Technology Foresight for Industry Sector: A Strategy for Sustainable Development

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Abstract

Purpose

"To develop a strategic and coherent view of the challenges, threats and opportunities associated with the Industry sector in Pakistan's economy" and 2. "To provide a nation-wide demonstration of the application and value of technology foresight techniques in addressing an issue of great and long-term significance.

Research Design

*STEEPV which is an acronym for **(Social, Technological, Environmental, Economic, Political and Values)** is an internationally recognized tool for brainstorming used in conducting Technology Foresight worldwide. This tool was used in the Technology Foresight for Industrial sector of Pakistan. Through this tool the Expert panel members identified various issues and drivers falling under the above mentioned 6 categories. Furthermore, scenarios were built on the basis of most important and uncertain drivers. A list of actions, policies, future viable projects and roadmap was devised by the panel members. There were about 25 experts who participated in the panel meetings, while suggestions of few experts were taken through e-mails. The experts were from diverse backgrounds, including **public sector, private sector, chamber of commerce & industries, Academia, and entrepreneurs.***

Findings

Most of the experts focused on promotion of entrepreneurship at national level and consistency of national industrial friendly policy for sustainable development of industrial sector. Apart from this a need for market based research and use of technology transfer to industry for the commercialization purpose was highlighted. Another point of emphasis was focus on the high value export sectors and find ways to reduce imports and increase exports.

Keywords: Future, Industry Projects, Policies, STEEP-V, Entrepreneurship, Commercialization.

Abbreviations: Technology Foresight (TF), Pakistan Technology Board (PTB), United Nations Industrial Development Organization (UNIDO).

Introduction

PTB is an organization working under the Ministry of Science & Technology and it is mandated to prioritize the research areas and identify the emerging technologies so as to align it with challenges of the 21st century. It is also mandated to assist upper echelons of Ministry of Science & Technology in terms of technology areas relevant to socio-economic development initiatives in the country.

Pakistan Technology Board is expected to forecast world markets and technologies of strategic importance essential for industrial growth and achieving a competitive advantage in the global markets. Setting-up of joint ventures with Multinationals for manufacturing and overseas marketing is another mandate of PTB. Based on a study by Minhas (2009), Industry was highlighted as one of the most priority area by all the experts requested to participate in Delphi for prioritizing the area/sector that can play pivotal role in socio-economic development of society. The expert panel was formed in industry sector and the members through various deliberation and brainstorming sessions looked at three different time periods of planning, which are long range policy planning, medium term policy planning and short term policy planning.

Literature Review

Pakistan and South-East Asian economies shared a very similar per capita income during the 1960's. In fact, Pakistan was leading the South-East Asian countries both in the industrialization process and exports of manufactured goods. The way South-East Asian countries managed the transition from developing economy to industrialized economy can be a guide line for the Pakistan's industrial sector. Pakistan's industrial policy mainly has its focus on an import-substitution strategy. Similarly, all types of restrictions on exports have also been removed. Pakistan has adopted a market-based exchange rate system which reduces the anti export bias. A more liberal world trading system would dictate changes in the industrial sector priorities for which a clear long-run vision is needed. **[Kemal, 2002]** It is important that we encourage investment in the industries capable of exploiting dynamic comparative advantage so as to broaden our industrial base. Experience of Asian economies including Japan, Korea, and Singapore, show that targeted intervention by the government along with sound public-private partnership are instrumental in fostering a wide range of new industries that can compete effectively in the global marketplace. Accordingly, industrial diversification policies may be designed in close consultation with the private sector.

Pakistan's major industry is Textile industry. About 80% of the textile production is export oriented. However, a number of imported raw material is being used in our textile industry. The need is to ensure imported raw material to all segments of textile industry at a competitive price**. [Musleh ud din, 1999].** The need is also to strengthen the human resource skills. It is important to develop appropriate steps to encourage innovation and entrepreneurship in our industrial sector. This would involve a close cooperation between government departments, universities, Ministry of Science & Technology, Higher Education Commission and the private sector**.** Technological up gradation needs to be considered for the industrial sector of Pakistan. Technology transfer and Technology diffusion play an important role improving technological capability. **[Technology based Industrial vision and strategy for Pakistan's Socio-Economic Development, 2003]**

The Domestic Resource Cost estimates for manufacturing sector for 1990-91 reveal that efficiency levels varied rather sharply across different manufacturing industries **[Kemal *et. al*. (1994)].** There are certain industries which have been so efficient that domestic resources are only a fraction of their value added while, on the other, some have proved to be so inefficient that they not only wasted labor, capital and non-traded inputs, but their material costs also exceed the value of output.

