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Fifth Generation University Data-Based Model in Islamic Azad University

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ABSTRACT

This research aims to develop a data-based model for fifth-generation universities. Creating a data-driven model in a university environment is essential in education. The primary mission of higher education is to address the specific educational needs of individuals, as well as the needs of society and its economic development. The study was conducted in both qualitative and quantitative sections. The grounded theory is conducted based on the perspectives of the chancellors of Islamic Azad University. 21 people were selected using snowball sampling techniques. In the following, a six-category model is provided. Analysis was done using NVIVO software. The statistical population in the quantitative section consisted of all professors from Islamic Azad University nationwide. A sample size of 381 professors was selected using the Cochran sampling formula. The research tool was a questionnaire created by the researcher. Then, using the model presented and the suggested pattern fit, the performance of the model is predicted based on the K-Mean method in Weka and RapidMiner software. According to the results, the proposed model was approved by experts. The analysis of structural equations was also confirmed. According to the Waode algorithm model, the highest accuracy was 81%. **©authors**

1. Introduction

Considering data as an asset and becoming a data-driven organization is necessary for universities in the macroeconomic age (Zanelti et al., 2023). In this approach, universities use organizational data as a tool to improve productivity, enhance operational efficiency, and make informed decisions based on real-world beliefs (KIAPI & VOLVoulis, 2022). Creating a data-driven model within a university environment is essential in education because the main goal of higher education is to meet the specific educational needs of individuals, as well as the needs of the community and the economic development of society (Alina Sandu et al., 2014). A closer examination of the evolution of universities reveals a significant need for education and scientific advancements in the first generation, as well as their integration with society, industry, and future generations in the second generation. However, the weaknesses of each generation have given rise to another generation. This is based on the discovery of hidden patterns in organizational data (Zand et al., 2023).

Higher education, with its vision of a promising future, requires universities to prioritize modernity in knowledge, culture, and society. As a result, universities must undertake the task of redefining their organizational mission. Such a redevelopment of higher education will enable universities to compete globally for excellence, using new indicators based on data-driven advancements (Barron, 2022).

Over the past few years, there have been significant changes in the adaptation of academic systems and the requirements of the European Higher Education Area (Hatim et al., 2022). European countries are striving to improve their response to social needs and expectations in order to meet the demands of human capital and foster a strong connection between social and economic welfare. However, the traditional flow of interactions between higher education and the labor market in contemporary Europe has not been proven. Therefore, Western societies continue to face the challenge of significant youth unemployment (Eurostat, 2009).

In order to address these challenges over the past few decades, higher education institutions have played a crucial role in regional economic development and knowledge transfer. This has led to the emergence of a third mission for universities - that of being entrepreneurial (Arthur et al., 2017). The third mission of universities, especially considering the dimensions of research, development, and innovation, involves fostering a shared understanding of programs and anticipating the future needs of stakeholders. This enables higher education institutions to comprehend the identified needs and effectively design and implement the necessary programs by using data mining.

The ultimate outcome of higher education institutions' activities is the provision of educational services, which fulfill consumers' intangible needs for knowledge and resources such as textbooks, manuals, monographs, methodological developments, etc. (Kukharska, 2022). Moving towards the triple helix model of partnership between government, industry, and higher education (Pechter, 2022; Ogunsanya, 2021), the program focuses on employability and skill development of graduates, preparing them for the global labor market. This strategic response addresses the increasing demand for higher education (Klofsten, 2019), the internationalization of universities (Ballantine, 2021), and strategies to navigate global competition, which present both opportunities and threats. These changes reflect the evolving nature of the knowledge society and pose challenges in organizing knowledge within higher education.

