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ANALYSIS OF UNIVERSITY & INDUSTRY LINKAGES IN SOFTWARE SECTOR IN KARACHI

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Abstract
It has been observed that the linkage between the software industry and universities in Pakistan is almost negligible. This missing links needs investigation, and it is rational for this research. This research will identify the gaps which cause the missing of linkage between the university and Software Industry in Software Sector, particularly in Karachi. The reason for chosen Software Industry particularly in the context of software sector in Karachi is that it is the central business hub of Pakistan and fastest growing city in the world. It accounts for the lion's share of Pakistan GDP and generates about 65% percent of the national revenue. Karachi has many software houses as compared to other cities of Pakistan. According to the recent statistical report by PSEB there are 611 software houses registered in Karachi (SMEDA-Punjab (June-2010)). It is universally accepted that the knowledge is a key driver of high technology, by applying the knowledge, the innovative products can be developed which contribute in the economic growth of the country. The universities are the main hub where the knowledge and manpower both are generated; therefore, universities need to work with the industry which utilizes their knowledge and manpower. The 21st century is the century of technology. In this information age the software industries have a major contribution in the economic growth of countries. Whereas on the other hand the universities are trying their best to contend the competitors by producing the talented and skillful graduates.

Introduction
Developing countries are attempting to shift their economies from a resource-based (or low-technology) to a high-technology based one. Their goal to make economies less reliant on natural resources and other growth-stifling issues is driving this shift. Knowledge is widely acknowledged as a key driver of high technology; by applying knowledge, creative goods can be generated, contributing to the country's economic progress. Universities are the primary source of both knowledge and manpower; as a result, universities must collaborate with the industries that benefit from their knowledge and talent. The twenty-first century is known as the "technological century." In this information age, software firms play a significant role in a country's economic success. On the other hand, universities are doing everything they can to keep up with the competition by generating talented and skilled graduates.

The industry engine of knowledge-based economies runs on academic fuel, resulting in happier and healthier societies. In Pakistan, the connection between university and industry is now very weak. As a result, Pakistan's software industry is frequently forced to go to industrialised countries for technology; similarly, highly skilled workforce frequently chooses to migrate to knowledge economies for greater pay. Academies nowadays are attempting to outperform their competition by creating competent graduates. Universities have evolved into a catalyst for a nation's progress when their functions are no longer limited to human capital improvement, but now include technology transmission, research and growth, and innovation.

The revolutionary capacity as a crucial enabler of growing, development, and innovation, information technology (IT), particularly the software sector, is progressively moving to the center of national competitiveness plans around the world. Because Pakistan's IT business grew steadily throughout the second part of the first decade of the twenty-first century. In 2007, software exports increased significantly. The industry was valued at $2.8 billion in that year, with a total of 1306 IT firms.

The software business has piqued the interest of curious bystanders, including local and expatriate entrepreneurs, industry experts, and possible investors. However, a lack of reliable data on the industry's current state and competitive dynamics has frequently been a barrier to engaging these individuals and bringing many potential enterprises to fruition. We were recently involved in an effort to incubate an IT-focused venture capital fund in Pakistan, at the request of an expatriate investor. We were regularly confronted with a series of difficult questions when we met with industry leaders and members of the financial community, for example:

- Why hasn't Pakistan's software sector produced a single world-class software firm in the last 10-15 years (e.g., Wipro, Infosys, or TCS of India)?
- Why haven't we been able to increase Pakistani software exports beyond a particular threshold ($30-60 million per year) in the last five years?
- Is Pakistan's software sector just at a lower stage of development, or is it on an entirely different path than that of known peer countries
- What, in the local software business, defines a generic collection of best practises (i.e., what distinguishes better performers from those who don't)?

During this time, Pakistan's economy has been under severe strain. This has had a negative impact on the software industry as well. The country's growth has stalled, with no major and large investments coming in during the 2009-10 fiscal year. Despite the slowdown, the IT sector remains vibrant, and it is expected to pick up by 2010-11. The Pakistani government has taken strong steps to develop the country's IT sector. It is working to improve collaboration and interaction between government, business, and academia in order to reap the full benefits of information technology (SMEDA-Punjab) (June-2010).

Although university-industry collaboration is not new, it has been more formal, frequent, and organised since the 1970s. It's also piqued the interest of governments and policymakers in both developed and developing countries, who see it as a mostly untapped scientific technological resource (Vedovello, 1998).

1.1 PAKISTAN SOFTWARE INDUSTRY

The software sector has exploded into one of the world's fastest-growing industries, raking in billions of dollars on a global scale. It makes a substantial contribution to the country's socioeconomic development, especially in developing countries. According to the Pakistan Software Export Report, nearly 1500 IT companies have been registered, with two of them being listed on the Karachi Stock Exchange (KSE), two on the National Association of Securities Dealers Automated Quotations (NASDAQ), and one on the Dubai International Financial Exchange (DIFX). Around 700,000 square feet of IT-enabled office space is available at nine STPs. In Pakistan, seven international corporations have 'Development Centers.' Companies have 110 ISO 9001, 23 CMMi, and 11 ISO 27001 certifications. The expansion of the IT industry is aided by a robust telecom sector. According to conservative

estimates, Pakistan has around 660 software houses that produce and export software to the developed world in areas as diverse as database administration, Internet applications, e-Commerce, CAD/CAM management systems, and so on (www.moitt.gov.pk).
The global value of Pakistan's IT industry is projected to be $2.8 billion. In the economy, there are 110,000 English-speaking IT experts, with 24,000 of them working in exports.
According to the researcher Kolachi (2004), more than innovation is necessary to boost Pakistan's software sector. Pakistan's IT industry is based on a strong national revolution aimed at establishing Pakistan as a key player in the worldwide arena. Many options for achieving this goal are being created by government support programmes combined with a well-established private sector. IT specialists with a variety of backgrounds, both from overseas and locally, are putting their creative ideas to work to maximize the benefits of the information revolution. To stay competitive in the global market, an increasing number of foreign companies are seeking answers from Pakistani specialists. With the global economy decreasing, Kolachi (2004) recommends that Pakistan needs to further transform its IT sector.