Methodology

Brainstorming (STEEPV)

Standard method of STEEP-V **(Unido Manual, 2006)** was used by TF project team for the brainstorming sessions in which experts from public sector, academia, industry/private sector and civil organizations representatives participated (UNIDO Manual, 2006). The number of experts participating in all the 5 meetings were about 25, with few others being involved through e-mails. The minutes of meetings were communicated to all members through online groups. The focus was kept on the fact that all stakeholders are represented in the panel meetings so as to develop an action plan which is owned by all the relevant segments of society.

STEEPV: Brain Storming for Identifying Issues and Drivers

Social	Technology	Environmental	Economical	Political	Values
1. Lack of entrepreneurship. 2. Lack of awareness of Technology. 3. Urbanization. 4. Lack of collaboration between Industry/ Academia 5. Women empowerment 6. Brain Drain 7. Poor management	1. Nano-technology. 2. MEMS 3. Shorter life-span of Technology. 4. Lack of pilot plant facilities 5. Global R & D Database. 6. Indigenous Technology encouragement. 7. Solar Technology Promotion. 8. Automation by digital houses. 9. Data Mining 10. Energy efficient Products. 11. Star Rating. 12. Lack of Applied Research	1. HRD 2. Skill/ Technical oriented basic education system. 3. Lack of local standards/ certifications. 4. Trend awareness 5. Brand loyalty 6. Environment Quality Standards. 7. Public awareness through Seminars. 8. Public-private partnerships 9. Unfavorable circumstances in Pakistan.	1. Banking (Interest rate issues) 2. Competition lacking. 3. Lack of appropriate funding. 4. Registration of innovation (D.B.) 5. Indigenization of international standards. 6. Public demand 7. OEM 8. Inflation 9. R & D incentives from C.C.I. 10. PPF 11. Taxation incentives in PPF	1. Consistency of policy. 2. Publicity & Ownership of Pakistan Products. 3. Lack of leadership 4. Enforcement of international standards 5. Promotion of quality products. 6. Rejuvenate TEVTA 7. Industry needs analysis w. r. t Ph.D funding. 8. Same rules for all 9. Lack of ideology 10. Portray success & hope. 11. Local industry friendly policy.	1. Lack of commercialization 2. Media role in S & T 3. Transparency 4. Bureaucracy 5. IPR 6. National pride 7. Multidimensional quality assurance 8. Lack of professional ethics 9. Made in Pakistan slogan 10. Reliability 11. Corporate Social Responsibility

Outputs of STEEPV Brainstorming (Most Important Drivers/Issues)

1. Lack of entrepreneurship. 2. Brain Drain 3. Poor management Industry/ Academy linkages.	1. Focus on Emerging technologies 2. Lack of appropriate research. 3. Pilot plant facility to R & D. Access to global R & D database.	1. Skill/ Technical oriented basic education system. 2. Environment quality standards. 3. HRD Public awareness	1. Easy access to capital • Govt. funding • Capital issues • Banking 2. PPF Taxation incentives	1. Consistency of policy. 2. Leadership 3. Ownership 4. Transparency Local industry friendly policy	1. Ethics 2. Commercialization IPR

STEEPV Voting – Importance

The members after having a very productive brainstorming session were asked to achieve a consensus on the identification of the top 7 drivers based on their importance for the industrial sector development of Pakistan. Various suggestions were recorded and very positive comments were observed during this session.

Identification of top 7 drivers based on Importance

1. Need based technical education
2. Promotion of entrepreneurship at national level
3. Market based research & development for commercialization
4. Consistency of national industrial friendly policy
5. Professional ethics
6. Business growth friendly financing system
7. Awareness and application of quality systems and standards

Result of Voting for the identification of top two important and uncertain issues/drivers

After a very healthy brainstorming session, the members voted to identify 2 most important and uncertain drivers for the development of scenarios using the 2*2 matrix.

