

TECHNOLOGY TRANSFER AND ACADEMIA-INDUSTRY LINKAGES IN DEVELOPING COUNTRIES: CASE OF PAKISTAN

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ABSTRACT

Technological innovations are altering the business operations and structural framework

of industries across the globe. In this regard, academia-industry linkage has played a significant role in strengthening the industrial sector in west. Observing the success of west based on academic commercialization, there is extensive emphasis on academia-industry linkage in other countries all over the world. China, India, Malaysia are among those Asian countries that are striving hard to make effective academia-industry linkages. Pakistan like other South Asian countries is far behind in filling this gap of academia-industry linkage as technology transfer is possible through strong academia & industrial linkage. Innovation and technology developments in universities contribute for the welfare of nations. Industries like Biotechnology, Pharmaceuticals and Information Technology can excel through academic commercialization and gain insight of technological innovations. The study revealed different aspects of university industry linkages. Industrialists and academicians have taken part in the study through structured focus group strategy and suggested a framework to build strong and effective academia-industry relationship

Keywords: Academia, Commercialization of academic research, industry linkages in developing countries

1.0 INTRODUCTION

In knowledge economy, higher education institutions are marked as driver of education through distribution of knowledge among large pool of societal members. These institutions are also expected to play an important role in technology transfer and innovation [1,2,3,9]. Moreover, higher education institutions have taken a step towards third mission activities assigned to them by the policy-makers initiatives. Universities are now under pressure to develop and maintain a sustainable academia industry linkage via academic research commercialization [5]. Universities have increased their focus on activities related to academia industry linkage in order to play a vital role in trade and industry development. The emphasis is on the third mission activities of the universities that is academia industry linkage. The movement towards academic commercialization can be determined by the peripheral conditions specifically the political condition and status of university level education. Furthermore, the policy makers discourage the grants and funds for higher education as they view university education as a personal

and private investment rather than a public good[6,7]. If we look at university industry linkages since 1990s there has been remarkable changes occurred. University's Vice Chancellors and government are emphasizing on Knowledge Transfer (KT) and this is the most debatable and strategic issue in developing countries to gain the competitive advantage in terms of generation of income for universities and overall economic development of the country [3,4].

Higher education institutions are the main partners of the industries and business organizations in this journey of commercialization. Academia industry linkages journey has been started in 1990s when expert knowledge is transferred from universities to industries and this resulted in gain of competitive advantage in knowledge intensive economy[10,11,12,1]. According to Science Policy Research Unit Report (2002) third mission activities are defined as those activities that are concerned with creation and development of expert knowledge. These activities also facilitate conversion of knowledge for industries for betterment of society and economy development [13]. In developing countries universities are not

considered as active player of academic research commercialization. Few developing countries like China, Malaysia and India have invested for promoting the local universities as an agent of technological progress by linkages with industries [14,15,16,17]. Malaysia and Singapore are the examples of Asian successor, as these countries realized in true sense the importance of academic research commercialization and implemented it in the fields like electronics, engineering and petrochemicals. Singapore has achieved the industrial progress and development by 1990s. Moreover, academic industry linkages were realized lately in Singapore. Economic growth rate is fastest in Singapore in the world it was 17.9% during first half of 2010. According to Ministry of Education Malaysia official portal [18], Malaysia is much ahead in terms of academia industry linkage. Malaysia is the only Muslim country that is contributing 86.5% of total high technology exports that is a significant success of Malaysia [18].

