A SWOT Analysis of Collaborative Strategies between Engineering Universities and Industry in Pakistan

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RECEIVED ON 24.03.2014 ACCEPTED ON 17.10.2014

ABSTRACT

Collaboration among academia and industry is a long aspiring vision of every country to promote innovation and commercialization. A deeper analysis of collaborative efforts among them may reveal significant aspects to look for well informed decision making. The purpose of this research is to conduct the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis of collaboration in engineering education, research and practices in Pakistan. The study attempts to identify strengths and weaknesses of the current collaborative strategies; opportunities for establishing strong and rewarding relationships, and threats that may hinder development of this association. It further provides practical schema to establish productive association between the two partners through creative leadership, effective strategic partnership, and systematic modus operandi to way forward with implications for academics, researchers, and industry. The research is qualitative in nature, based on interpretivist approach. The data is collected by using focus group and semi-structured interviews of experts in industry and academia; primary data obtained by these tools is analyzed by using thematic analysis through open and axial coding. The study identifies the barriers in collaborative efforts, and delineates the roles of industry and academia to overcome these barriers along with SWOT matrix in the context of Pakistan.

Key Words: SWOT Analysis, Collaboration, Research and Practice, Engineering Education.

1. INTRODUCTION

Higher education in Science and Technology in Pakistan is undergoing major reforms presently. Of the various measures adopted to update and enhance the quality and outcomes of academic institutions, both general and professional, research has received major focus. There is increased emphasis on promoting research culture especially in science and technology; and numerous steps have been initiated to attain this goal, namely grants for pursuing higher education and research, establishing research centers, and funding for publishing and presenting research findings in journals and conferences [1-2]. Majority of these steps through extended financial support involve academia in research. However, this
research largely remains inert since it does not get translated into practice by the industry. Further, the research conducted by the academia has been undertaken on issues that have little relevance to the innovation and commercialization. Most of the research work, undertaken by the faculty members of the universities, is merely for the purpose of increasing research publications [3]. Therefore, there is a pressing need to develop effectual strategies that transform pure research into practice, and create a dynamic link between industry and academia leading to mutually beneficial and significantly productive research directions [3-4].

Technology has been considered a critical input for the economic development next in line to the basic factors of production; hence, there is a serious need to create technically skilled workforce which is vital for economic growth and prosperity at the local and global levels. The seventeenth article of world declaration on higher education for the twenty-first century: vision and action emphasizes the importance of partnerships and strategic alliances between the HEI (Higher Education Institutions) and the world of work stakeholders [5]:

“Partnership and alliances amongst stakeholders - national and institutional policy-makers, teaching and related staff, researchers and students, and administrative and technical personnel in institutions of higher education, the world of work, community groups - is a powerful force in managing change. Also, non-governmental organizations are key actors in this process. Henceforth, partnership, based on common interest, mutual respect and credibility, should be a prime matrix for renewal in higher education.”

A proper account of collaborative efforts between the industry and universities, and its closer analysis is the need of time. Although in Pakistan scattered and intermittent efforts for collaboration are present; but the continuity, effectiveness, and impact of these efforts are not analyzed from the point of view of stakeholders. The purpose of this research is to conduct the SWOT analysis of collaborative strategies and efforts between industry and academia, more specifically engineering universities to identify strengths and weaknesses, and explore opportunities and threats. It further recognizes the barriers to collaborative efforts and outlines the roles of academia and industry to overcome these obstructions.

University-industry collaboration has many facets and the interaction depends upon knowledge or technology transfer. Technological cooperation banks on innovation, break through and product development; whereas, basic science rely on knowledge creation and utilization. Therefore, there is a fundamental difference in university-industry collaboration for engineering and basic sciences. The knowledge transfer can take place through various channels which are basic characteristics of knowledge, scientific discipline, and industrial sector. The combinations of these factors determine the nature of collaboration. For example collaboration of a university with chemical or textile industry largely depends on the industry specific requirements in the country and knowledge in question. However, this alliance will be entirely different for pharmaceutical or polymer industry. Hence collaboration of pure sciences with industry is different from the engineering and technology.