The pressure on universities to socially and economically address the challenges of regional development in a global context highlights the failure of previous generations to adapt to the evolving needs and dynamics of society (Suprijandoko, 2022). Issues such as the relationship with the industry, government investment, increases in tuition fees and education costs, and people's attention to quality issues are among the

main reasons for focusing on responsiveness through the identification of hidden needs in organizational data (Steinle et al., 2022). The demand for university accountability is not a passing or sudden wave, but rather a reflection of the need to demonstrate that students are genuinely learning and that resources are being utilized effectively and efficiently. In the same vein, the fourth generation is focused on fostering local and regional development through the establishment of creative universities or what is commonly referred to as community building and indigenous development (Yacoub et al., 2023).

In terms of purpose and role, fourth-generation universities are willing to plan based on data and create an intelligent database. They aim to use knowledge research and preventive economic development to create strategic goals and serve as an engine in the local economy. From an output viewpoint, professionals, scientists, and entrepreneurs are focused on the local and competitive economy. They also have professional and local experts who possess practical and functional features in terms of multilingual language (national and English) and management (Ahmad et al., 2022). Changes in technology can be observed in various educational communities. According to the trend of technological developments, universities, as leading institutions in the field of science, are transitioning towards electronic processes for education management. This shift has led to the creation of databases with a large amount of information in educational environments. By analyzing this massive amount of educational data, techniques can be identified to enhance the educational situation for students. Educational data mining in the fifth-generation university aims to uncover knowledge within the educational system's data and enhance and optimize the system. Examining and predicting educational performance provides valuable insights for the success of educational systems and can assist managers in making informed decisions to enhance the efficiency of the educational system and

improve university performance (Hilliger et al., 2022).

Therefore, universities need to respond to new data-driven challenges in a rapidly changing world in order to succeed. Universities need to measure their sustainability performance by monitoring organizational data in order to leverage their main strengths, address their weaknesses, and meet new expectations (Nagy et al., 2020).

Innovation in the areas of private ownership of universities, innovative budget strategies, and quality assurance practices (Etuk, 2015) are important. Additionally, sustainability policies that focus on transversal skills (Gallagher & Savage, 2022) and effective governance of higher education during times of crisis are crucial for achieving an equal distribution of quality. Education (Bangkara et al., 2022), innovation, criticism, power, security, continuity, care (Leathwood & Read, 2022), citizen-centered approaches, and smart city management (Vilariño, 2022) are examples of the changes in the academic field.

Distance learning has evolved over the generations and has taken on a more comprehensive form in fifth-generation universities (Martin et al., 2022).

According to the challenges faced by the Islamic Azad University system and the need for successful implementation of a transformative program for dramatic changes in organizational management, it is necessary to develop a data-oriented model to enhance the performance of the university and establish it as a fifth-generation institution. The results of this research can provide a model on which to base the review and reform of the country's higher education system, particularly in the studied Islamic Azad universities.

Evaluating educational performance through the identification and analysis of data from university activities using data mining procedures can lead to effective improvements in educational performance. Educational data mining can help transform Islamic Azad University into a fifth-generation university model. Based on data

mining techniques, what is the data-oriented model of a fifth-generation university?

2. Literature Review

Universities with models to test the commercialization or exploitation of knowledge underwent a transformation during a time when the Western world was experiencing a reduction in growth rate. This transformation involved the implementation of a new organizational structure, marketing activities, and new methods of financing, all aimed at turning universities into tools of economic growth (Huerta et al., 2023). In this transitional stage, entrepreneurship emerged as a means to facilitate and implement changes by integrating the university and entrepreneurship with a transitional approach. The development of three generations of universities took place during this transition period (Saqr et al., 2022).

Then, a special function beyond the third generation of universities emerged, and the concept of the fourth generation of universities was introduced in the international literature. This concept refers to a future university with characteristics that are still being explored and require further investigation, as there is scientific consensus on its precise definition. The reference "Tishkina et al., 2022" is missing.

This concept refers to the fact that modern universities today face global competition and must have the ability to actively influence the social and economic processes of the region in which they are located.

