a civil aircraft from Indonesia.

The changing scenario throughout the world, presents a challenge to the leadership and people of Pakistan. Can we fight the inherent adhocism in our economic policies to ensure our national economic security? Can we take control of our own destinies?

No matter how one chooses to put it. The writing on the wall is crystal clear. We are now entering an era marked with an insatiable demand for science and science-based technology. Tomorrow would belong to us only if we show the courage and ability to go scientific. This leaves our development planners with no other choice but to buy tomorrow’s riches today, by investing heavily in science and technology.

#### **STATE OF SCIENCE AND TECHNOLOGY IN PAKISTAN**

Despite efforts to organize Science and Technology in Pakistan on proper grounds by some of the leading Scientists and Technology managers in the country like the legendary Dr. Abdus Salam, Dr. A.Q. Khan and Dr. Salimuzzaman Siddiqi to name only a few, S&T remains a neglected theme in the development policies of the country. There are many reasons for this unfortunate state of affairs. For instance, we failed:

- a) to provide a political leadership with a clear vision of the future that could have made a real difference in terms of providing driving force to the launch of a major S&T restructuring in Pakistan.

- b) to provide an atmosphere of political stability in the country. Throughout the five decades of our history, our development was marred by the political instability that resulted in the absence of a sustained effort in developing science and technology in Pakistan.
- c) to bring the general literacy level in the country up to a certain minimum that could spur development and ensure effective utilization of whatever technology was available to us.
- d) to provide the necessary infrastructure and legislative support that could have had a self-generating effect on the S&T front.
- e) to involve the private sector i.e. the businesses and the industry to participate in developing the S&T potential.
- f) to motivate our scientists and technologists to engage in Research, Development and Implementation (RD&I).
- g) to evolve a mechanism for the commercialization of the research results in the form of technology products thus providing further impetus to growth.
- h) to achieve substantial degree of vertical transfer of technology and hence achieve the basic goal of self-reliance.

In short, we have so far lacked a comprehensive strategy to look forward to which could integrate our haphazard attempts into an organized reconstruction effort. This would require conscious efforts by each and every individual, although the major share of responsibility lies on the shoulders of decision makers in government, bureaucracy, legislature, industry, agriculture, businesses and the S&T establishment itself. It would demand a sustained commitment from all those who have a role to play in national reconstruction. A clearly chalked out policy for science and technology, an strong

support from all walks of life, unity of purpose and a sense of direction would be the basic ingredients of a *sure-fire strategy for development*.

#### **SCIENCE AND TECHNOLOGY FOR SELF-RELIANCE AND BEYOND**

The importance of Science and Technology in the achievement of Self-Reliance has been established through the development histories of the newly industrializing countries. A brief glance at Pakistan's trade record of the last five decades, would provide us with a rough estimate of the degree of our dependence on foreign resources not only in terms of aid and loans but also in terms of trade of essential commodities like synthetic fiber, wheat, sugar and metals; highly important technological know how for the medium and low-tech. industrial sectors; important areas infrastructure like energy, communications and transportation technologies; and sensitive technology areas like nuclear technology, defense electronics, military aircraft etc. One of the major aims of any national level S&T movement must be to lessen and/or put an end to this ever-increasing foreign technological dependence.

A brief look at the figures give a rough estimate of our technological dependence on foreign countries and provide an insight into our terrible national security situation. Need has been repeatedly felt to reduce the technology contents of our imports and shifts towards a trend of value-addition in the export sector. The above idea forms the back bone of our Self-Reliance drive.

Apart from this, S&T penetration must not be restricted only to the import-substitution sector. In the coming age of trade globalization, the importance of science and technology, as a means to penetrate new markets through better products created by scientifically improved processes on technologically advanced manufacturing equipment, cannot be undermined. Science and Technology finds its applications in all walks of life turning life in the next century into an altogether different ball game. Technology, infact, now threatens to take over as the biggest business in the world. Investment in new and emerging areas like micro-electronics, semiconductors, new materials, information technology, electro-optics and bio-technology could mean

continued prosperity for years and years to come. Furthermore, the death of protectionism in the Post-GATT era of free trade makes it imperative for a nation to go for export promotion and diversification instead of looking at import-substitution as the ultimate end. This demands an aggressive strategy of technology transfer, adoption, indigenization and re-creation. Self-Reliance, thus remains a means to the end, not the end in itself. We must look for greater opportunities beyond the scope of self-reliance. Science and Technology is an impressive tool that can be used to bring richness to human race by improving their quality of life in more ways than one. It must therefore be pursued as a strategy for development and social welfare with self-reliance and export promotion being the major milestones to success.

<b>PAKISTAN'S TECHNOLOGICAL DEPENDENCE ON FOREIGN SOURCES</b>			
<b>IMPORTS &amp; EXPORTS BY COMMODITY (% SHARE OF TOTAL, 1993-94)</b>			
<b><u>MAJOR IMPORTS</u></b>	<b><u>% SHARE</u></b>	<b><u>MAJOR EXPORTS</u></b>	<b><u>% SHARE</u></b>
. MACHINERY (EXCL. TRANS)	22.26	. COTTON GROUP	57.1
. PETROLEUM & PRODUCTS	16.58	. RICE	3.5
. CHEMICALS	17.31	. LEATHER & PRODUCTS	9.4
. EDIBLE OIL	5.95	. CARPETS	2.3
. MOTOR VEHICLES	6.88	. SYNTHETIC TEXTILE	9.1
. WHEAT	3.05	. OTHERS	18.6
. IRON AND STEEL	3.66		
. SYNTHETIC FIBER	1.29		
. OTHERS	23.02		

Time for us is running short. We must act, and act in earnest before it is too late to act. What we need now is a Scientific and Technological Transformation of revolutionary magnitude because trickle down effects won't do the trick for us. We have already wasted enough time in the "Awakening Act", trying to determine our priorities. But, we must remember that a scientific and technological revolution is a *Three Act Process* which must reach its completion before any rewards of success can be reaped.

As the new millennium approaches, we find ourselves messed up in a terrible state of affairs. With exports eroding and imports plummeting, our balance of payments crisis is bound to deepen. We as a nation are living a threatened existence. We find ourselves heavily dependent upon others to satisfy our basic requirements. Our credibility abroad has been tarnished by compulsive over-borrowing followed by constant threats of a default. The investment-starved economy shows signs of a perennial recession. Should we continue at the present state of the affairs, our survival as a nation seems to be at stake. We must, as a nation, do some soul searching, and question ourselves. Is this what we had planned for Pakistan? For how long would we continue to live like virtual-beggars? Can all this be changed? If yes, then can we do it?

#### **PAKISTAN IN THE TWENTY-FIRST CENTURY -- THE VISION**

Our vision of the Pakistan of the Twenty-First should be that of a country on the road to economic security, rising standards of living, burgeoning exports and massive investments (Foreign, public and private sectors) in infrastructure. Our Economy should be able to exhibit the following structural characteristics.

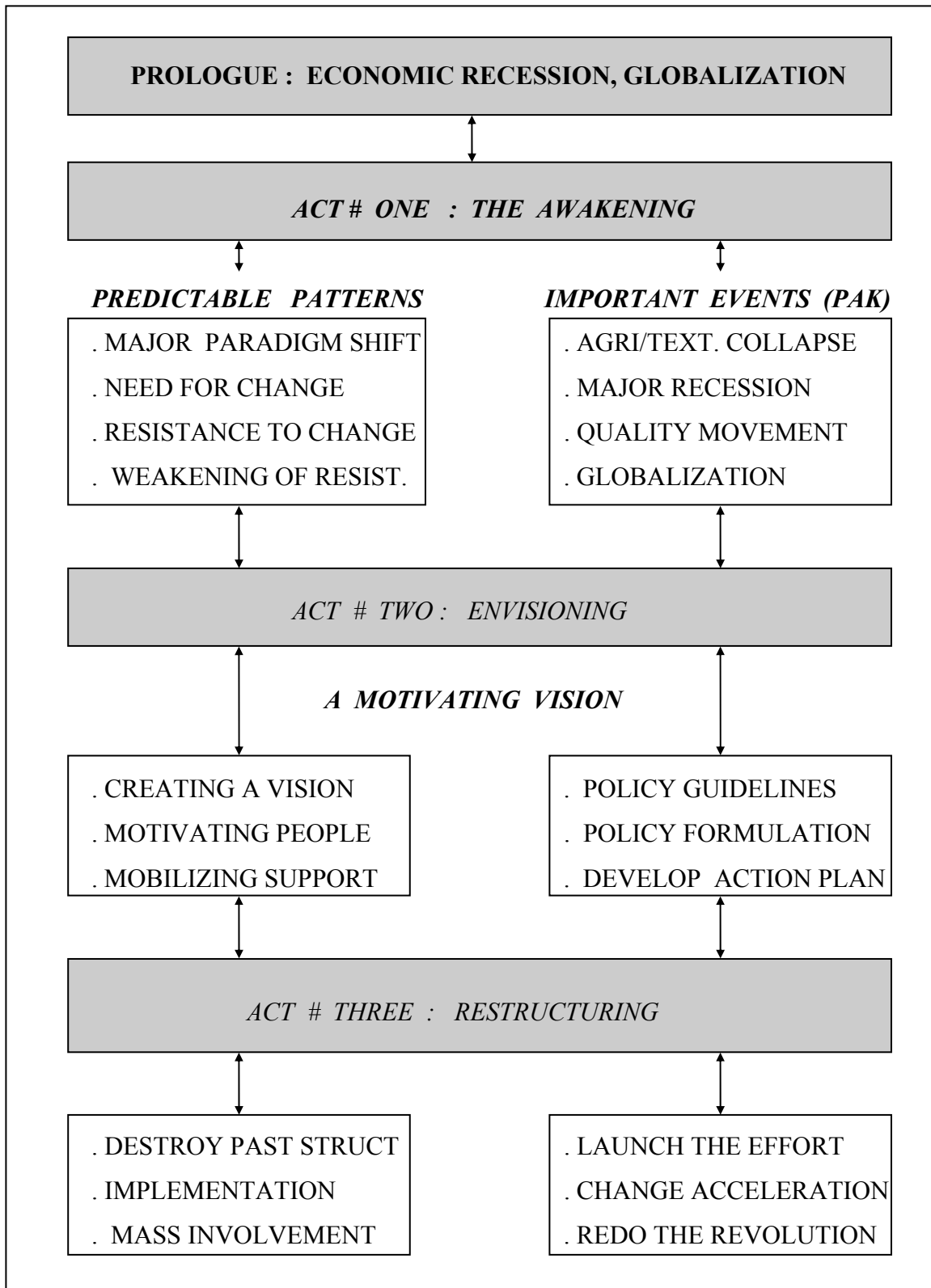
##### *A National Resolve to bring about a Techno-Economic Change:*

Like any other known movement of the world, the first and foremost step in its realization is a resolve that acts like a driving force against the greatest of all odds to bring that movement to success. Our movement, “*Science and Technology for Self-Reliance and Beyond*”, that spans the entire nation, would require a strong determination, sustained commitment and a conscious effort from people from all walks of life. Without such a resolve, a movement of this magnitude cannot be undertaken.