The scope of the research is limited to only engineering universities; therefore, it does not extend to other fields of pure science and technology. Collaboration for pure sciences like physic and chemistry or biological science requires different forms and nature of collaborations. Further, the focus of the research and central idea revolves around the mechanism of transfer of knowledge from university to industry through collaborative partnerships. The major limitations of the study are that it does not take into account the role and policies of the government and neither furnishes the impact of longitudinal efforts taken in the past.

2. LITERATURE REVIEW

It is an established fact that university and industry are the two fundamental pillars to create education-research-business relationship for advancement of economic growth. Engineering education is central to harnessing and creating world class technical workforce through provision of avenues for industry-academia collaboration. Globally, universities have undergone this experience of initiating and sustaining beneficial partnerships and linkages that consequently reaped mutual benefits in connection with technological innovation and advancement. The beneficial impact is quite well-documented in relevant literature as mentioned that industry-academic cooperation could give rise to competitiveness of industry, and industry could be treated as learning environment for younger generation [6]. Moreover, it is strongly advocated that for making such policies had provided incentives to academia for commercial ventures or to collaborate with industry for various commercial innovations [1-2].
Another important idea of entrepreneurial university has propagated by the researchers [7], and it is claimed that the traditional role of a university is being transformed from merely imparting knowledge or disseminating information related with research to creating linkages with the industry for the commercialization of the innovation. Although, the partnership convergence between academic and commercial ventures is still obscure, and working relationships are at a nascent stage; however, there is an emergent need and demand on both sides i.e. academia and industry to strengthen this relation in order to promote the technological advancement through engineering education and research [3,5,8].

In various countries industry and academic collaboration is gaining impetus through strategic partnerships resulting in mutual benefits. The term strategic partnership is defined as collaborative efforts between two or more firms that pool their resources in an effort to achieve mutually compatible goals that they cannot achieve easily alone [9]. This partnership and collaboration is an inter-organizational endeavor [6] and the purpose of this cooperative agreement is to achieve competitive advantage. Universities have long been treated as the primary source for creation and dissemination of knowledge; and that academia has been participating in economic development through their intellectual input related to the variegated aspects of the economy [6].

Nevertheless, with the recent advancements in technological field, the role of engineering and technology universities is changing from being the hub of knowledge creation to that of technological innovation [10]. This innovation is not possible without understanding the commercial needs of the industry and consumer demand in the market [11]. Various countries are promoting this commercialization and linkages through policy framework and various laws [12]. University-industry centers and technology parks, science parks and incubation centers are now common terms among academia to realize the need for commercial linkages [13]. Even universities are engaging in training of knowledge transfer and enhancing the capabilities to fill the demand gap in the market. A new term ‘triple helix’ has emerged at the helm of growing involvement of universities in social and economic development along with their traditional roles of education and research [7]. It is mentioned that universities are increasingly becoming involved in playing a dual role, one related to research and alongside this playing a strategic role in the development and commercialization of technology; thus, the role of academia is shifting from technological innovation to technological commercialization [14].

Exchange theories advocate that while the industry is collaborating with the university to seek expertise and facilities; it requires an evolutionary process by successively exchanging complimentary resources to create greater synergy. One advantage to the industry of this collaboration can be in the form of low risk and cost effectiveness [15]. An important question in this regard is that why university faculty should involve themselves in commercial ventures and quit the pure academic pursuits? To answer this vital question, it is posited that many universities have formal policies to engage their faculty in seeking industry projects and to provide incentives along with facilities and relaxation; however, it is also argued that many universities provide incentives for disclosure of innovation, and subsequently faculty plays an active role in product development thereby enhancing the number of patents owned by the university [16-17].

There are two perspectives that people uphold regarding the motivation behind the decision of faculty to pursue collaboration with the industry. First perspective is that academicians involve in research and development through commercial organization for two reasons – one, for getting financial benefits; and second, for availing a platform to implement their ideas along with state of the art technological facilities and resources, which only commercial ventures can provide, in the hope to reap the profit through future product development, and this allows them to cut down on their R&D department expenditures. The second perspective entails that a researcher in academics requires testing the research results; hence the only motive for this researcher is to support the research ideas through active experimentation made possible through the industry. Thus, there are enough convincing arguments to support the pursuits of industry-academia linkages for mutual benefits and growth [14].