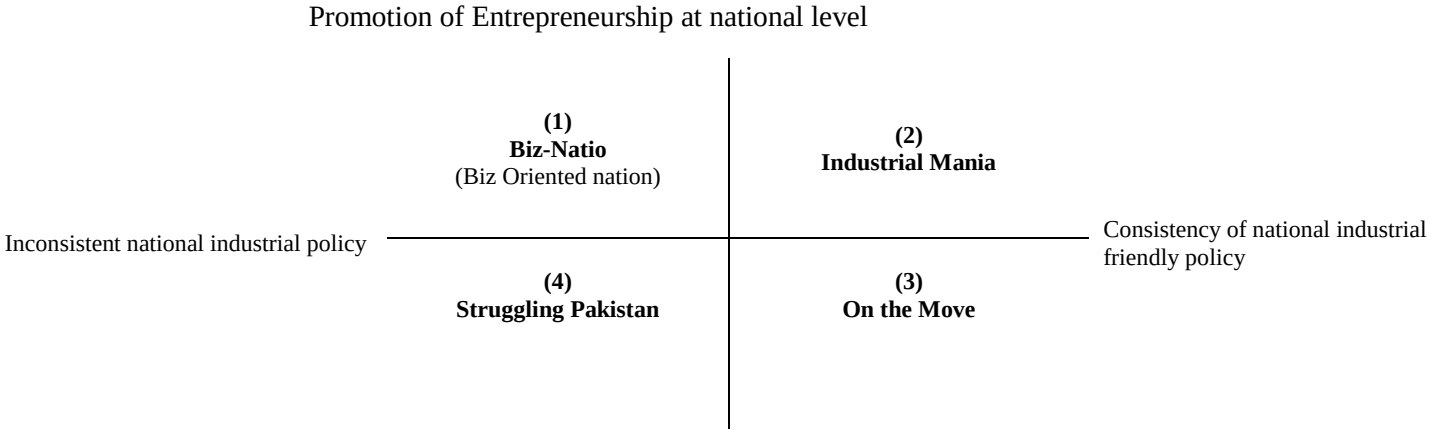
	List of Issues and Drivers	No. of Votes
a)	Need based technical education	-
b)	Promotion of entrepreneurship at national level	5
c)	Market based research & development for commercialization	-
d)	Consistency of national industrial friendly policy	5
e)	Professional ethics	4
f)	Business growth friendly financing system	1
g)	Awareness and application of quality systems and standards	2

The results of voting suggest that the drivers which are thought to be most important and uncertain for the industrial sector development by the year 2020-2025 are;

a) Promotion of entrepreneurship at national level
b) Consistency of national industrial friendly policy

SCENARIOS

Development of 2*2 Matrix Scenario



Description of scenarios

Through following a STEEPV process, four alternative scenarios were developed on our industrial sector development over the time horizon of next 10-15 years. These scenarios give an insight to four various possibilities that can occur by 2020-2025 based on the findings of expert panel members of industry sector. The members were asked to explore each of the four possible scenarios. Following a common practice in these exercises, participants were invited to imagine and think how each scenario would be at the horizon year, 2020-2025.

Scenario 1

While fleshing out the scenario 1, which points towards the future where we will be able to succeed in the promotion of entrepreneurship at national level, but on the other hand it will not be backed up by a consistent industrial friendly policy. It is vital that we develop appropriate steps to encourage innovation and entrepreneurship at national level. This would involve a close cooperation between government departments, universities, Ministry of Science & Technology, Higher Education Commission and the private sector.It is a fact that the current situation demands from us that we should impart such skills in our youth so that they have the ability to think critically, innovate, communicate effectively, work effectively in teams, develop entrepreneurship and risk-taking skills, and the ability to face and manage changes in a flexible manner.

Similarly, the government needs to ensure that the entrepreneurs of Pakistan are fully supported through a consistent industrial friendly policy, whereby the young entrepreneurs are motivated to set up their own businesses and a culture of entrepreneurship in Pakistan is promoted.

The lack of incentives from the government are one of the reasons alongside the huge initial cost associated with setting up an initial business in Pakistan. In USA more than 85% of the jobs are created by small and medium entrepreneurs which goes on to show its importance in the national economy of any country. On the contrary Soviet Union had superior technologies and well developed knowledge base but lacked favorable policies to promote entrepreneurship, thus resulted in the economic collapse of Soviet Union. We as a nation must make a serious effort at all levels to transform our civil service society into entrepreneurial society. **Our education system and government policies should promote job creators rather than job seekers.** Knowledge economy needs an eco system that may include;

- An educational system and environment that promotes innovation and entrepreneurship
- Favorable government policies that encourage entrepreneurs
- A paradigm shift at national research laboratories and Research centers to pursue 'Market Need Based Research'
- Intellectual Property rights protection culture
- A system to transfer technology to industry for commercialization.
- Technology Incubation and business incubation centers at universities to help young entrepreneurs with low cost space and services during the business initiation phase
- A funding mechanisms and funding instruments for entrepreneurship during business start up, business development and business growth phases
- A manufacturing Resource center to assist entrepreneurs with prototype production through commercial product production as well production trial runs.
- A technology Park at the universities for bringing together academic, business and relevant organizations into one physical location and supporting inter-relationships between these groups through incentives established by governmental policies.

