Faculty Perspective on Quality Assurance Practices: Case of an Engineering University in Baluchistan

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ABSTRACT

The study examined faculty perspectives on the sustainability of quality assurance (QA) practices and their influence on productive teaching and learning environments, practical competencies, and academic mobilization in an engineering university in Pakistan, using a convergent mixed-methods design. Quantitative data were collected from thirty faculty members across four engineering departments through an adopted questionnaire. Simultaneously, we conducted semi-structured interviews with 12 faculty members. The findings revealed, in general, a positive perception of digital and virtual teaching and learning resources and alignment of curricula with the Outcome-Based Education (OBE). However, participants expressed concern over outdated laboratory infrastructure, inconsistent renewal of physical resources, and limited engagement of internal and external quality managers. Findings also show that faculty recognized the importance of research internships and final-year projects; however, noted weak coordination between university and industry partners. Suggesting the procedural rather than developmental character of many QA mechanisms. Qualitative findings further underscored operational challenges within the R&D and quality enhancement departments, as well as students' financial and motivational barriers. Study concludes that the effectiveness of QA systems depends not only on policy compliance but also on institutional learning, leadership commitment, and stakeholder collaboration. The findings suggest that revitalizing the functions of the R&D and Quality Enhancement departments, strengthening incentives for industry–university linkages, and investing in infrastructure renewal can foster a sustainable quality culture in engineering higher education institutions in underserved regions of Pakistan.

Keywords: Quality Assurance, Teaching-Learning Environment, Practical Competencies, Academic Mobilization, Engineering Education, Pakistan

Conflict of Interest: N/A
Funding Acknowledgment: No funding was received for this research

1. INTRODUCTION

In recent, the concept of quality assurance in higher education has evolved from narrow procedural techniques to a more holistic strategic framework that emphasizes continuous improvement and accountability. Academic quality is conceptualized not only in terms of standards but also as quality to exceed expectations in academic settings and the professional labor market (Javed & Alenezi, 2023). In today's competitive employment environment, the practical competencies, applied skills, hands-on experience, and professional credibility are highly prized (Gora et al., 2019). Most studies show strong correlations between practical activities and students' knowledge, skills, and workplace competencies, which are strongly tied with sustainable quality-assurance practices in HEIs (Gora et al.2019).

Worldwide universities are positioned as agents of knowledge-based economies, innovation, and technological change. Most institutions in developed countries have transformed into "entrepreneurial universities" that integrate research projects and industry collaboration (Clark, 2011). Good revenue is generated by these institutions through consultancy, spin-offs, incubators, licensing, and technology transfer. While industries provide funding and access to practical innovation (Pauw et al., 2008; Boersma et al., 2008). This model has proliferated across Europe, Asia, and Latin America (Clark, 2011). In Pakistan engineering higher-education sector still faces challenges, including curricular practices that are theoretical, a limited research culture, and barriers in university-industry linkages (Ahmad et al., 2025). Several studies in Pakistan show the relevant insights like, a study of engineering students from three provinces (Punjab, Khyber Pakhtunkhwa, Sindh) with individual and classroom-related factors that affected knowledge-sharing behavior in engineering universities (Safdar et al., 2022). The study of (Shafiq et al., 2025) identified weak alignment between communication competencies and professional communication. Basit et al., (2025) also revealed significant gaps between anticipated and knowledge-related learning outcomes. Moreover, a review of Pakistani HEIs highlighted challenges of infrastructure and financial resources that hinder quality in higher education (Sain et al., 2025). A recent report on graduates' employability in Pakistan highlighted the requirements between academic preparation and industry, about 63 % of graduates faced difficulty securing relevant employment. The employers identified the weak technical skills, communication, and problem-solving skills (Riaz et al., 2025). While quality assurance mechanisms have been investigated, empirical studies connecting practical competencies, teaching-learning productivity, and institutional quality assurance practices within engineering HEIs in Pakistan are scarce (Inayat, 2022).

Despite this, the research landscape in Pakistan's engineering higher-education context has notable gaps. Most studies broadly focus on employability and graduate skills, but few examine the relation between practical competencies and productive teaching-learning environments within engineering HEIs (Shafiq et al., 2025). The study gaps observed about knowledge, learning outcomes, the role of teaching-learning, assessment practices, and academic mobilization (Riaz et al., 2025), influence on practical competencies, and teaching-learning productivity remain under-explored. While quality assurance mechanisms have been investigated, related studies highlighted the practical competencies, teaching-learning productivity, and institutional quality assurance practices within engineering HEIs in Pakistan (Riaz et al., 2025).

2.. LITERATURE REVIEW

Effective Teaching-Learning Practices

The studies indicate that the availability and quality of educational infrastructure, laboratories, classrooms, and technological equipment. These resources highly influence effective teaching-learning processes. A global analysis conducted by Abad-Segura et al. (2020) found that higher education technology integration identified that advanced laboratory equipment and digital tools enhance meaningful academic engagement. They improve program outcomes and enhance graduates' employability. Similarly, a comparative survey of Ventura and Lopes (2017), in European universities, reported that most institutions are equipped with updated facilities. Students with better performance in practical work have developed good employability profiles. Cohen and Bhatt (2012), in a case study, explored the role of infrastructure in learning. Their findings showed that advanced laboratory facilities not only improved students' academic competencies

and concepts. Also, improve research productivity and skill development. They argued that technology-enabled classrooms and laboratories are very important to promote active learning and students' technical competencies.

Teaching-learning practices play an important role in transferring academic infrastructure into meaningful outcomes. International analysis highlighted that the quality of curriculum design, innovation, and assessment practices plays a central role in academic productivity. Houston and Paewai (2013) conducted a study across New Zealand universities. Used mixed methods to evaluate quality assurance mechanisms. The findings indicated that the teachers' professional development and student-centered assessment improve academic teaching standards.

Classroom Assessment and Learning Environment in Global Context

In the European higher education context, Haarala-Muhonen (2011) conducted a quantitative study among 426 students at the University of Helsinki's Law, Pharmacy, and Veterinary Medicine faculties. Used standardized questionnaires, found that academic staff interests, feedback, and supportive classroom environments influenced students' quality of learning. Similarly, Ruohoniemi et al. (2017) compared first and third-year veterinary students in two European universities. The correlation analysis assessed perceptions of workload and learning academic learning. Study found that supportive academic environments were positively associated with students' deep learning strategies.