Industrial organizations can have an access to trained personnel, qualified researchers and latest technological knowledge to gain the competitive advantage in the market; while universities can have an access to greater resources and financial incentives. While pointing out the reasons for the industry to look forward to collaboration, it is noted that access to well trained staff, latest research findings, field expertise, scholarly facilities, training of their staff, and creating community relations [14]; and another major benefit of
this is early access to upcoming research and early product development [8]. On the contrary, the reasons compelling universities to pursue this partnership include access to financial resources, acquiring additional funds, real-world exposure to students and faculty, and more stimulating projects with access to state-of-the-art facilities [18].

University industry collaboration is considered as one of the most successful knowledge transfer mechanisms [19], but little effort is evident by the researches to conduct the gap analysis and identify the factors hindering the successful collaboration. But a number of studies conducted across the globe in past by different researchers in China [20], Korea [21], Italy [22], Japan [23], UK [24], and Australia [25] show a growing interest in this area. The most common path, as identified by these research studies, of a university to transfer knowledge to the industry is through licensing, and generating more patents [19].

Another aspect that significantly enhances the industry-university collaboration is to directly conduct the projects assigned by the industry via agreements and provide indigenous solutions of their problems through technology, research, and development. However, this factor largely depends on the funds allocated by the industry and joint efforts done by the universities to exploit their expertise. A third approach which is although less feasible, at least in the context of Pakistan, is to operate on the facilities of the companies by the university-run high-tech firms to produce joint innovation [26].

Firms are operating in diverse industrial sectors and owing to this fact they adopt various mechanisms to transfer knowledge from university to industry for their collaborative efforts. This mechanism is based on the form of technology and expertise required, level of interaction between the firm and the university, efficiency and risk factors involved [27-28].

The mechanism of knowledge transfer and active collaboration may include conferences and publications, exchange programs and consultancies, work, joint ventures and cooperative work, contracts and licensing, incubation and research centers [26,29]. A formal mechanism that is adopted by many universities and helps to liaise with the industry is the TTOs (Technology Transfer Offices), which facilitate the licensing and patenting the technological innovation. The central element to make a TTO successful is the agreement of the faculty members of

to submit their IPs and accept for the formalization of transfer [30-31].

Another important collaborative strategy adopted by the incubation centers is the academic spin-offs that can lead to innovation transfer, but mostly depends upon the capabilities of the university or research center to initiate and promote the venture creation process by fostering the needed skills and resources [32]. A relative examination of above-mentioned channels has resulted in four factors: nature and sector of the industry, scientific discipline of the university or center, level of the knowledge and expertise required by the industry, and characteristics of the organizations and individuals involved in it [25]. The consideration of these four factors, while undergoing any collaborative effort, will help to facilitate and materialize these efforts, and will reduce the barriers by providing an understanding of relevant strengths and weaknesses [25].

3. RESEARCH METHODOLOGY

The design of this study is interpretivist in terms of philosophy, and inductive logic is used as an approach to formalize the results. The data is collected by using multi-method through cross-sectional segments. The primary data is collected in two stages; first by using two focus groups interviews; and second one-to-one personal interviews of 16 industry experts and academics. The participants of focus groups are from three public and private sector university faculty members and two industry experts belong to manufacturing sector. The interview participants are 10 university faculty members of engineering departments having a range of experience from 5-17 years, whereas 6 industry experts included have represented the different industry sectors. The participants are selected by using purposive sampling technique ‘intensity sampling’ [33]. The reason of using intensity sampling is the knowledge of participants who are working at the helm of affairs in university or industry. The selection criteria are based on willingness to provide information and allowed to record the focus group and interviews. The selection of the participants of the focus groups and interviews is not based on probability sampling to generalize the findings regarding the entire population; rather it reflects the theoretical sampling to gain insight which can be further testified through statistical generalization. Focus groups are used to generate the initial understanding to develop the protocol for
individual interviews. The instrument used for the interview was a self-developed tool (attached in appendix) which the researchers developed on the basis of literature review. The validity of the instrument was achieved through three expert’s review one each in industry, academia and research expert in the field; and the reliability of the tool was ascertained through purpose of explaining [34].

