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STRATEGIC POLICY INTERVENTIONS FOR ENHANCING THE FUTURE OF ENGINEERING GRADUATES IN PAKISTAN

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ABSTRACT

Immediate action is needed in the engineering industry of Pakistan. Every year, there are more than twenty-five thousand graduates in engineering fields getting ready to take up employment. There is an ever-growing problem of mismatch between the rapid advancements in technology, the skills of these graduates, and the current job market. This research aims to understand the reason behind the gaps and offer solution policies to strategically guide graduates towards meeting the global expectations for the Engineering fields. Pakistan's engineering education is evaluated in this research using a comprehensive mixed-methods approach that focuses on a broad range of data sources. It includes newly collected data from employer and graduate questionnaires, as well as expert interviews, policy document reviews from the HEC, PEC, NAVTTC, TEVTA, and other relevant institutions. The analysis suggests that the major engineering education problems include obsolete syllabi and insufficient hands-on learning, inadequate soft skills, weak relationships between industries and universities, minimal research and development, and inequality regarding access to quality engineering education. Policy documents provided by HEC and PEC try to resolve these challenges by using the Outcome Based Education (OBE) model and by employing various accreditation systems. Completion in particular as the study highlights is a problem when it comes to implementation, evaluation, and monitoring is weak and poorly constructed. Furthermore, the gap between the policymakers, academic world, and industries has been a hurdle for any real development. The value of international case studies especially Germany, India, and China vis-a-vis vocational training, private sector participation and regulatory scrutiny stand out in context to Pakistan. This study concludes that, within the proper context of educational infrastructure, engineering skills and job opportunities, graduates in Pakistan can significantly contribute to its development. The accompanying policies and guidelines with this document serve as an initial guide to suggest appropriate solutions for educational policymakers, institutional leaders, and business leaders regarding the outbound mobility phenomenon in Pakistan's engineering education system.

Keywords: *Innovation, Development, Engineering, Policy, Academic, Challenges, Graduates, Education.*

INTRODUCTION

The education pillar helps a nation grow and advance in different ways, including industrially, technologically, and infrastructurally. With the rise of engineering institutions in the last twenty years, Pakistan has seen a notable surge in the number of students enrolling in engineering courses. This

shows how the country is trying to utilize engineering for improving its economy and modernization. But, there still seems to be lack of balance between the growing numbers of educational institutions offering engineering and the skill set that is taught and needed by the graduates, which is worrying. Every year, there is an influx of new engineering graduates looking for jobs, but struggling to find jobs in their field or getting stuck in dead-end alternatives that pay less than what they deserve. This highlights the reality of having qualified professionals paired up with controlled educational training systems combined with an outdated workforce system. There is the problem of having an excess number of graduates needing employment as well as the nature and standard of education they acquire. Most engineering courses have archaic, oversimplified, impractical curricula with derivations lacking relevant application to indusry. Engineering students' direct contact with actual engineering challenges is limited, and the teaching of essential soft skills, which include interactions like communication, teamwork, flexibility, and creativity, is usually absent. In addition, the absence of partnerships between universities and industry restricts possibilities for nurturing creativity, innovation, and even practical work experiences like internships. There is an attempt to rationalize these practices with PEC and HEC policies like OBE (Outcome Based Education) and accreditation policies, but implementation is lacking, and there is still no measurable change in the employment opportunities for graduates on a national scale.

This disconnect poses a serious threat to Pakistan's aspirations for economic development and self-sufficiency. The country is at an important turning point: it has a demographic opportunity in the form of a youthful population that can be harnessed only through the transformation of human capital into a productive workforce. As the world shifts towards knowledge-driven economies tied to the Fourth Industrial Revolution, the functions of engineers have become more multifaceted and require specialization in newer fields such as artificial intelligence, data science, renewables, smart infrastructure, and automation. Unfortunately, Pakistan's engineering education system does not seem ready to address this problem. This gap has consequences that go beyond the scope of private employment opportunities. The inability of engineering graduates to secure productive employment severely limits the industrial value of educational resources, the economic potential of the nation, and the innovative capacity of its citizens(Ahmed, Urooj & Hassan, Mohammad & bano, rafia & Ahmed, Rukhsar. (2024). Moreover, unequal access to quality engineering education with regional education gaps, gender disparities in STEM subjects, and the absence of insufficient representation all contribute to deepen the already complex problem. The purpose of this research is to analyze these issues deeply and formulate coherent policies that deal with the system's underlying problems leading to the graduate's lack of performance in the engineering field. Considering the current policies, this vision for reform incorporates scholarly, industrial, and graduate insights. Addressing these issues goes beyond facilitating improved personal employment prospects; it is vital tohelp Pakistan enhance its standing as a major competitor in the technological domain. With the right set of policies, it is possible to synchronize engineering education with national developmental objectives, improve strategic policies to be more competitive in the job market, and transform engineering from a mere profession in Pakistan into a cornerstone of national advancement.

