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ACCELERATED, INNOVATIVE AND PARTICIPATORY MECHANISM FOR COMBATING NATION'S CRISES

DR. ENGR. JAVED YUNAS UPPAL

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By:

Dr. Engr. Javed Yunas Uppal

BSc Engg Hons, PhD London, CEng, MICE London, MASCE USA

Chairman, Institution of Engineers Pakistan, Lahore

ABSTRACT

Pakistan is facing a number of crises today. Most urgent and pressing of them are power, water and employability. Without the effective participation of engineering and technology, and introduction of accelerated, innovative, and modern mechanisms, addressing of these pressing issues is difficult. There are a number of research and academic institutions present in the country where most highly qualified researchers are available; the laboratories are furnished with abundant equipment; and the youth is being trained in numbers. There are a number of professional bodies, who are actively disbursing the knowhow and are providing platform for commonalities. The linkages with the most advanced technology providers on the global levels are developing. The government is keen to resolve the issues and has funds allocated for this purpose. Yet, the efforts are fragmented. They reach nowhere. Element of participative mechanism; a mechanism of working together and collaboration is not there. Element of innovation and allowance for experimentation is not there. Technology is there, but it does not flow down to the bottom lines where young pass outs are struggling for livelihood. What is required is an accelerated, innovative and participative mechanism. There are examples in other countries of the world such as Spain, Korea and Eritrea, where innovative and participative development models have been evolved and have produced successful results. In this Paper, the author has presented a participative mechanism connecting stakeholders; the academicia, the professional bodies, the governments, the international technology providers, the industry and the youth, geared towards action oriented innovations arriving at appropriate technical solutions and their assimilations in the market. The model is derived from the author's recent involvement with a USAID project on the creation of world accreditated centres of excellence at various universities of Pakistan, in which surveys and studies were conducted over a number of universities, professional bodies, industry, government, international technology providers and youth pass-outs, and their strengths, weaknesses, opportunities and gaps were examined.

INTRODUCTION

Much of the urban and rural infrastructural development in the sectors of agriculture, energy and water that was carried out in the United States was initiated by groups of private individuals who were university graduates and who had the support of research and innovation.

China addressed its national problems in a rather harsh and abrupt way, closing down universities and schools for many years and sending the youth to communes to impart upon them job training related to how to develop its agriculture, energy and water resources. Furthermore, central control was kept within the government sector.

Pakistan is more suited traditionally and culturally to follow the Western model. However, reaching right down to the bottom line of the imminent problems at the national level with respect to agriculture, energy and water is what is required. This can be done by producing teams of university graduates who are specifically trained in "how to do it." These graduates will

be enabled and provided a platform by the private sector, which is already aware of the huge investment potential of business in agriculture, energy and water sectors. However, the private sector currently lacks suitable human resources and research and development which can be provided by universities.

A number of universities and professional development institutions are already providing linkages with the private sector and are going ahead with internship programs, continued professional programs, and executive development programs. Such universities and institutions are also contracting assignments of research and development from the private sector. These efforts need to be studied, and the problems and opportunities faced by these efforts will provide a good guideline.

The United States of America is a huge reservoir of the latest technology and know-how, and America's universities are great contributors to such technology and know-how. Using the linkages with certain American universities, will be a great source for the flow of education, research, know-how and contracted activities.

The proposed participative mechanism will be vibrant, activated and fully operative in meeting the challenges of agriculture, energy and water faced by the country.

INTRODUCTION

With the above objectives in mind, a related literature has been reviewed here below. In addition, two sets of interviews have been held with structured questionnaires the results of the same have been described below. These exercises have been used to capture the findings about the view points of various stakeholders and their preparedness to act as effective contributors.

The specific potential participant research institutes, user associations, business companies, employers, professional groups, technical specialists, alumni and employment agencies have also been identified. Using the above data collection instruments, the necessary information for the gap assessment has been collected, and the data has been analysed.

In addition, knowledge and experiences derived from the involvement in following activities have been included:

- A number of activities and projects undertaken at the Institution of Engineers Pakistan, to bridge the gap between private industry and government[5],[6],[7],[8].
- Experience working with universities and industry at the Pakistan Foundation for the Advancement of Engineering and Technology[2],[3],[4].
- Advisories provided as an active Member of various Committees for Development of National Codes at the Pakistan Engineering Council,[1].

LITERATURE REVIEW

Pakistan Engineering Council [1} as a Government regulatory body, regulates the quality of engineering universities and has recently set up regulatory guidelines for continued education programs to be run by certain separately registered 'professional engineering bodies' so that the engineering graduates and mid career professionals are geared more towards the needs of the industry. The document can be a guideline for developing universities and industries interactional relationship.

Uppal J. Y [2] has suggested self generation as a way to reverse the prevalent power crisis. This is the direction in which government effort and the foreign assistance programs should

concentrate. For building systems up for self generation, what is needed is disbursement of technology and development of entrepreneurship. This is where the role of the universities comes in. Participative mechanisms need to be formed in which an integral effort is done at the house holds, small communities, and industries while, need analyses, design development, development of tools and plant, management, micro-credits, and marketing functions are performed by professional bodies and volunteers in the respective fields after receiving suitable training.

Uppal J. Y. [3} has portrayed the practices of water use in Pakistan are far less than what is required for an efficient system of water conservation and water quality. In Pakistan, water is drying up. What little remains is heavily polluted. A paradigm shift is needed in the attitudes, in the policies and in the practices, which includes institutional strengthening, participative mechanisms among all stakeholders and capacity building.