4. DATA ANALYSIS AND DISCUSSION

The data collected from the participants by using focus groups and interviews are analyzed by using thematic analysis. For interview data, initially open coding is performed to identify the keywords, and then axial coding is applied to extract more abstract meaning from the open codes. Later memos are developed on the basis of interview codes and notes developed during the interview process. The emergent themes are further validated by the participants. Following major themes are gleaned from the data.

4.1 Understanding of Shared Concept

Industry and academic collaboration is still at a nascent phase in Pakistan and there can be many explanations to account for this scenario which is in contrast to the global developments and trends. First explanation, which is expressed by the industry experts and academic heads of different engineering institutions, is the lack of clear and complete understanding regarding the need and benefits of this much-desired collaboration between the two partners. This concept of collaboration is, neither, comprehended well by both the associates, nor, discussed openly on any common platform where both the parties can share their ideas and provide the practical meaning to the industry-academia collaboration. Industry representatives, in the study sample, were found to have a very vague idea regarding the collaboration. To some of them collaboration with the universities meant providing internship opportunities to the students or jobs to the graduates. For some, the collaboration also encompasses arranging field visits for the students, and providing latest technological information to the faculty members. Various industry experts also accepted that providing guest lectures on the cutting-edge technology to the engineering and computer science departments of various universities is a form of collaboration. This shows that there is a serious lack of understanding on the part of the industry. On the other hand, when the same evidence is gathered from the academia as to their concept of collaboration between industry and academia, most of the faculty members provided the examples of foreign university faculty that have multi-million projects, thus they are only looking for lucrative projects given to the academia, and access to the resources of the industry to the university students and faculty. However, they also failed to recognize the joint role of industry and faculty to create a win-win relationship that can produce the anticipated mutual benefits through innovation, research and development.

In responding to a question that how a university and industry can collaborate, the participants accentuated that university and industry experts should have joint committees, conferences, and collaborative events. In this case university alumni can play an active role by acting as a bridge between the two segments. Alumni are at key positions and their greatest strength is that they have had both the experiences, of industry and academia, and can understand the dynamics of both organizations. With most of them at key decision making positions, they can actually become the driving force.

Another element that can be vital to bridge the gap and strengthen the link is invite industry experts to deliver guest speaker sessions, short and special trainings, seminar talks, and associate various faculty members according to their interest to the industry experts for further linkage, visits, student projects, and those designated faculty members, with additional responsibilities and resources, address the reservations of their concerned industrial partners, prospective and current, and expand the existing links to open further avenues.

Many respondents during the interview underscore that there should be platform either through HEC (Higher Education Commissions) or Ministry of ICT R&D (Information and Communication Technology and Research & Development) that should provide the framework to work together along with the representatives from both from industry experts and academic practitioners. This framework will illustrate the roles and responsibilities, chalk out the timelines, develop different themes, and bring diverse stakeholders on a common ground. Information dissemination along with acceptable, functional and
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effective monitoring and evaluation system should also be in place for the smooth execution and continuation of policies.

An important aspect that often gets neglected during any discussion regarding the industry and academic partnership is the identification of a specific process to adopt. The participants had the divergent views regarding this concept; some were in favor to start the process and allow various universities and industries to initiate and participate in the process, it will evolve through collective efforts over the period of time. The maturity in the process will not be attained in one shot rather through process evolution of all stakeholders will change their strategies and learn from their own mistakes. However, the other group, especially from the industry, raised their concerns, regarding the transparency, objectivity, and effectiveness of the adopted collaborative strategies and processes. They have given the argument that presence of well-established policy and process will help to sustain in future. The academics disagreed with this concept and stated that hard policies and bureaucratic nature of work has already undertaken in the past, has produced no appreciating results so far. The common ground where both academia and industry agreed is that a silhouetted plan will be more beneficial in the beginning and can provide the stepping stone.