##### *Efficient and Meaningful Transfer of Technology :*

In the modern era of accelerated technical change, it is imperative that we acquire the best possible technology through Technology Transfer Agreements

with foreign firms and MNCs. However, a blind rush for new and expensive technology can be as detrimental to a nation's technology policy as can a



technophobia be. Great care must be taken to ensure a robust and efficient *vertical transfer of technology* .

*Development of Self-Sustaining Infrastructure :*

The existing infrastructure available to the Science and Technology establishment should be strengthened and updated as per the requirements of the modern age. Greater Private Sector involvement and less government intervention can ensure a much smoother and more result-oriented functioning of the required institutional setup. Science and Technology Policy should be made a mandatory part of a greater 15-20yr. *National Development Plan* and enforced through a *Constitutional Amendment*.

*Achievement of Self-Reliance through Import-Substitution :*

Achievement of Self-Reliance through massive investment in the import-substitution sector of industries is envisioned. This is only possible through an aggressive technology transfer strategy, strict compliance with indigenization and deletion deadlines, massive investments in agricultural and industrial productivity and a national resolve to buy home-made products.

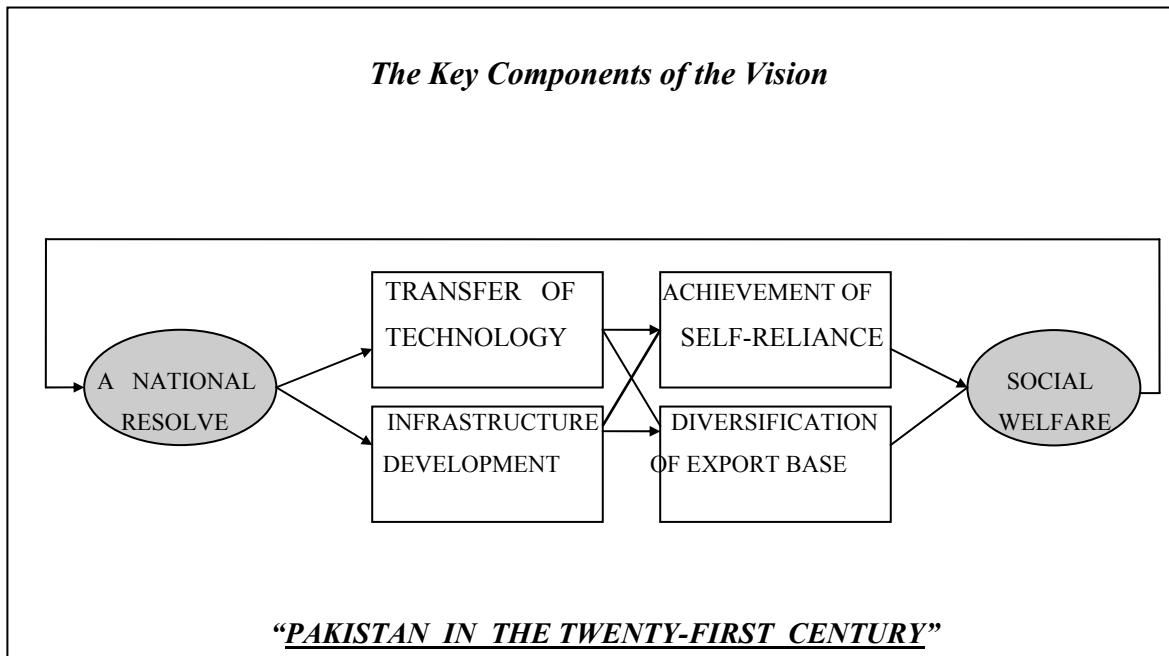
*International Competitiveness through Export Promotion and Diversification:*

Pakistan's success in fulfilling her ambition to join the Newly Industrializing Economies (NIEs) depends on her ability to diversify her export base in the coming era shrinking distances and globalization or trade and commerce. We must concentrate on expanding our manufactured goods export base and export markets through a conscious effort to shift towards greater value-addition in our traditional sectors that include cotton and cotton-based textile products, leather goods and light engineering equipment. We must also endeavor to diversify our existing export base to include non-traditional areas like machinery, processed food, chemicals, engineering goods, automobiles, synthetic fibers and software etc. Export diversification can have a positive impact on our

balance of payments situation that has been a major area of concern for us.

*Translation of Techno-economic benefits into Social Welfare :*

As the final and most important step of the process, the economic benefits of the Science and Technology movement must be translated into Social Welfare,



thus strengthening our belief that S&T is not an end in itself rather a means to an end. Greater economic security and stability, higher productivity, better quality of life and increased international competitiveness cannot be achieved without concrete science and technology effort.

**A NATIONAL SCIENCE AND TECHNOLOGY MOVEMENT FOR SELF-RELIANCE**

*A National Science and Technology Movement (NSTM)* can be envisioned to bring about the necessary changes required for an ***Economic Renaissance*** . The National Science and Technology Movement, like any other movement would, by design, have two basic components: the Strategy and the Action Plan. Structural weaknesses in any one of the two can have serious repercussions for the results it can provide. The strategy is the basic

scheme of achieving a particular objective. It provides us with a *modus operandi*, a way of going about a particular problem. The action plan on the other hand is a step-by-step approach to the successful culmination of the task-at-hand. It serves as a road map for the followers of a movement. Both are mutually re-enforcing in nature. Together they can work wonders for a movement.

Traditionally a lot of approaches have been used by many NICs to achieve an initial breakthrough in Science and Technology. Japan used a technique based on transfer of technology from the West, its absorption, modernization and ultimately mass production for export in world markets. Korea, Taiwan and Malaysia used a strategy based on import-substitution-export promotion to perfection. Singapore and Hongkong capitalized their geographical and historical positions respectively to attract foreign investment and became the world's largest export-processing zones. India and China have used protectionism followed by indigenization to a substantial degree of success. These countries have adopted one of the two classical approaches in the selection of industrial clusters to be used as harbingers of technological change, namely : the *Basic Industry* approach whereby the core industries like heavy metals, chemicals and capital goods are relied upon as catalysts of change, and the *Consumption Industry* approach in which development of market-oriented consumption goods industries trigger a reaction that works backward to pull the capital goods industry along with it.

The selection of a particular mode of operation however, should solely be based on a country's individual characteristics. Pakistan is a country blessed with vast areas of fertile land, a burgeoning agricultural sector, world's finest cotton and a central geographical location. All this can be used to our advantage through adopting an effective strategy for development. Keeping in mind our own geographical location, historical background and socio-economic constraints, we can chalk out a development strategy tailored to the needs and problems of this particular country. Based on extensive research of the available options, we end up with a couple of very effective development models that can be used with great effectiveness in our particular case. These are:

- a) The Traditional Import-Substitution-Export-Promotion Model
- b) The Technology-Driven Competitive Advantage Model

Lets study these models in greater detail with reference to Pakistan.

### **THE TRADITIONAL MODEL OF DEVELOPMENT**

The traditional model of Science and Technology Development prefers the approach used by a number of newly industrializing countries in East Asia during the current century. The model outlines the normal sequence of endeavor as ***Technology Transfer-Import Substitution-Innovation-Export Promotion and Diversification***.

Experts divide Science and Technology into four basic categories depending upon the intensity and application aspect of its science and technology components. These are :

#### ***Classification of Science & Technology :***

##### *Basic Curiosity Oriented Sciences*

- . Physics
- . Chemistry
- . Biology
- . Mathematics
- . Geology etc. etc.

##### *Sciences in Application*

- . Agriculture
- . Medicine and Health
- . Conventional Energy
- . Environment & Pollution
- . Earth Sciences

##### *Classical (Low) Technology*

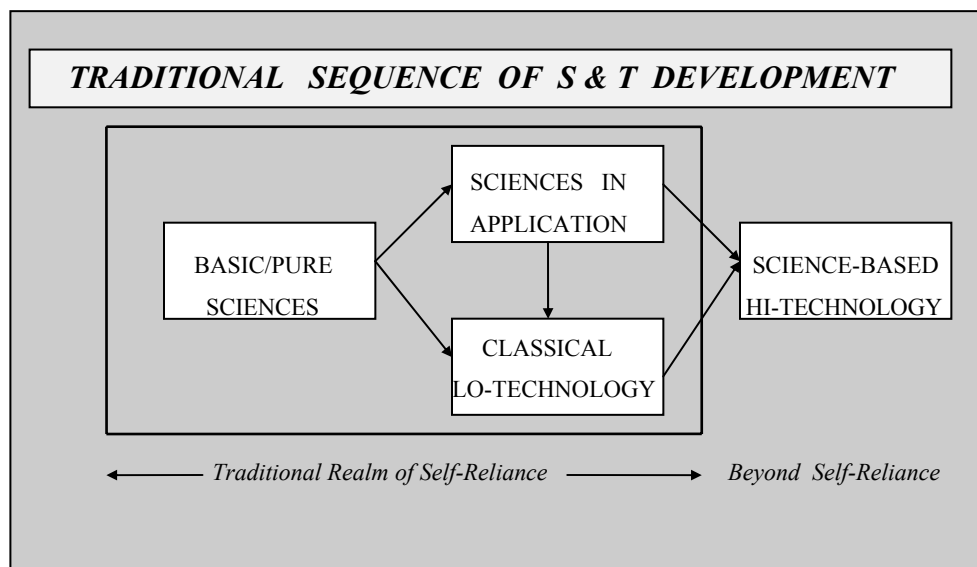
- . Traditional Chemicals
- . Traditional Industries (Cotton & Leather)
- . Petroleum Technology
- . Metal Industry
- . Power Generation and Transmission
- . Appropriate Technology