1.2 Research Objectives

The objectives of this research work are:

- To find out which type of linkages can be established between the university and industry
- To examine the mode of adaptability of these linkages

1.3 Research Methodology

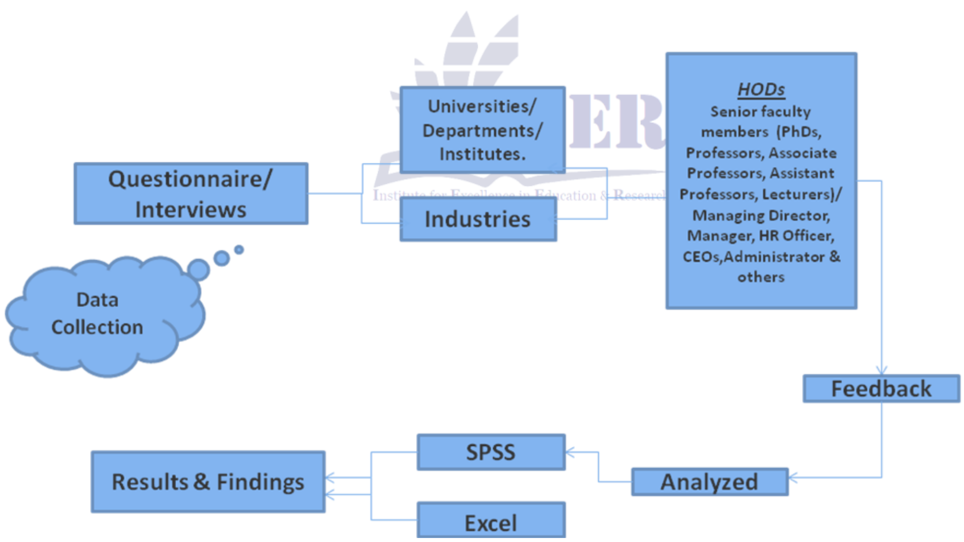

Fig: 1 Data collection

Personal interviews and questionnaires are used to obtain data from visiting academic and industry stakeholders. Researchers, academic members, administrators, and PhD holders from the individual universities were given questionnaires to fill out. Responses from the software industry's top executives were also recorded. By paying them a visit, personal interviews were done. So that the greatest number of challenges faced by stakeholders can be identified.

1.4 Scope of the Study

This research focuses on the current state and difficulties of university-software industry collaboration in Karachi. This research examines university-industry and government contacts from the academic and university perspectives, focusing on the types of interactions, impediments to successful interactions, and promotional approaches to strengthen interactions. The report finishes with actionable recommendations from a variety of stakeholders, including the university, industry, and government. The paper is designed to serve as a resource for policymakers, academics, and business leaders interested in forming long-term collaborations between universities, industry, and government.

1.5 Structure of the thesis

The thesis is organized in the following manner. A full literature assessment on university-industry and government linkages follows in the next chapter. The approach utilized for the investigation is summarized in Chapter 3. The results and discussions of university-industry and government links are presented in Chapter 4. It primarily comprises of the types of university-industry ties, as well as the relevance of linkages to the government, as well as hurdles to linkages and proposals for improving linkages between UIG views. Finally, in Chapter 5, the study's findings and recommendations for developing long-term university-industry and government collaborations are provided. All of the literature researched and studied during this investigation is referenced at the end. Appendices include survey questions and a list of sectors and universities.

Review of Literature

It is widely recognized that universities and other public research institutions play a central role within systems of innovation for basic research generation, technology transfer and knowledge diffusion to firms (Archibugi and Filippetti 2017; Bercovitz and Feldman 2006; Hall et al. 2000; Mowery and Sampat 2005; Mowery and Shane 2002; Thursby and Thursby 2011). These processes are ensured by university–industry (UI) interactions, in their various modes (i.e. joint publications; joint research projects; co-patenting; spin-off), and their crucial role being recognized by both researchers and policy makers (Link and Scott 2005; Perkmann et al. 2013; Protogerou et al. 2013). Over the last ten years there has been a sizeable increase of the literature on the topic, while policymakers, are increasingly seeking the best handles to maximize the effectiveness of interactions between firms and public research institutions at the regional and national level. Within this context, the policy debate revolving around academic entrepreneurship and innovation at the regional and local scale has been revamped, and a few aspects have emerged as crucial. First, given the paramount importance of UI linkages for science and technology policy, contributions to the policy debate should consider that some scientific disciplines are more relevant for the industry than others, and this affects the links with industry that scientists in different fields have. While differences among scientific fields have long been recognized, only recently these differences have been more carefully discussed in relation to innovation and innovation policy (Cohen and Fjeld 2016; Nelson 2016; Whitley 2016). Recent empirical research has highlighted the different patterns of innovation resulting from the different scientific and knowledge base that characterize different sectors, as for instance in the case of the health sector and medical knowledge (Consoli et al. 2015; Consoli and Ramlogan 2008; Nelson et al. 2011). Also, science-based disciplines such as chemistry, behave differently from other disciplines in the exchanges between academia and industry (Hanel and St-Pierre 2006; Meyer-Krahmer and Schmoch 1998). By contrast, very little attention has been devoted to collaboration between university and industry in the humanities-related fields (see Gulbrandsen and Thune 2017). Importantly, differences among scientific disciplines have started to be taken into account also to inform policy (Gerbin and Drnovsek 2016; Gulbrandsen et al. 2011). There are also differences in the potential for commercialization depending on the area; for instance, research in the life sciences lends itself to commercial exploitation since fundamental research and applied work tend to co-evolve (Stephan and El-Ganainy 2007). Finally, an increasing number of studies have researched UI collaborations within a single sector, e.g. in the nanotechnologies (Leech and Scott 2017; Ponomariov 2013), pharmaceutical (Giunta et al. 2016), biotechnology (Thursby and Thursby 2011), chemistry (Kwiram et al. 1995) etc. Hence, studying the presence and importance of different patterns in UI linkages is crucial to design more suitable innovation policies.