4.2 Barriers of Collaboration

Communication: Many barriers emerged during the data collection with the study participants. One of the most serious and significant barrier that emerged from the synthesis of the interviewee’s data, is the lack of communication and coordination between the two partners. Industry accuses that often academia neglects the communication part and various projects that are given to the university faculty and students fall short just because nobody takes the complete responsibility of communication. Often coordinating members pass on this responsibility to others at later stage and many projects suffer due to the lack of poor and timely communication. Even projects are supposed to be readjusted, explained, recast or withdrawn due the absence of proper communication channel and lack of clear responsibility.

Trust: Different companies often do not fully trust external entities owing to company’s policies, fear of infringement of patent or intellectual property; whereas the university faculty is more interested in publication of the results. Hence, both of them fail to develop the common trust which hinders the progress of the project and ends up disbanning the projects on trivial issues. Information sharing is vital for R&D project in any company, but access to the hub of information may prove risky since the competitive advantage for the industry is hinged upon it. This concern is central to the lack of trust which ultimately restrains the working relationship between the partners. Industry claims that university faculty and students have nothing to lose if they are working on the projects with the company, but the survival and growth of the company depends on the progression and success of the stipulated projects. Consequently, they are more cautious in giving projects outside the company, and directly hire relevant faculty or students who would be working on those projects.

Time Bound Projects: Companies or firms, that provide academia opportunities to collaborate on their projects, have time bounds from their clients. These deadline driven projects have an element of cost associated with them, therefore the companies are under great pressure to meet the timeline. On the other hand, academic institutions, also, have their own calendars and schedules. This situation is bound to surface incompatibility, arising due to differing time slots, scheduled activities and deadlines; and the two partners face disagreement while deciding milestones towards project completion, and mutual consensus does not arise. In many cases the mutual projects that are undertaken as joint venture by industry and academia are either delayed drastically and or compromised on the deliverables. Hence, timely communication and swift coordination is vital for the survival and completion of those industry projects, a fact which is grossly neglected by the universities.

Desired Technological and Professional Competence: Industry functions inherently to adopt latest technological innovation to become market leaders, and they make conscious attempts to espouse innovative approaches to gain leverage in the market over their competitors. In contrast, universities are not pushed to acquire and or provide latest technology in their syllabi, since they are bound to teach a specific
syllabi which is controlled by statutory bodies. This basic difference in the core functioning between industry and academic circles is another reason for this technological incompatibility. Further the students who fuse their technological competency with the industry lack in high standard professional skills and demonstrate poor managerial skills that create an undesirable situation for the industry. In contrast to the developed countries, in Pakistan the flow of technological innovation is not from academia to industry rather from industry to academia. When academia does bring technological innovation and competency, then industry is rather reluctant to take risk through collaborative efforts, instead they minimize their risk through direct hiring of people having foreign qualification and exposure.

Rights and Obligations: The collaboration between the two parties is often documented through MoU (Memorandum of Understanding), which is signed by both the parties. These MoUs, although provide the basic terms of reference to work collaboratively, are deliberately kept risk free without imposing any restrictions on any party. Thus, from the very outset of the project both partners are loosely bounded despite a formal agreement. When the agreement has very little legal value due to the value due to the absence of any obligation, both parties are free to neglect, disobey, or discard altogether this agreement at any point of time.

Financial Obligations and Dispute: Different agreements that are worked out between industry and university are based upon non-monitory, knowledge-sharing, and skill-learning aspects. Industry desires a low-cost solution of the problem; while academia desires an exposure for their students in the industry with the expectation of exploring future job-market. This agreement, at the faculty level, might also have a low financial obligation. Thus, owing to a low financial obligation for the two parties in an agreement, initially losing interest, and later evading from this contract in case of any dispute is relatively easier. This low financial commitment also poses a huge barrier in taking this initiative seriously at both ends.

4.3 Overcoming and Reducing the Barriers

A major aspect of this research is to identify the ways that can help in removing the barriers that hamper academia-industry collaboration. Experts from both the camps have provided insightful suggestions for reducing and overcoming these hindrances, in order to create new relationships or strengthen the existing ones, to address concerns and reduce distrust, and to provide an overarching solution for bridging the divide. The data collection process not only aimed at extracting information regarding the hindrances faced in the collaboration, rather the participants were probed to share their ideas regarding the role they can play in order to overcome these barriers. The Table 1 outlines the major barriers that are indicated by the study participants and the roles that they feel academia and industry can play in order to surmount these obstructions for a beneficial and meaningful collaboration.

