

## Bridging the gap between higher education and the Telecommunications Engineering Sector\*

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**Abstract:** In this paper, the growth of the telecommunication sector in Pakistan and consequent development in the related professional education is studied. The widening gap between the telecommunication industry and associated education sector is identified. The higher educational programs in Pakistan have grown very rapidly to meet the needs of the explosive growth in the telecommunications' engineering sector but this growth is not in synchronization with the requirements of the industry due to non-existence of collaboration and co-operation between the two. The professional education in telecommunication in Pakistan and the higher educational degree programs are very precisely focused on producing quality graduates with refined technical and mathematical skills. While the telecom sector in Pakistan is in principle a service provider and a consumer market that mainly requires engineers for operation and maintenance related activities. As such the skills imparted by the education sector are rarely utilized, which results in dissatisfaction among the telecommunications' engineers. A survey of both the telecommunication sector and the academia has been conducted along with detailed discussions to explore the reasons for this ever-increasing gap, ways and means to arrest this trend and future course of action for the academia and the telecom sector to develop. A study related to other emerging technical fields like computer science has also been made for the comparison. On the basis of this extensive exercise outlined above, measures have been suggested to bridge the gap between the education and the industrial needs of the telecom sector. By adopting these measures not only our education sector will become more beneficial to the industry, but the industry would also get the advantage of immense potential of young graduates and the academic research.

**Key words:** telecommunication engineering education in Pakistan; higher education; university-industry co-operation

### 1. Problem definition and elaboration

The higher educational programs in Pakistan have grown very rapidly to meet the needs of the explosive growth in the telecommunications industry, due to the recent encouraging policies of the HEC, the gap between the requirements of the telecom engineering sector and the courses taught at the institutes of higher learning has been widening. In recent times, a lot of emphasis has been placed on developing higher education in emerging technologies in Pakistan by providing more facilities in various institutes, developing scholarships and

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encouraging research activities in the local universities by providing research grants. The telecom sector in Pakistan has also witnessed an unprecedented growth in the last few years, however, in principle, the telecom sector within Pakistan remains a service provider and a consumer market. We have hardly made any progress towards establishing any manufacturing unit what to say of product development and research in the telecommunications' engineering sector. The higher educational degree programs are very precisely focused on producing quality graduates who have highly refined technical skills. Unfortunately, those skills rarely get utilized in an industry that mainly requires engineers for operation and maintenance related activities. These conflicting interests of academia and the industry are forcing them to diverge needs and not facilitate a university/industry liaison process. This article surveys this widening gap and suggests ways and means to bridge this ever-increasing gap.

A comparison with the computer science higher education and industry clearly reveals that highly trained computer scientists remain in demand in the industry at all times, and the education imparted at the quality computer science institutes is pretty much in line with the requirements of the industry. Also, a strong liaison is maintained between some academia and the industry. The outsourcing of new application development and related research issues to the universities is also actively undertaken. Unfortunately, contrary to this, the telecom sector is in principle more in the need of degree holders who have a strong basic know-how of the latest telecom technologies, but rarely requires the properly qualified mathematical communications' engineers that the universities are trying to produce. This trend if not checked and modified, would take the telecom education and industry further away, which would not benefit either of the two.

The main reasons behind the current disparity between the universities and the industry is that the universities are generally governed by foreign qualified faculty, who have all done their research and development work in the Western developed countries where the research problems originated often by industrial developmental needs. Such non-existent needs within the telecom sector in Pakistan are creating islands where the universities are trying their best to prepare engineers and professionals for an R & D based environment and in actual practice, these well-educated and well-versed students loose interest in the mathematical rigor of these advanced university courses, due to their non-applicability in the practical fields. They often request to revise the course contents to make them more relevant to the local industrial needs. The requirements of the industry are generally technology oriented. By introducing such changes in the curricula, the engineering degree program would change to a technology program. Having identified the bridge, in this article, methods are suggested to help bridge this gap. These proposed solutions are based on an extensive survey of the telecom sector and in-depth discussions with the telecom sector professionals, and academic professors. The primary contribution of this work is towards the identification of a very relevant issue within the higher education sector in Pakistan and towards providing a generic framework for improving the university-industry liaison within the telecommunications' engineering sector.

The paper provides in the next section, compiled results from a survey conducted among the managers and high ranking officers in the telecom engineering sector thus providing the perspective of the industrial spearheads. The view of the academics which has evolved through many elaborate discussions is summarized in the next section and the final section provides recommendations and suggestions of the authors to arrest the trend of the telecommunication engineering education and industrial sectors following different paths of evolution towards a diverging future. These suggestions aim at bringing the practice and teaching closer together for an enhanced and sustainable development of the telecommunication engineering within Pakistan.

## 2. Survey of managers at major telecommunications' engineering organizations

The recent government policies towards the liberalization of the telecom sector in Pakistan has given rise to new challenges and issues (Muhammad Hanif Akhtar & Humaira Waqar, 2004), which also require the future telecom engineers and practitioners to be conversant to adapt to these changes and remain productive in the highly competitive evolving telecom sector. The telecom sector however is still to discover and find ways by which research and development become integral parts of the expanding telecom companies. This required the authors to seek the opinion of the major players within the telecom sector in Pakistan, and their opinions and views about the evolving higher educational degree programs in telecommunications' engineering.