Second, the role of geographical proximity has traditionally been considered the main determinant of UI interactions, smoothening institutional differences out (Ponds et al. 2007). This view is being complemented by one that also looks at non-geographical dimensions of proximity (such as organizational and institutional proximity), which in some cases emerge as having a larger impact than geographical proximity on the presence of cooperation (D'Este et al. 2012; Lindelo¨f and Lo¨fsten 2004). Recognizing the importance of the local scale for knowledge diffusion and innovation, regional governments are 720 A. Filippetti, M. Savona 123 increasingly involved in policies aimed at creating technology-based economic development (Feldman and Choi 2015). Several initiatives have been taken in all European countries in order to strengthen the links between academia and industry, and to increase technology transfer efforts by academic institutions. However, evidence on the effectiveness of these initiatives is rather sketchy (Albats et al. 2017; e.g. Lerner 2009). Recently published in Research Policy, the "Special Section on University–Industry Linkages: The Significance of Tacit Knowledge and the Role of Intermediaries" edited by Gulbrandsen et al. (2011) and the "Special Section on Heterogeneity and University–Industry Relations" (Kodama et al. 2008) have both focused on the traditional debate on UI linkages in advanced countries. A great deal of research has also analysed the role of university entrepreneurship, as in the Special Section on "University Entrepreneurship and Technology Transfer" published in Management Science (edited by Mowery and Shane 2002), which has focused on the technology transfer through licensing and university start-ups. All these contributions belong to the so-called "secondgeneration" stream of research that looked at the heterogeneity of UI linkages in terms of academic disciplines, types of universities and channels, research teams and individuals. A recent review (Perkmann et al. 2013) has put forward the concept of 'academic engagement', which refers to a broad range of activities, including collaborative research, contract research and consulting, which are carried out by an increasing number of academics. Academic engagement "represents inter-organisational collaboration instances, usually involving 'person-to-person interactions' that link universities and other organisations, notably firms" (p. 424). This shows that the boundaries of the potential modes of engagement of academics with the private sector are changing, and so it might be their effectiveness. Finally, the interest has more recently extended to developing and transition countries, where the institutional contexts and the objectives for local development might be substantially different, and the need for evidence is all the more compelling (Albuquerque et al. 2015). For instance, in national systems of innovation that are at an infant phase, universities face the dual challenge of linking to global science, and of addressing local economic and social problems, which in the short run might be a different priority and a trade off with the desire to keep up with frontier knowledge. Understanding the drivers for academics and scientists, the barriers that firms and other actors might encounter and situating UI linkages in these contexts is thus critical to inform policy in developing economies. It is therefore timely to reappraise how the current literature is developing, by building upon the more established and the recent debates on UI linkages. Here we aim to take stock of the most recent development of the literature, which has looked at how UI linkages are changing boundaries at the individual, firm, sectors and government levels, in both developed and late developing countries.

The marketplace is witnessing significant changes in competition, technical innovation, and a transition to knowledge-based economies as a result ofglobalisation. Against this backdrop, the value of information as a competitive weapon has skyrocketed (Dierdonck, 1990). Research facilitates the advancement of knowledge and technology, hence fostering an atmosphere favourable to innovation, which is seen as the engine of economic growth. Universities are known for being knowledge centres that can support a country's innovation system.

Due to rapid technical advancements and increased competitiveness, industry must partner with universities. This has allowed them to pool their efforts to foster knowledge and innovation diffusion inside the national innovation system.

Lack of in-house R&D, shorter product life cycles, cutbacks in R&D expenditures, and changing nature of research priorities are all regarded specific causes for collaboration with universities by industry. University research centres also seek to collaborate with industry since they are increasingly in need of new revenue streams as the government plans to cut R&D spending. Firms also form university–industry partnerships to obtain access to students as prospective future workers and to assist with product development (Links and Rees, 1991).

Discovering, creating, and using information is becoming increasingly obvious and regarded as a crucial, if not the fundamental key, to long-term competitive advantage in business. When it comes to discovering, developing, and using information, strategic leaders have three options: do it completely internally, outsource it, or do a hybrid of the two. As a method for external sourcing of knowledge innovations, strategic partnerships have gotten a lot of attention. The focus has largely been on business-to-business collaborations. For knowledge, major companies are increasingly forming relationships with colleges. Strategic associations have gotten a lot of attention as a way to get external knowledge innovations, but as previously said, most of the focus has been on business-to-business partnerships. However, today's leading firms are looking to universities for information since universities are the cosmic reservoir of knowledge, with vast knowledge discoveries and capacities. Higher education institutions are increasingly recognized as strategic actors in national and regional economic development in the context of knowledge-intensive economies, given their ability to upgrade labour force skills and knowledge, as well as contribute to the production and processing of innovation through technology transfer [6].The knowledge chain is depicted in Figure 1. In an inter-organizational relationship, the knowledge chain represents the critical steps in the development and eventual use of knowledge. As shown in the diagram, information is created in these collaborations through a chain of three key links: the university connection, the industry link, and the link that connects them all, the knowledge interface.

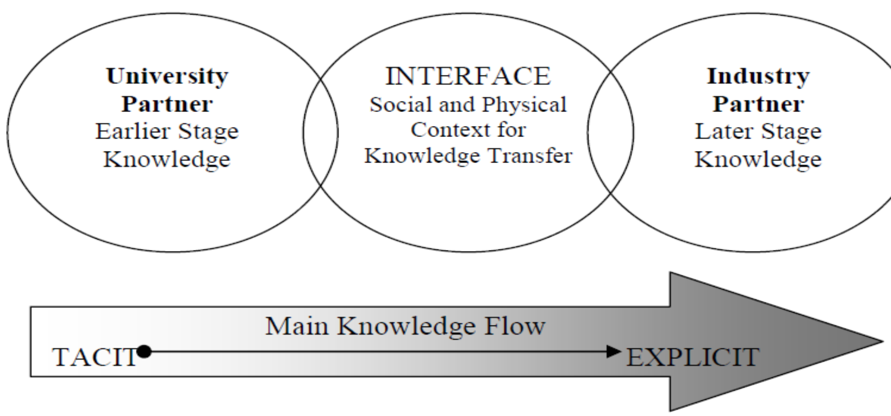

Figure No. 2: The University-Industry Knowledge Chain
Source: L.Sherwood, Susan B.Butts, (2004)

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late. This corresponds to the explicit character of knowledge becoming more explicit as it develops [4]. After recognising the significance of the U-I relationship, its contribution in the context of Pakistan must be studied. Therefore, this research will answer the following objectives in order to assess the U-I link in the Software Sector in Karachi.
From the perspective of the Triple Helix concept, this chapter describes the function of universities in a knowledge-based society. Then, based on literature on the evolution of university-industry (U-I) interactions, a model is proposed. This is followed by a detailed overview of technology transfer, which covers background information, the technology transfer process, procedures, and benefits.