The study is primarily using SWOT analysis as a technique for understanding the dynamics of the academia-industry collaboration. The data collected regarding recognition of the perceived strengths, weaknesses, opportunities, and threats are summarized in Table 2. The information represents the prevailing perceptions and a validation across participants representing the other partner in this alliance.

The final phase of this study was to consolidate the data around a framework which helps different members involved in this partnership by providing a holistic understanding of the existing scenario and guiding them on the way forward. This framework is referred to as the SWOT Strategies Matrix and is delineated in Table 3.

4.4 Success Factors

The factors that are crucial in making the proposed SWOT Strategies Matrix to function successfully are:

- Well-organized collaborative projects, research and incubation centers, with complete documentation and project planning under the established and shared framework of mechanism based on mutual trust and understanding.
- Allocation of required physical, human, and intellectual resources from all the partners i.e. industry and academia with a strong commitment to succeed.
- Identifying the potential threats, risks involved, perceive hurdles; and plan to mitigate the risks, alleviate the threats, and remove the hurdles.
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**TABLE 1. ROLE OF ACADEMIA AND INDUSTRY IN OVERCOMING THE BARRIERS**

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<tr>
<th>Barrier</th>
<th>Role of Academia</th>
<th>Role of Industry</th>
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<tbody>
<tr>
<td>Two way communication</td>
<td>Establish a dedicated office with competent personnel having experience to liaise with industry and well versed with diverse nature of industrial requirements. Develop calendar for annual planning, have active monitoring and evaluation system to boost the activities.</td>
<td>Appoint a spokesperson to connect with academia and create vibrant relationship. Visit different universities, and invite academic personnel to industry for creating active linkages. Keep periodic meetings and invite many university personnel together to create competing environment.</td>
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<tr>
<td>Trust between industry and academia</td>
<td>Start with small projects and trainings and build the trust so that industry can rely and look forward for larger ventures. Show the commitment and dedications through completion of the projects promised as per timeline. Listen actively, and accommodate the possible requirements of industry over the period of time.</td>
<td>Provide a test bed to understand the capabilities and shake hand for technical guidance by making technical guidance committees. Keep initial resources and information sharing low, and gradually increase to as project progressing. Keep short deadlines and achievable mile stones to begin the process.</td>
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<tr>
<td>Long term orientation</td>
<td>Orient the industry regarding the resources, capabilities, technological and otherwise expertise to orient them and prepare them fully to understand where university cannot provide the support. Agree upon time bound projects and fulfill the commitment through dedicated staff and committees to show the periodic progress reports. In case of hurdles and facing other problems immediately communicate to complete the time bound projects.</td>
<td>Orient the university experts regarding the technological and other aspects for complete and comprehensive awareness. Keep several sessions to orient before starting any venture by clearly assessing the potential and do-ability of the project. Create a long term vision instead of short-term project and an environment of mistrust.</td>
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<tr>
<td>Technological and professional competence</td>
<td>Universities can provide the human resource with optimal blend of required technological and professional expertise and competence for the project to sign, and in case of lack or absence of the required expertise may provide the training to the existing personnel for the best fit to the project to ensure the success and timely completion.</td>
<td>Industry may gauge and test the required potential before entering into the venture and extend a helping hand and provide the orientation to the necessary technical assistance to bring the professionals at par and as per the immediate requirement of project in hand. Sessions can be arranged by both the parties to orient and well-versed themselves to the acute technological requirements.</td>
</tr>
<tr>
<td>Rights, obligations and expectation</td>
<td>All projects must be documented with details of scope, limitations, roles, responsibilities, rights, obligations, expectations, assumptions, and risks involved in the agreements undertaken between universities and industry. University must ensure to record all minutes of every meeting, and chart the progress of all steps taken, and share it will all stake holders periodically.</td>
<td>Industry nominee and spokesperson go through all documentation takes place between the two parties and must try to provide the details of requirements as much as possible to avoid any confusion. Identify potential threats and provide the possible solutions to mitigate the threats. Develop a working framework to make things as transparent as possible.</td>
</tr>
<tr>
<td>Financial obligations and dispute</td>
<td>Financial obligations must be documented separately, with all possible details. Involve finance department and experts from the university; and one independent finance expert outside the university should review documents. Try to keep things clear but flexible to operate under certain legal conditions. Possible points of dispute should be shared and openly communicated across the board.</td>
<td>Financial details should be discussed, communicated, and understood by avoiding technical and legal jargon. There should be wrap up plan in case of any financial dispute between the parties. Finance and legal departments or nominee should explain the consequence of breakdown at each stage to take into confidence the other party and voice out concerns openly.</td>
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### TABLE 2. SWOT ANALYSIS