A thorough survey was conducted of the Telecommunication Engineering Sector by distributing a well thought of and well prepared questionnaire entitled "survey form to find the match in the industry and the education sector". This survey questioned the top experts and managers of the telecommunications organizations about their feeling and experience about finding the skill set required at the jobs among the graduating engineers. The survey also specifically questioned the skill set lacking among the engineers which is a necessity at their jobs. Furthermore, the survey tried to find the opinion of these well versed professionals towards the efforts that were required at the universities to provide the industry with the engineers that become successful at the organizations and benefit these organizations in order to grow and expand their businesses.

The survey results in principle emphasize that the engineers hired for operations and maintenance related tasks at the telecom organizations often feel that they are not able to utilize their technical expertise at their job requirements. The organizations hire the engineers for jobs which could be fulfilled by less qualified people in the hope that since the engineers have a tendency to self-learning and progress, they would help the organizations grow. Many high ranking experts at these telecom sector organizations argue that actually those who are able to grow towards the top executive positions within these organizations are the engineers who are able to understand finance and management, human resource planning, and budgeting, and are exceptionally good at handling pressure situations and at their presentation skills. Thus, basically these organizations provide a career track enhancement to those engineers who either self-learning the management skills and/or help their career progress by supplementing their engineer qualifications with a degree in management sciences.

More specifically towards the courses being taught in the Telecom Engineering Institutes of higher learning, the field experts seem to agree that these courses do provide good basics but the engineers often need to update their knowledge and skill set at their jobs. Here, the industry also seems reluctant in providing good on job training for their fresh hiring as they appear to consider such trainings as additional expenses. However, this need to be understood by the good organizations that human resource development remains a task which needs the support of the telecom sector besides, the educational institutions. The existing corporate culture within the telecom sector requires the engineers to have highly refined presentation and time management skills. Though, these skills vary among individuals and are often a personal trait but often among the engineer degree programs such skills seldom get developed. It is imperative to mention here that many telecom engineering degree programs now include courses like "technical report writing", "English language proficiency" and "engineering management" where an effort is made to improve the soft and management skills among the graduating engineers. The experts within the telecom industry emphasize that the jobs in their organizations do require non-technical skills like conflict resolution, public relations (including correspondence with clients and international vendors), team building and handling operations and maintenance related time lines (which are often stressful). The

commissioning that remains a major task among many telecom operators is often a time constrained tasks as well, and requires the Engineers either to be highly refined managers or to spend many extra hours at work. All in all, the telecom sector in general, requires diversified and easily manageable personalities amongst the engineers, which is actually in conflict with the real training, these engineers acquire during their degree programs. The academic degrees try to prepare them in principle as design engineers and develop their mathematical and design skills, which often remain under utilized in the telecom sector. On this the experts, in the telecom industry, argue that since the telecom sector is in principle a consumer market, we have few and limited possibilities of providing jobs where the design skills could be utilized. It's important to mention here that there do exist some organizations within Pakistan, which are purely research and development based organizations and are actually working hard towards product development and providing local low cost solutions to the telecom industry and these organizations do actually require highly refined design engineers, but these organizations are very limited, and the opportunities they provide are few and far apart.

### **3. Academic perspective towards higher education in telecommunications' engineering**

The rapid progress in electrical engineering field of studies in general and telecommunications engineering in particular, calls for a rapid and unremitting change in the curriculum requirements for these degree programs. Many educationists argue that we should not respond aggressively and rather focus on the fundamentals which will serve the students well for an entire career (Lee E. A. & Masserchmitts D. G., 1998).

Many of the well versed academic professors believe that creative education is the foundation on enlightenment (Herani Gobind M. & Lodhi Saeed A. K, 2008) and engineers and technologists who can formulate solutions to the engineering problems are a dire need of the day. The educators further add the importance of innovation and agree that one must possess comprehensive knowledge and competence in the current sophisticated and competitive world of engineering which keeps evolving. Many educators agree that their task lies in providing the correct fundamentals for their students which serve the students over an entire length of their career and since the technologies keep evolving, the graduates need to have the capacity to self-learn the evolving technologies as they progress in their career paths. The professors always stress the need to maintain an undergraduate degree program which allows the telecommunications' engineers to pursue higher education at the advanced western countries and prepare engineers who can adapt and work not only in the service provisioning telecom sector but also in the design offices and the R & D wings of multinationals. The academics also argue that since human learning varies from person-to-person, the universities should keep trying to produce quality graduates of international standard and they may adapt to their circumstances and company requirements. Often also, many young academics are trying hard to build small research groups within their universities which can generate relevant research; they emphasize the need of mathematical sophistication among their students. However, there actually exists a big conflict of interest in terms of the academics and the industry in terms of the result that needs to be extracted out of these research teams. Whereas, the academics aims at enhancing their own careers, so they are always looking for ways and means to do research which can get an international acceptability and since such research is mostly on the cutting edge of technologies it is not of much benefit to the local telecom industry. As emphasized earlier, the local telecom sector remains a consumer market and there is no focus on product development or research, so the academics do not find benefits in collaborating with the industry as it cannot provide the kinds of problems on which internationally acceptable research can be undertaken. This