LITERATURE REVIEW

Debates on the gap left by the inapplicability of engineering education to exercises of employment has been described in almost every nook and cranny of the academic world both at the local and global levels. Various studies have noted in detail how crucial the impact of engineering graduates is towards the development of a country, particularly with respect to the innovation, industrialisation and technological self- reliance of the country. In Pakistan, the literature indicates growing worries about the current systems of engineering education and the lack of services being offered to students in the context of an evolving and highly competitive global market. Adoption of successful models of engineering education around the world has undergone a strong linkage with industry practise, updating of curricula, active learning and a strong focus on research and innovation. For example, Germany's dual system of vocational and academic training has been noted widely for providing holistic training to enable engineering graduates with the application of theory and practice in real life scenarios. Also, some other countries like South

Korea and Singapore have state driven reforms that ensure that postsecondary education is closely integrated with national industrial policies and that graduates are actually useful, armed with necessary skills. UNESCO (2018) notes that this is important for countries wanting to engage meaningfully in the Fourth Industrial Revolution. On the other hand, engineering education in Pakistan is still impacted by older models of teaching. Ahmed et al. (2021) and Malik & Hussain (2019) show that the engineering curriculum in most of the Pakistani instituties is infoharmonious with the rapid pace of technology. This gap creates a huge deficit of equality between the skills of graduates and the availble jobs in the indudstry. Even though the Higher Education Commission (HEC) and Pakistan Engineering Council (PEC) have made attempts to implement Outcome-Based Education (OBE) and the uniform system of accreditation criteria, the progress has been very sluggish and inconsistent across many institutions. Aslam (2020) researched this and emphasizes the lack of technical abilities that these engineering students possess. Due to absence of modern and advanced laboratories, industry funded reserach and well coordinated internship programs, most of the universities do not teach skills that are required outside the classroom. Qureshi and Farooq (2022) have also highlighted other fields that BASIC fail to address and in this case that include communication and collaboration, leadership and flexibility, as equally as important for engineers as any other technical aspect.

Weak collaboration between academia and industry in Pakistan is a recurrent theme in literature. In managed isolation, the World Bank Report (2020) indicates that most engineering universities in Pakistan are Islands unto themselves. There is practically no industrial participation in the development of curricula, and in turn, universities do not address industrial problems. There is very little exchange of documents and students are not exposed to real engineering problems and industrial machinery, which stunts their understanding of technology. In addition to academic and infrastructural elements, there exist a plethora of socio-economic constraints impacting the prospects of engineering graduates in Pakistan. A report from Pakistan Institute of Development Economics (PIDE, 2021) depicts regional inequalities in the availability of resources, such as education, with pupils hailing from rural regions unable to access quality teachers, sophisticated laboratories, and professional mentorship. There is marked disparity in gender also; although the number of women enrolling into engineering courses is on the rise, such women face enormous social and organizational hurdles to practice engineering as a career. Another dimension covered in the literature refers to the slow culture of innovation and entrepreneurship among engineering graduates. Khan et al. (2018) mentions that very few universities in Pakistan provide incubation centers or startup assistance, and the engineering syllabus rarely promotes an entrepreneurial culture. This differs significantly from models in India and Malaysia, where there is increasing (through university–industry linkage) graduate employment stimulus engagement with the entrepreneurial ecosystem by systems in government funded initiatives. At the policy level, some strides have been made to respond to such issues. The document HEC Vision 2025 poses measures to enhance higher education quality by focusing on faculty recruitment and development, supporting research activities, and overhauling the curriculum. The NAVTTC and TEVTA have also introduced some employability skills training programs aimed at addressing the skill gaps. However, there is literature that suggests these initiatives often operate in isolation and are not strategically integrated with the core concepts of engineering education(Noor, Umar Ahmad & Ahmad, Iftikhar. (2024).

To summarize, the literature indicates that there are multiple academic, institutional, and systemic barriers to the professional development of engineering graduates in Pakistan. Even though some policy documents and pilot programs provide reforms, a comprehensive strategy is still absent. Many scholars believe that without purposeful strategic policies, Pakistan stands to squander a significant amount of its engineering human resources and engineering competencies, falling behind in the global markets. This literature review builds a case for conducting research designed to address the gap between adduced evidence and the actionable policies needed to address the challenges. The study aims to formulate strategic solutions that modify successful models from other countries for the unique socioeconomic conditions of Pakistan, particularly to revolutionize the prospects of engineering graduates in the country.

METHODOLOGY

This study will try to look at the gaps in the

engineering education ecosystem in Pakistan as well as seek input from practitioners, policymakers, and stakeholders in academia using a **mixed methods approach**. This approach uses qualitative and quantitative research techniques all at once. It focuses in carrying out an in-depth examination of challenges encountered by engineering graduates in Pakistan and attempts to formulate appropriate strategic policy solutions.

1. *Research Design*

The research design is a combination of exploratory and descriptive as it seeks to look into the existing gaps while figuring out what policy interventions are required to bring about positive change. Employing the mixed-methods technique is also helpful in data validation which further strengthens the findings of this study by comparing what different sources have relayed.

2. *Data Collection Methods*

2.1 Primary Data Collection

Surveys: Questionnaires were designed and given to a sample of 200 recently graduated engineers from several private and public universities across Pakistan. The survey aimed to achieve specific objectives under the following broad headings:

Quality of engineering education received in the universities

Provision of practical training and internship opportunities

Employability and workplace readiness

The data was analyzed using descriptive and inferential statistics to identify trends and correlations.