##### *Science-based High Technology*

- . Computers, Communications & Informatics
- . Microelectronics (Hardware and Software)
- . New Materials (Alloys & Superconductors)
- . Nuclear Technology and Photonics
- . Pharmaceuticals and Fine Chemicals
- . Biotechnology and Genetics

This model emphasizes a much lengthy but a more balanced approach of scientific and technological development for any under-developed country. The above classification of

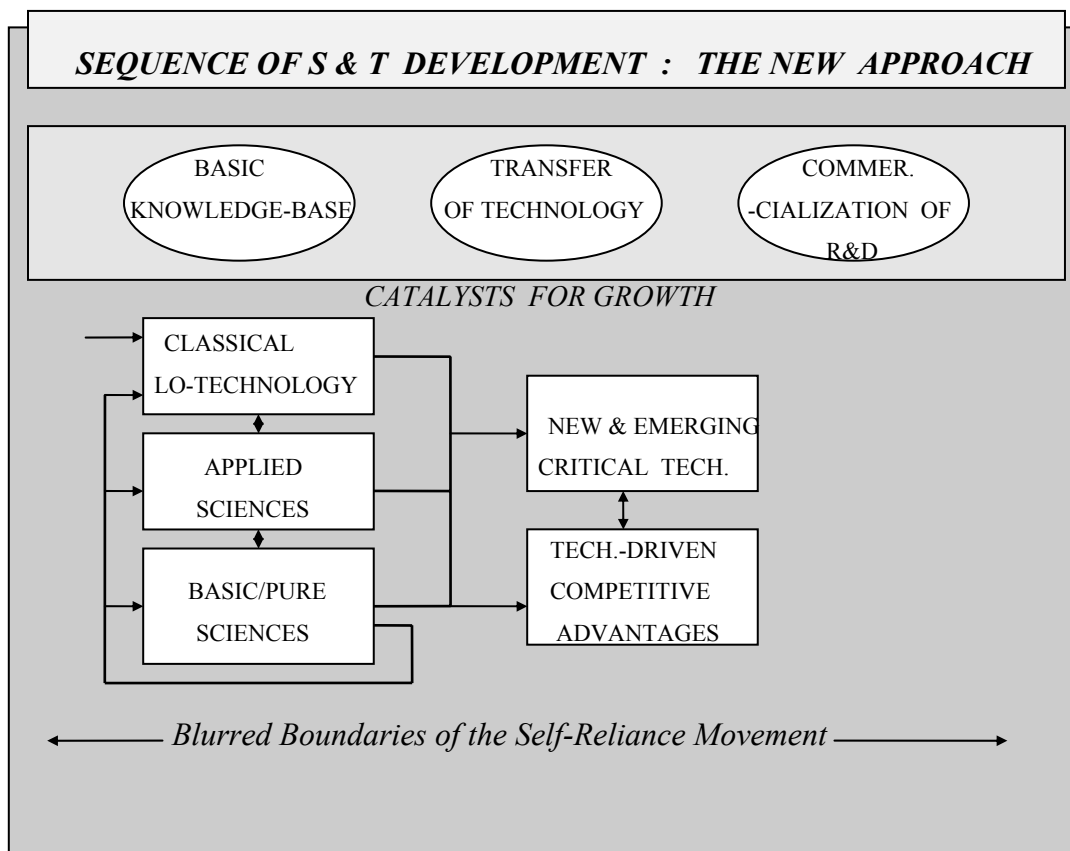
technologies encompasses, in a broad sense, all the known sciences and technologies. Research and Development (R&D) in the basic sciences remains a costly activity which pays back in a very long period of time. The research results from this phase then move on to play their part in the areas stressed under sciences in application like medicine, agriculture, energy and environment etc. This strengthening of the knowledge base then also triggers a wave of innovation and experimentation in those areas of technology which are known for their less knowledge contents and greater labor-intensity. As a last step in this chain of events, comes the all-important area of high technologies that have become the backbone of the modern day economic successes. Most of the newly industrializing countries have used this very aspect of science with appreciable degree of success. Countries like Singapore, Korea, China, Malaysia and even India have made rapid advances in the fields of genetic engineering and biotechnology, semiconductors and optical computing, new materials and superconductivity etc. and have emerged as major exporters of software, semiconductor chips and memory devices.



Although there can be no single model that can be applied to all countries, the more popular and advised approach is to emphasize initially on the classical low technology areas, followed by applied sciences, provided a substantial knowledge base in the area of basic sciences already exists. This process can then be further extended to particular hand-picked areas of high technology and advanced sciences. The size and nature of the

infrastructure should vary with the population, available setup and other individual characteristics.

This brings us to our second model of development which is a logical conclusion of the one described above. “*Building Competitive Advantages*” in the age of cut throat economic competition and globalization is a logical step to be undertaken. The pace with which the world of science and technology is progressing makes it imperative to concentrate on a group or cluster of industries and its supporting scientific and technological infrastructure. The next model provides a down-to-earth picture of



what can be a technology-driven competitive advantage in the textiles and garments sector for Pakistan.

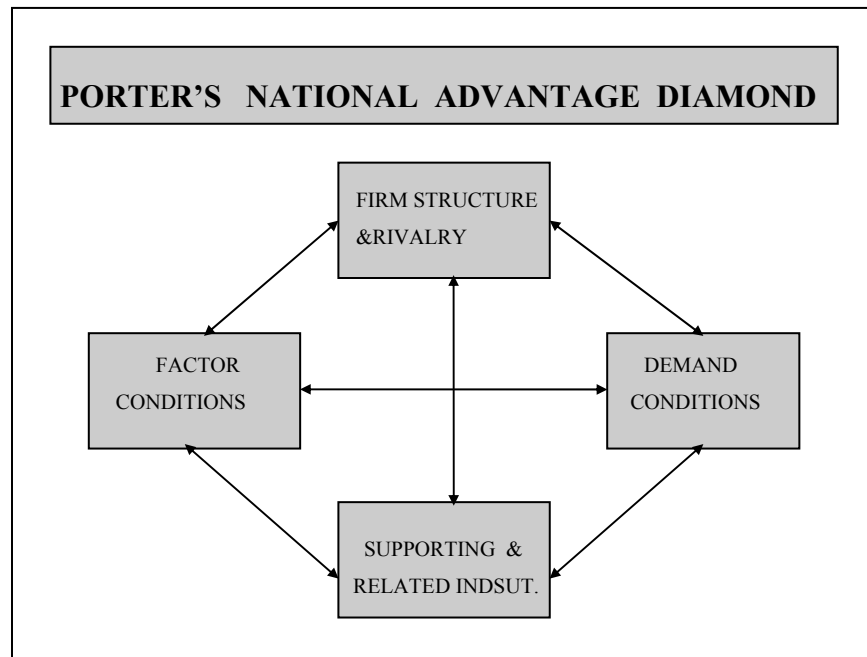
### **THE TECHNOLOGY-DRIVEN COMPETITIVE ADVANTAGE MODEL OF DEVELOPMENT**

Looking around at the globe we would find a lot many countries enjoying a very competitive status in a particular industry or an industry segment while totally lacking the same in the rest of them. Their remarkable levels of success in these particular industrial niches can be easily attributed to some obvious national characteristics. These countries have actually transformed some of their traditional or acquired characteristics into a dynamic competitive advantage through the adoption of technology and dynamic marketing. Infact, with a little bit of insight into the American success story, one doesn't find it difficult to realize that the Americans have used a mixture of the Niche Strategy and the Competitive Advantage Model to perfection. After the Second World War, America developed into a military-industrial complex capitalizing on its capable military R&D infrastructure. Some of today's finest technologies owe their existence to the research labs of the DOD. This technological development had a trickle down effect on the American industry transforming it into a truly formidable one.

In order to analyze Pakistan's industrial scenario with a view to mark an industrial sector that might, with a little bit of planning and foresight be transformed into our competitive advantage, we have to take into account a large number of considerations. After an in-depth analysis of the strengths and weaknesses of various industrial sectors, we find our textile and garments industry as the only one that can be easily transformed into a catalyst of growth for others. We must look at numbers to substantiate our point. Textile industry occupies 8 % share of the GNP and a 42% share of employment in the large scale manufacturing sector. It contributes more that 60% of the total to our export receipts. Pakistan is the world's fifth largest producer of cotton. Raw cotton and its by products make up a major portion of the foreign exchange earnings making it the largest sector of our industry. *Michael E. Porter*, a Harvard Professor and a leading American expert on industrial competitiveness, has developed a very interesting model after an in-depth analysis of over 100 industries in ten leading nations of the world. Porter identifies the fundamental determinants of national competitive advantage in a particular industry and how they work together as a self-reinforcing system. Porter defines a "*National*

**Advantage Diamond**” and claims that nations succeed in those particular industries where the national advantage diamond is most favorable.

