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Justification of Combined Methodologies for Innovation Research in the Higher Education System

[1] Ceyhun Ganjali

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Abstract: This article explores the methodological foundations of innovation research within the higher education system of Azerbaijan, substantiating the necessity of applying mixed-method approaches. Based on quantitative and qualitative data from 2020–2024, the study employed SPSS-based factor analysis, focus group interviews, and content analysis of policy documents. The findings were synthesized using the triangulation method, which helped identify the key success factors and interactive mechanisms of innovation initiatives. Results indicate that the presence of innovation infrastructure, management incentives, and financial support significantly influence the efficiency of innovation projects. The article concludes with recommendations for future research and policy strategies.

Keywords: *higher education, innovation, methodology, triangulation, factor analysis, Azerbaijan*

INTRODUCTION

In the modern era, the higher education system stands out as one of the key strategic sectors in the development of society, the formation of human capital, and the realization of innovation potential. Globalization, technological advancement, and dynamic changes in the labor market necessitate that higher education institutions function not only as knowledge-transferring bodies but also as centers of scientific research and innovation. In this regard, innovation research conducted within the higher education system requires more flexible, complex, and multifaceted methodological approaches.

Mixed methodologies have become widely applied in educational sciences in recent years and play a significant role in achieving high-quality results. By combining the strengths of both qualitative and quantitative research methods, this approach enables a more comprehensive and in-depth analysis of complex educational issues. Such methodologies are particularly important in the study of areas like innovation, which are characterized by multifactorial and context-dependent variability.

In the Republic of Azerbaijan, several significant steps have been taken in recent years to modernize higher education and implement innovations. State programs, legislative acts, and the process of integration into international education standards have made it necessary to revisit and reassess the methodological foundations in this field. At the same time, the context-appropriate selection and

[1] Ganjali, J. T. PhD Student, Department of Economics and Statistics, Azerbaijan Technical University. Email: jeyhun.ganjali@student.aztu.edu.az. ORCID: https://orcid.org/0009-0002-7982-5672.

justification of research methodologies are crucial for determining the effectiveness of innovation policies in higher education.

The aim of this article is to theoretically and practically analyze the justification of mixed methodologies for innovation research in the higher education system based on the case of Azerbaijan, to evaluate the effectiveness of methodological approaches, and to establish a scientific foundation for new research directions in this field. Taking into account the current situation and innovation opportunities in Azerbaijan's higher education system, the article also aims to reveal the potential for applying mixed methods.

LITERATURE REVIEW

The development of innovations in the higher education system and the methodological justification of research in this field are widely explored topics in the global academic literature. The literature review covers three main directions: the role of innovation in higher education, the scientific foundations of mixed methodologies, and local and regional research conducted in the context of Azerbaijan.

1. The Importance of Innovation in the Higher Education System.

At the global level, it is emphasized that higher education institutions should not be limited to being centers of instruction alone, but must also function as hubs of science, research, and innovation (Etzkowitz & Leydesdorff, 2000). The "Triple Helix" model highlights the potential of universities to create an innovative environment through interaction with the government and business sectors. Reports published by UNESCO and the OECD underline that innovation is regarded as a strategic priority in enhancing the competitiveness of higher education systems (OECD, 2019).

In the experience of the European Union countries, innovation policies in higher education, university autonomy, and the financing of scientific research are key focus areas (European Commission, 2020). Moreover, supportive mechanisms such as mentoring, startup incubators, and digital infrastructure are particularly emphasized to involve both faculty and students in innovation activities.

2. Application of Mixed Methodologies.

In recent years, mixed methodologies have been widely used in educational research to enhance the effectiveness of studies. Creswell and Plano Clark (2017) emphasize the advantages of this approach, noting that the combined use of quantitative and qualitative methods allows for a more comprehensive analysis of complex socio-educational phenomena.

Exploratory and explanatory mixed models have been supported by numerous researchers for their applicability in education research (Johnson, Onwuegbuzie & Turner, 2007). The use of analytical tools such as SPSS, NVivo, and others in alignment with this methodology increases the validity and reliability of research outcomes (Teddlie & Tashakkori, 2009).

3. Research Conducted in the Context of Azerbaijan.

In recent years, several studies have been carried out on the implementation and development of innovations in Azerbaijan's higher education system. The 2022 report by the Ministry of Education highlights the establishment of innovation centers at universities, the transition toward research universities, and the expansion of international cooperation as key objectives. Qurbanov and Aliyeva (2021) emphasized that digitalization in the teaching process strengthens the innovation potential in higher education institutions.