Further, in the Asian higher education context, Othman (2017) identified problem-based learning (PBL) implementation in Malaysian engineering programs. The study employed surveys and follow-up interviews. Found that PBL enhanced teamwork, communication, and practical problem-solving skills, which are highly valued by employers. Morgan and O'Gorman (2011) surveyed at the University of Ulster, indicating the need to redesign the curriculum and industry-integrated learning. These initiatives increased the employability (95%) of graduates who secured jobs within one year of graduation.

Moreover, Gracia (2009) in Germany and Waswa and Katana (2008) in Kenya explored how academic climate and staff support teaching productivity. Employed a mixed-methods approach, including interviews and document reviews. Found that gender discrimination and remuneration disparities negatively influenced teaching quality and students' engagement. These findings showed that supportive academic environments are important to ensure the productivity of academic teaching-learning.

In South Asia, Alam et al. (2014) reported on Bangladesh-affiliated universities through a large-scale survey of faculty and students. The report found that (80%) of respondents were not satisfied with academic quality assurance mechanisms. Further, emphasized the need for reforms to strengthen human capital development. Similar issues were identified in Pakistan, where systemic challenges were found in inconsistent accreditation standards and a weak monitoring system.

A productive teaching-learning environment depends on the integration of innovation, academic support, and access to learning resources. As Seyfried and Pohlenz (2018) highlighted in a study in Germany and the Netherlands. Used a survey-based assessment of university quality mechanisms. Their findings showed that institutions with good quality assurance systems achieved greater alignment between teaching practices and students' needs.

Moreover, academic mobilization refers to the collaboration among faculty, administration, and policymakers to enhance employability through curriculum alignment with practical exposure. Huet et al. (2011) conducted an experimental study in Portugal and found that academic mobilization initiatives improved the reliability of teaching-learning and strengthened academia-industry linkages. Similarly, Lambrechts et al. (2013) also reported that sustainable quality was developed through internal and external quality managers. This initiative improved student employability that integrates practical skill development into higher education curricula. In developing countries, Trencher et al. (2014) and Ramos-Vielba et al. (2010) emphasized the integration of universities, industries, and governments. A comparative case study analysis reported that closer university–industry partnerships facilitated applied research and increased graduate employment rates.

Higher Education in Pakistan: Teaching-Learning Practices

In Pakistan, similar studies emerged, as Haq (2021) surveyed public and Private Universities of Punjab, highlighting disparities in infrastructure between public and private institutions. The findings showed

that institutions with good facilities and the highest student satisfaction improved teaching outcomes. It was observed that infrastructure inequity is a critical challenge to sustaining education quality in Pakistan. Ramzan et al. (2024) reported that teaching-learning practices in higher education institutions. A descriptive survey design included 20 universities. Study found that faculty training, clear assessment criteria, and resource availability were notable factors for teaching quality. Further, highlighted gaps in institutional leadership are supportive of quality assurance systems. These findings aligned with Allui and Sahni (2016), who reported that higher education quality management must be both practical and productive. This concept engages all stakeholders from administrators to students.

In Pakistan, several initiatives have taken aimed at institutionalizing such linkages. As Ullah and Dost (2018) conducted a policy and case analysis of the Higher Education Commission's (HEC) Office of Research, Innovation and Commercialization (ORIC) framework. Study findings reported that ORICs have enhanced collaboration in research and innovation (Noureen et al., 2024). While observed limited contribution to employability due to weak industry participation and insufficient funding. Similarly, Bhutto et al. (2012) analyzed that early efforts toward U-I collaboration were based on only policies rather than practice-based. As Ashraf et al. (2018) found in employer surveys, found that students who completed structured internships under industry supervision have higher employability skills than those without such experience. Further, Gope and Gope (2022) stated that curriculum modernization, like the integration of teamwork and communication skills, is essential to meet industrial demands to emerge economies. These findings align with Pakistan's ongoing efforts to update engineering and technology curricula. The international and Pakistani research shows that quality equipment, well-designed infrastructure, and sound teaching-learning practices enhance students' skills, knowledge, and employability. Most local studies rely on cross-sectional surveys and limit causal conclusions. The studies related to infrastructure quality, faculty development, and employability outcomes are limited. Furthermore, limited analysis exists on the impact of university–industry partnerships on graduates' employment.

3. RESEARCH METHODS

The convergent mixed-method design is known as one of the most comprehensive and advanced research strategies (Creswell & Plano Clark, 2017). Accordingly, this study employed a convergent parallel mixed-method design to ensure both quantitative and qualitative insights were systematically integrated. Simultaneously, quantitative and qualitative data are collected. While analyzed independently, the study used different analytical procedures. Collectively, the comparisons and interpretations drew comprehensive conclusions (Creswell & Plano Clark, 2017).

The research instruments used in this study were a structured questionnaire, adopted from the study of Javed & Alenezi (2023) consist of 30 items. Some 19 semi-structured interview questions were developed. The adaptation of existing and validated instruments from previous studies ensured both relevance and reliability. For this, appropriate permission was taken from the original developer for using or adopting specific components. (Creswell & Plano Clark, 2017). All items were rated on a six-point Likert scale, ranging from strongly disagree (1) to strongly agree (6).

In the qualitative portion total of 19 semi-structured interview questions were designed to collect data from engineering faculty members. Among them, five questions were teaching-learning sustainability, and seven questions focused on skill-based knowledge and practical competencies. Three questions assessed academic mobilization. Two questions examined curriculum and assessment, and two questions covered miscellaneous aspects. All responses were asked with strict confidentiality, and participants' personal information, including names and email addresses, was neither requested nor disclosed.

In a mixed-method design, the quantitative survey intended to generalize findings from the sample to the population. As noted, specific characteristics, behaviors, or attitudes (Fowler, 2009). Consistent with this, the present study adopted a convergent mixed-method design to integrate quantitative and qualitative data. The quantitative data were collected through face-to-face interactions with participants. The descriptive statistical procedure was applied, where only the percentage was considered to measure the scale responses

from 06 point Likert scale. Participants were informed about the purpose of the study and assured that their responses would remain confidential. Simultaneously, both quantitative and qualitative data were collected from Balochistan University of Engineering and Technology, Khuzdar, Pakistan.