These processes and effects can be influenced in the competitive field by direct and indirect complex systems on a diverse scale in various regions with varying levels of development.

The performance of fourth-generation universities addresses the following questions: "What conditions should universities have in order to develop locally and establish and sustain their global presence?" And, "How can universities actively influence local economic development in less developed areas?"".

The most significant difference is that these universities possess substantial and current knowledge, allowing them to actively influence their surroundings (Lezhnina & Kismihók, 2021).

The fifth-generation universities have characteristics that go beyond the functions of previous generations, such as education, research, services, and entrepreneurship. They also focus on regional development models, addressing social problems, enhancing competitiveness, and promoting human-economic development. The Fifth Generation University is a flexible institution that utilizes existing data and generates information in order to adapt to the changing world around it. Evidence shows that the concept of the "fifth generation" of universities has emerged in the international literature, revealing interesting insights that can be considered in relation to economic development activities (Richard, 2023).

The purpose of this study is to investigate and systematize the active and passive initiatives of universities that enhance the competitiveness of a region (Lukovics & Zuti, 2017).

Based on research evidence, universities face several challenges. These challenges include providing quality-based education (Gopinath & Poornappriya, 2022), transitioning from an "instructive" and lecture-oriented approach to a more student-oriented "constructivist" approach (O'Connor, 2022), improving students' competence and educators (Núñez et al., 2022), fostering multiplicity and collaboration between stakeholders (Mei & Symaco, 2022), incorporating distance learning and the use of new technologies (Mateos-Ronco, 2022), and implementing effective employee recruitment and research strategies (El-Tawy & Abdel-Kader, 2022) that require a generational transition. Therefore, the research indicates the absence of a practical model in the field of the fifth-generation university.

3. Method

Considering its purpose, this research is of a mixed type in terms of the nature of the data and the research approach. In the first step, the criteria of a fifth-generation university have been qualitatively identified.

According to the grounded theory technique, the relevant codes have been discussed based on the opinions of Islamic Azad University administrators. 21 people were selected using the snowball technique. In the following, the data model of the six-category foundation is presented. Analysis was done in Nvivo software.

The statistical population of the quantitative part was all the professors of the Islamic Azad Universities in the country, of which 381 people were selected as the sample size using Cochran's sampling formula. The random sampling method was proportional to the volume based on the units of the provincial centers. The data collection tool was a 92-item researcher-made questionnaire. This questionnaire was the result of the qualitative part and to ensure content and construct validity, content validity was used by the CVR method and confirmatory factor analysis. The reliability of the tool was estimated using Cronbach's alpha coefficient. The analysis was done in AMOS software.

Based on the presented model and its fit, as determined by the K-MEAN method in WEKA and RapidMiner software, the performance of the model has been predicted. Based on the database of Islamic Azad University, an operational definition has been provided for each identified category, and the performance of this model has been evaluated using the proposed algorithm.

4. Research Findings

The open and central codes of model sections are defined to answer the research question, "What is the conceptual paradigm of the fifth-generation university model?"".

Fifth Generation University Model Conditions: Causal conditions are the factors that impact the core category.

Based on the conducted interviews, axial codes were identified and linked to a broader selective code known as causal conditions. These codes include knowledge development.

Modern social needs; intra-organizational factors; extra-organizational factors; first-generation university mechanisms; second-generation university mechanisms; third-generation university mechanisms; fourth-generation university mechanisms. Table 2 displays the codes within this category.