conflict has actually been created by the recent policies of the Higher Education Commission of Pakistan which has been stressing research contributions to international journals and conferences, and such papers are becoming the need for progress in academic careers. Whereas, we are not trying to undermine the need for such research, we would like to re-iterate that the committees that review academics should not try to use the same yardstick to evaluate chemists, mathematicians and telecom engineers, because if this trend continues, it would not have any long-term impact on the development of the local telecom industry. Those academics, which under-take small projects which are relevant to the local industrial needs, even if they do not generate “research papers”, they should be given due appreciation when their positions (or tenures) are being reviewed.

Further, almost all academics agree that efficient educational institutes contribute to the economy of a country by producing graduates who have learned analytical skills and have the capacity to think and innovate for their organization in a manner that makes them “economically productive” and can thus add value to their organization.

#### **4. Recommendations and possible solutions towards bridging the gap**

Whereas the higher education sector within telecommunication engineering has seen a rapid growth in recent years (thanks to the private sector universities and the aggressive promotion of ICT related technologies by the government), these educational degree programs are being developed on the western model of university degrees in telecom engineering. Most of the faculty involved in curriculum development as well as the regulators of such activities (the HEC and the PEC) are governed by these foreign qualified decision makers. Blindly following the western models cannot be an acceptable approach in the long run in our local settings. As this would very severely widen the gap between the requirements of the telecom related industry and the graduating students, and when these technically trained graduates do not find job opportunities which match their skill set, they would start getting frustrated and thus, their potential would go wasted.

It might even become a reality in a few years where a masters in “management in telecommunication engineering” might become a viable degree program within Pakistan since the telecom sector within Pakistan is more in the need of entrepreneurs who understand corporate finance, organizational behaviors and human resource management instead of purely technical people with a strong mathematical background. We would in the long run either need to tune the bachelors and masters programs in telecommunication engineering to provide more space for management related courses and reduce the number of technical courses or start parallel programs like the one mentioned above which would try to train “leaders for telecom sector”.

The telecom industry in Pakistan also needs to realize that having deployed the networks now, they do need efforts to generate local solutions to their problems, and reduce their dependencies on the vendors. Since the vendors would always provide very high cost solutions, and if these solutions are locally tackled, they would reduce these costs tremendously and since the development of these solutions would require highly refined technical skills. These small solution providing groups within the telecom operators would give a valuable chance to the highly technical engineers to practice their scientific abilities and utilize the knowledge they acquired in their professional education. Thus, in principle, there are efforts required from both ends to bridge the gap and the academics need to understand the requirements of the industry and tune their courses to match the local needs, and the industry also needs to put in some effort to develop small research and development groups within their organizations to tap the full potential of the best technical minds among the graduating engineers. This would also

help reduce the brain drain of the best minds from Pakistan.

Among the various ways towards closing the gap are steps in developing University-Industry Liaison offices within the telecommunications' engineering departments of higher learning. These offices should proactively participate in the industrial needs and try to align their undergraduate and graduate programs according to those needs. The university requires to upgrade and update their curriculum on a continuous basis, introducing "elective specialized courses" in their degree programs which are relevant to the needs of the local telecom sector. Courses need be continuously re-designed and revised in a very intelligent manner so as to integrate the latest technologies and trends relevant to the basics of those courses in particular relevance to the needs of the expanding telecom sector. The universities also need to invite senior people from the industry to teach some elective specialized courses or at least provide short seminars or workshop talks for the benefit of the students. For their long-term sustainability, the universities should form small research groups headed by senior academics which try to facilitate the research and development needs of the local telecom industry and interact with the industry on a regular basis. To cater the needs of the telecom sector in a way to keep pace with international developments, it requires both the top level academic community and the industrial spear-heads within the telecom sector to do some visionary thinking and planning which is beyond their day-to-day management tasks in order to bring them together. This approach would be highly beneficial for both and will provide low-cost solutions to the developing needs of the telecom sector.

There is also a dire need for the higher education in telecommunications' engineering to evolve in a manner that benefits both the graduating students and the telecomm engineering industry. Whereas, the current industry is in principle concentrating on "service provision", highly skilled graduates who have the capacity to think and innovate (when having acquired a place of respectable stability within their organization) can start some preliminary research and development units within their organizations. Such units can collaborate with research groups at the institutes of higher learning and can thus together contribute to the "knowledge based economy". We conclude by emphasizing that the islands being created within the education and the practice of telecommunication engineering would not serve the purpose towards the economic development and sustained growth unless all those who matter start thinking over the current state of affairs and create an environment of co-operation and mutual benefit.

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