Analysis and Results

The process of quantitative data analysis followed the systematic steps outlined by Creswell and Plano Clark (2017). The number of participants who completed the survey was recorded. The response was determined whether responses could have influenced the results (Fowler, 2009). The study findings, especially quantitative results, were presented in tables. Quantitative data were analyzed through SPSS software. For the qualitative data analysis, a manual coding procedure via thematic analysis was used. Transcribed responses were uploaded and systematically coded, and key ideas and patterns were identified. From this process, four themes were generated, demonstrated in Table 01, which represented the core areas.

Demographic Information

The questionnaires were distributed among participants; the table representation is attached in the Appendices, whereas a total of 30 responses were received from four engineering faculty members: Civil, Electrical, Mechanical, and Software. The responses were uploaded to SPSS for quantitative analysis. For the qualitative, participants were also selected from four engineering departments: Civil, Mechanical, Electrical, and Software Engineering. Table B in the appendices illustrates that 12 teachers participated voluntarily, and three teachers represented each department. The respondents' perception provided in-depth qualitative data to complement the quantitative findings and enhance the overall interpretation.

As one-fifth of respondents (20%) strongly agreed with institution has sufficient resources to create a productive teaching–learning environment. Institutions offer adequate resources to contribute to teaching and learning. Additionally, (23.3%) agreed and (26.7%) somewhat agreed. The majority of respondents acknowledged the availability of good academic support. However, some respondents expressed opposite views (13.3%), somewhat disagreed, 10% disagreed (6.7%) strongly disagreed. The results suggested moderate concern among faculty members who faced difficulties accessing academic resources to achieve teaching-learning objectives. Most of the respondents (33.3%) somewhat agreed, while (16.7%) agreed, and 16.7% strongly agreed. Approximately two-thirds of the participants perceived some difficulties accessing resources. In contrast, (10%) somewhat disagreed, (20%) disagreed, and (3.3%) strongly disagreed. This showed that one-third of the respondents experienced no difficulties.

Comparative Analysis: Survey and Semi-Structured Interviews

The analysis was conducting for both qualitative and quantitative data, where statistical analysis shows a description of the responses in 06 point Likert scale, emphasizing how much a respondent agrees or disagree to the particular question about the productive teaching and learning, competencies to show academic motivation, and teaching learning assessment, however, the in-depth responses indicate the faculty perceptions on these key themes considering teaching, learning, classroom environment, pedagogical competencies, motivation to teaching-learning and assessment procedures.

Table 1: Themes & Sub-themes of the Qualitative Insight

Themes	**Sub-themes**
Teaching Practices and Assessments	• Academic quality • Quality management practices • Practical activities & research publications • Quality assessment

	• Assessment process
Classroom Learning Environment	• Digital and virtual resources • Outdated resources • Smart classrooms
Pedagogical Competencies	• Technological infrastructure • Virtual learning library • Pedagogical benefits • *Lectures and play online videos*
Motivation for Teaching and Learning	• Teaching–learning sources • Digital tools and virtual resources • Access to academic resources • Digital learning platforms • institutional support & research internships

Predominantly, the responses are favorable regarding teaching–learning sources, including digital and virtual resources. Approximately (16.7%) strongly agreed, 30% agreed, and (30%) somewhat agreed. A total (76.7%) of respondents agreed that it reflected widespread satisfaction with the university's technological infrastructure. Only (3.3%) somewhat disagreed, (10%) disagreed, and (10%) strongly disagreed, which indicated limited dissatisfaction. Importantly, a balanced pattern was observed of agreement and disagreement about the institution's replacement of outdated resources with new and updated ones. More than half of the respondents (13.3%) strongly agreed, (16.7%) agreed, and (26.7%) somewhat agreed. These results showed that some efforts were made to renew academic resources. Meanwhile, (10%) somewhat disagreed, (23.3%) disagreed, and (10%) strongly disagreed, representing (43.3%) disagreement.

The responses are divided regarding the academic quality managers' appropriate utilization of available resources. About (10%) strongly agreed, (20%) agreed, and (23.3%) somewhat agreed, found (53.3%) overall agreement. In contrast, (16.7%) somewhat disagreed, (23.3%) disagreed, and (6.7%) strongly disagreed. Further, the qualitative data illuminated the survey findings. The interviewees emphasized the lack of a functional virtual learning library and raised concerns about underutilized facilities. The study interviewee discussed the situation in the following comments:

There is no proper library for virtual learning, just a classroom developed with HEC funding, but that is not functional. (Interviewed Faculty 1)

Notably, the interviewee highlighted the pedagogical benefits of digital tools and virtual resources. Similarly, participants pointed to the effectiveness of digital learning platforms and HEC-supported facilities. The interviewees discussed the situation in the following comments:

I think there are many advantages to virtual resources. I use animations in my lectures and play online videos for them; I think it is a more effective way to teach (Interviewed Faculty 5)

We have effective digital and virtual resources, like Autocade and Mate-Lab. This software is used for designing, which is performed in computer labs… (Interviewed Faculty 7). *Yes, the digital learning platform and virtual resources are so effective and are being used, as some of our students did not have their academic fees…* (Interviewed Faculty 9)

I think these resources are available to us. Did you see the HEC-established smart room…?

(Interviewed Faculty 11).

The qualitative results reinforce the quantitative findings. Indicated digital and virtual resources are available and effective. However, utilization remains constrained by infrastructural and operational challenges. These insights highlighted the need for improved management, maintenance, and access to academic resources to support teaching-learning excellence.