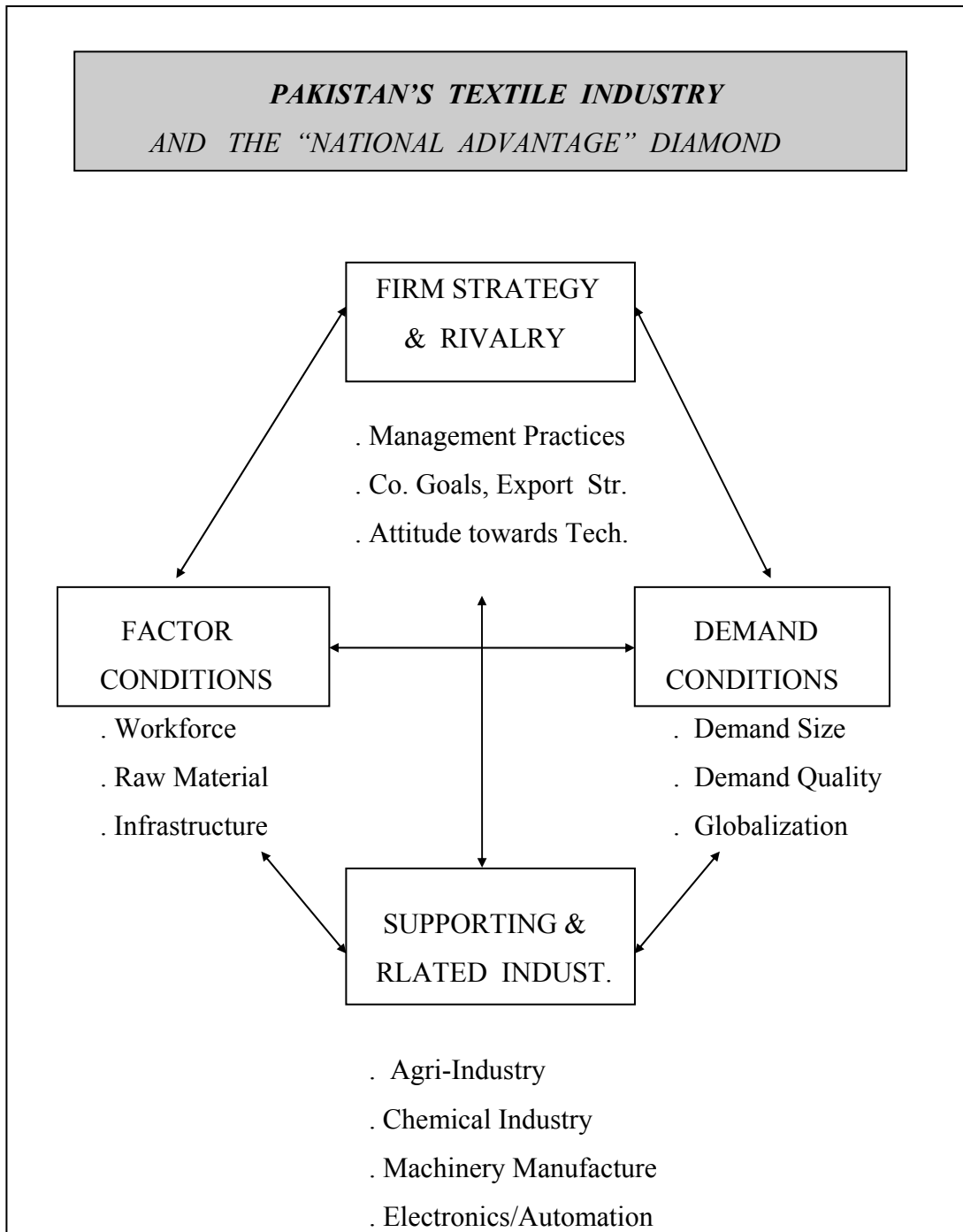
Applying Porter’s “*National Advantage Diamond*” to Pakistan’s textile industry provides us with a very interesting and useful mental exercise. With an annual production of 9 to 9.5 million bales of cotton at an annual average productivity that exceeds that of the US, Pakistan remains highly competitive in this critical industry. Couple this with a large demand of the textile products back home and in the international markets and a



comprehensive network of supporting industries, Pakistan’s textile industry, despite its weaknesses and some problem areas, holds the promise characteristic of a world leader.

Despite all these factors, the events of the last few years have actually resulted in a major slip in our share of the world’s textile markets. The ready-made garments export alone fell from Rs. 5 billion to Rs. 2.5 billion during the period 1991-93. This has led to a gradual erosion of our competitive advantage in this highly critical sector of our

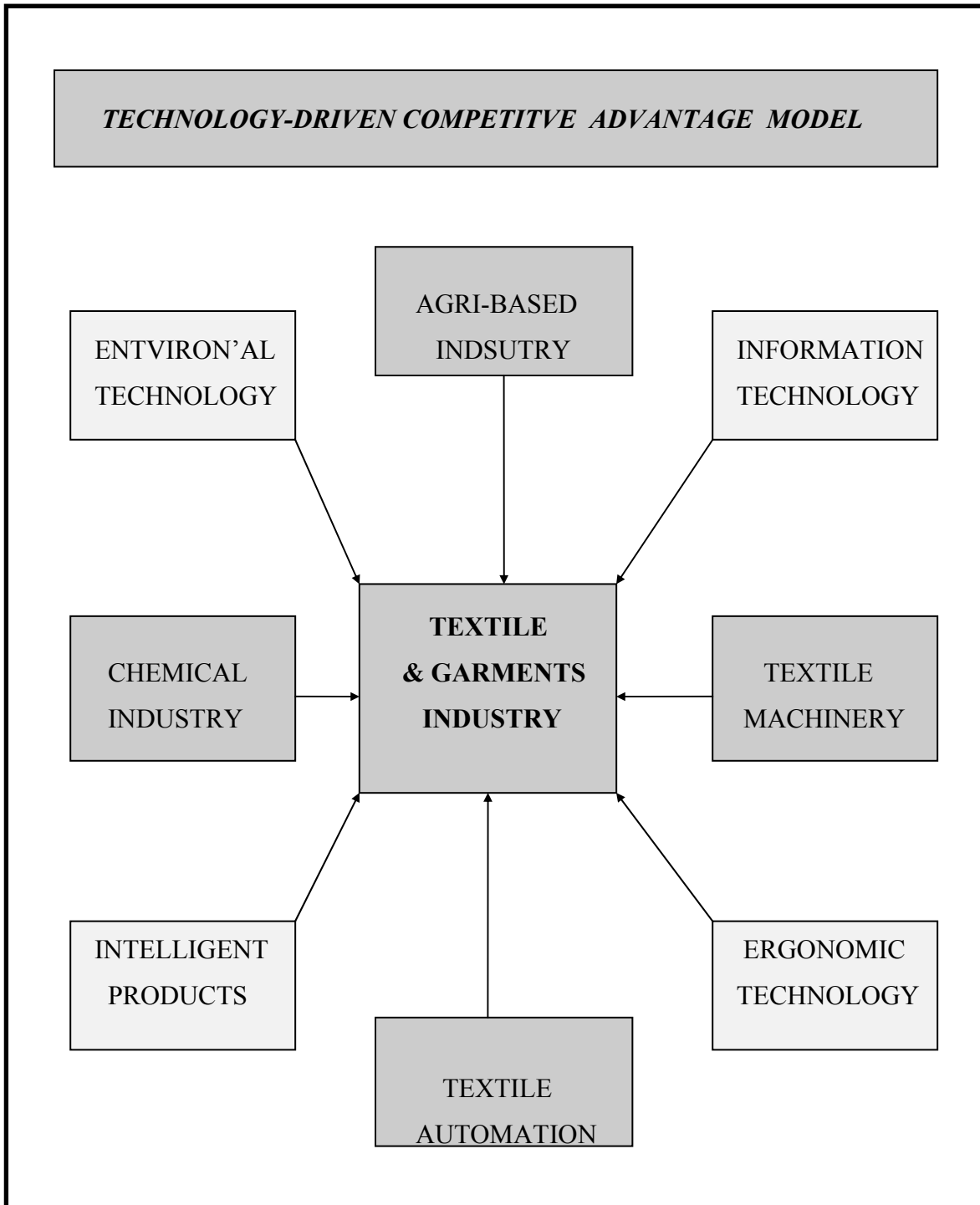
economy. The future holds even bigger challenges for Pakistan in this sector. With a little bit of imagination, careful planning and modernization, not only can we recapture our lost business, but transform this sector into a dynamic engine for growth for the other sectors of the economy.



*Characteristics of the Technology-Driven Competitive Advantage Model :*

The Competitive Advantage Model envisions the development of Pakistan's Textile and Garments sector on firm foundations in such a manner that it could boost the economic potential of the other sectors of the economy, thus transforming the gradually slipping market shares into continued growth and prosperity. This would require capital investments, transfer of technology and development of human resources in both upstream and downstream industries. This has been chosen due to multiple reasons. *Firstly*, the textile and garments sector offers vast opportunities of value-added manufacturing through the integration of scientific knowledge and technology. *Secondly*, an already well-developed textile sector can be easily upgraded into an internationally competitive one without major investments as in the case of consumer electronics, automobiles or semiconductors etc. Further more a very short pay back period can be used to full advantage in attracting private sector investment. *Thirdly*, owing to the nature of the textile and garments industry, the development in this sector would have a multiplier effect on a host of other industries like chemicals, automation, machinery and agriculture etc.

We can even go beyond the status of a textile giant and develop ourselves into a producer of world class textile technologies. We might learn from the example of Finnish electronics industry which started as a exporter of automation systems and instruments for the forest industry, a competitive advantage of Finland. Today, Finnish firms are the producers and exporters of the world finest paper mills and other related equipment. We can develop our capability in textile automation systems, application-specific software for the textile/garments sector, management information systems for the textile sector, computerized design workstations for garments manufacturing, CNC equipment and communications infrastructure necessary for Quick Response (QR) advantage. This would not only lead to the establishment of an integrated textile/garment industry in Pakistan but would also have a domino effect vis-à-vis the development and maturation of a host of other industries in Pakistan.



As clearly obvious from the above figure, the spill over effects of Competitive Advantage Development Model can be seen in a large number of other technologies and sciences that play a major role in determining the competitive position of a country's textile/garment manufacturing sector. These industries include :

<b><i>Core / Basic Industries :</i></b>		
<u><i>Agri-based Industries</i></u>	<u><i>Chemical Industries</i></u>	<u><i>Engineering Goods Ind.</i></u>
. Biotechnology	. Finishing & Processing	. Textile Machinery
. Agri-fertilizer	. Dyeing and Bleaching	. Agri-Machinery
<b><i>Supplementary Industries :</i></b>		
<u><i>Automation Systems</i></u>	<u><i>Information Technology</i></u>	<u><i>Knowledge-Based Prod.</i></u>
. Electronics	. MIS Systems	. Intelligent Products
. Industrial Engineering	. POS Data Tx. Syst.	. Artificial Intelligence
. Quality Management Syst.	. Software Development	
<u><i>Ergonomics Technology</i></u>	<u><i>Environmental Technology</i></u>	
. Specifically Tailored to Textile Industry	. Specifically Tailored to Textile Industry	

The impact of technological advancement in the above sub-sectors of the Core and Supplementary industries can lead to dramatic improvements in terms of utilization of technology in other sectors of the economy. Furthermore this would provide our industry with substantial gains in terms of market shares, export earnings and transfer of technology to be re-invested in the lagging sectors of the economy.

#### **SCIENCE AND TECHNOLOGY FOR SELF-RELIANCE : A PLAN OF ACTION**

Developing a comprehensive plan of action is the first step in the transformation of the “ideas into reality”. The Action Plan is a very important part of any movement for change. Without a properly chalked out Action Plan, that divides the necessary policy

guidelines into small and manageable steps, an idea can be effectively killed. This is followed by yet another important part of the movement i.e. the implementation. Together these two can be instrumental in the execution of a particular idea into meaningful results. Developing a plan of action is a tedious job that requires great expertise. A plan that is too ambitious or too humble can lead to undesirable results or results of insignificant magnitude. Similarly a beautifully chalked out plan that is not implemented would also be of no use to a nation. While devising a Plan of Action for Pakistan's Science and Technology movement, we must take into consideration, the various constraints and limitations we normally encounter in their implementation.