Uppal J. Y. [4] has studied the problems of floods of Aug 2010 in the river plains of Indus that played havoc and chances of reoccurrence cannot be ruled out. Therefore measures of minimising future damage need be taken. Technologies, components and materials are there for fairly flood proof sustainable housing. A system of insemination of the so developed knowledge into the populations is proposed with the help of publications, guidelines, training programs and construction of prototypes. Technology insertion participatory mechanisms are proposed to help individuals reduce flood damage to their houses and their property.

The Institution of Engineers Pakistan [5] has narrated their experiences as to how university students are inducted into industry for internship. They are given introductory lectures understanding of the professional practices there. Sites are allocated to them where they visit. They prepare reports of their own observations on planning, design and execution of works. They make a brief on the benefits that the public will accrue from the project, a report on the contractor's organization, as to how the project is being handled by the Contractor, what are the issues involved, and how can he improve, and technology gaps between theory and practice and how to reduce them.

The Institution of Engineers Pakistan [6] has described various continued professional development courses which are offered in different subjects by qualified resource persons mixed from universities and industry to midcareer and fresh entrant professionals from various departments, private organizations, consultants, contractors and manufacturers. Further studies, research and development projects emerge as a result of this interaction.

Iqbal S. et al [7] have described a proposal that has been prepared by a group of university students in response to the call for proposals from the Punjab Government Water and Power Development Board. The platform has been provided by the Institution of Engineers Pakistan and know how has been obtained from low head turbine manufacturers in the USA. The proposal is on an actual site identified by the Department and the effort includes survey, planning, design, cost estimates and feasibility. The report illustrates how a university industry interaction can lead to projects.

Punjab Government Water and Power Development Board [8] have listed a call for proposals for low head hydro electric power generation plants. There are about 90 sites. The technology is new to Pakistan. International commercial companies are asking for colossal amounts. The cost will be fractionally less, if it can be locally evolved through university industry interaction, and still mutually benefitting to parties, to an extent that such money is hardly available to research and academic world.

Agricultural research and development in Pakistan [9] is dominated by the public sector; private-sector agencies account for just 6 percent. Foreign donors have a substantial part in financing

agricultural R&D; USAID, USDA and the World Bank. The number of scientists in agriculture, institutes and equipment are by no means adequate to meet the needs of the country. Private sector neither has confidence nor means to avail even those limited resources. A bridge between the academicia and the end user is needed to be established so that the degree-level training and researches can be effectively utilised.

Iqbal, M. et al [10] have described Pakistan's low yield compared to many other countries can only be improved be providing adequate funding for the R&D efforts to make new discoveries, human resource development/capacity building, creating working environment and incorporating new scientific discoveries in agricultural research, e.g. agricultural biotechnology and up-gradation of land resources. Small number of Ph D scientists who are unevenly distributed have to be brought online with the agricultural producers. They need lab equipment and library facilities and better service structure and incentives. The private agriculture sector has so far not benefited from the full potential of modern technology. A combined research effort at public and private levels is required. The number of researchers and financial resources need to be increased in order that they can reach commercial productive scale.

Jane Walker, et al [11] have described that the private sector participation in environmental services of water and wastewater is low. To increase the participation, the methods suggested are: provide a clear and secure regulatory framework and enabling environment for the private sector to operate efficiently and profitably; define outputs from private sector service which are equitable and measurable; and develop a reliable revenue base to cover the private sector's need to meet its cash flow obligations for debt service, capital replacement, operation, maintenance, and repair; and structuring and phasing of privatization arrangements need carefully developed in order to optimize competition, accountability, and transparency.

Asian Development Bank [12] has reported the ingredients of the on-going ADB-assisted Private Participation in Infrastructure Program which is continued. Following proposals are related to our focus: establishing appropriate PPP structures and policies and regulatory frameworks; developing innovative financial tools for infrastructure project finance; developing climate risk mitigating products especially for crop insurance and catastrophe insurance; developing a carbon trading regime; enhancing support for investments in clean / renewable power projects to attract investors; supporting the agricultural development of medium-sized agricultural commodity procuring, sourcing and forwarding agencies that can supply premium products to high end markets; and investment in the private sector in biotechnology and hybrid seed production, corporate farming, integrated food handling and distributions systems incorporating standardized, containerized cold chain fresh food handling systems and modern grain storage systems along with strengthening of agricultural commodity markets.

Haider, S. H. [13] has reported a questionnaire based survey. The findings suggest that it is important to facilitate the school-to-work transition for young people in Faisalabad. Important policy areas are economic strategies that create sufficient labour demand, as well as policies that improve chances of young people in labour markets. Education and skills are an important policy area, and there is a need for more research in possible mismatches between the supply and demand for skills.

Silas Reed [14] has described career prospects in renewable source of energy and are of the opinion that these are not of the type of other traditional or alternative jobs. Universities have started programs focused on renewable energy. This is an indication of the coming new energy age. It, however, requires a dedicated team of workers to make it a reality. For engineers seeking career prospects in a renewable source of energy, a bachelor's degree in an engineering specialty is required. A graduate degree is required for some basic research positions. An engineer has to keep continuously educating him with the current and fast

changing technology.The job prospects are excellent during the next 10 years mostly due to replacement needs on account of retirement

Xiaohui Hou [15] has studied the challenges of youth employment in Pakistan. Long-term investment in human capital through formal and informal education and strategically strengthening the links between education and the market would greatly benefit youth in a long run. One striking feature in Pakistan employment market is that unemployment rate is much higher for better-educated youth, and the initial earnings of better educated youth are not much different from those of less-educated youth. Thus, youth-specific interventions should be implemented to generate more job opportunities for better-educated youth, to smooth the transition from school to work, and to help youth realize their investment in education.

Ahmad, S. [16] has given a historical perspective of the role provided by US organizations in promoting active and result oriented research in Pakistan. It has been observed that involvement of universities can contribute more than consulting firms in producing effective results. This way, significant number of manpower is developed in the country using locally recruited agricultural engineers for working with US University Professors in conducting research and diagnostic studies. In the process of attaching Pakistani engineers with the American professors resulted in practical on-job training while doing the actual field work, data analysis and reporting.