2.2 UIG TRIPLE HELIX MODEL OF KARACHI

Although innovation is characterized by 'newness,' it is not a new phenomenon in and of itself. Perhaps no sector can function without the collaboration of academia and industry, which are the two essential parts of the triple helix model, and the regulating body, which is the government. In areas as diverse as database management, mobile applications, Internet applications, e-Commerce, CAD/CAM management systems, and so on, the top leading Software/IT businesses in Karachi are busy producing and exporting software to the developed world. The remainder are employed as service providers. In terms of worldwide standards, Karachi has a large number of well-known and ranked institutes/universities that do IT/Software research and development, and these institutes produce a large number of IT professionals every year. The function of universities and industries in encouraging linkages between them is highlighted; the third and most essential part of the triple helix, government, plays a significant role in UI connection.

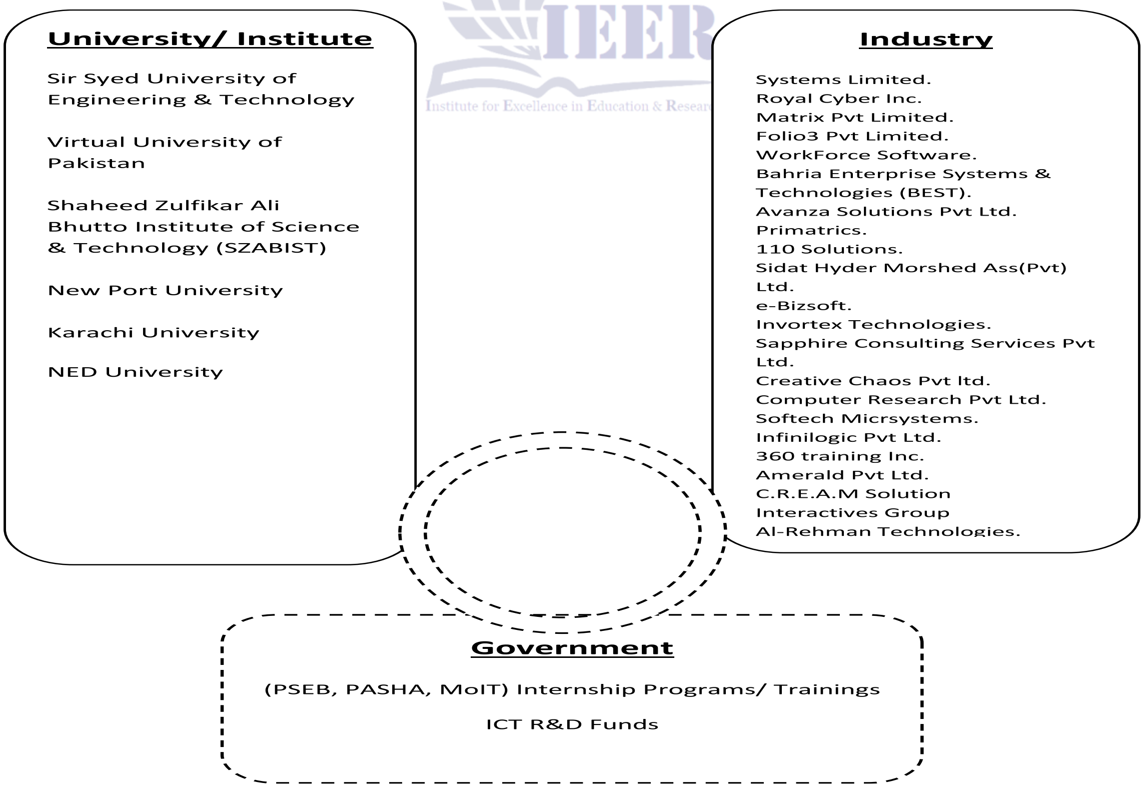

Fig: 3:Triple Helix Model (University-Industry-Government) Karachi

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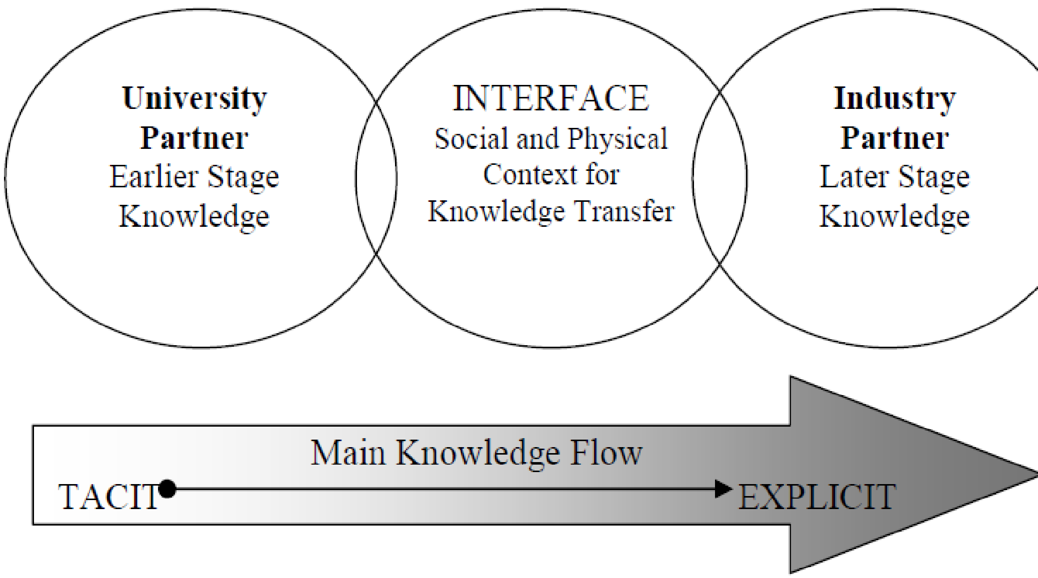

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2.3 ROLE OF MINISTRY OF INFORMATION TECHNOLOGY

March 2000, the country's IT focal point, which had previously been lacking and diffused, was restored (MOST). This division was created to house all IT-related enterprises. The MOST was divided into two divisions: Science and Technological Research (S&TR) and Information Technology and Telecom (IT&T). Other than IT and telecommunications, the S&TR Division was focused on Science and Technology. However, in November 2002, a distinct Ministry of Information Technology was established, and the IT & Telecommunications Division became a component of that ministry (MOIT). The Ministry of Information Technology's main objectives (MOIT) .The Ministry of Science and Technology was initially in charge of overseeing the country's computerization (MOST). With the construction of new IT, Pakistan's IT competency in the twenty-first century was restored, which had previously been lost or spread. Its main goals are to transition to electronic government, develop the software industry, build a cutting-edge infrastructure, and develop a high-quality human resource pool.