Semi-Structured Interviews: For more in-depth understanding, I conducted interviews with 20 stakeholders which included:

- Engineering faculty members along with university deans
- Engineering-related industry and HR personnel
- PEC & HEC & NAVTTC representative

These interviews assessed how current policies are aligned with the education being offered, industry expectations, and the scope for improvement.

Focus Group Discussions (FGDS): Two FGDs were held with students in the final year of their engineering program to gather information about their expectations, prior experiences, and career goals. The discussions were helpful in contextualizing students' perceptions of relevance of the curriculum to skills training and employment opportunities.

2.2 *Secondary Data Collection*

Secondary data were collected through the following means:

- Review of policy documents (HEC, PEC, Vision 2025, NAVTTC, TEVTA)
- Peer-reviewed journals, case study articles, and white papers issued by government institutions
- Benchmarking studies from Germany, India, Malaysia, and South KoreaThe information helped create an overarching policy environment and analyze it comparatively with the most advanced practices from other countries.

3. *Sampling*

In order to interview and survey participants, a purposive sampling strategy was used that targets individuals with specific knowledge and experience. To get students from a variety of geographical areas, engineering graduates from Punjab, Sindh, KP, and Balochistan were included. To form a representative sample of the Educational Ecosystem, interviewees were selected based on their expertise and the institutions they are affiliated with.

4. *Data Analysis*

For each survey, quantitative data such as demographic data was collected and analyzed with SPSS. A mean, standard deviation, and frequency were calculated alongside simple descriptive statistical assessments for monitoring important trends, with cross-tabulation and correlation analysis used to identify relationships between variables such as education and employability. Interviews and FGDs collected qualitative data as well, and the data provided by participants was analyzed using thematic analysis with NVivo as the software tool of choice. Responses were sorted into relevant themes which included the practical aspects of curriculum, collaboration with industry, gaps in policy implementation, and gendered skill sets.

5. *Limitation*

Despite attempting to provide an exhaustive coverage of data, the factors presented some challenges to the study.mApart from the active and passive respondents, the sample population was rather broad, but still did not encompass the experiences from all engineering colleges or

institutions in Pakistan. A few policy makers and businesspeople could not be interviewed which adds a gap to the institutional understanding of the breadth. Findings are subject to continuous change, given the pace of advances in technology and education integration, which renders them as only a temporal representation of reality.

CHALLENGES FACING ENGINEERING GRADUATES IN PAKISTAN

Similar to other nations, graduates of engineering disciplines in Pakistan face various interrelated issues that pose hurdles with respect to converting their educational training to actual employment opportunities. These hurdles stem from deep-rooted systemic and socio-economic issues and persist even after some reforms introduced by PEC and HEC. Here, the most crucial issues are stated and elaborated upon.

1. *Outdated Curriculum and Limited Practical Exposure*

An equally problematic and persistent concern for employing institutions remains the age-old syllabus of engineering subjects taught in several Pakistani universities. Increasingly, practitioners of the engineering profession across the globe the world are shifting to new age technologies like AI, data analytics, green energy, robotics, smart infrastructure, etc. However, these subjects are either absent or inadequately covered
in most engineering programs in Pakistan. In Pakistan, engineering instruction is highly theoretical tending towards rote learning bounded by classroom walls which poses a challenge of applying learned knowledge. Further, laboratory equipment is antiquated, coupled with the absence of emphasis on project work that encourages active learning. This is detrimental in terms of bridging the learning/education of a graduate and the industrial expectations(Ali, Syed. (2021).

2. *Weak Industry-Academia Linkages*

There is a dramatic divide between engineering colleges and the industries in Pakistan. Unlike in developed countries, universities in developed regions work alongside industries to structure curricula, conduct research, and provide internships. Pakistani educational institutions work in isolation. Hence, the industrial skills taught in these institutions are not aligned with the market requirements. There is a lack of industry participation in curriculum development, and university departments do not consult employers for feedback when formulating their programs. This lack of coordination is also responsible for diminished internship and employment opportunities. Most students pursuing engineering degrees lack practical exposure to industrial workings, which strategically disadvantages them in the employment market.

3. *Limited Soft Skills and Professional Development*

Additionally, modern roles in engineering require a candidate to possess technical expertise along with soft skills like communication, leadership, problem-solving, teamwork, and even adaptability. The Pakistani educational engineering system neglects these essential skills. Most students complete the schooling and university programs with inadequate soft skills, which hampers their ability to perform in job interviews, collaborate with colleagues, or take charge in professional roles. In addition, most universities do not offer career counseling or mentorship services. Students lack comprehensive instruction on effectively setting up a career, such as managing a professional resume, strategizing for employment, or navigating the job market. This gap often fosters confusion when transitioning from an academic setting to an actual job(UNESCO, 2021).