Kopsas, S. [17] has described global employment trends. According to him, recession has hit employment in many countries, however since end of 2009 some early positive signs are seen. At the global level, employment in agriculture has been on a steady downward trend, while employment in services has steadily risen. Employment in industry is now on a moderate increase. It is observed that Pakistan is lagging behind India. Severe floods have directly affected 4.7 million workers, yet the economy grew by 4.8 per cent. Developing economies, such as Pakistan, have typically benefited from a faster rebound in growth, underpinned by comparatively greater fiscal space and macroeconomic influences, there is a sound basis for a reorientation of growth toward domestic consumption. At the same time, major shifts in sources of global growth may lead to unforeseen instabilities, and countries must recognize that domestic policies can have major effects abroad. Strengthening mechanisms and international cooperation is essential to ensuring a sustainable and balanced growth.

Khan, I. et al [18] have given a historical record which shows that Pak-US partnership in the field of agriculture education, research and extension has been very productive. This partnership needs to be strengthened by launching similar programs regarding advanced training such as space and IT technologies for uplift of the agriculture sector and rural development. Joint degree programs between US and Pakistani Universities may also be launched to strengthen the indigenous research and outreach programs.

Wheeler, J. [19] has argued that Pakistan has shown quite a remarkable success in meeting the challenges it faced in the sector of agriculture in the last 60 years. This is in terms of seed development, and water management, salinity and reclamation. The key to address labour inefficiencies was the development of tools and machinery. Soil nutrition problem was tackled by production of fertilisers. The problems now that are lurking are those that are related to global warming.

Odell, M. Jr. [20] has asserted that the lesson that can be learnt from the USAID-funded program for development of higher education with respect to university partnership is that, the universities partnering across the cultural and social boundaries need to pay due regard to the differences and be frank in discussions with constructive feedback so that successful results are ensured. Along the way, it is necessary to maintain rolling on course-correcting mechanisms.

There are challenges but, these can be overcome, by development of long term relationships—relationships that are founded on friendship, trust, and mutual respect. A collaborative problem solving mechanism is to be developed and practised sharing experiences openly.

Ali, R., etal [21] have reported a survey that the professors and teachers possessing higher qualifications, longer experience, and job security strongly back up the quality in higher education, than younger teaching staff. The quality of higher education was expressed in terms of infrastructure, standard of teaching faculty, and curriculum of higher level courses. Most private universities have financial gains in mind, than needs and aspirations of individuals and society. Administrators responded more positively, as compared to teachers, regarding the quality than students were more concerned with the financial stress of heavy fees.

COMSAT [22] has described their proposed policies and strategies for successful implementation of employment generating programmes in renewable energies, biotechnology, agriculture, environment and ICTs. Proposals were put forward calling for integration of various technologies, capacity building of R&D institutions, as well as involvement of industry members and policy-makers in order to generate sustainable livelihoods for the masses. Suggestions included the promotion and facilitation of innovative entrepreneurship, interdisciplinary mode of working, revitalized political will, freedom of movement of capital and an enhancement in the intellectual capacities to formulate effective policies.

Adnan, D. [23] has suggested a mechanism for research in higher education sector. Huge amount has been allocated for producing quality research in the public sector universities of Pakistan. The HEC has established a system of calling research proposals so that these can be funded. About 230 research proposals are in the pipelines. An effective mechanism has been developed which is fast and efficient enough in evaluation process of these research proposals.

Qureshi, A. A. has described a technology incubation centre that has been established at the National University of Science and Technology. The Technology Incubation Centre has been established to help potential entrepreneurs such as students, faculty, and general public to incubate their technology based companies. It helps to provide support to colleges, institutes, and centers for patenting their research and development work. It provides liaison with private and public sector enterprises and funding sources, govt. agencies, industrial associations and chambers to provide facilitation and networking.

Khan, A. A. [24] has shared experiences of providing research backup for enterprise development through an outreach journal. A research journal has been established to address the core issues of providing research back up to the start up business enterprises. Survey has been conducted to establish the needs of the private enterprises for achieving quality. Market orientation and innovation have been shown to be the key elements.

LCCI-UIP [25] is a university industry portal which has been established to bring about national economic and social transformation by establishing the strong interaction between the industry and academia; and improving the quality of research work and resolve the industrial competitiveness issues. To achieve this, the objectives of the University-Industry interaction project have been undertaken that provide a platform to create trust building and partnership among the university and academia to accelerate the innovation, technology up-gradation, and research-based solutions for economic growth. The projects promote the knowledge-based economy through synergy of resources and exploitation of hidden potential.

Federal Govt [26] budgetary allocation is a trend setter for research and development at the educational institutions connected to industries.

Punjab Irrigation and Power Department [27] budgetary provisions has an emphasis on research and development for development of agriculture, water and energy Aized, T. [28]has carried that the academia-industry collaborations, which are common in developed countries but are just beginning in Pakistan, are a win-win prospect for both universities and industries. It can be a substantial source of funding. Specialized skill groups inside universities are needed for this purpose. Student projects should be need based. Industry related short and medium-term courses to attract industrial staff should be conducted. The hurdle in this is that cultures of academia and industry are very different. It usually takes a considerable amount of patience from both sides to persist with the relationship long enough for a workable relationship to form: ironing out intellectual property issues, identifying problems that are both interesting to the academic and relevant to the industrialist, etc.

Aida, L. [30] has spelled out the steps that are to be taken to develop a community-university participatory development program, through which the community requirements are met through researches in universities.