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<th>Strengths</th>
<th>Weaknesses</th>
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<td>Universities have the acumen and potential to collaborate with the industry</td>
<td>Universities are deficient in taking initiatives and responding to the needs of the industry.</td>
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<tr>
<td>Many ideas are already pitched off and universities are linking these ideas through incubators</td>
<td>Top management commitment at university level is weak and lacks clear policies to promote the linkages.</td>
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<td>Baseline work has already been started in various public and private universities to explore opportunities and strengthen the relationships</td>
<td>Absence of formal mechanism between industry and academia is creating the hurdle to strengthen the partnership.</td>
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<td>HEC is promoting the need, providing the shared framework, enhancing the capabilities through funding and trainings</td>
<td>The role of HEC is not clear, precise, and stable, over the period, hence hindering the ongoing progress.</td>
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<tr>
<td>Industry has the potential to absorb the initiative and lend the support</td>
<td>Industry is resistant to adopt new technology on experimental basis.</td>
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<tr>
<th>Opportunities</th>
<th>Threats</th>
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<tr>
<td>Industry requires technical manpower and expertise to grow faster and compete with the rest of the world</td>
<td>Communication gap exists between the university and industry at different levels.</td>
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<tr>
<td>Both industry and academia are feeling the need of collaboration and partnership to create win-win situation</td>
<td>The element of trust is missing among the stakeholder viz. academia and industry.</td>
</tr>
<tr>
<td>Competitive environment is pushing both partners to pursue new avenues</td>
<td>Changing landscape of technology and innovation is threatening the relationship among the partners.</td>
</tr>
<tr>
<td>Fresh graduates inducted in the industry and alumni having strong relations with their universities can bridge the widening gap</td>
<td>Socio-economic swirl is creating a resistant environment.</td>
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5. CONCLUSION

This research study is carried out to conduct SWOT analysis for collaborative strategies among Engineering universities and industry in Pakistan. It encompasses the investigation of the shared concept of collaboration among these stake holders; and delineates the barriers to collaborate between the two strategic partners. The results of the study propose that university-industry duo needs to understand shared concept of collaboration in their respective domains and to develop a platform and process to achieve this purpose. The barriers outlined by the study are – communication and mutual trust among the partners, time bounded activities, cognizance with technological and professional competencies, and rights and obligations of the partners involved in meaningful relationship. It has further identified the roles of both the partners to reduce the obstacles between them through various mechanisms of transfer of knowledge and innovation. In addition the study divulges that despite an absence of proper initiative, complete trust, and top management commitment among the partners, a possibility exists to tap this relationship through well thought policy framework and strategic alliance. The SWOT analysis, performed in this study, has provided the strengths, weaknesses, opportunities, and threats for this partnership; and strategic matrix offers consequential suggestions to tap the opportunities by creating a formal mechanism to harness the competing environment. During the study both academia and industry representatives have demonstrated keen interest in establishing a formal and dynamic collaboration and are convinced to the mutual benefits of initiating and sustaining such linkages. It is suggested that identification and nomination of champions in both universities and industry may pave the way to create the synergy among industry and academia.

ACKNOWLEDGEMENTS

The authors are sincerely thankful to various academicians and industry experts who voluntarily participated in this study and provided us their valuable insights and suggestions in creating intellectual rigor. Authors also would like to thank the Editorial Board, Mehran University Research Journal of Engineering and Technology and review panel experts for their pain-staking efforts to bring clarity, coherence, and concreteness in the manuscript.

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