Scenario 2

While fleshing out the scenario 2, the experts pointed out towards an ideal situation for the Pakistan's industrial sector, whereby we will be able to achieve promotion of entrepreneurship at national level and also a full support from the government through a consistent industrial friendly policy. There are a number of factors that have affected the performance of the industrial sector in Pakistan, mainly industrial and trade policy distortions, narrow industrial base, lack of promotion of entrepreneurship, inadequate infrastructure and frequent changes in industrial and economic policies. Our industrial and trade policies must be formulated in a way that they encourage local technology firms and enterprises, through continuous upgrading of technology and skills and access to markets small industry must be encouraged to convert into medium sized ones and medium sized industry into large ones. This will certainly be a key step towards leading to a raise in GDP per capita, employment generation and poverty alleviation.

Scenario 3

The third scenario depicts a future of Pakistan's industrial sector in the horizon of 2020-2025, where the government will persist with a consistent national industrial policy but on the other hand the target of promotion of entrepreneurship at the national level will not be achieved. There the **need is to focus on Entrepreneurship at national level and while focusing we need to work on clusters and networks based methodology of intervention.** It would give us comprehensive approach to understand and intervene in the specific industrial clusters/sectors. The methodology can be used not only for technology intervention but also for relevant policy alignment with the requirement of the industry/sectors in Pakistan. **Financing and the conducive policy are the other two areas which can be directly linked with the technology intervention and entrepreneurship in Pakistan.**

Scenario 4

The fourth scenario depicts an ugly picture of Pakistan's industrial sector where we would be lacking both the promotion of entrepreneurship at national level as well as a consistent industrial friendly policy. The current situation of Pakistan more or less depicts the same story. Although we have promoted entrepreneurship to a certain extent but we need to go a long way forward. To avoid this unwanted scenario we need to take certain steps immediately which include;

Prioritized list of Actions

After a detailed brainstorming session the expert panel reached a consensus on the following actions which are of most priority and must be addressed immediately.

i. Promote entrepreneurship
ii. Establishment of Tech. Incubation Centers & Technology transfer organizations
iii. Ensure funding for entrepreneurs through regulation
iv. Need based research in Universities should be ensured
v. Promotion of Industry friendly regulations
vi. Reverse import trends by improving product quality and productivity
vii. Development of skilled labor should be addressed
viii. Need to promote expo centres for industrial development
ix. Need to address lack of financial planning

Some other recommendations to work on

To consider our major high value export sectors and high value import sectors. **Our major high value export sectors include;**

Textile and made ups	Exports worth US $ 12.5 billion
Leather and Goods	Exports worth US $ 0.8 billion
Rice	Exports worth US $ 1.5 billion
Light Engineering Products	Exports worth US $ 0.4 billion
Software & IT	Exports worth US $ 0.25 billion

Our major high value import sectors include;

Palm oil for Ghee sector	Imports worth US $ 1.5 billion
Crude oil, lubricants, grease tarcol and paints	Imports worth US $ 6.5 billion worth of (crude oil, diesel, petrol)
Cotton Bales	Imports of 1.5 million bales
Vehicles & spares	Imports worth US $ 1.5 billion
Foodstuffs	Imports worth US $ 1.0 billion
Toiletries and make-up	Imports worth US $ 1.0 billion
Chemicals and rubber	Imports worth US $ 1.5 billion

Depending on the availability of blue collar skills, improvement in technology via the method of licensing can only be done in light engineering, leather finishing and textile weaving. Autos, truck trailers, railway wagons, motorcycles and fishing boats could be a part of the rejuvenated industrialization process. But licensing of technology would be a compulsory issue to develop competitiveness in the local market and based on the 80:20 rule, only by dominating the local market can an access capacity be built to export the item by the help of competitively pricing and building an edge over competitors by developing a long time period technological advantage over other exporting nations in a certain sector.

Another recommendation included to study future data for taxes levied, employability, export figures, new investment needed, further investment in technology licensing, spill over smaller employment clusters generated, need for more specific and modernistic training centers required etc. will become a familiar routine, generating role model work to be applied to other areas of the Pakistani economy. This data can then be benchmarked for comparison with other growing economies. Another recommendation from the panel was to develop proposals for the pilot projects. These proposals should be suggested by panel members as concept papers and should be presented in Departmental Development Working Party (DDWP meeting).

Conclusion

While considering all three time frames of development, i.e. short, medium and long term development the expert panel committee members through a number of deliberation and brainstorming sessions came up with a number of issues and drivers, list of actions, policies and projects which should be initiated for the sustainable development of the sector. The major emphasis was on promoting entrepreneurship (clusters and networks based methodology of intervention) and promoting industry friendly policies and encouraging private sector lead indigenous industrialization. Experts believed that Financing and the conducive policy are the other two areas which can be directly linked with the technology intervention and entrepreneurship. The panel agreed to focus on reducing the imports and maximizing the exports as this will have a positive impact on the social well being of the country.

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