4. *Unemployment and Underemployment*

In Pakistan, graduates of engineering programs encounter considerable waiting times before securing job offers. Most surveys of the labor market indicate a considerable number of graduates remain without a job for several months and in some cases even years. Others are forced to settle for positions outside their area of expertise or well below their level of qualifications. This issue is aggravated by the oversupply of graduates compared to the available vacancies in the region's job market. Every year, there is an influx of thousands of engineers into the market, however, the demand for jobs within engineering-heavy industries is not parallel. There has been little job absorption due to the economic downturn, limited industrial investment, and absence of government-sponsored infrastructure projects.

5. *TERABUS – There's a Real Disparity In Institution*

Within Pakistan, one of the most basic issuses of

engineering education is the inconsitency within its infrastructure and programs throughout different regions. The condition is better in urban areas such as Islamabad, Lahore, and Karachi, which possesses older institutes with moderately educated faculty and reasonable standards of middles and/or industry availbility. On the other hand, centers struggle with the more basic qualifiers such as modern resources, competent teachers, and academic facilities. These students face severe deficits including a lack of availabe jobs due to the insufficient quality of education claimed to offered. Additionally, a gap seems to grow within the public and the private sector universities. Some well-known private universities provide up-to-date resources while the vast majority seem to function as money making businesses with unreasonably low stanards for education and employment acceptance(Kash, J.A. & Doany, Fuad & Kuchta, & Nystrom, M.. (2005).

6. *Barriers in Gender Balance Alongside the Profession*

Women reprducation in the workforce has seen increaement within the engineering sector particularly in the field of civil and mechanical engineering, but attitudinal shift does not overlook the easy reach towards equal opportunities. Women within the workarray are stillased off due to their gender and this lacking supportive infrastructure erect barriers first placed into femal engineers. Encouragement to take on field roles is extremely curbed, more so in the civil and electrical sides masculained engineering fields. The engineering profession's visibility and outreach to women is merely symbolic and they are not met with appropriate representation within mentorship structures, leadership frameworks, societies of a technical nature which works against women's influence and presence in the said field(Shoaib, Dr & Ali, Syed & Iqbal, Tabassum & Abdullah, Farooq. (2025).

7. *Lack of Encouragement towards Research and Innovative Activity*

The most important challenge is the very weak the culture of research and innovation in the work of engineering institutions. They give more importance to theoretical instruction in form of memorization, rather than inspiring students to develop their problem-solving skills. Teaching faculty has too much work and too many courses assigned with no motivation to conduct research. As a result, too little is done in the way of advanced research and innovation attempts at engineering laboratories in Pakistan's universities. Furthermore, almost no support is provided which is directed at innovation entrepreneurship at the student's initiativity. There is lack of innovation funds, invention funding, sponsored research by business, and business help. This does not allow most participants in engineering programs to change their positions from job applicants to employers(Asmat, N & Khattak, & Ghulam, Dr & Bhatti, Ghulam & Khan, Ishtiaq. (2025).

8. *Inefficient Policy Execution*

Despite the PEC and HEC, among other bodies, outlining multiple policies to streamline improvements in the education of engineering disciplines, there are marked gaps within the execution phase of said policies throughout the education system. Adopting OBE or Outcome Based Education for all faculties within polytechnics is applied unevenly across institutions and failing to adequately apply the resources, knowledge, or training needed to sustain accreditation guidelines results in a disparity. In the same way, the skill development programs launched by organizations such as NAVTTC and TEVTA are not linked to the core engineering courses and do not connect with the career prospects of the graduates.

ANALYSIS OF EXISTING POLICIES

In Pakistan, the quality of engineering education and the employability of graduates have been relatively low, which has prompted several policies and frameworks during the last two decades. These include the initiatives of HEC, PEC, the Ministry of Education, NAVTTC, and TEVTA at the provincial level. However, regardless of the initiatives taken, the impact has always been limited and uneven. This subsection analyses policies through their strengths, limitations, and gaps in the policy framework.

1. *Higher Education Commission (HEC) Initiatives*

The HEC has been instrumental in developing higher education policy in Pakistan. In its Vision 2025 document, goals such as curriculum integration and revision, enhanced faculty training, increased research productivity, and fostering innovation and entrepreneurship are included. One of the positive milestones of HEC has been the

development of higher education institutions and the tertiary education enrolment in various regions of the nation. Even though HEC has provided guidelines surrounding Outcome-Based Education (OBE), the execution within engineering colleges has been heterogenous. A significant number of universities do not have the knowledge, capacity, and resources to transition from traditional frameworks to an outcome-based teaching model. Moreover, there is very little monitoring or subsequent action from HEC towards ensuring compliance, which leads to reforms being only superficially implemented. Lack of policy focus on the low integration with industry is another critical gap in HEC's policy. While there are some vague goals regarding the heightened focus on employability and research commercialization, the alignment of engineering education to the needs of the labor market does not have a national policy framework dedicated to it. Academic and industrial collaborations continue to be inadequately developed and disjointed with HEC policies(Rafique, Ghulam & Mughari, Shahzeb & Khan, Hina. (2025).