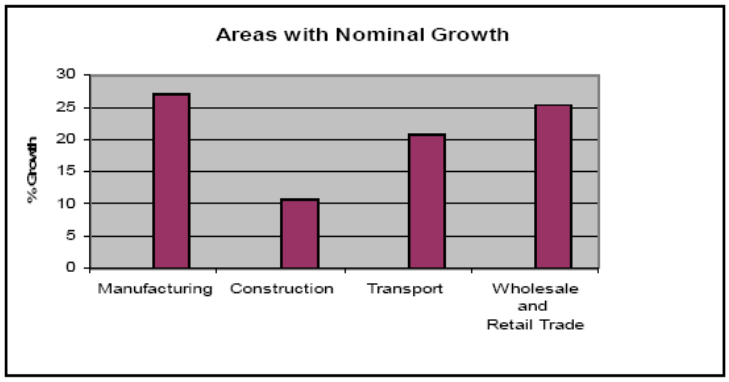
Drugan, J. [31] power point presentation describes the experiences obtained in running a translational program of education and training, and spells out the challenges and difficulties that have been encountered. This program was necessitated because of the rapid changes in the field., thereby the academic curriculum gets outdated every now and then. If taught properly, this can become quite exciting. Teaching the technical translator of the future could really open up New Horizons. The translator becomes proactive rather than reactive.

Lisa M. Jones, L.M. [32] have described the experiences of the National Science Foundation (NSF) USA, sponsored Industry-University Cooperative Research Projects Program (I/UCRPP) and the Industry-University Research Centres Program (I/URCP). A number of centres are run to operate the Programs. The advantages are that the society benefits from university-industry research relationships through innovative products and technologies. Industry-sponsored university research is often developed into practical applications that benefit society. Disadvantages are that university is caught between two of its compelling interests because of its relationship with corporate sponsors. Academic researchers are compelled to approach research without regard for its commercial benefits; to share the results with peers so they can be examined and validated; and to train future researchers for universities and industries. Universities must balance their relationships with industry to reflect traditional academic norms, as well as those of industry.

PRIVATE SECTOR IN PAKISTAN

The private sector in Pakistan is a substantial sector in respect to its contribution to GDP at over 84 percent of total GDP[34]. This figure will rise if the contribution of the informal sector is added. The contribution of private sector in the total gross fixed investment is about 73%. There is an overall increase in private investment in recent years even in infrastructure and social sectors. Total foreign investment has been fluctuating between 5.2 $ billion in 2008, $8.4 billion in 2007 rising from $559 million in 2003.

The primary sub-sectors among the private sector are mining and quarrying, agriculture, textile, food and beverage, automobile, fertilizer, cement, finance, gas, and telecommunication. In addition, there is manufacturing, construction, transport and communication, and wholesale and retail trade, a comparison of growth of which is given in Figure-1. Some of these sub-sectors are almost entirely in private sector, while others have public sector competitors, and still others have international companies to face with. For the purpose of this report, we will focus on those sub-sectors which are related to water, energy and agriculture.



Source: Pakistan Economic Survey 2006-07.

Figure-1: Main Sub-sectors of the Private Sector in terms of Investment

1. Employment in the Private Sector

The size of the labour force is over 55.8 million in as per the statistics of the year 2010. About 43% of this labour is involved in agriculture, 20.3% in industry and the remaining 36.6% in other services. The trend in employment is increasing in the construction sector, and only marginally in the agriculture and manufacturing sectors, while is stagnated or falling in the transport, trade and community and social services sectors, Table-1.

TABLE-1: Percentage Distribution of Employed Persons 10 Years of Age and Over by Major Industry Division and Sex

Major Industry Division	% Distribution of Employed Persons		
	Total	Male	Female
Total	100	78.21	21.79
Agriculture Hunting and Forestry	44.75	28.42	16.33
Fishing	0.21	0.21	
Mining and Quarrying	0.10	0.10	
Manufacturing	13.24	10.84	2.40
Electricity Gas and Water Supply	0.80	0.79	0.01
Construction	6.74	6.68	0.06
Wholesale and Retail Trade	15.16	14.71	0.45
Hotels and Restaurants	1.12	1.10	0.02
Transport Storage and Communication	5.24	5.18	0.06
Financial Intermediation	0.51	0.50	0.01
Real Estate Renting and Business Activities	0.97	0.95	0.02
Public Administration Defence and Compulsory Social Security	2.79	2.70	0.09
Education	3.68	2.42	1.26
Health and Social Work	1.33	0.98	0.35
Other Community and Personal Service Activities	3.28	2.56	0.72
Activities of Private Households as Employers and Undifferentiated Production	0.07	0.05	0.02
Extra Territorial Organizations and Bodies	0.02	0.02	

Source: Federal Bureau of Statistics, Pakistan labour Force Survey 2009-2010, Pakistan, Islamabad, Dec 2010 [36].

The private sector employs 7 million workers in the formal sector, and 18.6 million in the informal sector. In the last five years, an estimated 8.6 million new jobs were created in the private sector. The informal sector is second only to the agriculture sector as the largest generator of jobs in the private sector. The sectoral concentration of informal labor force employment shows the retail and personal service sectors as the leading employers in the informal sector, followed by manufacturing, and community and social services. With increased diversification of the economy to service oriented sectors, most jobs are being created in the telecommunication sector, hospitality industry, IT and banking. At the same time, job generation is on the decline in public sector corporations, nationalized banks, the public education sector, ministries and their related departments.

The vast majority of jobs in the private sector are generated in the small enterprise sector. Table 7 shows that small enterprises, comprising 1-4 people, employ almost 95% of the total labor force. On the other hand, Pakistan has an insignificant ”medium” sector that employs only 5% of the labor force. The proliferation of small businesses that employ the bulk of the labor force in Pakistan and which in most cases do not graduate to the “middle” category indicates lack of economies of scale, difficulties in accessing finance to grow in size and complexity, and insufficient absorption of technology needed to scale up operations and generate greater employment opportunities possible in large sized companies.