Table 2: Construct 0_ Practical Competencies

Statement	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
• Practical outlines are effectively directed with practical strategies and competitiveness.	1 (3.3%)	1 (3.3%)	4 (13.3%)	9 (30.0%)	9 (30.0%)	6 (20.0%)
• Internal and external quality managers actively engage students in practical and progressive report activities.	1 (3.3%)	6 (20.0%)	3 (10.0%)	5 (16.7%)	13 (43.3%)	2 (6.7%)
• Final-year students are encouraged to pursue research internships.	1 (3.3%)	4 (13.3%)	1 (3.3%)	9 (30.0%)	9 (30.0%)	6 (20.0%)
• Students have opportunities to engage in research and practical activities annually, both locally and internationally, through the university.	4 (13.3%)	7 (23.3%)	4 (13.3%)	5 (16.7%)	7 (23.3%)	3 (10.0%)
• External and internal quality managers exhibit a practical-oriented approach within the university.	1 (3.3%)	8 (26.7%)	2 (6.7%)	11 (36.7%)	6 (20.0%)	2 (6.7%)
• Coordination with other engineering universities regarding practical activities and research publications are effective.	4 (13.3%)	7 (23.3%)	5 (16.7%)	7 (23.3%)	3 (10.0%)	4 (13.3%)
• Students' publications during or after graduation are encouraged and supported.	3 (10.0%)	5 (16.7%)	1 (3.3%)	9 (30.0%)	7 (23.3%)	5 (16.7%)

published research articles in international and national journals journals	2 (6.7%)	1 (3.3%)	5 (16.7%)	0 (0%)	7 (23.3%)	15 (50.0%)
• Study scholarships are granted to faculty members by external quality managers to support higher education.	2 (6.7%)	4 (13.3%)	5 (16.7%)	5 (16.7%)	8 (26.7%)	6 (20.0%)
• Quality managers prioritize research activities and papers publications.	3 (10.0%)	6 (20.0%)	4 (13.3%)	6 (20.0%)	8 (26.7%)	3 (10.0%)
• Department deans introduce strategies to assess quality assurance effectively.	3 (10.0%)	3 (10.0%)	5 (16.7%)	11 (36.7%)	6 (20.0%)	2 (6.7%)

The findings in Table 2 provide insights into respondents' perceptions regarding the practical competencies of students and quality management practices within the institution. Responses were recorded on a six-point Likert scale ranging from Strongly Disagree to Strongly Agree.

The majority of participants perceived practical outlines as well-structured and strategically designed. Approximately (20%) strongly agreed, (30%) agreed, and (30%) somewhat agreed, demonstrating that 80% of respondents recognized the effectiveness of practical strategies to promote skill development and competitiveness. Only a few expressed disagreements, about (3.3%) strongly disagreed, (3.3%) disagreed, (13.3%) somewhat disagreed. The Internal and external quality managers' engagement to support students in practical activities found positive response. As (43.3%) agreed, (6.7%) strongly agreed, and (16.7%) somewhat agreed. Notably, (33.3%) expressed degrees of disagreement (3.3% strongly disagreed, 20% disagreed, 10% somewhat disagreed). These results suggested that the majority acknowledged the efforts of quality managers and engagement in practical activities. Generally, there was a positive perception of institutional support for research internships for final year graduates. About (20%) strongly agreed, (30%) agreed, and (30%) somewhat agreed; in total, 80% of respondents viewed that final-year students are encouraged in research internships. While few expressed disagreement (3.3% strongly disagreed, 13.3% disagreed, 3.3% somewhat disagreed). The encouragement is widespread; some students may experience limited opportunities. The respondents had mixed statements about sstudents' opportunities to be engaged in research and practical activities. While (23.3%) agreed, (16.7%) somewhat agreed, and (10%) strongly agreed. However, (50%) of respondents expressed disagreement, as (13.3%) strongly disagreed, (23.3%) disagreed, and (13.3%) somewhat disagreed. These findings suggested that opportunities for research and practical activities may be limited, inconsistent, or unevenly distributed among students. Most respondents viewed quality managers' approach as practical-oriented, with (36.7%) somewhat agreed, (20%) agreed, and (6.7%) strongly agreed. However, a significant proportion expressed disagreement, as (3.3%) strongly disagreed, (26.7%) disagreed, (6.7%) somewhat disagreed. These results indicated that some respondents recognized the practical focus of quality managers; however, they perceived it as insufficient or inconsistent for others.

The responses indicated moderate satisfaction with inter-university coordination regarding practical activities and research publications. About (23.3%) somewhat agreed, (10%) agreed, and (13.3%) strongly agreed. While (53.3%) of respondents disagreed (13.3% strongly disagreed, 23.3% disagreed, 16.7%

somewhat disagreed). This suggests that collaboration with other universities for practical activities and research publications is limited or inconsistent.Generally, respondents reported positive perceptions regarding support for students' publications. Approximately (16.7%) strongly agreed, (23.3%) agreed, and (30%) somewhat agreed. While (10%) strongly disagreed, (16.7%) disagreed, (3.3%) somewhat disagreed. These findings indicated that publication support may not be accessible to all students. Responses showed a high level of engagement in research publications among faculties. Approximately half of the participants (50%) strongly agreed, indicating active publication. Further, (23.3%) agreed and (16.7%) somewhat disagreed, while only (10%) expressed strong disagreement, (6.7%) strongly disagreed, and (3.3%) disagreed. These results showed a strong research culture among faculty members that contributed to national and international journals. Most respondents perceived support for higher education through scholarships. About (20%) strongly agreed, (26.7%) agreed, and (16.7%) somewhat agreed. While (6.7%) strongly disagreed, (13.3%) disagreed, and (16.7%) somewhat disagreed. Importantly, responses indicated moderate perceptions of research prioritization and paper publications. Approximately (10%) strongly agreed, (26.7%) agreed, and (20%) somewhat agreed. While (43.3%) viewed disagreement. As (10%) strongly disagreed, (20%) disagreed, (13.3%) somewhat disagreed.

Notably, responses reflected a positive perception of departmental strategies for quality assessment. Approximately (6.7%) strongly agreed, (20%) somewhat agreed, and (36.7%) somewhat agreed. However, (10%) strongly disagreed, (10%) disagreed, (16.7%) somewhat disagreed. These results indicated strategies to assess quality assurance. The qualitative findings further illuminated the survey. The data highlighted academic challenges in practical engagement and research-oriented activities. Several interviewees identified issues faced by civil engineering students. Particularly due to the limited functionality and lack of seriousness within the ORIC department. The respondents also noted limited involvement of external quality managers in student-centered activities and engagement quality assurance department. Moreover, different perceptions of students were observed, with some students showing limited interest in internships or group projects. The study interviewees described the situation below: *The internship practices are arranged by the ORIC department. Although the department has been open for three years, it does not seem serious or function properly, so students have many problems with internships.* (Interviewed Faculty 1)

I don't think external quality managers involve the students in the practical activities. But yes, the department is working on it. As such, the quality assurance department is not taking an interest in working on it. (Interviewed Faculty 2)

I do not think external quality managers involve the students in practical activities. But yes, the department is working on it, and as such, the quality assurance department is not interested in working on it. (Interviewed Faculty 3)

I think it depends on person to person. We cannot say to all; some of them give full-time work, and some do not. I think the students are not interested in it. If we talk about the final year project, it mostly consists of 4 to 5 members. The group leader leads the group, and others may not have a passion for work. (Interviewed Faculty 6).