The Ministry of Information Technology (MOIT) is the government of Pakistan's national focal ministry and enabling arm for planning, organising, and directing efforts to establish and deploy IT and telecommunication programmes for the country's economic development. It is working on a national agenda to establish a sound and long-term information technology and telecommunications foundation that will contribute to the country's socioeconomic development and the realisation of the vision for a better Pakistan.

Since its foundation, the Ministry has maintained firmness and viscosity with the policy and successes made in the IT and telecommunications sectors, and the policy is continually modified to cope with new difficulties and satisfy IT and tele-communications requirements. Many other departments and organisations., such as the Electronic Government Directorate, Pakistan Computer Bureau, Pakistan Software Export Board, Pakistan Telecommunication Authority, Computer Society of Pakistan, Pakistan Software Houses Association (PASHA)15, and others, collaborate with the Ministry of Information Technology to advance IT in Pakistan (NET Mag Cover Story, 2005).

The Ministry of Science and Technology's main agenda is to improve Pakistan's technological competence in the twenty-first century by leapfrogging into new markets, developing a larger pool of human resources for reverse engineering, participating soft technology organization into modern technological base, consolidation technology institutions, effective S&TR governance, and increasing the capacity of indigenous innovation systems.

In comparison to many other countries, Pakistan's overall IT exports have continually been low in value. Korea's IT exports, for example, were US$158.8 billion in 2013, Ireland's IT exports are predicted to reach US$69 billion in 2014, and India's IT exports are forecast to be US$72 billion.

It is worth noting that the cost of creating jobs in the ICT sector is far lower than in traditional industries.

Key stakeholders in Pakistan

The following are key stakeholders in Pakistan.

Public sector

- **Ministry of Information Technology and Telecommunications.**
- **Pakistan Software Export Board.**
- Pakistan Telecommunications Authority.
- Pakistan Computer Bureau etc.

Private sector

- **Pakistan Software House Association.**
- Call Centers Association of Pakistan.

Pakistan Software Export Board (PSEB)

The Pakistan Software Export Board (PSEB) is an apex government agency tasked with promoting Pakistan's information technology industry in both domestic and foreign markets. PSEB promotes the growth of the country's IT industry through a number of projects and programmes in infrastructure development, human capital development, firm capability development, international marketing, strategy and research, and technology promotion.

100 percent equity ownership, 100 percent repatriation of cash and dividends, and income tax exemption for IT companies till 2016 are among the government incentives offered to the worldwide outsourcing community. Pakistan boasts a huge pool of English-speaking, cost-competitive, and experienced workers, as well as a big number of internationally accredited businesses and dependable telecommunications infrastructure.

To promote Pakistan's IT business, PSEB collaborates closely with international trade organisations, commerce bodies, and the media. PSEB has over 1500 IT firms with competence in custom software development, enterprise resource planning (ERP), financial solutions, mobile content, document management, corporate computing, and business process outsourcing (BPO).Pakistani software companies that export must be registered with the PSEB. This registration allows these businesses to take advantage of the tax savings available to software companies.

PSEB offers the following procedures to facilitate the operations of software companies.

• An annual cost of (US$ 90) is paid to PSEB to register a software house. PSEB also maintains a database of company expertise.

• Prospective clients from all around the world contact PSEB for software or other services. PSEB then makes all of these enquiries public on its website.

• Interested software houses should contact the PSEB, which serves as a liaison between clients and software firms.

• A fee of 0.2 to 0.5 percent of earnings is charged by PSEB.

• In the event of services provided via mode 4, the PSEB assists with visa procedures for people travelling abroad to provide services.

• PSEB collects information from software houses on completed projects, timeframes, and client satisfaction levels on a regular basis.

Pakistan Software Houses Association (P@SHA)

PASHA is a platform that promotes, protects, and develops Pakistan's software sector. It serves as a focal point of representation for numerous outside agencies. Its major goal is to come up with creative solutions to problems by challenging the relevant authorities in order to obtain desired results for the organization's members. PASHA has formalised policies as the association's guidelines after learning from diverse attempts throughout the years. These have been forwarded to the government for the purpose of formulating policies for the development of Pakistan's IT sector. PASHA strives to achieve the following goals:

• Provide a forum for member software and service firms to exchange technical and management knowledge.

• Serve as a point of contact for outside agencies like as end-user organisations and foreign trade/donor agencies with questions about authorised software and service companies, as well as the general state of affairs in information and communication technology in Pakistan. • Solicit support for the software and services industry in Pakistan • Provide a forum for the formulation of standards for the software and services industry in Pakistan

• Develop strategies for dealing with and resolving the issues and challenges that members and related industries/trades face.

• · Initiate, safeguard, promote, and support members' rightful interests,that are required for and in the benefit of Pakistan, as well as take steps to secure public support for policies that influence the software and services industry.

• • Make representations to and interact with federal, provincial, local, and other authorities (both in government and the private sector) on any issue impacting its members' or trade's business.

• Ensure that all items relevant to or affecting the interests of its members are secured, organised, and coordinated.

• Attempts to settle, adjust, and resolve issues among members, as well as arbitrate conflicts or disputes amongst members.

• From time to time, frame, alter, change, and/or update the association's arbitration rules.

• Provide advice and assistance to the government in the creation of relevant and progressive policies, as well as collaboration in their successful implementation.

• Take effective actions to eliminate unethical trade, commerce, and industry practises.

• Formulate and help in the formulation of rules of practise to facilitate and simplify its members' business.

• Maintain and manage any training facilities that the association may establish with or without government aid.

• Encourage cordial relations, close cooperation, and unanimity among the association's members on all topics pertaining to their shared aims and objectives.

• Purchase, take on lease, exchange, or otherwise acquire or deal in and construct, maintain, develop, or control lands, buildings, or any other movable or immovable property, or any rights or privileges connected with such property or properties only in connection with the association's activities and operations.

• Invest and manage the association's money that is not urgently required in such a way as may be determined from time to time.

• In general, to do whatever is required or conducive to achieving and attaining all or any of the association's purposes and objects, both directly and indirectly.

2.4 Development of Information Technology Industry

For development of IT Industry and increasing software exports, following strategic direction may be adopted:

• Development of incubators may be encouraged to provide academia-industry- research linkages and thus inculcating spirit of entrepreneurship in the country.

• Incubator development may be supported in order to establish academia-industry-research ties and so instil an entrepreneurial spirit in the country.

• As a first step toward attracting large IT companies, Software Technology Parks might be designated as Tax Free Zones, allowing them to serve as a hub for value-added activities such as multimedia material, animation, computer games, knowledge development, and so on.