2. Agriculture

Agriculture, which is the largest sector of the national economy in terms of its contribution to total employment, is almost wholly in the private sector. Agriculture fuels Pakistan’s export base as it is the main supplier of raw materials for the export oriented industry (mainly textiles) and supports nearly two thirds of merchandise exports. The private sector owns agricultural land and generates primary and value added agricultural output. Public sector involvement in the agriculture sector is mainly concentrated in providing and maintaining irrigation infrastructure and developing waterways for cultivation as well as providing agriculture extension services and supporting agriculture research.

The major issues pertaining to the agriculture sector from a private sector perspective include inefficient agriculture and agriculture markets, distorted agricultural input and output pricing, and a continued inability to price and manage water. A recent IMF paper concluded that in addition to removing market distortions, there is a need for fundamental improvements in the market mechanisms in the agriculture sector, including reduction in government interventions and enforcement of more competitive behaviours.

Comprehensive private sector led agricultural growth requires strengthening the linkage with modern infrastructure, appropriate technology adoption, and the manufacturing base. A review is required of what value addition processes can be adopted to generate a more competitive and efficient agriculture sector[35]. Key value adding areas where the private sector could play a critical role include horticulture and livestock which have the potential to increase agricultural productivity and incomes while also promoting the creation of intermediate and high level agricultural service support systems and agro industrial activity in the SME and large Industrial sectors. With an expanded focus on livestock and horticulture, the private sector could profitably also invest in integrated transportation and delivery systems like standardized, palletized containerized transportation networks for transportation of high value livestock and horticultural produce. An expanded role of the private sector is also possible in food processing and agro-farm machinery industries. Private sector investments could also be considered in private sector

hybrid seed production facilities. Inadequate cold chains are another weak area where the role of the private sector can be encouraged.

3. Energy

The total installed electricity generation capacity in the country is about 19,478 MW, of which 30% is generated by the private sector. After the restructuring of the Water and Power Development Authority (WAPDA), four generation companies (GENCOs) have started functioning as public limited companies.

There are currently 16 Independent Power Producers (IPPs) in the country generating 3943.81MW of electricity, which have been implemented on a build, own and operate ("BOO") basis, under the private power policy announced by the Government in 1994. The Hub Power Project is the largest IPP, with a gross generation capacity of 1292 MW.

3.1 Independent Power Plants: The Government has allowed private sector to generate power with a package of incentives and guaranteed returns on investment. Today, there are 14 independent power producers (IPPs) in Pakistan. Their total installed capacity at 5,859 MW is about 30% of the total installed electricity generation capacity in Pakistan. In addition to the IPPs, one hydel power plant has also been commissioned by the private sector. A Private Power and Infrastructure Board (PPIB) was set up in 1994 to implement the Government's power policy. It has suffered the following drawbacks: absence of international competitive bidding procedures; un-staggered timing of the plants' commissioning; poor planning of the location of the power plants; inappropriate choice of fuel; and guaranteed high power prices to IPPs. The payments to the IPPs subsequently had a large adverse impact on the budget.

A National Electrical Power Regulatory Authority (NEPRA) has been established in 1997 to regulate the power sector and issue licenses, enforce standards, approve investment and power acquisition programs of utility companies and determine tariffs for generation, transmission and distribution of electric power. However, NEPRA's independence has remained undermined due to inadequacies in the NEPRA Act and the lack of rule based regulatory oversight. At the same time, private sector participation has remained limited mainly to power generation whereas the present policy allows private sector participation in distribution as well.

So far, the Karachi Electric Supply Company is the only one that has been privatized and, is, therefore, the only distribution company in the private sector. Attempts to privatize the Faisalabad and Peshawar Electric Supply Companies have so far not been successful due to bottlenecks created by the existing regulatory structures and the economic viability of these companies under the existing tariff regimes. The process of restructuring of distribution companies is underway with the process of rationalization, unbundling and corporatization, which will facilitate the ultimate privatization of these companies.

3.2 Hydro Power Plants

Pakistan water sector strategy has identified potential private sector hydropower projects. These projects have, however, so far not elicited much interest from the private sector because of the absence of an enabling regulatory and legal environment and tariff policy. The NEPRA Act, for example, is not even applicable to the Azad Jammu and Kashmir (AJK) and the Federally Administered Northern Areas (FANA), which are rich in hydel potential and offer the greatest possibilities for private sector involvement in energy sector.

3.3 Alternative Energy Plants

The Alternative Energy Development Board (AEDB) has been established, which has issued letters of interest (LOIs) to eighty two national and international companies for proposals to generate 700 MW of power through wind energy and 9700 MW by other means. However, implementation remains weak and slow[37].

3.4 Gas Fired Power Plants

There is a potential on the development of gas-based thermal projects in the private sector. Investors under the existing policy environment also have to bear cost escalation risks for civil construction in hydel projects. Tariff issues spill over to the wind energy. The exclusive franchise rights to state-owned distribution companies (DISCOs) inhibit private investment in the distribution sub-sector. The current legal constraints also restrict the development of small scale or grid-isolated distribution networks from meeting local distribution needs.

3.5 CNG Gas:

Low price of CNG has triggered conversion of vehicles from petrol to gas. In one year alone there has been a 35 percent increase in the number of vehicles running on CNG. There are many private companies involved in gas exploration and production activities. There are two public sector companies involved in gas exploration: the Oil and Gas Development Company Limited (OGDCL) and the Pakistan Petroleum Limited (PPL). The Government is providing incentives to the private sector for import of liquefied natural gas (LNG). An offshore LNG terminal is being planned at Port Qasim to boost import and availability of LNG.