Limitations and Constraints :

Following are some of the major problems faced by development planners in Pakistan :

- a) The *low levels of literacy* in Pakistan that cannot be transformed over night.
- b) Low levels of savings and an even *lower level of capital investment*.
- c) Recurrent Budgetary Crises and a *sub-critical size of budgetary allocation* to the development of science, technology and industry.
- d) Problems faced during the *transfer of technology* from the West and the MNCs.
- e) Absence of professional ethics and a *lack of general work-culture* in our labor force that results in major weaknesses in the implementation phases.
- f) Excessive *Red-Tapism in bureaucracy* resulting in a loss of impetus to change.
- g) Lack of an *effective political leadership* and a sense of direction. etc.

Key Characteristics of the Action Plan :

Keeping the view the above mentioned limitations, our plan of action should have the following key characteristics :

*Long Term Perspective :*

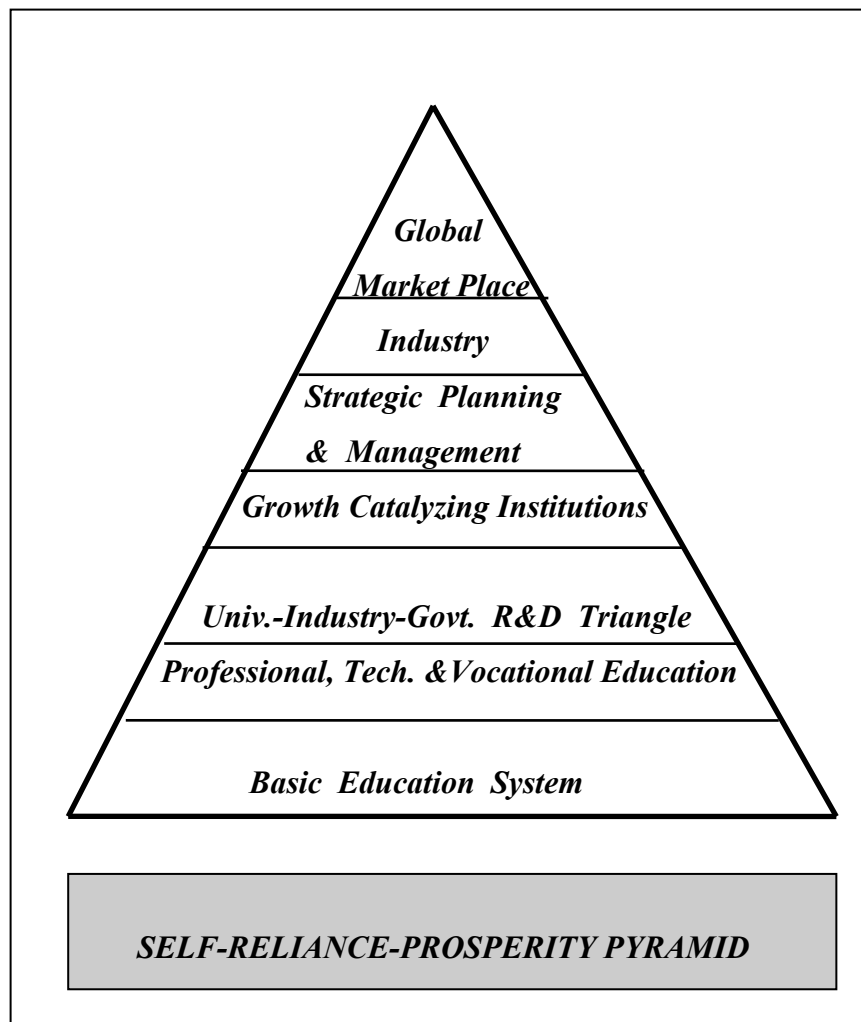
Owing to the political instability in the country, the Action Plan should have a long-term perspective but, should be able to provide quick returns.

*Constitutional Cover :*

In order to ensure its completion, the Action Plan should be provided with a constitutional cover along with other important policy documents.

*Low Initial Investment :*

The Plan should be made in such a manner that the investment requirements in the initial phases should be kept to a minimum.



*Institutional Re-Engineering :*

The initial infrastructural requirements should be kept to a bare minimum that could spur growth in science and technology sectors. Emphasis should be

paid on re-engineering and upgrading the existing setup to work at its full potential.

*Private Sector Involvement :*

An effort should be made towards the involvement of private and industrial sectors in the financing and execution of the Plan of Action. Government should delegate its responsibilities and authorities to private enterprises.

*Self-Sustaining in Nature :*

Once put into action, the Plan should be able to trigger a continuous process of S&T-induced growth in the industrial and economic sectors, and should be able to sustain itself without much further thrust.

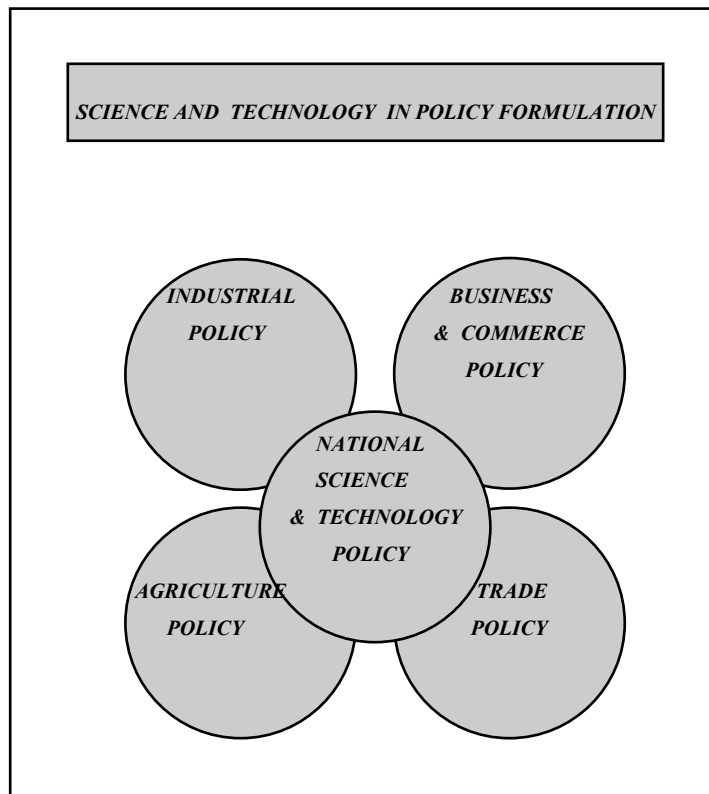
**THE KEY ELEMENTS OF THE ACTION PLAN**

Following are the key phases of the Action Plan, which if executed in the manner prescribed below can provide the above mentioned important characteristics to the Science and Technology Movement in Pakistan :

*Policy Formulation :*

The first aspect of a Science and Technology Movement, apart from a *National Resolve* is the development of a *Comprehensive, Coherent and Realistic* policy that can be implemented to a fair degree of accuracy. One of the biggest dilemmas with our previous S&T policies has been the inability of our planners and bureaucrats to translate them into tangible results. This can primarily be attributed to a total lack of commitment towards the development of scientific and technological capability, a culture of non-compliance with policy guidelines and political instability in the country. The *Policy Formulation Function* is perhaps the most important one in the whole scheme of things, and therefore must be accorded its due importance. A National Science and Technology Policy, if properly implemented, leaves a deep impression on other major policy concerns of a country. It is therefore recommended that a Central Policy Making Agency like an improved version of Planning Commission be formed which can provide a coherence in

the key policy issues of national importance like Science and Technology, Commerce, Industry, Trade, Agriculture and Defense etc.

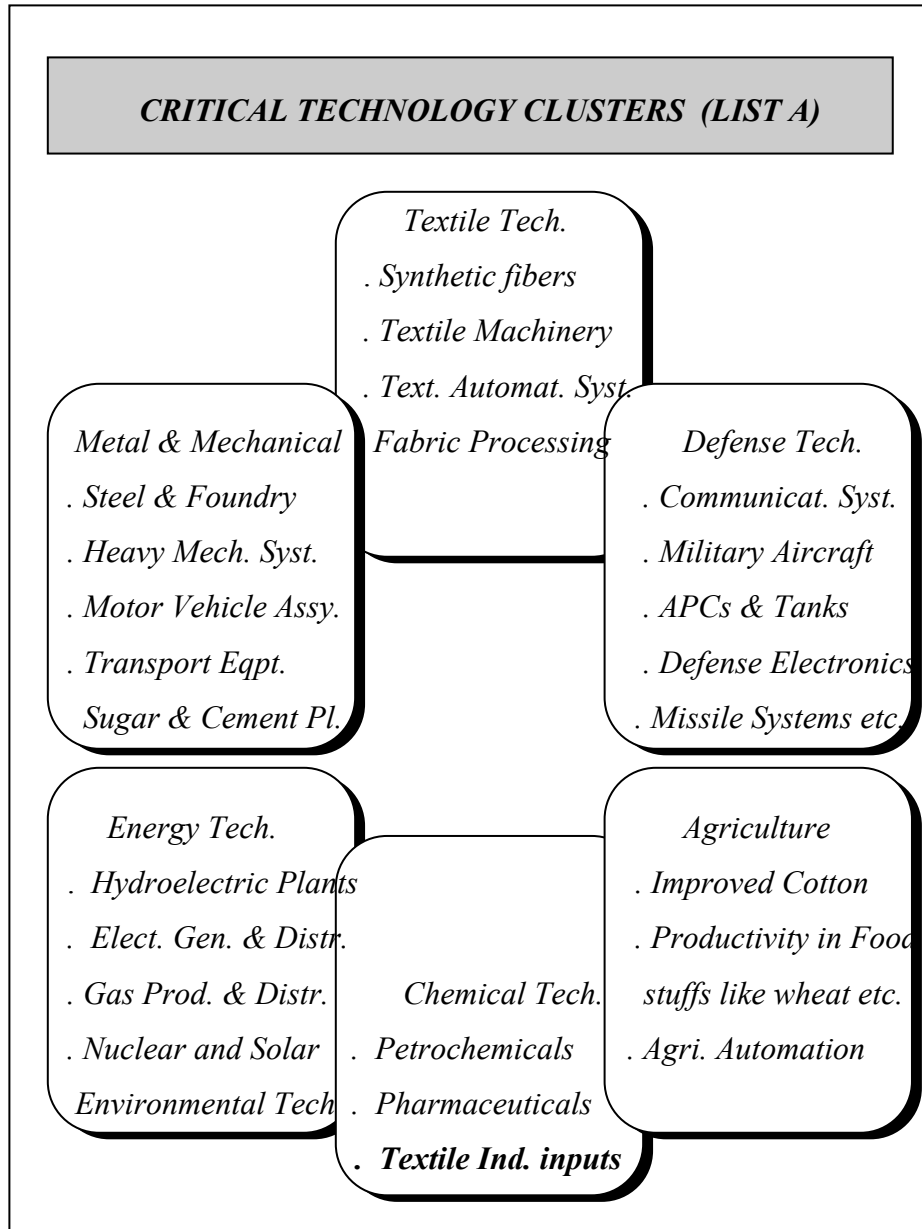


Furthermore an independent agency, like the Office of Technology Assessment (OTA) in the USA, be developed that can advise the President of Pakistan and the Planning Commission on issues relating to Science and Technology besides providing an in-depth evaluation of different policy matters from technology perspective. In the view of the on-going political instability, it is imperative that the Planning Function be provided a constitutional cover for a period of at least 10-15 years through an amendment in the Constitution. This would provide the much needed long term perspective to our policies and plans.