In developing countries, like Pakistan, importance of knowledge conversion and transfer to industry is deemed important in order to boost up the trade and industry growth. Role of

academic staff in higher education institutions is highly recognized for the creation and transfer of expert knowledge. Pakistan as compared to other developing countries has realized the importance of research and development. Mission of Higher Education Commission Pakistan's is to foster research oriented culture in each university of Pakistan. Existing five year plan 2015-2020 of Higher Education Commission of Pakistan is directing higher education institutions to change the economic structure of the country by academic research commercialization. Higher education commission, Pakistan has pressurized all universities for the development of Office of Research, Innovation and Commercialization and these offices are working now in public and private sector universities of Pakistan [19]. Pakistan has defined its innovation policy in 2012 in which significance and importance of academia and industry linkage is realized [21]. Arabella Bhutto et, al, [20] stated that developing countries contribute at least 1% of GDP in research, in Pakistan it ranges from 0.1 to 0.5% in various regimes According to PLFS [20] unemployment rate in Pakistan reached to 6% in 2011, while it was 5.6% in 2010, this clarifies that unemployment rate is

increasing in Pakistan [20]. Pakistan has 134 Higher Education Institutions in four provinces and Azad Jammu & Kashmir, in which 74 HEIs are Public sector and 61 are Private sector. National University of Science and Technology is the first university in Pakistan that has developed academia-industry linkage and now they are in the process of transfer technology. Almost 70% of universities are new and they are still in maintaining the structure of office of research, innovation and commercialization as universities are pressurized from Higher Education Commission for the establishment of Technology Transfer Office [21]. Moreover, Pakistani scientists'

2.0 METHODOLOGY

The research study is based on qualitative research design and focus group method is adopted for data collection. The data were collected through focus group activity in Rawalpindi Chamber of Commerce, Pakistan. This focus group activity was done by a trained moderator in a planned and controlled natural manner, with a small group of respondents, industrialist and academicians have taken part and discussed that how to

contribution in international journals is 8000 research papers only till 2009[21]. Higher Education Commission is trying to inculcate among university scientist the significance and importance of research, innovation and technology transfer via seminars, workshops and discussions sessions, business plan competition, still research culture is in nascent form in Pakistani Higher Education Institutions and IPR and funding policies are not yet streamlined. Moreover, need of the hour is to design and implement such policies and strategies concerned with academia-industry linkage.

build an strong and effective academia-industry relationship, and suggested a framework for building a positive relationship of academia with industries in order to drive the technology transfer and commercialization activities. Focus group discussion invitation was send to 20 local firms & multinational companies managers and technicians and 10 academicians of top 5 universities of Rawalpindi and Islamabad. 15 managers / technicians and 8 academicians attended the focus group discussion. This focus group discussion

session was a platform to get the perception of academicians and industrialist about technology transfer and academia-industry linkage. The structure of study is as follows:

- Detailed explanation of the specific research problem:
- Preparation of the grid of questions that is based on detailed literature

review and focus group participants may be asked to add questions;

- To get the qualitative feedback by asking the introductory questions to the participants, in this manner a grid of problems and solutions is developed with the help of comments of the participants by keeping the sequential track of discussion for analyzing the research findings.

3.0 FINDINGS AND DISCUSSION

This section of the paper deals with the interpretation of data that is collected through focus group activity. Table 1.1 highlighted the demographic details of the participants in the focus group as discussed earlier that 16 Local firms and

Multinational companies Managers/technicians and 8 academicians attended the focus group discussion and invitation was send to 20 local firms Managers and Technicians and 10 academicians of top 5 universities of Rawalpindi and Islamabad city in Pakistan.

Table 1.1: Demographics Statistic of Participants

Designation	No of Respondents		Frequency %
Academicians	8		8/24= (33.33%)
Managers	Local firms	Multinationals	10/24= (41.66%)
	3	7	
Technicians from Local Industries	Local firms	Multinationals	6/24= (25%)
	4	2	

Table 1.1 shows the demographic statistics of participants, as invitation was send to 20 local firms and multinationals managers and technicians and 10 academicians of top 5

universities of Rawalpindi and Islamabad out of which 16 local firms and multinational companies managers/technicians and 8 academicians attended the focus group

discussion, result shows that 33.33% of the academicians 41.66% of managers (local/multinationals firms) and 25% of technicians (local/ multinationals firms) attended the discussion group. Percentage of managers (local & multinational firms) is highest who have attended the discussion group as they keenly interested to make

strong academia-industry linkage in order to get the maximum benefit and as 33.33% academicians attended the discussion forum as the universities are keenly interested to cut down the problem of shortage of funding via technology transfer and side by side plays a vital role in overall progress and economic development of the country.