• . A conducive environment is required for indigenous IT firms to transform into world-class firms by complementing their knowledge and increasing their capacity by clustering with large international firms.

• • Local IT enterprises can earn significant foreign exchange by providing high-quality services and products in the global market. This can be accomplished by obtaining higher CMM Level accreditation and opening offices in other countries.

• By expanding connectivity infrastructure, introducing Public Key Infrastructure (PKI) for secure transactions, and implementing laws related to electronic transactions, data protection, and cybercrime, local manufacturing of computer hardware may be encouraged to broaden Pakistan's currently very small base of ownership of PCs and broadband penetration in comparison to other countries

2.5 Government should act to initialize the linkage program between enterprise and universities.

• To strengthen scientific breakthroughs, a national policy for academia-industry collaboration is required. Pakistan's government requires a national S&T reform policy to create S&T culture in the country, similar to China's policy reform in 1985, which resulted in the country's knowledge-based economy flourishing.

• Universities and other higher education institutions should be granted some degree of autonomy in order to engage with private businesses. Professors in universities should be encouraged to develop the link between academia and industry.

• The government's higher education expenditure should be increased from its current level (1.8 percent of GDP) to 6% of GDP. Pakistan's access to higher education is 7.8%, according to 2011 data, and it ranks sixth in terms of education investment.

• Funding must be allocated to priority research fields based on national demand, with the industry sector encouraged to contribute additional funds to the project. Approval of the project should be subject to strict requirements in order to foster academic-industry collaboration. Public research institute policies must ensure the production of commercially viable products.

• The taxation structure, particularly for S&T and high-tech businesses, should be overhauled. Special relief on national development projects in research institutes and industries not only accelerates the advancement process, but also helps enterprises and universities flourish in product creation.

• A "National Innovation System" must be established as a driving force for the development of science, technology, and high-tech research, with patenting and licencing regulations in place. Patenting rules and product licencing are critical in transferring technology from universities to industries while protecting both partners' intellectual property rights and promoting academia-industry collaborations.

• Technology Incubation Centers and Science Parks should be established within universities to help turn ideas into viable products and foster industry-academic collaboration. Since then, these centres have been a significant hub for industrialists seeking advice and sharing knowledge.

Government needs to speed up the process of establishing these centers and invest money on priority basis.

In light of the ministry of information technology's role in establishing an innovation system in Pakistan, I couldn't find a single piece of evidence in the entire study from any university/institutes or industry personnel that the government is assisting them in promoting linkages among them; in fact, some university personnel claim that the government has refused to entertain us despite our repeated requests.

According to previous research, there is a significant linkage gap between UIG and UIG, particularly in the context of developing countries like Pakistan. As seen by the triple helix model above, Karachi has all of the essential stack holders of the innovation system. The question now is whether there is any link between UIG and Karachi. What kind of connection/collaboration do they have? What are the compelling reasons for them to work together?

What are the challenges they face when it comes to collaboration? Find out what techniques they can use to enhance their ties with one another.

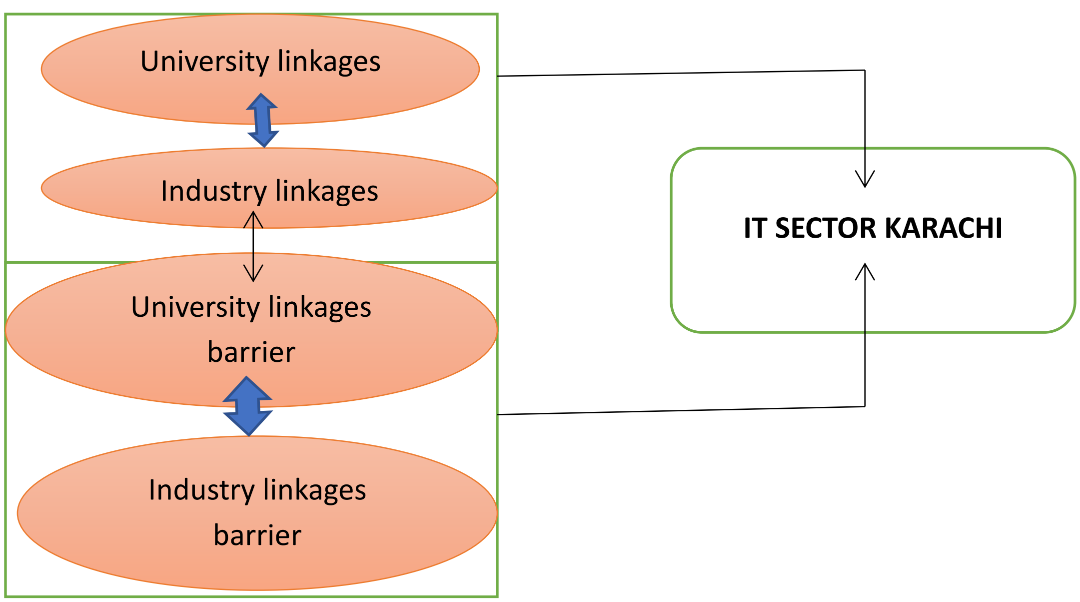
THE CHALLENGES AHEAD: A RESEARCH AGENDA

The rationale of reviving the debate on UI linkages within a context of academic engagement and barriers to innovation attempts to address dimensions that are overlooked in the extant, albeit large and established, literature. These are: first, the role of individual characteristics, behavior, incentives and constraints to engage in cooperation with other actors, most importantly the private sector, but also other actors within the innovation system; second, the specificities of both individual behaviors and organizational constraints in late developing contexts, with this latter evidence importantly contributing to the formulation of systematic and systemic innovation policies to foster advances in basic and applied research; third, the role of barriers and constraints to innovation in affecting cooperation between firms and public research institutes, from the perspective of firms and public organizations. Several novel aspects have emerged that contribute to reviving the debate on academic entrepreneurship and the innovation system literature. There are overlooked individual characteristics that affect the degree of engagement of academics and scholars in cooperating with other organizations, of which gender and the non-academic background of individuals are most crucial. The notion of academic engagement should be usefully enlarged to aspects that go beyond the commercialization or patenting of innovation, but embrace social and economic impact more at large. Beyond the individual, and most especially in late industrializing countries such as in the cases of Argentina and South Africa hosted here, what matters is also a dense network of social ties, and the specific identity and reputational characteristics of the academic organization. These characteristics represent more of a bottleneck than an incentive to engage in cooperation with other institutions. From the perspective of the firm, the evidence hosted here has highlighted that barrier to innovation might exert an effect on the likelihood to cooperate with other partners, most especially to cope with lack of finance or access to frontier knowledge. On the other hand, it is suggested that UI linkages, contrary to anecdotal evidence, are not doomed to fail more often than other types of cooperation among actors.