Most importantly, several interviewees viewed that research and internships are mandatory for graduates under the OBE system. As further stated, faculties and quality managers collaboratively engage students in such projects. However, others highlighted consistent workshops and seminars focused on research enhancement, as their comments below: *I think there is interest in about 30 to 40 percent of internal and external quality managers, but there is not 100 percent. I think the internal quality managers lack training and exposure to how to compete with modern industry demands.* (Interviewed Faculty 7).

In my point of view, I mean that, according to my experience, quality managers like the QEC team and other stakeholders make a committee in the middle or at the end of the year to collaborate with us about students' final-year internships or research. (Interviewed Faculty 9). *They have a good role in*

encouraging and actively involving students in research and internships. The internal managers, like department chairmen and deans, like QEC, are highly experienced people who ensure the productivity of students in internships or research. (Interviewed Faculty 10).

I think they encourage the students in final year reports like HEC, PEC, departmental chairman, and deans. However, I did not see any workshop or seminar regarding the students' encouragement in research and practical activities, but yes, they have indirect involvement. (Interviewed Faculty 11).

Additionally, one interviewee highlighted financial challenges among students, particularly regarding the purchase of system hardware, which occasionally delays their access to academic resources.

I think the final-year students have challenges because they cannot purchase the system hardware. There is also a funding system, and sometimes, they respond to them on time to get resources. So, students suffer in this, but this scheme has been running for a long time, and the final students are always helped through such funding. (Interviewed Faculty 12).

Collectively, these qualitative insights reinforced the quantitative findings, emphasizing that institutional efforts promote practical learning and research engagement. The barriers include insufficient coordination, inconsistent interest, and limited student motivation to meet students' interests and expected outcomes.

Table 3: Construct 03_Academic Mobilization Enhancement

Statement	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
• Productive planning and coordination between the university and Industries are actively promoted.	5 (16.7%)	5 (16.7%)	3 (10.0%)	8 (26.7%)	7 (23.3%)	2 (6.7%)
• The departmental assessment process measures each department's progress toward achieving its objectives.	3 (10.0%)	3 (10.0%)	0 (0 %)	9 (30.0%)	12 (40.0%)	3 (10.0%)
• There is an active academic linkage between the university and commercial industries, both local and foreign.	4 (13.3%)	5 (16.7%)	4 (13.3%)	11 (36.7%)	6 (20.0%)	0 (0 %)
• The university efficiently collaborates with companies and • industries for undergraduate practical activities and future employability.	4 (13.3%)	3 (10.0%)	5 (16.7%)	11 (36.7%)	6 (20.0%)	1 (3.3%)
• A significant percentage of students secure employment in local Companies and industries after graduation.	3 (10.0%)	1 (3.3%)	5 (16.7%)	8 (26.7%)	10 (33.3%)	3 (10.0%)

• Quality managers at the university provide professional training opportunities to enhance competitiveness.	6 (20.0%)	4 (13.3%)	4 (13.3%)	13 (43.3%)	2 (6.7%)	1 (3.3%)

Table 04 presents respondents' perceptions regarding the university's efforts to enhance academic mobilization through coordination with industries, departmental assessment, and professional training opportunities. Responses were recorded on a six-point Likert scale ranging from strongly disagree to strongly agree.

The study responses indicated a moderate perception of the university's engagement in planning and coordination with industries. Results showed that about (6.7%) strongly agreed, (23.3%) agreed, and (26.7%) somewhat agreed. More than half of the respondents recognized active promotion of university-industry coordination. Conversely, (16.7%) strongly disagreed, (16.7%) disagreed, and (10%) somewhat disagreed. This result showed that a substantial minority perceived university coordination efforts as insufficient. Moreover, the departmental assessment process and progress toward achieving objectives were positively received. Specifically, (10%) strongly agreed, (40%) agreed, and (30%) somewhat agreed, totaling (80%) positive responses. While only (10%) strongly disagreed and (10%) disagreed.

Moderately, responses were positive regarding active academic linkage between the university and commercial industries. About 36.7% agreed, 20% agreed, and none strongly agreed, indicating that some respondents recognize university-industry linkages, but strong engagement is limited. On the other hand, 13.3% strongly disagreed, 16.7% disagreed, and 13.3% somewhat disagreed, totaling 43.3% negative responses. The study responses indicated moderate satisfaction with the university's practical collaboration with industries and companies. Nearly (36.7%) somewhat agreed, (20%) agreed, and (3.3%) strongly agreed, as (60%) respondents viewed positively. Meanwhile, (13.3%) strongly disagreed, (10%) disagreed, and (16.7%) somewhat disagreed. Markedly, (40%) of respondents perceived a gap in collaboration for practical activities and employability. On the other hand, most respondents indicated a positive perception of graduate employability. Approximately (10%) strongly agreed, (33.3%) agreed, and (26.7%) somewhat agreed. While (10%) strongly disagreed, (3.3%) disagreed, and (16.7%) somewhat disagreed, reflecting (30%) negative perceptions.

The respondents had mixed perceptions that quality managers at the university provided professional training opportunities to enhance competitiveness. Regarding this statement, (43.3%) somewhat agreed, (6.7%) agreed, and (3.3%) strongly agreed. These perceptions indicated that some respondents perceive professional training. However, (20%) strongly disagreed, (13.3%) disagreed, and (13.3%) somewhat disagreed. The qualitative data further contextualized these quantitative results. Importantly, perceptions were analyzed regarding university-industry collaboration and academic mobilization mechanisms. Interviewees emphasized that the Outcome-Based Education (OBE) system has been implemented to enhance coordination between academia and industry. Accordingly, the participation of industries in such initiatives was observed to be limited. Despite the Pakistan Engineering Council (PEC) guidelines promoting such engagement, several barriers exist. As described below by the interviewee:

The OBE system is implemented in all engineering universities. OBE requires sound coordination between the university and the industry. Unfortunately, there are very few private sector industries; almost all are in the public sector. It has flaws. We arrange coordination meetings with industries, which is a requirement of PEC. When we request them, they do not come and join us and do not share their input, which is the biggest challenge, I think! (Interviewed Faculty 1).