Table 1.2: Distribution of Respondents by level of understanding

Understanding level	High	Medium	Low	Total
Frequency %	10/24 (41.66%)	8/24 (33.33%)	6/24 (25%)	24

Table 1.2 highlighted the categorization of respondents understanding level about academia and industry linkage as medium, high and low, 10 of the participants have recorded as high level of understanding about academia-industry linkages from academia and multinational firms as they have better understanding of the concept of technology transfer, innovation, commercialization and academia-industry linkages due to their experience and level of education. Moreover, local firms' managers and technicians have low understanding about the concepts of academia-industry linkage. 70% of the representatives agreed that the discussion session was relevant to their area of expertise. Pakistan, a developing country, as compared to other

South Asian countries it is far behind in academia industry linkage. Moreover, industrial sector of Pakistan is lacking the capable and skilled professionals. If we look on western countries, they are progressing due to back up support of academia which resulted in trade and industry development and in the end over all progress and development of country. The phenomena of technology transfer and academia industry linkage is in embryonic stage in Pakistan. Moreover, academia and industry has a huge communication gap. HEC stresses now a days on academic research commercialization and technology transfer to build strong linkages with business and industries.

The study identifies and elaborates various aspects of academia-industry linkage based on respondent's comments. In order to build up an effective collaboration between university and industry, it is needed to fill the gaps. The gaps identified from industry side are summarized here as follows:

- Lack of research facilities in industries.
- Lack of interest in Research & Development centers, Industrialist do not believe to spent on the establishment of these Research & development centers for further improvements in product quality.
- Industries are not paying attention towards training programs as this training culture has poor status in industries.
- Industries neither relay nor take interest to collaborate with academia.
- Lack of qualified, competent and skilled staff in Industries.
- Ignorance of Innovative culture in industries and immature industry.
- Small sized industries are greater in number, due to shortage of resources and finances they do not relay to take a risk of adopting any

new strategy in lieu of their product development.

The gap identified from institutions side is summarized here as follows:

- Research culture is in nascent form in higher education institutions due to which the competent graduates are not able to do their best.
- Knowledge is poor particularly in training aspect.
- Higher education institutions and industries both do not cater the training session due to which there is a great communication gap between trainee and trainer.
- Information about new technology and market need is one of the important aspects from industry and university perspective that is lacking in Pakistan.
- Lack of trained staff in academia and industry.
- Lack of well-equipped lab in universities to cater industrial needs.
- Universities curriculum is not up to mark to cope up with demands of industries.
- Lack of industrial attachments for students in order to get the complete know how of current industrial challenges.

- Lack of empowerment programs and ignorance of entrepreneurial behaviors among researchers in universities.

Higher education institutions in Pakistan are fulfilling only primary commitment that is teaching research and teaching is not at equal status in universities of Pakistan. Higher Education Commission, Pakistan stresses on research culture in order to fill in the gap of academia and industry, need of hour is to accelerate innovation and knowledge from academia to industry. Moreover, few universities in Pakistan like LUMS, COMSATS & NUST are trying to overcome this industry academia gap via projects and joint ventures, but still they are far off. HEC initiation of Office of Research Innovation and Commercialization (ORIC) is three years old phenomena, and not all of the universities have established this structure yet as 36 ORIC offices have been established up till now in nation-wide universities, few universities of Pakistan have this commercialization office working, still they are in learning phase as qualified staff and expert in field of Commercialization is lacking in Pakistan.

- Lack of well trained staff in lieu of training session, delivery of science and technology culture in the country.