Methodology

The quantitative approach examines, in general, research that has been primarily conducted on present business concerns, as well as the validation of ideas and notions developed by many researchers, taking into account a variety of elements. The quantitative study backs up the validity of broad views of ideas that are often employed in social science and commercial studies research. The ability to forecast reasons that have a significant influence on different variables employed in research studies is the fundamental reason for its adoption in social studies.

QUANTITATIVE CONCEPTUAL FRAMEWORK



The reliability of the research ensures that when a particular instrument is used to collect data from a different population or sample, similar results are obtained. Reliability tests show that the instrument performs well and that the higher the value of reliabilities, the more important it is for the study to be carried out.

RELIBILATY	CROBACH ALPHA	0.7

VALIDITY

The amount of assurance that the data collection instrument contains questions that are directing link or reliable to the study's purpose, and the results reflect the dependability of the questioner is known as validity or research instrument. The pilot research was used to test the validity of the instrument by carrying out the real data collection process.

POLIT TESTING

In this study, nice testing of the validity of the items was conducted, and the research questions were distributed among the short-listed ecce instructors to selected educational settings for pilot testing. There were 10 each research questioners filled out randomly by IT industry and universities in from Karachi. It was discovered that the information derived from the calculations and analysis of the obtained data matches to the research purpose of assisting in the comprehension of the topic under consideration, and that the research question's validity was demonstrated through a careful examination.

Results

The fourth chapter focuses on data interpretation and analysis. In this chapter, you will discuss two objectives with logical substance. Data analysis is the foundation of any investigation. This study focuses on two objectives that are achieved by statistical analysis, which is the main theme of this chapter. Response (dependent) variables and explanatory (independent) data are differentiated in most statistical analyses. And this statistical strategy is used to analyses data in order to reach a useful conclusion for IT sectors improvement.

4.2: RESEARCH OBJECTIVE

- To find out which type of linkages can be established between the university and industry
- To examine the mode of adaptability of these linkages in IT sector Karachi

.3: HYPOTHSIS

- H_1 = There is positive relationship between industry-university linkages in Karachi IT sectors.

Descriptive Statistics linkage university table 4.1

	N	Mini	Maxi	Mean	Std. Deviation
Offer trainings during vacations	33	1.00	5.00	1.6667	1.08012
Experts of University/Industry exchange with each other	33	1.00	5.00	2.6667	1.13652
Inviting in Events like conference/workshop/symposium	33	1.00	5.00	2.2424	1.19975
Financially Support to Universities in term of Research fellowship	33	1.00	5.00	2.5455	1.17502
Involved experts as Head in Various Programs	33	1.00	5.00	4.1212	.78093
Financially support in Purchasing laboratory equipment	33	1.00	5.00	3.0303	1.23705
Help to Develop Infrastructure	33	1.00	5.00	3.1212	1.08275
Provide Academic and Industrial Consultancies	33	2.00	5.00	3.8485	.79535
Encourage Faculty/Students to choose research topic as industrial problem	33	1.00	5.00	1.8788	1.24392
Invite Industrialist in the teaching university	33	1.00	5.00	2.4545	1.25227
Engage Industrialist in curriculum design	33	1.00	5.00	2.8182	1.18466

Joint Research Projects	33	1.00	5.00	2.2121	1.02340
Offer industrialist to offer services as Supervisor/research guide for university students	33	1.00	5.00	3.0000	1.17260
Share Facilities like Equipment, laboratories and Industrial Materials	33	1.00	5.00	4.1818	.88227
Aprretenchips and Internships	33	1.00	5.00	3.3636	1.14067
Exchange of information, literature, data etc with university academics	33	1.00	5.00	2.9091	1.15552
Joint patent	33	2.00	5.00	3.5758	.79177
Joint publication	33	1.00	5.00	2.0909	1.15552
Exam/thesis evaluation	33	1.00	5.00	2.3030	1.28659
Valid N (listwise)	33				

Table 4.1 showing the university linkages factors and here that Share Facilities like Equipment, laboratories and Industrial Materials (4.18) and Involved experts as Head in Various Programs(4.12) are the most existing factors which is related to universities linkages

Reliability Statistics table 4.2

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.870	.860	19

Table 4.2 shows that the dependability value and Cronbach's alpha value for university linkages data are both 8 out of 9, indicating that the data is good and dependable for study and issue solving.

Descriptive Statistics linkage industry table 4.3

	N	Mini	Maxi	Mean	Std. Deviation
Offer trainings during vacations	33	1.00	5.00	3.2121	1.19262
Experts of University/Industry excahge with each other	33	1.00	5.00	2.4545	1.37138
Inviting in Events like conference/workshop/symposium	33	1.00	5.00	2.9091	1.18226
Financially Support to Universities in term of Research fellowship	33	1.00	5.00	3.9697	1.13150
Involved experts as Head in Various Programs	33	1.00	5.00	3.1818	1.28585
Financially support in Purchasing laboratory equipment	33	1.00	5.00	3.3636	1.29466
Help to Develop Infrastructure	33	1.00	5.00	3.6970	1.07485
Provide Academic and Industrial Consultancies	33	1.00	5.00	2.5455	1.34840
Encourage Faculty/Students to choose research topic as industrial problem	33	1.00	5.00	2.0909	1.28364
Invite Industrialist in the teaching university	33	1.00	5.00	3.1515	1.14895

Engage Industrialist in curriculum design	33	1.00	5.00	2.5455	1.34840
Joint Research Projects	33	1.00	5.00	2.6970	1.26206
Offer industrialist to offer services as Supervisor/research guide for university students	33	1.00	5.00	4.0303	1.13150
Share Facilities like Equipment, laboratories and Industrial Materials	33	1.00	5.00	3.3333	1.26656
Aprretenchips and Internships	33	1.00	5.00	3.4848	1.25303
Exchange of information, literature, data etc. with university academics	33	2.00	5.00	3.8182	.95048
Joint patent	33	1.00	5.00	2.6364	1.41019
Joint publication	33	1.00	5.00	3.0000	1.17260
Exam/thesis evaluation	33	1.00	5.00	3.9697	1.13150
Valid N (listwise)	33				

Table 4.3 is showing that industrial linkages factors and here that Offer industrialist to offer services as Supervisor/research guide for university students (4.03) is most existing factors

Reliability Statistics table 4.4

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.905	.904	19

Table 4.4 shows that the dependability value and Cronbach's alpha value for university linkages data are both 8 out of 9, indicating that the data is good and dependable for study and issue solving.