A noticeable gap highlighted the infrequent collaboration between universities and industries. One

interviewee viewed that final-year students are occasionally provided opportunities for industry visits. Further, commented that no comprehensive mechanism exists to strengthen this collaboration. The comment is mentioned below:

I think there is a gap and very little collaboration between the university and industry. Students are given opportunities to visit industries and different companies in the 3rd and 4th years. The industry team comes and visits the department and conducts on-campus interviews. I think there are no such initiatives seen by companies or industries. There is a need for collaboration, but unfortunately, there is a lack of it. (Interviewed Faculty 3).

Another interviewee highlighted that an existing Memorandum of Understanding (MOU) with South Korea supports student exchange programs. However, the number of MOUs with local industries is limited. Respondents emphasized that coordination efforts need more improvements in practical activities and employment facilitation. The interviewees' responses are presented below:

I do not think so; maybe I don't know about it. But yes, there is an MOU with South Korea, and the students are provided opportunities to study there. This is an exchange program for students with the university. I think some students have gone there. (Interviewed Faculty 4).

I think that there is coordination with industries and companies, but it needs to be improved in terms of practical activities and students' future chances of employment. (Interviewed Faculty 6).

The Office of Research, Innovation, and Commercialization (ORIC) is responsible for facilitating industry collaboration and managing student internships. Notably, Interviewees acknowledged that ORIC has recently progressed in this area. The comments of interviewees are mentioned below:

As I said, the ORIC department deals with and manages such activities. The students are sent through ORIC to different commercial industries. I think there is coordination between ORIC and industries. (Interviewed Faculty 5).

I think before, there were no such activities, but now, for three years, the ORIC department has been playing its role. ORIC provides internships to students and coordinates with them to conduct conferences as well. (Interviewed Faculty 11).

Several interviewees reported the limited linkages with both local and foreign industries. These linkages are often restricted to formal MOUs or internship placements rather than meaningful collaboration. Further, comments are mentioned by interviewees:

I don't think there is any linkage with local or foreign industries. (Interviewed Faculty 1)

I don't know about the linkage between universities and industries. (Interviewed Faculty 2)

I think there is no linkage with industries; it is just limited to MOUs. (Interviewed Faculty 3)

I don't have any idea about it. I can say that it is limited. Students are sent for internships and study tours. There are MOUs with some companies. (Interviewed Faculty 4)

Conversely, some interviewees highlighted existing local linkages for internships and practical work. As well as existing linguistic collaborations with international partners. The interviewees' important comments are presented below:

I think there are linkages with local industries in terms of practical activities and internships for students, which are limited, but I don't think there is any linkage with foreign or multinational industries. (Interviewed Faculty 5).

One linkage you cannot say, there can be many types of linkages. We have a linguistic linkage with Korean officials. Except for that, there are local linkages, like the civil engineering department's commercial linkage. (Interviewed Faculty 9).

Some respondents mentioned active collaboration with national industries such as SSGC and WAPDA, as well as skill-based initiatives with NFTP and DG Skills, indicated partial engagement at the national level.

I do not have any idea about foreign linkages, but there are linkages with national industries like SSGC and WAPDA for students' practical activities. (Interviewed Faculty 10).

We have MOUs with them. There are also linkages with local industries like NFTP and DG Skills, which contribute to virtual skills. (Interviewed Faculty 11).

Interviewees acknowledged that the university facilitates students' internships across various industries. However, challenges exist in the alignment of academic training with industrial demands. Resource constraints, particularly the lack of modern laboratory equipment, were highlighted as key obstacles. These limited students' practical competence and competitiveness in the job market.

Some students themselves go into industry to request the industry to get internship experience for two or three weeks, and the university facilitates them. But now the university is struggling to coordinate with industries so that our graduates can learn something from the industries. The industries give us feedback that the students are better at knowledge but weak in practical activities. There are many reasons behind it; there should be the latest equipment in the lab, which is not available. Therefore, we cannot provide the practical competitiveness that the current system offers.

Table 4: Construct 04_Teaching, Learning, and Assessment

Statement	Strongly Disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
• Curricula are specifically designed to achieve stated aims and objectives.	1 (3.3%)	3 (10.0%)	4 (13.3%)	2 (6.7%)	12 (40.0%)	8 (26.7%)
• Different strategies are applied for teaching, learning, and assessment.	1 (3.3%)	1 (3.3%)	3 (10.0%)	10 (33.3%)	10 (33.3%)	5 (16.7%)
• Specific skills are developed in students through the teaching and learning process.	3 (10.0%)	0 (0 %)	2 (6.7%)	6 (20.0%)	14 (46.7%)	5 (16.7%)
• Assessment methods actively enhance the learning experience.	3 (10.0%)	1 (3.3%)	1 (3.3%)	6 (20.0%)	14 (46.7%)	5 (16.7%)
• Students' performance is consistently evaluated and improved upon	1 (3.3%)	1 (3.3%)	2 (6.7%)	8 (26.7%)	12 (40.0%)	6 (20.0%)
• The university actively develops 21st-century skills in students.	2 (6.7%)	1 (3.3%)	7 (23.3%)	5 (16.7%)	12 (40.0%)	3 (10.0%)
• The institution organizes academic awareness programs for faculty members.	5 (16.7%)	1 (3.3%)	5 (16.7%)	11 (36.7%)	6 (20.0%)	2 (6.7%)
• Academic seminars and workshops are conducted to	8 (26.7%)	2 (6.7%)	5 (16.7%)	7 (23.3%)	7 (23.3%)	1 (3.3%)

enhance
academic productivity.

Table 5 presents respondents' perceptions about teaching, learning, and assessment. The participants' responses indicated that most participants viewed the curricula as aligned with academic objectives. Specifically, (26.7%) strongly agreed, (40%) agreed, and (6.7%) somewhat agreed. Meanwhile, (3.3%) strongly disagreed, (10%) disagreed, and (13.3%) somewhat disagreed.