Successful commercialization is based on policies and expertise of commercialization office staff. Universities must have discussion session with industrialists apart from that student must have industrial visit during their study period in order to get know-how of industries demand. Training programs are platforms facilitating academicians and industrialists to interact and convert academic knowledge into industrial products. Ground breaking of knowledge and innovation from university is the need of hour for effective industry academia linkage. Government involvement is essential for the development of Science and Technology, economic condition of country and political situations plays a significant role for driving the commercialization activities. Government must formulate such policies that private and public sector gaps be minimized as these entities are working on their own way.

4.0 RECOMMENDATION

- Government must take necessary action for initiation of linkage program between business, industries and academia.
- Government must formalized a national policy for university-industry linkage, as this policy is very important for strengthen
- Universities must give some liberty to interact with public and private enterprises, academicians in the universities must be encouraged for academia-industry linkage apart from publications, technology transfer must be appreciated
- Government budget for higher education needs to be revised from existing amount of (1.8% of GDP). This practice is mandatory for successful academia-industry linkage.
- Allocation of funds should be on priority basis as per country demand and further encouragement of industrial sector for funding the specific project.
- Universities must ensure that specific project must end up with commercialized project.
- In order to boost up the industry and academia linkage, taxation system must be revised, if special relief granted to research institutions and industries for the development of national projects it will enhances the product development by industries and universities both.
- Patenting and licensing polices must be formulated as intellectual property right plays a significant role by keeping both the partners intact and promotes the academia industry linkage.
- Higher education institutions must formulate incubation centers, science parks as a channel to promote the idea and innovation and transfer it in a market.
- Science Parks and Incubators plays an important role and it act as a consultancy hub for industrialist, government must take rapid action and invest money on the initiation of these centers on prior basis

- HEC is the hub of scholars and scientists breeding in high-tech areas, in fact Higher Education Commission in Pakistan is the one sector who is responsible for the growth and development of higher education in Pakistan, so it's the foremost responsibility that is already on the shoulders of HEC to promote the academia-industry linkage in Pakistan with successful commercialization activities. HEC must approve funding for the projects with the obligation that this projects ends up with the development of commercialized project and with the condition to develop a strong academia-industry relationship.
- In order to flourish the research culture across Pakistan, need of the hour is knowledge based economy that is by sharing the information and technology transfer, introduction of scientific activities, like conferences, seminars, symposium, workshops and trainings. Such platforms play a very important role to share the ideas and knowledge.

As development and progress only comes by sharing the information, so knowledge sharing is the first step for commercialization of academic research.

- University students must take part in professional's trainings in the form of internship during their course of study, apart from that, universities must include the courses like entrepreneurship, business and marketing products in their curricula.
- Industries must be encouraged for knowledge-based product development, innovation and technology transfer and discussion session with academicians in order to find the suitable solution for industrial problems.
- Establishment of in-house research and development units is the need of hour where academicians engage in research activities apart from that in order to strengthen the industries consultancy and guidance must end up with improvements in quality of product.

- Pakistan's Industry major drawback is that industrialist are not willing to spend extra cost for improving the quality of product, this is due to lack of their interest in research and development and quality improvements. Industrialist must be convinced via trainings in order to highlight the importance of research and development, technology transfer and academia industry linkage that results in generation of revenues and in the end result in overall progress of country.
- Industries must select the young and motivated candidates in universities, who will paid by the

industry for their higher education and in return they have to work on those project that will benefit the industry, later on after completion of their degree they can work in that industry too. After a detailed discussion session, it ends up with this conclusion that effective trainings sessions are mandatory to build up strong academia-industry linkage in order to be successful in the race of developing nations, following framework is formulated under the circumstances of Pakistan.

5.0 CONCLUSION

Universities are responsible to provide education to large pool of societal members, apart from excellence in customary role of teaching, research culture must be introduced in universities in order to drive the technology transfer and academia-industry linkage activities. Research culture is in nascent form in universities of Pakistan, need of

the hour is to flourish research culture in higher education institutions.

Higher education institutions are dynamic organizations if they stress on innovation and technology transfer, they can play a remarkable role to win the race of commercialization and academia-industry linkage. Communication gap between industry and academia should be narrow down by effective training sessions.

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