4. Water

Water supply systems are owned, managed, and operated by public sector agencies and suffer from deteriorating institutional capacities, inadequate operation and maintenance funding, and poor cost recovery. Efficiency could be improved by introducing private operators and measures to provide an adequate revenue stream. The reasons why private sector does not come forward are: difficulties in pricing matching costs over a medium to long term; the high political interference; and limited capacities of local governments to operate public private partnerships. Other impediments are: absence of a legal framework and policy on public private partnership. As a result, no urban water supply and sanitation projects have so far been undertaken with private sector participation.

5. Higher Education and Training:

Pakistan ranks at the low 74th and is generally behind its comparative group on higher education and training, staff training and quality of management schools, and on enrolment for secondary and tertiary education.

5.1 Technological Readiness: Pakistan is ranked at the low 77th position on technological readiness. This is perhaps due to poor performance on the education and human resource development. Similarly, the firm-level technology adoption and technology transfer ranks low too. This is because the focus has been shifted towards the services industry from the manufacturing sector where the gains from technology improvements would have been highest.

5.2 Innovation: Pakistan is placed at a good rank of 60 in the GCI, which is driven by improvements indicators measuring capacity for innovation, University-Industry research collaboration, and company spending on R&D. A larger improvement in Pakistan's rank

on innovation is, however, held back because of lack of availability of scientists and engineers and inadequate intellectual property protection. The country's comparatively high rank on innovation is perhaps due to small data set collection restricted to top 120-125 corporate and multinationals operating in the country. This group could naturally be expected to have attained a higher degree of technological innovation than, for example, firms operating in the small to medium enterprise (SME) sector.

5.3 Improving the Quality of the Workforce: In the development of the private sector, the most crucial task is: developing educated, skilled, and in-demand human resources. The delivery service mechanisms in social sector rank amongst the lowest in the world. Technical education and vocational training systems remain supply driven and are not meeting the market demand. The result is a lack of quality manpower in all sectors that reduces total factor productivity of the economy. Development of human resources though focusing on primary, secondary, tertiary education and health sciences, are starting vocational and technical training systems to better respond to the market demand.

5.4 Private Sector Universities The number of private sector universities have grown from 25 in 2001 to 53 in 2010. The private sector enrolment in higher education institutions has increased from 43,873 in 2001 to 115,369 in 2009, although, the expansion in the institutional capacity of private educational sector may not have guaranteed employability. The private sector universities, need to improve access to education; promote excellence in learning and research; develop faculty; and establish industrial linkages. The focus of autonomous private sector universities has largely been demand-led and quality of research in pure/basic disciplines has been ignored to some extent.

Following steps [38] have been recommended to enhance the efficiency of the private sector universities:

1. Devise a comprehensive standard to ensure the quality.
2. Formulate a systematic consultation mechanism to share comparative advantage in academic and non academic services.
3. Provide autonomy to the "Centres of Excellence of the public universities so that they can increase participation of the private education sector universities.
4. Introduce accountability at the instructional level.
5. Extend scholarship plans to private sector universities.
6. Ease out budget constraints hampering the efficiency of private education institutes.

HIGHER EDUCATION INSTITUTIONS

As for an appropriate operational framework a balanced approach between a top down conformal strategy and a bottom's up industry-university need based strategy is strongly recommended.

While it is very important that the universities use US accreditation requirements with respect to their outreach activities and standards for practices and accountability be developed, this type of a top down approach need best be complemented and appended with the bottom's up need based direct intervention approach which will empower trained task force teams to expediently attend to urgent local needs. These are drawn from questionnaires, and are: Energy: Hydro power generation, alternative energy, self generation, co-generation, transmission and distribution. Water: Resources prospecting, dams and infrastructure building technologies, water

quality and environmental engineering. Agriculture: Yield enhancement, harvesting and post harvesting technologies, supply chain.

To starts with the pressing needs of the country with respect to agriculture, energy and water will be researched and prioritized for each sector.

It will be determined if the present private sector is fully ready and capable to meet these needs. Advocacy campaigns will need be lodged in the private sector to make them ready and capable to receive the planned inputs, in line with the demands of the country's economy. From this effort, we will come to know, what are their human resource requirements of graduate pass out from these universities, what research and technical back up they need from the universities, and what continued professional development and executive development programs they need from these universities so that the Private Sector can become full capable of addressing the needs of the country,[9],[10],[11],[12].

Yet, the urgency of need calls for reaching right down to the roots of the significant problems and develop affordable solutions expediently at the local levels.. This sort of direct intervention approach is seen as a determining driver for the framework for collaborative participation of the university-industry operations. Such an approach carries the potential to rapidly mitigate the ill social affects on people of Pakistan who are increasingly resorting to desperate measures in the face of problems they cannot solve without the engagement of intellectual power and insertion of affordable technology. It is unclear that we can depend on the promises of a slow natural process for urgent developmental needs, [13],[14],[15],[16],[17].

This report advocates the above framework.

Practically this framework requires formation of specific task force teams of university teachers, researcher, graduates, industry representatives who are specifically tasked to address specific problems and train graduates and industry on 'how to do it'. These graduates will be enabled and be provided the platform largely by the private sector. The private sector industry is already aware of the huge investment potential of business in agriculture, energy and water sectors, but they lack suitably qualified graduates with problem solving mind sets and educational training in skills that are really needed. The industry also has a crying need for the highly qualified university researchers to focus on the topics of interest to the industry, and the university curriculums to be more aligned with their needs.

The proposed framework can fill these needs,[18],[19],[20],[21].

A number of universities and professional development institutions are already forging linkages with the private sector industry and are going ahead with internship programs, continued professional training programs, executive development programs and universities are contracting assignments for research and development from the private sector,[22],[23],[24],[25],[26],[30].