A variety of pedagogical and assessment strategies are implemented; regarding this, (33.3%) agreed, (33.3%) somewhat agreed, and (16.7%) strongly agreed. These results showed that most respondents recognized diverse teaching and assessment approaches. While only (3.3%) strongly disagreed, (3.3%) disagreed, and (10%) somewhat disagreed. Results demonstrated perceptions that teaching practices support skill development. Approximately (46.7%) agreed, (16.7%) strongly agreed, and (20%) somewhat agreed. Only a few expressed disagreements (10%) strongly disagreed, (6.7%) somewhat disagreed. It is found that skill development is widely recognized as an outcome of the teaching and learning process.

Similarly, participants reported positive perceptions of assessment methods. As (46.7%) agreed, (16.7%) strongly agreed, and (20%) somewhat agreed. This indicated that assessments contributed meaningfully to learning. While only (10%) strongly disagreed, (3.3%) disagreed, and (3.3%) somewhat disagreed. Notably, about (40%) agreed, regarding performance monitoring and improvement, (20%) strongly agreed, and (26.7%) somewhat agreed. The disagreement responses were limited, about (3.3%) strongly disagreed, (3.3%) disagreed, and (6.7%) somewhat disagreed. These results reflected continuous performance of evaluation, supported students' development, and quality assurance practices.

Further, results show that about (40%) agreed on the perception regarding the development of modern skills. While (10%) strongly agreed, and (16.7%) somewhat agreed. Conversely, (6.7%) strongly disagreed, (3.3%) disagreed, and (23.3%) somewhat disagreed. However, positive perceptions were noted regarding faculty development initiatives. Approximately (36.7%) somewhat agreed, (20%) agreed, and (6.7%) strongly agreed, while 16.7% strongly disagreed, 3.3% disagreed, and 16.7% disagreed.

Most importantly, about (23.3%) somewhat agreed, regarding academic seminars and workshops to enhance academic productivity. Similarly, (23.3%) agreed, and (3.3%) strongly agreed, found totally positive responses (50%) positive responses. However, (26.7%) strongly disagreed, (6.7%) disagreed, and (16.7%) somewhat disagreed, represented 50% negative perceptions. The qualitative findings further enriched these quantitative insights. The interviewee highlighted the engineering students with competence in modern tools and technologies to enhance their technical competencies. Additionally, it was emphasized that academic departments require facilities and resources to increase effective learning. These initiatives prepare graduates for professional environments, as commented below:

Before I discussed that engineering students must have a good command of the latest tools and technologies. I always tell students that an engineer's technical skills should be sound. The facilities should be provided to departments so that the students' learning will be more productive and they will be ready for the job market. (Interviewed Faculty 1).

Interviewees also described the institutional assessment processes in detail. As emphasized in structured evaluation methods for final-year projects. The assessment typically involves internal and external committees and guidelines set by the Higher Education Commission (HEC) and the Pakistan Engineering Council (PEC) under the Outcome-Based Education (OBE) framework. The process included the evaluation of Program Learning Outcomes (PLOs) and Course Learning Outcomes (CLOs) to ensure alignment with the Washington Accord.

The project is given to the students through a supervisor who guides them. The students are given projects to apply what they have learned in the four-year program in the field. One internal and two external committees assess students' final year reports according to their set criteria, which are outlined by the

university or HEC. (Interviewed Faculty 2).

For this, the PEC introduced the OBE system, as we are following the Washington Accord, and the OBE system was adopted. The special method is made for the assessment of 12 PLOs and made CLOs, so we are following the OBE system for assessment. (Interviewed Faculty 3).

Interviewees also reported the use of Turnitin and other software tools to evaluate final-year projects. The Quality Enhancement Cell (QEC) is responsible for data collection and quality monitoring. Regular assessments are conducted through the OBE mechanism, and students' presentations and reports are graded using rubric-based criteria.

I think the only term software is used to assess the students' final year reports. I think the QEC department assesses these because they ask us for data, and we provide them; after that, they don't give us feedback or reports. (Interviewed Faculty 1,10).

I think there is a regular assessment. As I said to you about OBE, nowadays we are working on this mechanism... the committee assesses the final-year students' reports and presentations, and on behalf of the committee, the students are evaluated and provided with grades. (Interviewed Faculty 5).

Furthermore, interviewees elaborated that the assessment structure includes proposal defenses, progress evaluations, presentations, and final displays of projects. Some faculty noted the reliance on traditional assessment techniques, while others emphasized the rubric-based evaluation approach, considering factors such as observation, demonstration, experimentation, and engagement.

Yes, there is a described assessment for final year projects, like proposal defense, checked by different committees through presentations, the phase of approval and disapproval, progressive reports, and finally, what the product has made to display that! (Interviewed Faculty 6).

I don't think new strategies are used to assess the students' final year reports; all the old methods are used as the university has been following those for years... The reports are checked with the help of Ternate. (Interviewed Faculty 8).

I think the same strategies and techniques are used to assess as the other universities are following... I observed that project reports are assessed on the rubric base... based on observation, demonstration, conduct, students' interest, and data collection. (Interviewed Faculty 9).

I don't think that such strategies or tools are used to assess the reports... Turnitin and LMS are used to check the students' final year reports. (Interviewed Faculty 10).

Yes, through university funding, the students get the hardware for project work for every student... The internal experts assess the reports, and we also invite the external experts... followed by a question-and-answer session to assess the students. (Interviewed Faculty 12)

DISCUSSION

This study aimed to assess faculty perspectives on the sustainability of quality assurance (QA) practices and the factors that influence productive teaching-learning environments, practical competencies, and academic mobilization in an engineering university in Pakistan. The convergent mixed-methods approach was used to integrate quantitative and qualitative data to provide a significant understanding of how faculty interpret academic quality mechanisms within a resource's challenges in the higher education context. Study findings collectively revealed a mixed landscape where the availability of digital resources, alignment with outcome-based education (OBE) frameworks, and commitment to assessment improvements. Yet it is constrained by systemic challenges such as infrastructure renewal, inconsistent industry engagement, and limited functionality of academic quality.