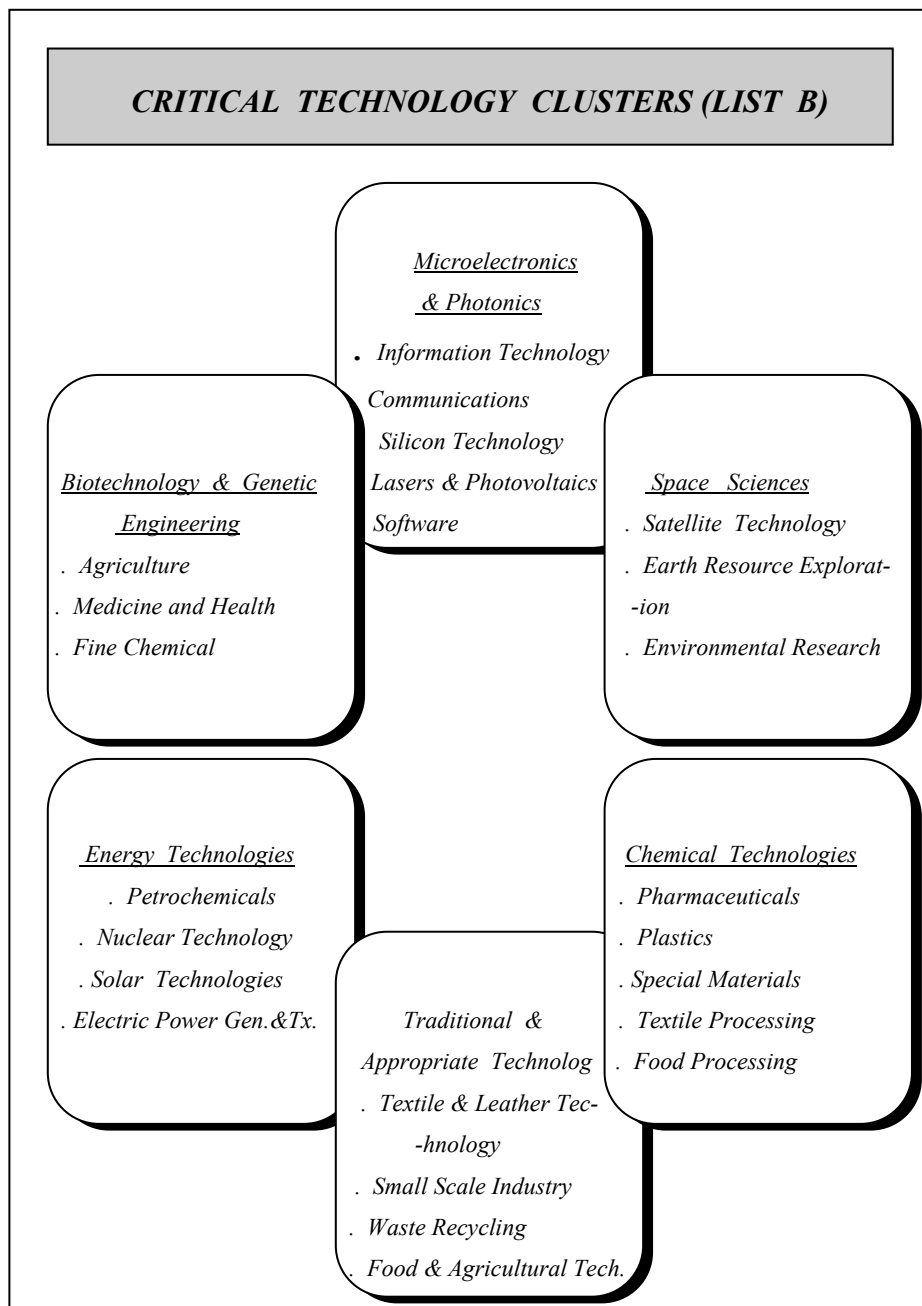
*Thrust on Critical Technologies :*

The Action Plan would also single out two separate lists of critical technologies based on the goals of the movement. List A corresponds to the set of technologies that have a high Self-Reliance value and therefore must be pursued with an aim of

indigenization. The policy package of the Action Plan would provide stringent policy guidelines for deletion, modernization and domestic production of technologies present in list A.



List B should include those areas of technological activity which are a little bit towards the higher end of technology and therefore are of little immediate economic benefit to us. However, their importance cannot be neglected in the long run as they make the backbone of tomorrow's important technologies.



*Privatization of S&T Establishment :*

Another major aspect of the National S&T Action Plan is the move towards greater private sector participation in the development of Science and Technology Capability in the country. A very ambitious plan can be envisaged and implemented in this regard. This can lead to the transfer of activity and authority from the public to the private sector vis-à-vis the S&T establishment of the country. The government, through a series of policy reforms, can transfer its role and responsibility of developing the S&T Capability to the private sector. A very promising example of this trend was the establishment of National Institute of Leather Technology (NILT) as a joint venture between the public and private sectors. Similar institutes can be developed in the areas of textile technology, automobile engineering, information technology, machinery manufacturing, industrial automation etc. as joint ventures between government and leading trade bodies, multinational corporations and major industrial groups in the particular industry segments.

*Transfer of Technology :*

Transfer of Technology is a major area of concern for any third world nation planning to leap-frog the initial stages of development. The effective *Vertical Transfer of Technology* can play the role of a change accelerator in developing the capability of indigenization and ultimately innovation, production and export of technology and technology-based products. Government should encourage the import of foreign technology but must provide stringent guidelines for adoption, reverse-engineering, upgradation, modernization and development of indigenous capability. We have already performed a similar task in case of cement and sugar manufacturing plants and HMC and have the capability to do the same with a host of other technologies as well.

*Promotion of Women's Role in S&T Development :*

The participation of women in economic activity in general and S&T-based activity in particular has not been upto the mark in the last five decades of our existence. The role of women in accelerating the overall economic progress has now been widely

accepted as a critical factor. In Pakistan, the majority of women have been relegated to a reproductive and hence dependent category. Although their exposure and contribution to the agriculture/traditional sectors has been growing with time, but their involvement in S&T based sectors of the economy has been negligible. Pakistan's S&T Movement would not be able to acquire the required momentum without the active participation of women in the S&T based professions and entrepreneurial ventures. The Action Plan should also include instruments for the promotion of women's role in S&T based movements, popularization of use of appropriate technology in rural-women, creation of avenues for their participation in the movement and initiate training programs and educational schemes with a women-only perspective.

*Catalysts for Growth of S&T :*

In order to achieve a robust growth in the S&T sector, the Action Plan must important growth catalysts in the following areas :

a) *Technology Commercialization :*

A major building block of a robust S&T sector is a technology commercialization mechanism. The absence of a proper mechanism through which the R&D results could be transformed into marketable technologies and technology-based products, induces a basic structural weakness in the S&T sector leading to its collapse. The Action Plan must provide a mechanism for commercialization and marketing of technology through the introduction of a separate institution or an upgradation of an already existing one.

b) *Technological Finance and Investment :*

Providing the necessary finance and investment for the science and technology sectors is a major concern for developing countries. This can be achieved in a number of ways, namely, providing soft loans and risk-capital to entrepreneurs for technology-based businesses, providing tax-holidays to industrialists who are willing to invest in research and

development and reducing import duties and other taxes on imported machinery used in R&D institutes and technology-based businesses.