2. *Pakistan Engineering Council (PEC) Regulations*

PEC serves as the national accrediting body for engineering programs, which makes them responsible for the delineation of academic policies and the regulation of engineering practice in Pakistan. PEC has recently placed more focus on engineering education by applying OBE-based criteria for program accreditation to align with the Washington Accord, which Pakistan is a signatory to. In other ways signatory Pakistan in PEC does not serve in the best possible way due to:

- Slow adaptation by institutions, especially public sector universities, due to capacity constraints.- `Inability to collaborate with industry constituents' stakeholders results in a lack of competencies and skill mapping in the area.
- Seldom updates to the curriculum results in an academic output that is not aligned with the technologies of the day: outdated techno academic syphilis.

Even though PEC requires industrial internships for students, these are poorly organized with little supervision or quality assurance. In addition, PEC has put more attention unto compliance and accreditation rather than active policy driving, or proactive support for employment opportunities for the graduates.

3. *NAVTTC - National Vocational and Technical Training Commission*

NAVTTC is responsible for promoting skill development and technical trainings throughout Pakistan. Some initiatives NAVTTC has recently implemented include:

- Hunarmand Pakistan (Skill for All) Program
- National Skills of Youth (NSY) Program
- Collaboration with foreign sponsors to provide short courses and certifications

The aim of these programs is to equip the youth with skills in emerging fields like information technology (IT), mechatronics, and technical services but are often disconnected from the core disciplines in engineering education. These programs are of little value for engineering graduates because NAVTTC is perceived to offer vocational training without any formal academic qualifications. Also, NAVTTC does not provide any career pathing or career nurturing support for engineering graduates. It continues to prioritize blue-collar and semi-skilled occupations and does not strategically intervene in the professional employment policies of technically employed engineers(Haider, Farhan & Siddiqui, Afshan & Ali, Syed. (2023).

4. *Provincial Technical and Vocational Bodies (TEVTA)*

The Technical Education and Vocational Training Authority (TEVTA) in Punjab and similar other provincial bodies have set up skill education programs and technical education arms. These programs, though laudable in theory, are fundamentally flawed because:

- Inadequate national uniformity and coordination with HEC or PEC
- Focus on certificate skills, superfluous to the needs of engineering graduates
- Infrastructural and resource constraints and outdated materials

Apart from these, TEVTA's support toward engineering graduates has been virtually non-existent considering TEVTA's mandate concentrates on sub-degree level training.

5. *Innovation Policies in Youth Employment*

The country of Pakistan has also taken a step further by establishing additional policies focusing on the enhancement of entrepreneurship and employment of the youth. Some of the policies include,

- Startup Pakistan
- National Innovation Strategy
- Prime Minister's Youth Programme

Such policies assist in the formation of new businesses and aid in the sustenance of already existing youth enterprises. With some engineering students garnering aid from the incubation centers and participation in different competitions, these programs have started to take off on a small scale. On a larger scale, however, these initiatives are neither sustainable nor are they able to scale up. The bulk of the existing aid is focused towards metropolitan regions, and there is a huge lack of tutoring and advertising around these programs which makes large numbers of students unable to make use of the frameworks provided. Additionally, these policies are bound to fail because of limitations within the organizational structure of the country which includes but is not limited to: bureaucratic slow lanes, inadequate amount of initial funding, and insufficient layers of other businesses that have already been established.

6. *Gaps and Overlaps in Policy Landscape*

Even though multiple institutions and policies focus on enhancing the outcomes for graduates, the system is still facing challenges.Vertical and horizontal gaps in policies, leading to fragmentation and duplication of efforts across HEC, PEC, NAVTTC, and provincial departments with minimal internal communication. Unavailability of a national policy concerning engineering education. Policies on curricula, skills, training, industry partnerships, and employment information systems are not integrated with engineering education. Insufficient evaluation of the effectiveness of the existing policies and strategies to understand what is being done in the system. Absence of a systematic approach from industry steer the education triad or provide organized guidance and practical training placement schemes.

Strategic Policy Interventions

In order to improve the situation for engineering graduates in Pakistan, employable skills should be developed through comprehensive and precise policy interventions. Bridging the divide between academic preparation and industry application, enhancing the quality of engineering education, and cultivating the potential of graduates are steps previously taken, but real change requires attention to be directed at developing economic prospects both regionally and globally. The need that stands out the most is the upgrading of the engineering syllabus. For the time being, the engineering programs in Pakistan are offered with a curriculum framework based on a syllabus of bygone eras. Routinely updating curriculum in collaboration with industry and employers requires effort on the national level. The curriculum should also encompass advanced AI, Renewable Energy, Robotics, smart infrastructure and much more. Furthermore, the pedagogy of engineering disciplines should also include managerial and interpersonal skills in addition to the technical aspects which are equally important in the modern professional society.