Faculty members perceived that digital and virtual teaching-learning resources were available and useful about (76.7%) agreed. Interview narratives confirmed this view, with respondents' descriptions about

the usefulness of animations, AutoCAD, MATLAB, and virtual smart classrooms supported by the Higher Education Commission (HEC). However, participants also emphasized that the lack of presence of facilities did not guarantee their functionality or pedagogical impact. The HEC-funded digital rooms were reported to be not functional and underutilized. This finding reflects international research that emphasizes the importance of operational maintenance and engagement rather than technological acquisition alone (Abad-Segura et al., 2020; Cohen & Bhatt, 2012). In the Pakistani context, Sughra (2021) and Ramzan et al. (2024) reported similar constraints in infrastructure renewal and digital access. Further, observed the physical resources gaps and inequitable access to learn technologies that limit academic quality improvement. Notably, from this perspective, the limited utilization of academic quality resources of the quality mechanisms may remain more procedural than functional. Consistent with Seyfried and Pohlenz (2018), reported effective QA frameworks required participatory use of resources. The academic responsive maintenance systems and faculty ownership, to convert facilities into meaningful learning outcomes. Hence, this study showed an encouraging digital environment; the challenge is to transfer this infrastructure into a sustainable teaching-learning culture, active use, maintenance, and academic reflection.

The faculty respondents (80%) agreed that practical outlines and strategies were well structured to promote competitiveness, and most perceived encouragement for student internships and final-year research projects. While half of the respondents noted limited opportunities for consistent research and practical engagement throughout the academic year. Interview insights provided a deep understanding of these findings and revealed an underperforming Office of Research, Innovation, and Commercialization (ORIC). The limited engagement was noted by internal and external quality managers in practical learning initiatives. Respondents also noted that students' motivation and financial constraints often hindered active participation in internships. These findings align with international literature that links experiential learning to employability and skill formation. Studies in Malaysia (Othman, 2017) and Europe (Morgan & O'Gorman, 2011) showed that industry-integrated learning enhances graduates' problem-solving, communication, and teamwork skills. Locally, Noureen et al. (2024) and Bhutto et al. (2012) reported that ORIC institutionalized research innovation operates as an administrative body rather than a dynamic facilitator of students' engagement. The current study found that the presence of ORIC and Quality Enhancement Cells (QECs) in Pakistani engineering universities has not automatically produced a supportive culture of practice-based learning. Their effectiveness depends on leadership commitment, functional links with industry, and accessible funding for students' support and participation.

However, interviewed faculty emphasized that final-year projects and internships are integrated under the OBE system and Pakistan Engineering Council (PEC) requirements. The limited number of workshops, inconsistent industrial feedback, and insufficient hardware resources constrain students' ability to meet industry expectations. These barriers illustrate the structural weakness of the practical training ecosystem. The system of quality assurance in engineering education remains more compliance-oriented than innovative. To move forward, institutions must reposition QA offices to enable agencies to practice-based learning rather than documentation.

These findings aligned with prior analyses, which showed limited institutional mechanisms to bridge academia and industry in Pakistan (Ashraf et al., 2018; Gope & Gope, 2022). Although policy frameworks of HEC ORIC and PEC Outcome-Based Education system are designed to enhance industrial alignment. The local implementation is often inconsistent due to a lack of incentives for industry participation and weak follow-up from universities. Collectively, engagement of faculty, administrators, and external stakeholders is a critical yet underdeveloped concept of QA in Pakistani engineering institutions. Comparatively, Trencher et al. (2014) applied research and industry partnerships drive national innovation systems. However, this study's interviewees reported limited linkages, mainly with SSGC, WAPDA, and Korean technical programs, which reflected an early stage of mobilization. There is more need for strategic alignment between university QA

structures and employability frameworks to operationalize the policy intentions of HEC and PEC.

These findings suggested a commendable degree of policy compliance and alignment with international accreditation. However, several respondents pointed out that the assessment practices remain largely traditional, rely on project reports and Turnitin rather than innovative evaluation tools. This observation aligns with global concerns, outcome-based frameworks, and risks (Ahmad et al., 2025. The alignment of assessment systems with international standards reflects institutional current rending need. However, the lack of feedback from QEC to departments reported in multiple interviews signaled a missing link between quality documentation and actionable improvement. Therefore, the challenge is not only technical alignment with OBE but also a reflective quality culture. Where data collected through QEC mechanisms informs teaching innovation and continuous improvement.

The study also shows the argument of knowledge recombination and mobility approaches. Ahmed et al. (2025) suggested that exposure to broader networks of international collaborations or industry linkages enhances institutional capacity for innovation. In this sense, quality assurance in Pakistani engineering universities remains inward. Universities strive for horizontal linkages across institutions and industries to recombine knowledge sources and improvements in practical outcomes. The findings collectively imply that Pakistani engineering universities have achieved limited progress in building quality-driven, outcome-based systems but remain constrained by operational and cultural factors. For the enhancement of the sustainability of QA to Functional, the revitalization of ORIC and QEC.

CONCLUSION AND FUTURE DIRECTIONS

In brief, the findings of this study contribute to enhancing teaching-learning productivity and strengthening practical competencies in engineering education. While earlier studies worldwide have explored teaching-learning and assessment practices in higher education (Nicolescu & Nicolescu, 2019; Javed & Alenezi, 2023). In Pakistan Some relevant studies address the quality assurance practices in the engineering education context. These insights guide policymakers, institutional Quality Enhancement Cells (QECs), faculty-development programs, and research-innovation sponsorship frameworks (such as by the Pakistan Engineering Council (PEC) and Higher Education Commission of Pakistan (HEC) (Abad-Segura et al., 2020). For effective alignment of curricular practices with practical training, considering the industry needs, to enhance innovation capacity and academic mobilization resources effectively. These initiatives can better position engineering HEIs in Pakistan for global competitiveness and recognition. The study was limited by its modest sample size (N = 30 survey respondents; 12 interview participants), which restricts the generalizability of the findings. Future research across a larger number of engineering universities in Pakistan could determine whether the observed patterns are systemic. As the study relied primarily on faculty perceptions, future investigations should triangulate these findings with student perspectives, employer surveys, and objective internship placement records to strengthen conclusions regarding graduate employability outcomes. Longitudinal studies could also examine the impact of ORIC and QEC reforms, as well as infrastructure and equipment investments, on graduate employment and the development of practical competencies over time.

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