Descriptive Statistics table 4.5

	Mean	Std. Deviation	N
Industrylinkages	60.0909	14.18266	33
Universitylinkages	54.0303	11.47411	33

Table 4.5 is showing that industrial linkages (mean=60.09) and university linkages (54.03) so data shows that industrial linkages more existing rather than university linkages in IT sector.

H_1 = There is positive relationship between industry-university linkages in Karachi IT sectors.

Correlations table 4.6

		Industry linkages	University linkages
Industry linkages	Pearson Correlation	1	.778**
	Sig. (2-tailed)		.000
	N	33	33
University linkages	Pearson Correlation	.778**	1
	Sig. (2-tailed)	.000	
	N	33	33

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.6 is showing that correlation of industrial linkages and university linkages so according to data that the correlation between industry and university linkage (.778) is positive and significant value is (.000) which is less than 0.05 that means industry significantly effective on university linkages of IT industry. So here alternative hypothesis accepted that there is positive relationship between industry and university IT sectors.

Descriptive Statistics barrier university table 4.7

	N	Minimum	Maximum	Mean	Std. Deviation
Low interest by industry/ University	33	1.00	5.00	3.3600	1.55134
Lack of trust	33	1.00	4.00	2.5600	1.26095
Unsufficient infrastructure facilities in university/Industry	33	1.00	5.00	3.2800	1.48661
Financial barriers	33	2.00	5.00	3.6000	1.11803
Irrelevant Domains	33	1.00	5.00	3.0800	1.60520
Time constrains	33	1.00	4.00	2.5600	1.19304
Lack of Awareness	33	1.00	5.00	2.8400	1.43411
Ineffective Policies and Strategies	33	1.00	5.00	3.2400	1.47986
Different ethos/ work culture	33	1.00	5.00	2.9200	1.41185
Unawareness about IPs	33	1.00	4.00	2.1200	1.33292
Unclear Objectives	33	1.00	4.00	1.8000	1.08012
Valid N (listwise)	33				

Descriptive Statistics barrier university table 4.7 is showing that financial barriers (3.60), Low interest by industry/ University (3.36) insufficient infrastructure facilities in university/Industry (3.28) are most existing barrier in university linkages in IT sector.

Descriptive Statistics industry barrier table 4.8

	N	Minimum	Maximum	Mean	Std. Deviation
Low Interest by Govt	33	1.00	4.00	2.5938	1.01153
Low interest by industry/ University	33	.00	5.00	3.4062	1.01153
Lack of trust	33	1.0	5.0	3.000	1.4368
Unsufficient infrastructure facilities in university/Industry	33	1.00	5.00	2.7500	1.27000
Financial barriers	33	1.00	4.00	2.3125	1.02980
Irrelevant Domains	33	1.00	5.00	3.1563	1.54731
Time constrains	33	1.00	5.00	2.8750	1.26364
Lack of Awareness	33	1.00	5.00	3.3750	1.33803
Uneffecitive Policies and Stategies	33	1.00	5.00	2.6250	1.53979
Different ethos/ work culture	33	1.00	5.00	3.3438	1.28539
Unawareness about IPs	33	1.00	4.00	2.6563	1.06587
Valid N (listwise)	33				

Descriptive Statistics industry barrier table 4.8 is showing that Low interest by industry/ University (3.40), irrelevant domains (3.15), lack of awareness (3.37) these three factors are most existing industry linkages barrier in IT sector.

Descriptive Statistics table 4.9

	Mean	Std. Deviation	N
UB	31.3600	11.55739	33
IB	32.0938	7.69734	33

Table 4.9 is showing that university linkages barriers are complicated rather than industry barrier means data show that university must doing strong strategies which is related to stronger IT industry sectors

Reliability Statistics table 4.10

Cronbach's Alpha	N of Items
.873	2

Table 4.10shows that the dependability value and Cronbach's alpha value for university linkages data are both 8 out of 9, indicating that the data is good and dependable for study and issue solving.

Correlations table 4.11

		UB	IB
UB	Pearson Correlation	1	.872**
	Sig. (2-tailed)		.000
	N	33	33
IB	Pearson Correlation	.872**	1
	Sig. (2-tailed)	.000	
	N	33	33

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.11 is showing that the barriers of the industry and university linkages so here there are positive correlation table shows that university have some Barrier and industry also have some barrier which is most problematic to linkage on industry and university alliances so it must take serous action that reduce this barrier for improve and development university and industry linkage in IT sectors and significant valve .000 is less than 0.05 is showing these are affective each other in IT sectors

4.4: SUMMARY

Data interpretation and analysis has been done in this chapter. There are some data related in university linkages and some data showing industry linkages and here are some data showing barrier which is direct related in IT University and industrial linkages

Conclusions

Pakistan's software industry has grown over the last decade, but it still requires qualified graduates to grow. Pakistan's software sector is significantly impeded by a shortage of human resources in conditions of quality and quantity. This problem can be addressed by creating a mechanism that addresses both parties' challenges. The current study looked at the software sector and universities in Karachi and Hyderabad. The majority of the connections are based on common research interactions, such as industry participation in workshops/seminars/conferences, summer internships for students in industry, and industry participation on the university's board/committee. Academic interactions, on the other hand, are a sort of existing connectedness that has been identified as a weak link. Universities and industry collaborate on scholarly exchanges of knowledge, literature, and data, among other things. The purpose of establishing those links is to prepare students for future industrial jobs and to obtain access to industrial feedback for curriculum development.

Universities and industry stakeholders have a major communication gap, and as a result, there is little trust and appreciation for the efforts that universities are making to develop collaborations. According to the findings, the Pakistan government has a small role in developing these relationships because personal contacts and, to a lesser extent, chambers of business are the sole avenues via which these links are built. There are no systems in place to deal with this. Universities should adapt their curricula to meet industry expectations so that students can perfect their skills for future employment prospects, and industrial trips should be required.

University and industry stakeholders must get down and articulate their requirements while also appreciating one another in order to build trust, communication, and understanding, which could lead to the formation of successful university-industry relationships.

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