An analytical report by the Azerbaijan National Academy of Sciences (ANAS) in 2023 noted that, despite the existence of scientific potential in local universities, the lack of coordination and analytical depth in methodological approaches hinders the sustainability of innovative outcomes. Local researchers Abbasov and Rahimli (2020) investigated the positive impact of project-based learning practices on the formation of an innovative environment in universities.

METHODOLOGY

This study employs a mixed methodology to analyze innovation activities within the higher education system. The methodological framework is based on the integration of quantitative and qualitative approaches, the principle of triangulation, and empirical validation. The aim of the research is to understand the dynamics of innovation development in Azerbaijan's higher education system in recent years, analyze the structural factors influencing this process, and interpret the findings based on scientific evidence.

1. Quantitative Approach. The objective of the quantitative phase is to identify general trends in innovation activities and to perform statistical analyses on a mathematical basis. The following tools and methods were used during this phase:

- **Statistical Analysis:** Innovation indicators were collected and analyzed for innovation projects implemented across various higher education institutions in the Republic of Azerbaijan from 2020 to 2024. These indicators include parameters such as the number and types of projects, sources of funding, and project outcomes.

- **Survey Research:** A standardized survey was conducted among a group of 200 respondents, including students and faculty members. The survey aimed to measure key aspects such as the innovation environment, infrastructure, support mechanisms, and project participation.

- **Factor Analysis:**The collected survey data were analyzed using factor analysis via **SPSS** software. This enabled the identification of key factors within respondents' answers and helped uncover relationships between various variables.

Table 1. Number of Innovation Projects Implemented in Higher Education Institutions (2020–2024)

Year	The number of the projects
2020	35
2021	47
2022	63
2023	72
2024	81

Source: State Agency for Science and Higher Education of the Republic of Azerbaijan (2024)

Table 2. Distribution of Respondents by Role

Roles	Number of Respondents
Students	130
Teachers	70

Source: Compiled by the author

The analysis revealed that although students exhibit a high tendency to participate in innovation processes, there is a need for more systematic encouragement of their involvement. In contrast, faculty members primarily highlighted resource shortages and management challenges.

Table 3. Key Factors Determining Innovation Activity

Factor	Mean Score (1-5)
Availability of Infrastructure	3.8
Financial Support	3.4
Management Incentives	3.9
Training and Mentorship	4.1

Source: SPSS analysis results, calculated by the author (2024)

The results indicate that training and mentorship are considered one of the key factors in strengthening the innovation environment in higher education. Management incentives and infrastructure development also serve as other important factors. Although financing was rated relatively lower, there has been an observed increase in initiatives from both the public and private sectors in this direction.

2. Qualitative Approach. The qualitative phase aimed to gain a deeper understanding of innovation activities and to identify the perspectives of decision-makers and experts. The following methods were employed in this phase:

• **Focus Group Interviews:**Semi-structured focus group interviews were conducted with vice-rectors, researchers, and heads of innovation centers at 10 higher education institutions in Baku and regional areas. Discussions during the interviews covered innovation strategies, encountered challenges, and future prospects.

• **Document Analysis:**Content analysis was performed on educational strategies, state programs, and policy documents related to higher education adopted in the Republic of Azerbaijan. This analysis provided insights into the legal and institutional framework for innovation research.

Focus groups at the 10 institutions used semi-structured questionnaires and addressed key topics such as:

• University innovation strategies;

• Interactions within the innovation ecosystem;

• The role of legislation and regulatory frameworks;

• Faculty motivation and initiative.

A key finding from the focus groups was that the lack of administrative and financial autonomy restricts innovation initiatives.

Documents analyzed included the "State Strategy for Education Development 2022–2026," the "Law on Science and Education," and other relevant legal documents of Azerbaijan. While these documents define the normative basis for innovation activities, weak coordination and monitoring mechanisms in practice were identified as major issues.

To integrate quantitative and qualitative data, the triangulation method was applied in the study:

• Results obtained from surveys and statistical analyses were compared with focus group data.

• The mutual influence and confirmation levels between results derived from different methods for the same indicators were assessed.

Ultimately, although training and mentorship emerged as statistically significant factors, focus groups noted that their effectiveness depends on systematic leadership support. This indicates that individual factors interact with each other and outcomes may vary depending on the context.