These efforts need to be studied, and the problems and opportunities faced by them will provide a good insights to develop the Centers of Excellence. The COE can then introduce standards and measures to ensure that such university-industry partnerships are effective, sustainable and accountable. A share from the development budgets and investment programs can be obtained,[27],[28],[29].

The United States of America is a huge reservoir of latest affordable technology and know- how, and its universities are at fore fronts of research and standards of education. The Centers of Excellence if accredited by the American universities will be a great linkage of to and fro flow of education, research, know-how and contracted activities with the American institutions,[31],[32].

FINDINGS

The participative mechanism developed under the above approach, as such, will be vibrant, actively engaged in solving practical problems and cost effective in meeting the pressing challenges of the agriculture, energy and water faced by the country. In order to achieve these targets, following gaps can be identified, and recommendations can be made:

1. The mechanism needs to align itself with a technology provider American counterpart. The movement then forms a collaborative mechanism with industry. Together, they need to focus on providing goods and services that directly address the issues of energy, water and agriculture. Graduate curricula, research projects, internships and continued professional development programs are needed accordingly.
2. Proposed activities, programs, research areas, and advanced degrees are:
3. Energy: Hydro electrical power; Alternative energy; Transmission and distribution. Self and co-generation.
4. Water: Water prospecting; Salinity and water logging; Water recycling; Water storage and distribution; Water management.
5. Agriculture: Yield enhancement technologies. Post harvesting technologies, Supply chains.
6. The academic staff is needed to be trained in latest know how on their subjects. They have exchange programs with the industry.
7. Industry needs to divert colossal resources to afford research and training support programs, once they are convinced that these programs will lessen their losses, will enhance competitiveness and will generate income.
8. Effectiveness of the activities needs to be assured by: exact identification of the needs; exact comprehension of the solutions; right technology and competence, right resources.
9. It is needed that the programs hit the right targets; they will bound to bring economic returns.
10. A system of fulfilling the interests and needs of the individuals is needed to be created by self esteem development, career growth paths and incentives. It will be prerequisite for meeting the objectives of the programs.
11. A system for fulfilling the interests and needs of the clients or stakeholders in terms of return to their investments, material gains, and meeting of their objectives will be prerequisite to the success of the programs.
12. Areas leading to transformative growth of economy are: Energy: Self generation of energy; Water: Water management, Agriculture; Post harvesting improvement and supply chain.
13. Stereotyped trainers or trainees will not bring results. They will need to be self actualized and sensitized towards the overall objectives of the program.
14. Such technologically enabled, materially benefitting and self esteemed individuals developed from the framework suggested herein, will have demand in industry and community wherever they go.

15. The majority of the research institutions, employer organizations, and industry, who are once convinced of the benefits offered to them, will be potential clients and stakeholders, as established from the questionnaires.
16. The program will have to be run on social entrepreneur style, focusing on interests of the public at large and running it as a business.
17. University industry collaborations are on the way, at many places. They need to be strengthened.
18. Specific lab equipment, instruments, computer and tools will be needed which in today world are not expensive.
19. Specific demands will need to be worked out.
20. Job placement services and internship services will be required.
21. Outreach community service centers will be needed.
22. Building of the technological capability will be carried out through collaborative arrangements with the designated technology providers.
23. Internet access with portals, classroom based teleconferencing, and classroom and public space computer stations will be required.
24. Cost of upgrading will have to be borne from endowment funds, grants and contracts proceeds.
25. Researches and publications will be the basis of performance assessment of the faculty members.
26. Financial assistance programs will need be developed and generated.
27. U.S. accreditation will be advisable for effective collaborations with the American technology provider universities.
28. Collaborative partnerships with a number of American technology provider universities will be required.
29. Practical outreach activities will take the form of collaborative mechanisms with industry and communities.
30. Framework will rest on collaborative mechanisms, linkages with technology provider universities, competence and motivation of the academic staff and provision of resources.
31. A detailed systemic approach to the overall program will need be developed.
32. In order to assure intended results, specific system inputs and outputs will need be identified and monitored.

DESCRIPTION OF THE RESULTS OF THE QUESTIONNAIRES

1: Type of Organization Represented:

The persons interviewed were a happy mix from the backgrounds of research, teaching and technical training institutes, user associations, business companies, employers both government and private, technical specialists and alumni.

The sectors that the interviewees mainly dealt in were: energy, water and agriculture.

2: Cross match the universities with the sectors:

Following cross matching was indicated by most of the interviewees;

1. University of Agriculture, Faisalabad: Agriculture
2. University of Agriculture Tandojam, Sindh: Agriculture
3. University of Engineering and Technology , Peshawar: Energy
4. National University of Sciences and Technology (NUST), Islamabad: Energy
5. Mehran University of Engineering and Technology, Jamshoro, Sindh: Water
6. University of Peshawar: Water

3: Rating to the universities with respect to the quality:

The interviewees remarked the quality with respect to the universities as below:

a. Quality of Education: Well known.
b. Re-search: Noticed
c. Industry Govt Linkage: Noticed
d. Community Involvement: Unknown
e. Business Development: Unknown

Only marginal differences were observed among the different universities.