c) *Technology Change Accelerators :*

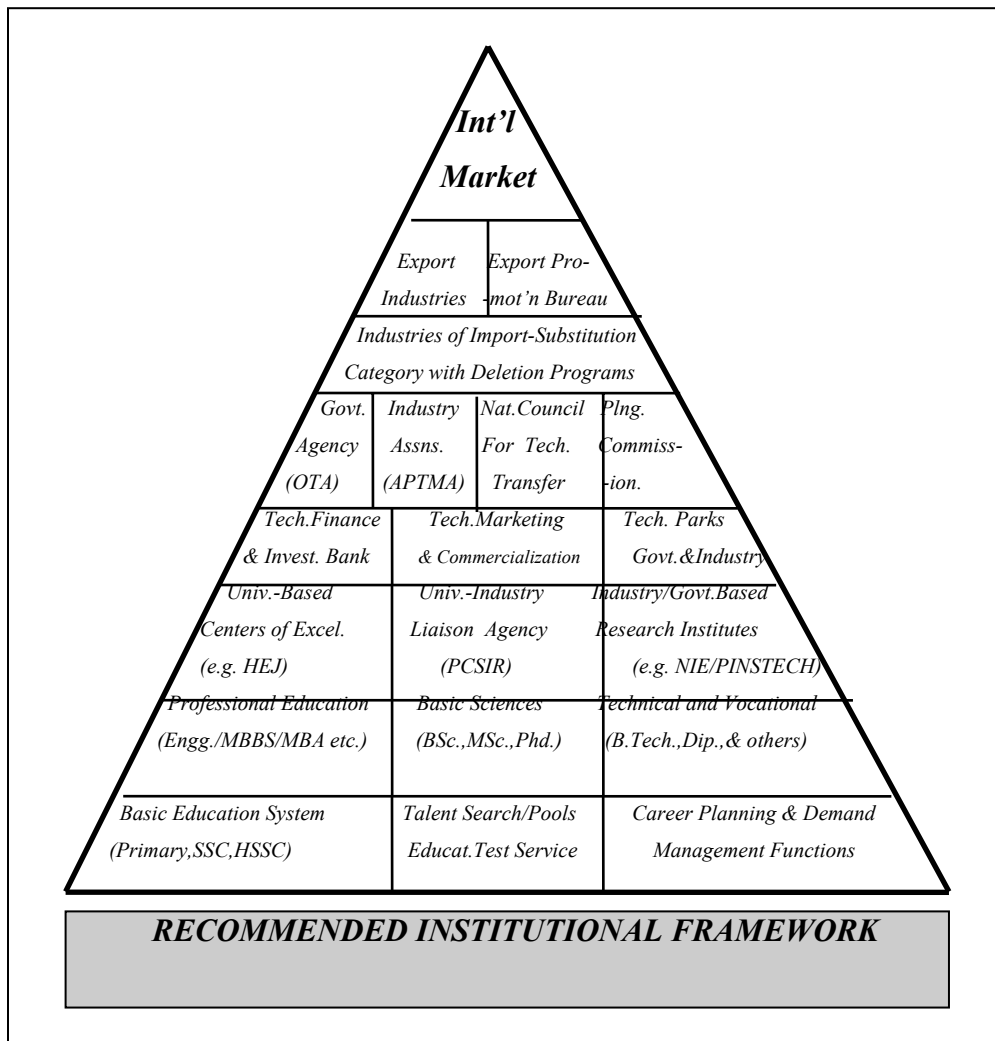
The Action Plan should include a policy package for technology change accelerators like technology parks and special industrial zone aimed at technology-based businesses. Furthermore an effort should be made to invite foreign companies and MNCs to setup operations in high-tech. businesses with an aim towards indigenization of technology. Government should establish technology parks in areas like textile technology, software engineering, materials science, chemical technology, energy technologies, genetic engineering and agricultural automation etc.

d) *Technology-Industry Liaison Agency :*

The last of the main areas of important catalysts for change is an effective liaison between technology centers, training institutes and universities and the industry. PCSIR and EPB should be strengthened to perform this important task. Another way of doing the same is to privatize the research establishment as discussed above.

*Infrastructure and Institutional Setup :*

Infrastructure is a *sin qua non* for development. Without a firm government commitment towards S&T development and an institutional framework within which this development can take place, neither the businesses nor individuals would take the personal and financial risks necessary to bring about the required change. If it hadn't been for the MITI, probably Japan would not have been an economic super power today. Infrastructure development requires huge capital investments. Pakistan being a cash-hungry country with an exploding debt situation and a deep economic recession, capital is the last thing that can be easily committed. It is therefore imperative that a low-investment institutional and infrastructure policy be developed that could provide us with a bare minimum necessary for a head start.



The Action Plan should include the following infrastructure that makes up the bare minimum required for a robust growth :

INSTITUTION	EXISTING EXAMPLE	PRIMARY FUCNTIONS
Basic Education System (Primary/SSC/HSSC)	System Already Exists	A gradual improvement in literacy rates and quality of Education provided.
Talent Search Programs & Educational Testing	To be Developed from scratch	Quality Check and advice on integration of nationwide educational services/systems besides talent search, and aptitude testing.
Career Planning and Demand Mgmt. Function	An efficiently functioning PCPA	Career Planning and manpower Demand-Supply Analysis based on market study and futuristic models of growth.
Professional Education / Basic Sciences	System Already Exists	Further strengthening of Professional Univ. and Basic Sciences Depts. of other Univs.
Vocational / Technical Training Institutes	Upgraded Version of Existing Setup	VTIs be made compulsory for industrial associations, industry groups and large corporations to cater for manpower req.
University-based Centers of Excellence	like HEJ & AERC	Similar institutes in Basic Sciences be developed under different Universities in areas like Agriculture, textile, genetics etc.
Industry-based Research Centers	To be Developed from Scratch	Majority of institutes under the auspices of MOST or GOP like NIE, NIST, NIP, NIO be handed over to private sector for efficient functioning. New institutes in the areas of Applied Chemistry, Machinery and Material Sciences, Biotechnology, Clinical Pharmacy and Health, Advanced Energy Systems and Environmental Technologies etc. be established under HMC, HEC, PTCL, PIMS etc.
Technology Bank	New Concept	A specialized and dedicated Bank or financial institution that provides loans, risk

		and venture capital to technology-based businesses and entrepreneurs.
Technology Marketing & Commercialization Agency	An Upgraded Version of PSCIR & EPB	Technology marketing and commercialization of R&D results be included as functions of PSCIR (Domestic) & EPB (Int'l market)
Technology Parks	New Concept	Jointly financed by govt. and industry, Tech. Parks be established to facilitate the growth of technology-based entrepreneurship.
Office of Technology Assessment (OTA)	Improved Version of PCST	A specialized Agency under MOST to provide technology-related Advice on different Policy Issues suggesting legislative and regulatory action to protect technology interests.
National Council For Technology Transfer	Upgraded Version of NCTT	To judge the requirement of imports; facilitate the Transfer of Technology; provide guidelines for indigenization and monitor deletion programs.
Industrial Think Tanks and Interests Groups	Like APTMA	To provide the industrialist's perspective in policy formulation and ensure active private sector participation.
Export Promotion Bureau	Already Exists	To promote technology-based exports; develop Pakistan's image as leader in technology and quality products; explore new markets for Pakistan's technology.

Regulation and Legislative Support :

The National Science and Technology movement must be provided a legislative cover that forms a very essential part of the overall action plan. This legislative support would be in the following to forms :

- a) A constitutional cover to the complete policy package as discussed above.
- b) Separate Policy packages catering to different aspects of the Action Plan like Technology Transfer, Commercialization of Technology, Women's Role in S&T Development, Technology-related Finance and Investment, Technology-Change Acceleration Packages, and Private Sector Involvement in S&T Development etc. A brief description of the key features of each of these separate policy packages is given below:

***POLICY PACKAGES : DIRECTIONS AND GUIDELINES***

**TECHNOLOGY TRANSFER**

- ◆ The main thrust of the Technology Transfer process must shift from blind import of foreign technology towards progressive deletion and development of indigenous capability through vertical transfer of technological know how.
- ◆ As a key element of the future tech. transfer strategy, joint ventures, leading to a meaningful transfer of technology in the form of technical details, management practices and marketing know how, should be preferred as compared to turn key projects.
- ◆ National Council for Transfer of Technology (NCTT) should be upgraded to assume the role of the all-important technology regulatory institution whose sole aim would be to decrease our technological dependence on foreign sources and achievement of self-reliance in this vital area.
- ◆ National Council for Technology Transfer (NCTT) would identify country's technology needs, facilitate and regulate the influx of foreign technology in the country by assisting in selection, negotiation and acquisition process.
- ◆ NCTT should ensure effective import, adoption, upgrade, modernization and subsequent domestic production of foreign technologies by providing deadlines and monitoring progressive deletion of critical technologies.

***POLICY PACKAGES : DIRECTIONS AND GUIDELINES (Contd.)***

**TECHNOLOGY COMMERCIALIZATION**

- ◆ Keeping in view the importance and costs of the technology commercialization process, a technology marketing and commercialization agency would be developed.
- ◆ Separate *Technology Marketing Units (TMUs)* should be established at PCSIR (for the domestic market) and EPB (for the international market) to cater for the marketing and commercialization aspects of the technology businesses.
- ◆ TMUs should adopt aggressive marketing strategies for technology-based products for the import-substitution and export markets.
- ◆ Govt. grants and aids to state-sponsored R&D institutes should be linked to their success not in terms of quantity of research but in terms of quality and commercial viability.
- ◆ State-owned R&D institutes should be encouraged to form industry partnerships with a view to commercialize their research findings.
- ◆ A move should be made towards result-oriented research by a national prioritization of basic and applied research needs. NCTT should develop a detailed list of technologies critical for self-reliance.
- ◆ R&D institutes and University-based Centers of Excellence should be provided with grants and soft loans for utilization of research results from lab to pilot plant production to commercial scale production.

***POLICY PACKAGES : DIRECTIONS AND GUIDELINES (Contd.)***

**TECHNOLOGY FINANCE & INVESTMENT**

- ◆ In order to spur growth in the Science and Technology sectors, a *National Technology Development Agency* (on the pattern of PIDC & PMDC) should be established to look into the possibilities of foreign and private sector investment in technology-based businesses and industry.
- ◆ A private sector *Technology Bank* and/or *Leasing Company* should be established to provide venture/risk capital to entrepreneurs interested in technology businesses and industries with high technology contents.
- ◆ Income Tax concessions, import duty rebates, rationalized custom duties be offered to businesses participating in Govt.-Industry S&T partnerships and investing in Research and Development.
- ◆ A Technology Fund be established from the revenue generated through import duty on foreign technologies to be used for promotion of indigenization.

**WOMEN'S PARTICIPATION IN S&T DEVELOPMENT**

- ◆ To develop avenues for the participation of women in the *National Self-Reliance Effort* through identification, motivation, information and counseling on feasible areas of participation.
- ◆ Promote women entrepreneurship by strengthening of *First Women Bank's* capability to provide risk/venture capital to aspiring women.
- ◆ Establishment of women-only training institutes to provide training in management and entrepreneurial skills besides technical skill development and practical exposure to industrial environments and appropriate technology.
- ◆ Removal of impediments, physical and psychological, to equal employability of women.

***POLICY PACKAGES : DIRECTIONS AND GUIDELINES (Contd.)***

**TECHNOLOGICAL CHANGE ACCELERATORS**

- ◆ The levels of prevailing technological activity in the country may be stepped up through a series of *Technological Change Accelerators (TCAs)* like Technology Parks and special industrial zones for technology-based industries.
- ◆ These Technology Parks should provide Income Tax holidays, relaxed import duties, “one-window” infrastructure facilities to private and foreign investors.
- ◆ Development of Technology-Parks (TPs) and thus formation of strong Industrial Clusters in the key areas of Software Export, Biotechnology and Agriculture, Materials and Machinery manufacturing, Textile Technology and Agricultural Automation should be undertaken as a first step in this regard.
- ◆ Specific critical factors like land for Agri-related TPs and communication facilities for Software TP be provided at subsidized/low costs.