While implementing curricular changes, it is equally important to focus on the relationship of academia with industry. Private sector firms should be on a first name basis with the engineering institutions, and partnerships should be strengthened to ensure that the skills being taught are relevant. Professionals from industry should actively participate in the creation of the learning materials, from designing curricula to guest lectures, even down to the research projects done. In addition to that, the creation of basic quality monitored internship programs is needed to provide students with handled exposure during the course to prepare them for the world outside of books. These compulsory internships should be integrated within the degree program, and companies should be encouraged to externally funded elevating tax recognition programs to improve student company enrollment. Career development and employability planning are prime examples that focus on other interventions for university students to further aid students impact self-advocating employability skills. These units would enable students to achieve personally devised goals on their own, serving concepts such as updating curriculum vitae and attending mock interviewing sessions. Equally as important, they would assist students to willingly explore options that complement requirements for identified career goals. These units primarily assist employers direct students towards enable active participation towards employment opportunities enabling a higher employment placement ratio,

shortening time taken in looking for employment opportunities post completing studies(Adelakun, Najeem & Adebesin, Akeem Adekunle. (2024).

Additionally, we must work to promote a culture of research, innovation, entrepreneurship within the engineering student populations. It is the responsibility of the universities to fund research-based projects and provide resources through incubators and innovation hubs for student startups. These centers will offer the required guidance, capital, and facilities for the students to develop their ideas into actual business models. Also, the grants given for research in the final year projects should be offered too with the aim of addressing local and regional challenges in order to motivate students to tackle real issues and help foster development. Inclusion through gender equity policies constitutes another area where something needs to be done. Like most technical disciplines, engineering has a history of being dominated by men. In order to provide women with equal access to opportunities, there should be policies that grant scholarships and financial support for women pursuing engineering. Where they work also has to be made more inclusive through policies that respond to harassment, limited upward mobility, and inflexible working conditions(Kayyali, Mustafa. (2024). Designing mentorship programs targeted at women engineers actively along with a supportive climate will enhance their participation and retention of women engineers.

In order to formulate effective policies, a data-driven approach is critical. For example, a national database tracking the employment outcomes of engineering graduates would help understanding the gaps they encounter along with enabling policymakers to measure the impact of their policies. This data can be leveraged to make necessary changes in curricula, to identify skill gaps, and to project future demand in the labor market, giving a guarantee that educational institutions will always be in step with the industry. Moreover, the success of these policies will rely greatly on institutional coordination. Various government arms such as HEC, PEC, and NAVTTC need to join hands and streamline policies for holistic cross-sectoral cooperation. This calls for the setting up of a national committee or council to coordinate policies pertaining to engineering education and employment so that resources are put to their most efficient use and policies responsive to changes in the labor market sustain. Pakistan can ensure its engineering graduates possess the requisite skills, competencies, and experiences needed to thrive in a competitive, tech-centric world by employing the aforementioned specific measures. This will enhance the prospects of engineering graduates and also aid in the economic and technological development of the country.

CASE STUDY: STRATEGIC POLICY INTERVENTIONS AT AIR UNIVERSITY

1. *Background*

The Pakistan Air Force's (PAF) Air University is one of the leading universities in Pakistan serving its undergraduate and postgraduate students in engineering, science, and technology. Air University is one of the top institutions for engineering and technology in Pakistan, having campuses in Islamabad, Kamra and Multan. The university's objectives include striving for a world-class educational model and an integrated system of research, innovation, and industrial collaboration. They also understand the need for skilled engineers in emerging technologies and industries. Because of this, they are working towards improving the employability of graduates and the gap between academia and industry.

2. *Identifying the Challenges*

Like other engineering universities in Pakistan, Air University recognized a number of issues that were broadening the gap between the potential and actual success of engineering graduates. The listed challenges came from the university's internal evaluation system, employer feedback, alumni inputs, and stakeholder consultations:

Curriculum Relevance: There were gaps in the implementation of modern technologies like AI, machine learning, data science, and even renewable energy into the engineering curriculum.

Doing Practice-Not Showing Work Concept: Due to the heavy focus on theory in their academic syllabus, most graduates lacked the practical work experience necessary to solve engineering challenges.

Connection with Other Organizations: Even though Air University is a reputable institution, the university struggled to cultivate long-term connections with industry
partners, reducing the availability of internships and hands-on learning for the students.

Career Development and Placement: Most of the students came from good educational backgrounds, however, there was little to no assistance on developing further their CVs and supporting documents, and in creating strategic step plans for employment opportunities, interviewing, and career advancement activities.

3. *Strategic Policy Changes In Response To The Issues Encountered*

To address these issues, Air University implemented a number of strategic policy changes focused on the employment and skill readiness of their engineering graduates. The changes focused on curriculum adjustments, strengthening industry partnerships, encouraging research and innovation, and providing comprehensive career planning services.

3.1 *Changes To The Curriculum And Updating It*

An industry-focused and relevant curriculum is vital for the employability of graduates, and Air University acknowledged this need. In order to fulfill this, the university undertook a comprehensive review of the engineering programs offered at the university.

- Tailored Strategy from the Industry Advisory Boards: Air University created Industry Advisory Boards which comprised of senior engineers and professionals from top companies like multinational corporations and local industries. These boards offered useful advice on the changes which needed to be made to the curriculums.
- Inclusion of New Configuration Technology: The university added specialized courses in AI, ML, data science and robotics to the engineering curriculum. These changes were made to ensure students would be trained with the required skills for modern employment engineering.
- Laboratory work as per the Curriculum: The university implemented laboratory work carry out based instruction and introduced practical projects pilot programs which dealt with real problems in engineering including aerospace, electronics and energy, especially renewables. This approach is aimed at enhancing project and problem solving skills and critical thinking among the students.