4: Popularity of the activities at the universities:

The knowledge of the various activities of the universities among the interviewers was as below:

a. Student interest clubs: Unknown
b. Career centers: Noticed
c. University exchanges: Noticed
d. Internship: Well known
e. Community service: Unknown

5: Popularity of the programs offered by the universities:

Knowledge of the various programs offered by the universities among the interviewees was as below\;

a. Executive training: Noticed
b. Quality of instruction: Well known
c. Research: Noticed
d. Entrepreneurship training: Noticed
e. Market awareness training: Noticed

6: Need to improve the listed activities:

A high need to improve the listed activities was expressed by the interviewees:

a. Make research practical
b. Improve quality of instruction

c. Add relevant technology
d. Add entrepreneur training
e. Improve facilities

7: Known participation in the programs of the universities:

The interviewees had been participating in the programs of the universities in the following ways:

a. Executive training
b. Quality of instruction
c. Research
e. Entrepreneurship training
f. Market awareness training

8: Recommended programs:

The interviewees have marked the following programs:

Agriculture:

i. Yield enhancement
ii. harvesting
iii. post harvesting technologies
iv. supply chain

Energy:

i. Hydro power generation
ii. alternative energy
iii. self generation
iv. co-generation
v. transmission
vi. distribution

Water:

i. Resources prospecting
ii. dams
iii. infrastructure building
iv. water quality
v. environmental engineering

9: Strengths of the universities:

The interviewees have observed the following strengths at the universities;

1. The intellectual level
2. Collaborations with foreign universities

3. Internships
4. Consultancies and contracted researches

10: Challenges at the universities:

The interviewees have expressed the following challenges:

1. Faculty more theoretical less practical
2. No technology updating
3. Programs not need oriented

CONCLUSIONS

In summary, the following can be learnt from the above study:

Strengths

The intellectual level at a number of universities is adequate in terms of number of PhDs.

Collaborations with some foreign universities have been done.

Practice of sending internees to industry is also growing.

Some consultancies and contracted researches are visible.

Gaps

Faculty carries more theoretical knowledge. They are not practical and need oriented.

Continuous technology updating is not being done.

Curricula, training programs, and research programs are not oriented towards the needs of the industry.

Factors that facilitate or constrain the effectiveness of proposed activities and programs are: the existing faculty, existing linkages, institutional build up, surrounding clusters of industry, surrounding economy and surrounding resources.

Capacity Building of the Universities

The know how of the academic and research persons at will need be upgraded to meet the needs of the industry and the economy of the country. Collaborative arrangements with the American universities can play an effective role for this purpose.

Making Private Sector Ready and Receptive

Advocacy campaigns will need to be lodged in the private sector to make them ready and capable to receive the planned inputs from the universities, inline with the demands of the country's economy.

Mode of Operation

The participation mechanism would best operate as autonomous body with constitutive members derived from strong technology provider universities and local industry, funded jointly by public private investments.

Such a body will identify the areas that produce quickest results on national economy. It will sensitize the industry on these areas. It will conduct the needs survey, identify technology and training requirements and where to procure them from. It will produce innovatively and service oriented graduates. It will produce researches that have direct bearing on the industry's needs, translated from the demands of the national economy.

Following action plan can be suggested:

a. Address issues of national economy on expedient basis, through targeted smart curricula, research programs and executive development programs.

b. Procure relevant technologies from foreign universities and upgrade faculty of the universities.

c. Produce relevantly trained stream of graduates and develop research programs meeting the needs of the industry.

Preferred Sub Disciplines to Work On

The sub disciplines within the sectors, that are most likely to lead to the transformative growth of Pakistan's economy over the next 10-20 years are:

Energy: Hydro power generation, alternative energy, self generation, co-generation, transmission and distribution.

Water: Resources prospecting, dams and infrastructure building technologies, water quality and environmental engineering.

Agriculture: Yield enhancement, harvesting and post harvesting technologies, supply chain.

Desired Assistance Programs

Desired assistance programs are: Transfer of know how and technology to the universities, training in required fields, lab equipment, computers, tools, and instruments.

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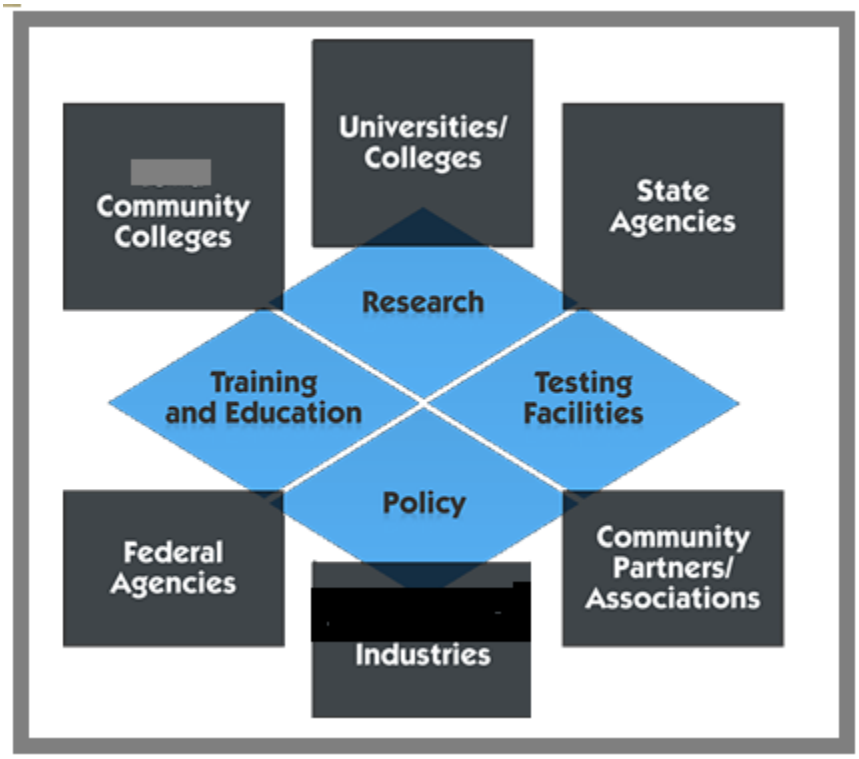

Figure 1: Participative Mechanism