**PRIVATIZATION OF S&T ESTABLISHMENT**

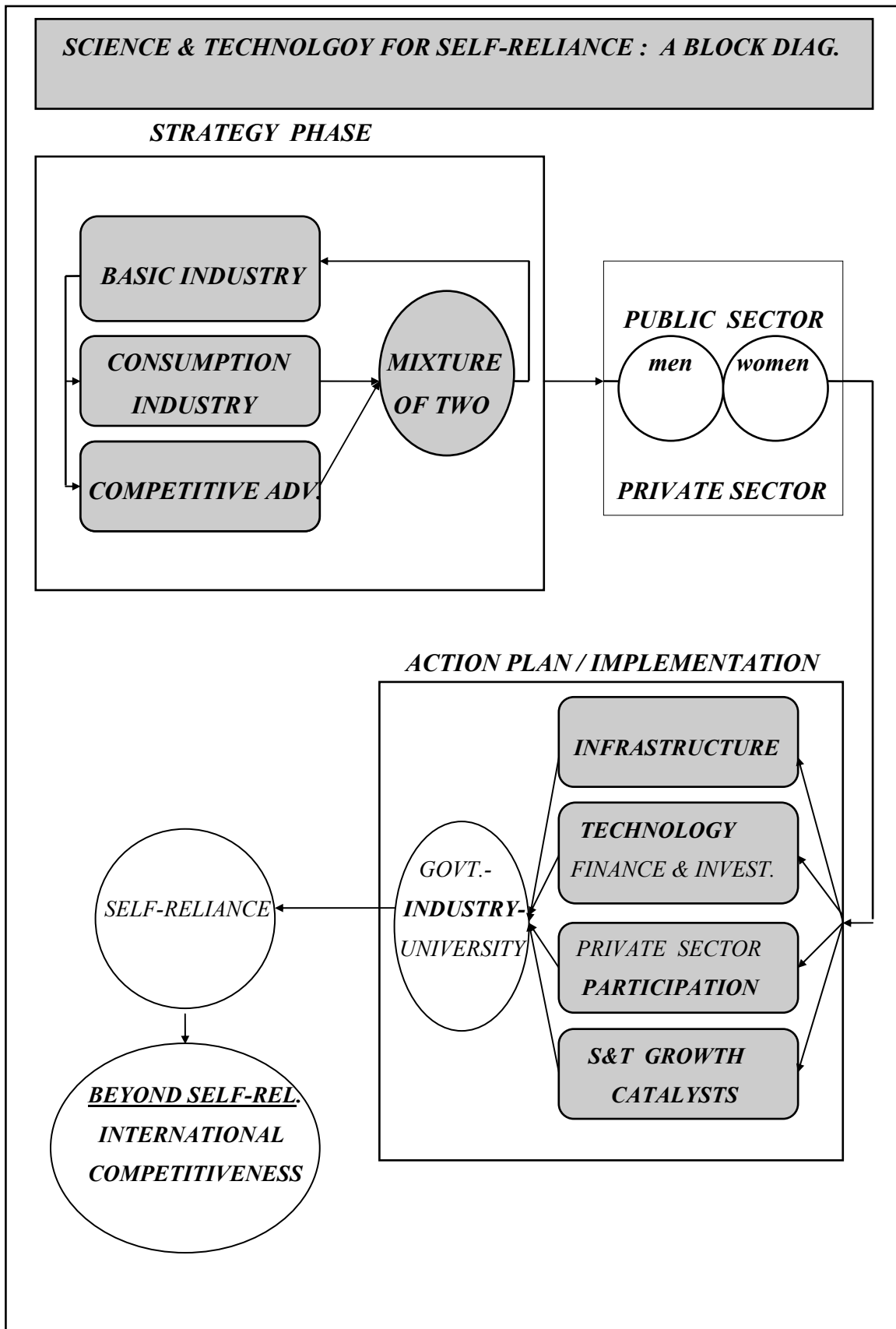
- ◆ An effort should be made to towards an active participation of private sector in the development of science and technology resulting in a progressive transfer of major state-performed functions to the private sector institutions.
- ◆ Private Sector involvement in the R&D process should be attracted through income tax concessions and other fiscal benefits.
- ◆ Development of Research and Training Institutes should be made mandatory for large industry clusters, trade associations and large businesses catering to the research and manpower training needs of their particular industries.
- ◆ Private Sector concerns should be invited to share the costs of development of TPs and demonstration sites in exchange for rich fiscal policy incentives.

**Manpower Planning and Utilization:**

Last, but not the least, aspect of an efficient plan of action is the inclusion of a comprehensive manpower development and utilization strategy. Pakistan faces a grave crisis of demand and supply that results not only in an increased rate of unemployment among the science and technology graduates but also in a massive brain drain through the hands of people leaving the country in search for better career prospects. To top it all, we also have a chronic problem of under-utilization in the science and technology sector. The size of our S&T workforce engaged in R&D activities is sub-critical by all international standards. We need massive investments in our education system to bring ourselves at par (in terms of quantity as well as quality) with other newly industrializing countries. However, the very first and logical step in this regard is to develop strategies to optimize the use of existing manpower capabilities instead of going for an out-right expansion in the educational infrastructure. This calls for better a recognition to the men of science and technology, greater career opportunities and professional challenges. The manpower situation is very closely linked with the degree of importance given to the scientific sector as a whole and is expected to improve with that.

**THE CRUX OF THE SELF-RELIANCE MOVEMENT**

The above discussion regarding the most *Appropriate Strategy* for the development of Scientific and Technological Capability aimed at achieving Self-Reliance (Import-Substitution) & International Competitiveness (Export-Base Expansion & Diversification) and an efficient *Action Plan* provides us with a broad picture of what lies ahead of us in term of the challenges, opportunities and threats. The *Comprehensive Planning* carried out during the *Strategy Phase* and the *Implementation Mechanism* chalked out during in the *Action Plan* must now be integrated into an efficient system that works towards the achievement of the goals envisioned. Together they would have a re-enforcing influence on each other which is of great importance in the success of the movement. Six separate Policy Packages have been discussed that would further strengthen the movement in their particular areas by facilitating the achievement of the goals outlined in the Action Plan.



**PAKISTAN IN THE “NEW MILLENNIUM AND BEYOND”**

As time marches on, with Science and Science-based technology creating an ever-widening gap between the haves and the havenots, it is imperative that our people; scientists and technologists, industrialists, government officials, bureaucrats and policy planners show the foresight necessary in enabling this nation of a hundred and thirty million people to claim its share in tomorrow’s riches. This would require radical transformation not mere incremental change in the existing state of affairs. Science and its accompanying technology must assume the role of a “motor of economic growth”. The *1991 World Development Report* puts this phenomenon in the following words :

*“Technological Progress, more than any other single factor, has fueled the economic advance. Innovation has produced great strides in Agriculture, Industry and Services.”*

The twenty-first century approaches us with great celerity, and we the people of this nation have been caught unawares. As we glance at our state of affairs, we find ourselves in a complete mess of things brought upon us by our own negligence, our own criminal misdeeds and procrastination. The reality that Science and Technology has now become a must for our economic and political survival comes as a surprise to most of us. “The Neglected Child” has played havoc with our aims and ambitions to join the community of developed and economically self-reliant nations. We, instead, find ourselves totally dependent on the whims and fancies of our lords sitting across the border. We are no more the captains of our own destinies.

Suddenly, the gravity of the crisis shakes us to our bones. We tend to question ourselves and those around us. Is there a possibility of a reversal? Can we, the nation of a hundred and thirty million gifted individuals do it? We feel a strong urge within us to break through the shackles of economic dependence and register ourselves as a Self-Reliant and technologically advanced nation. Our goals are possible, by all definitions of the word. But, in order to make them a reality, we must learn to live beyond our day-tight compartments, give things their due importance, and create a nation-wide movement for

change. Prof. Dr. Atta-ur-Rehman, in one of his papers, provides an apt ending for this debate. He says :

*“So hearken, for the time is cruel and it does not come back again to give you a second chance. The exciting, pulsating world of science can be ours, and we too can change the face of this nation, but to do so our leaders must realize the critical role of science in the world today, so that they can give science and technology the very highest priority in the national development programs”*

The next century can be ours provided we make an all out effort to develop scientific and technological capability. *May God Help Us.*

**The Achievement of Self-Reliance Through Science and Technology**  
**The SWOT-MATRIX Analysis**

<b><i>STRENGTH</i></b>	<b><i>WEAKNESSES</i></b>
<ul style="list-style-type: none"> <li>. Existence of an upgradable institutional setup</li> <li>. A huge base of Experts in terms of Professionals both at home and abroad.</li> <li>. A large Agricultural Resource Base.</li> <li>. Internationally Competitive Textile/ Cotton Industry.</li> <li>. An Emerging National Consensus to develop the Science and Technology Sector.</li> </ul>	<ul style="list-style-type: none"> <li>. Generally low levels of literacy.</li> <li>. Lack of an R&amp;D Culture and Mechanism.</li> <li>. Sub-critical size of Institutional Framework and infrastructure.</li> <li>. Low rate of Saving and lack of Capital Investments.</li> <li>. Political instability and lack of a Concrete Effort.</li> <li>. Difficulties in the Vertical Transfer of Technology.</li> <li>. Absence of a work-culture and weakness in the implementation of policies.</li> </ul>
<b><i>OPPORTUNITIES</i></b>	<b><i>THREATS</i></b>
<ul style="list-style-type: none"> <li>. Development of a Competitive Advantage in Textiles/Garments Sector.</li> <li>. Indigenization of Technology in Critical Areas.</li> <li>. Achievement of Self-Reliance.</li> <li>. Expansion of Export-base to include Engineering goods, IT, &amp; high value added.</li> <li>. Move from low price/quality markets in Asia, Africa &amp; ME to NICs, US and EU.</li> <li>. Increased foreign investment and joint ventures with MNCs</li> </ul>	<ul style="list-style-type: none"> <li>. New International Economic Order i.e. emergence of Trade Groups and GATT.</li> <li>. Globalization of International Trade.</li> <li>. The International Quality Movement.</li> <li>. The Simultaneous appearance of East Europe, PRC and Central Asia as potential competitors on the world economic scene.</li> <li>. Ever-widening Technology gap between North and South.</li> <li>. Inadequate macro management and bureaucratic hurdles in implementation.</li> </ul>