3.2 *Strengthening Relationships Between Academia And Industry*

In view of the above, during the academic year, Air University worked towards reinforcing the relationship between universities and the private sector and some other organizations.

- Internship and Industrial Training Programs: Air University created relations with critical industry leaders in order to offer their students internships and industrial training opportunities. These internships were aimed to provide the students with hands-on experience in their engineering specialties. The university made certain that the structure of the internship included guidance and supervision so that the students were compulsory to report and undergo evaluation by their industrial supervisors.
- Collaborative Research Projects: The university pursued more broader local and international relations through joint research programs. For instance, Air University partnered with some aerospace and defense contractors for undertaking researches in unmanned aerial vehicles (UAVs) and aviation technologies Students benefitted greatly from these researches because they were able to work with industry experts and learn engineering problems that are encountered in real work situations.
- Industry-Sponsored Competitions and Hackathons: Air University conducted industry-sponsored competitions as well as hackathons where students were given the opportunity to demonstrate their technical prowess by engineering solutions to complex problems. Students were not only able to hone their skills as effective problem solvers but were also exposed to prospective employers during these activities.

3.3 *Self Promotion of Research, Innovation, and Entrepreneurship*

It became clear that Air University exploited the value of its innovation and development of the critical thinking skills and even encouraged entrepreneurship among its students.

- Research Institutes and Innovation Facilities: The university created numerous research institutes and innovation facilities like the Center for Artificial Intelligence and Robotics and the Aerospace Research Lab. These centers enabled students to participate in cutting-edge research projects through advanced mentorship in critical disciplines such as AI, robotics, and aerospace engineering.
- Entrepreneurship Development Programs for Students: Air University initiated an entrepreneurship development initiative with the hope that students would take advantages of their

creative ideas and develop actual startups to change the world. The incuabtor provided students with mentored and peer led networking opportunities to access seed funding as well as business development plans through The Entrepreneurship Incubator. Such initiatives led to the formation of several student-led startups concentrating on technology solutions, renewable energy, and smart agriculture.

- Overview of Innovation Recognition at Air University. An innovation recognition program at Air University was introduced to acknowledge the provided innovations from the students and faculty of the institution. This program offered support for stuiodents to file patents and take appropriate connections to potential investors, thus, ensuring valuable intellectual properties are commercialized.

3.4 Career Development And Supports In Employability

As a response to the desire for better career support services, Air University has established a Career Development Center (CDC). The sole focus of this has been to create seamless transitions for the students into the workforce.

- Career Counseling and Employment Services: The Center for Development and Communication offered CDC career counseling services that aided students in determining what careers suited their skills and sought after interests. Furthermore, the Center also held job placement drives where major employers from different industries were invited to hire students directly from the university.
- Mock Interviews and Resume Workshops: The university held mock interview sessions and arranged resume-building workshops aimed at teaching students how to effectively showcase their credentials and prepare for interviews. These steps were instrumental in boosting the self-esteem of these students and aiding them in increasing their opportunities.
- Soft Skills Training: Besides the technical skills, Air University also offered soft skills training programs to develop the communication, teamwork, and leadership skills of the students. These programs equipped the graduates with skills for the workplace that have become extremely important.

4. *Outcomes and Impact*

As a result of the strategic initiatives taken by Air University, a notable change has been observed putting into light the skills and employment opportunities that the Engineering graduates of the university were severely lacking. With the addition of the industry-relevant curriculum and internship opportunities, the focus that the university has been putting on these aspects has resulted in a positive change in the employability of the students. The university's alumni stated that there has been an increased rate of employment with a large number of graduates getting jobs in leading aerospace, telecommunications, and renewable energy companies. The strong linkages formed between industry and academia have resulted to an improved collaboration with the university and other major companies in the sector of aerospace and defense. These collaborations have enabled students to take part in collaborative research, internships as well as employment opportunities. A good number of students have been able to start successful startups, with some receiving prizes and funding for their innovative solutions. This marks a significant milestone for the university, which is fast becoming nationally known for innovation and entrepreneurship. The different research centers at Air University have advanced the development of aerospace engineering and artificial intelligence and have undergone several projects funded by industry and government partners. There has also been an increase in the amount of research publications and patents the university holds.

The Air University case highlights how developing policies aimed at the strategic intervention on the future of engineering graduates can make a positive difference. Broadening their bound of innovation and creativity while providing adequate career counseling and offering relevant support to aid in industrial attachment placement enables the university to contribute towards the shape and growth the emergence of Pakistan's technology and economy. Air University is an adroit institution for other engineering universities that wish to merge their courses with the dynamic world of industry and train their engineering graduates to meet global competitiveness.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The analysis systematically captured strategic interventions in policy concerning the current problems faced by engineering education in Pakistan including prospective employment opportunities for graduates. The most notable case study in the research demonstrates a mismatch

between the engineering curriculum offered by most of the Pakistani universities and the requirements of the job market. The Pakistani engineering programs largely emphasize theoretical aspects of knowledge, and as a result, graduates are often not adequately trained to deal with the practical and technical aspects of work in their professions. But, as the case study done on Air University showed that, introducing new fields like artificial intelligence (AI), data science, robotics, and machine learning into the curriculum fostered greater versatility among graduates and enhanced their contribution in the workforce. This ensured better employment outcomes for the graduates and increased their adaptability to changes in technology and industries. Lack of sufficient industry-academia linkages is a problem common to a number of engineering institutions. The gap between universities and industries is still very wide in many of these universities, and there is a distinct absence of opportunities for work such as internships or collaborative research projects for students as published in various dissertation abstracts.