3. Principle of Combination. A distinguishing feature of the research is the integration and triangulation of quantitative and qualitative data. This principle was realized as follows:

• **Triangulation Method:** Consistencies, discrepancies, and complementarities between results from the quantitative and qualitative phases were analyzed. This method served to jointly interpret data from various sources and to enhance the reliability of findings.

• **Mutual Influence Mechanisms of Results:** Statistical trends identified in the quantitative analysis were linked with qualitative insights from focus groups, explaining how these factors impact the innovation environment in the higher education system.

Through this methodological approach, the study offers deep and complex results grounded both in empirical data and contextual analysis. Consequently, a strong scientific basis has been established for formulating more targeted policies and decisions to promote the development of innovation in higher education in Azerbaijan.

DISCUSSIONS

The discussion of the research findings reveals that although innovation activity within Azerbaijan's higher education system has significantly developed in recent years, a number of structural, methodological, and institutional challenges remain for its full functional and sustainable organization. The empirical results obtained through the mixed methodology, as well as the observed parallels and divergences between quantitative and qualitative indicators, are systematically analyzed in this section.

1. Annual Growth and Strengthening of the Innovation Environment.

The steady increase in the number of innovation projects implemented between 2020 and 2024 (Table 1) demonstrates the strengthening of innovation potential within the higher education system. This trend is a result of both strategically adopted state-level documents and internal university initiatives. However, an increase in the number of projects does not automatically ensure their quality and impact. During focus groups, many university representatives emphasized the lack of practical outcomes and weak commercialization mechanisms.

2. Analysis of Respondents and Participation Levels.

The respondent base of 200 individuals (Table 2) showed that students are more active in innovation initiatives. This can be explained by young people's high interest in technology and advanced digital skills. Conversely, the lower participation of faculty members is attributed to lack of motivation, additional workload, and insufficient financial incentives. This finding aligns with international experience: the OECD (2019) report highlights students and young researchers as the main driving forces of innovation in higher education.

3. Key Factors: Infrastructure and Leadership Support.

Factor analysis results (Table 3) indicated that training and mentorship (mean score 4.1) and management incentives (mean score 3.9) are the most influential factors on innovation activity. This aligns with both survey results and opinions voiced in focus groups. Although university leaders acknowledged the existence of training programs and incentive mechanisms, they noted these need to be improved and systematized.

At the same time, the availability of infrastructure (mean score 3.8), despite technological advancements, highlights the inequality in resource distribution (between regional and central universities), which creates disparities in the innovation environment.

4. Implementation of Legislation and Policy Documents.

Document analysis revealed that education and innovation strategies adopted in Azerbaijan (e.g., the "State Strategy for Education Development 2022–2026") provide systematic support for innovation.

However, discrepancies and coordination gaps between normative acts and enforcement mechanisms have been observed in practice. The majority of focus groups identified this gap as one of the main obstacles.

5. **Synthesis of Triangulation Results.**

The triangulation principle applied within the mixed methodology framework allowed for uncovering the mechanisms of mutual influence between results. For example, the high rating of training and mentorship in survey results was repeatedly emphasized in focus groups, confirming the need for further development in this area. This synthesis demonstrates that methodological pluralism not only enriches information but also builds a reliable bridge between different analytical levels.

CONSLUSION

The research findings indicate that innovation activity in Azerbaijan's higher education system has demonstrated increasing dynamics in recent years. The observed rise in the number of innovation projects between 2020 and 2024 (Table 1) confirms the growing interest of higher education institutions in this field. However, the quality, sustainability, and commercialization of these projects remain below the desired level.

According to the survey results (Table 2), a large majority of students and faculty members acknowledge the importance of innovation initiatives in higher education. The factor analysis results (Table 3) revealed that the primary factors strengthening innovation activities are training and mentorship (mean score 4.1), management incentives (3.9), and availability of infrastructure (3.8). This highlights the need for a comprehensive approach to organizing an innovation environment in universities.

Qualitative analysis results indicate that university leadership primarily emphasizes two directions for innovation development — strategic planning and strengthening human capital. Data from focus groups showed that most decision-makers associate innovation more with scientific research activities and give relatively less attention to promoting practical applications.

Content analysis of policy documents demonstrated that although certain steps have been taken at the state level to stimulate innovation in higher education, the implementation of these strategies is poorly coordinated and insufficiently resourced.

The joint analysis of these findings through the triangulation method reveals the necessity for comprehensive reforms at structural, cultural, and managerial levels to advance innovation activities within the higher education system.

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