At Air University, however, attempts to enhance these linkages using Industry Advisory Boards and collaborations with leading firms proved to be very useful to the students in terms of industry exposure, real world problem understanding, and relevant skills aiding their career preparedness. The investigation also found that most engineering education providers in Pakistan do not offer adequate opportunities for experiential activities, which is important for bridging the gap between theory and practice. The emphasis that Air University placed on practical exposure through involving students in project-based learning, laboratory activities, and internships enabled students to acquire relevant skills that eased their entry into the job market. Furthermore, Air University also focused on developing entrepreneurship and innovation, which is often overlooked in most traditional engineering programs. By nurturing an althe creativity and providing access to the Entrepreneurship Incubator and innovation challenges, Air University was able to shift students' focus from traditional careers to entrepreneurial ventures. An important problem highlighted in the research was the insufficient attention paid to developing the career aspirations of engineering students in the majority of universities.

The lack of soft skills, inadequate professional counseling, and weak networking frameworks leave many graduates unprepared for the realities of the professional world, despite having the relevant technical skills. At Air University, establishing a Career Development Center (CDC) that helps students with resume writing, mock interviews, and job placement was a game changer improving graduate outcomes and bridging the academic and professional gap. Feedback from employers pointed out that graduates from Air University were better prepared and more flexible than the graduates from other institutions. This was due to the completely integrated nature of the interventions as well as the systematic approach Air University took towards its graduates. The strategic policy interventions that aimed to align the educational experience of Air University's graduates with industry needs are clearly evidenced by the industry recognition they received.

Recommendations

Following the study, reconstructing the future outlook of engineering graduates in Pakistan yields a few distinct recommendations. Addressing curriculum reform is one of the most glaring recommendations for engineering universities in Pakistan. Their programs must adopt a more dynamic approach and integrate emerging fields, including AI, machine learning, robotics, and data science. This should be done so that learners are not only versed in basic engineering practices but are also trained in critical future technologies. There is also a need for substantial collaboration between industry partners and higher educational institutions on content development to ensure students are equipped with essential skills. These are also some of the most effective recommendations that address the lack of industry-academia linkages. University leaders need to forge strategic partnerships with top-tier engineering companies to avail more internship, industry-sponsored research, and collaborative projects opportunities for their students. Students will acquire practical exposure and be able to apply theoretical principles learned in class.

Consider forming Industry Advisory Boards that consist of professionals from primary industries to assist in the development and updating of the curriculum, academic programs, and courses offered at the university. Moreover, there is a need to further enhance the practical exposure for engineering students. There should be an increase in the

application of term project-based learning, laboratories, and internships so students can address real-world challenges. Such strategies not only improve technical skill sets but also enhance the students' problem-solving, team collaboration, and analytical thinking which are a necessity in the modern workforce. Entrepreneurship and innovation should be embraced more into engineering education. There should be heightened emphasis on entrepreneurial activities provided by students where curricular frameworks allow individuals to grow their ideas into businesses. The creation of Entrepreneurship Incubators, innovation challenges, contest with startup funding, and mentorship can enable the framework for a new class of engineers able to problem solve societal issues while nurturing economic development through enterprise.

Besides the technical competencies, ensure that soft skills IT are integrated into the curriculum of other engineering disciplines. Boost the students' efficient grasp of communication, leadership, teamwork, and professional networking to complement their technical skills for seamless multi-disciplinary collaboration. Ill-structured Career development support enables students with tools such as resume crafting, career path strategies, mock assessments, and even professional networking to succeed in their objectives or goals. A university of repute would consider forming dedicated facilities termed as 'Career Centers' that would enable students leverage such resources. Additionally, universities must focus on fostering education driven towards innovation by creating focused interdisciplinary resarch or engineering facilities that actively support and promote inclusive technological innovations and engineering problem solving at the undergraduate level. Industry collaborations on research tend to promote creation of new world problem solving technologies and solutions. It is the university's responsibility to provide adequete research funding for forward-thinking projects designed by students and faculty to improve the funded initiative's reputation while enhancing and aiding the development of new technologies within the country.

As a final note, this report outlines policy changes geared towards improving any gaps in curriculum instructional method modernization, forming constructive relationships between formal employment and educational sectors, proactive learning, as well as promoting enterprise and scientific inquiries have the potential to improve engineering graduates from Pakistan's employment opportunities. Adapting these recommendations offers an avenue to help the students align with the expectations of the world's employment avenues while ensuring position them to lead new innovations contributing towards economic recovery in the country.

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