In table 1, some of the conducted interviews are mentioned

Table1. Interviews and coding

Code	Interview
Entrepreneurship-creating employment	The university needs to create a platform for applying knowledge and creating jobs
Commercialization of knowledge	Commercialization of knowledge can be facilitated by supporting student innovation
supply of resources	The necessary financial and physical resources should be available to the university
Adoption of laws	Necessary laws for modeling and globalization should be approved

Table 2. Axial coding of quality data

MAIN CODING	Axial Coding	Secondary coding	Open coding
CASUAL CONDITION	Knowledge Development	Stability and stability of science and knowledge	Training of specialized human resources
			learning process
		The speed of progress of science	Production of knowledge and innovation
			Generational changes
	Modern social needs	Revival of the spiritual civilization of the university	Identifying the needs of the community
			The position of the university in the culture of society
		The position of the university and higher education	How to manage
			The structure of the fifth generation university
	Intra -organizational factors	Academic values	University perspective
			Goals of the fifth generation university
		Human interaction. University. Technology	Extracurricular communication
			The relationship between man and technology
	Extra-organizational factors	Identification of environmental-social conditions	Social factors
			Environmental factors
		Academic independence	Policy
			Non-dependence on government and religion

		Funding	University equipment
			Economic conditions of fifth generation universities
	First-generation university mechanisms	Educational and teaching mission	Scientific education
			Teaching method
		The structure of the first generation university	Goals of the first generation university
			Lack of financial independence
	Second-generation university mechanisms	Applied and research training	Research-oriented science
			Changing the function from teaching to research
		Changing the academic function	University attitude
			Student education method
		The structure of the second generation university	Goals of the second generation university
			Providing financial credit
	Third-generation university mechanisms	Utilization of technical knowledge	Development of new businesses
			Entrepreneurship education
		Based development Expansion of the organizational environment	Third generation university environment
			Increasing the cost of advanced studies
	Fourth-generation university mechanisms	Changing the university's approach from duty-oriented to responsibility	Taking a strategic approach
			Converting training into action
			community oriented
		International partnerships	Internationalization of higher education
			Providing credits
BACKROUND CONDITION	Creating social, cultural and political networks at university	cultural factors	A culture of responsible innovation
			Cultural Revolution
		Political-social factors	Political factors governing the society
			social factors
	University Economic Development	Financial growth and equipment	Funds
			Infrastructure development
		Economic factors	Economic conditions
			investment
	Corporate support platforms	Support and participation	participation
			Support structure
		Design a model to identify government expectations and regulations	Terms and Conditions
			Supervision
	The existence of a dynamic environment and structure in the university	Creating a global environment and technology	Adapting to technology
			Special conditions of technology
		Academic independence	Attention to the type of management
			Administration of the university by itself
INTERVENTING CONDITION	Change of the educational approach	Production of knowledge and innovation	Developer training program
			A multi-layered approach to the production of knowledge and innovation
		Reforming the educational structure of the university	Empowering staff
			Recruitment, evaluation and scientific promotion
	Environmental reversal	The relationship between science and employment	Employment and income generation
			The connection between the university and the market
		Environmental factors	Attention to the environment
			Taking advantage of environmental opportunities
STRATEGIES	Development Architecture	Data management	Transferring the values of one generation to the next generations
			data transfer
		Creating and promoting sustainable development	Sustainable development
			Needs assessment by specialized and committed people
	Academic Effectiveness	Independence of the university in terms of human and scientific manpower	Student independence
			Independence of university professors
		Creating strategic goals	Changing goals
			Maintaining goals
			Increasing the number of educated people

	Elite development	Support and support of the elite	Scientific-applied interactions
		Economic Development	Reduce economic recession
			creating jobs
			Reducing the needs of society
CONSEQUENCES	University inclusive effectiveness	Political and cultural development	political development
			Cultural development
		Social and environmental development	Environmental development
			Social Development
	The emergence of the fifth generation university traits	Improvement of existing conditions	Competitiveness
			Achieving development and transformation
		Independence of university action	Upgrading the position of the university
			A university independent of the ideology of the government

Among the identified factors, a selective coding paradigm was employed.

Based on that, the linear relationship between the secondary code and the central code, including causal conditions, background conditions, intervening conditions, strategies, and consequences, was determined.

In the second stage, the designed model was validated using the designed questionnaire and the confirmatory factor analysis method.

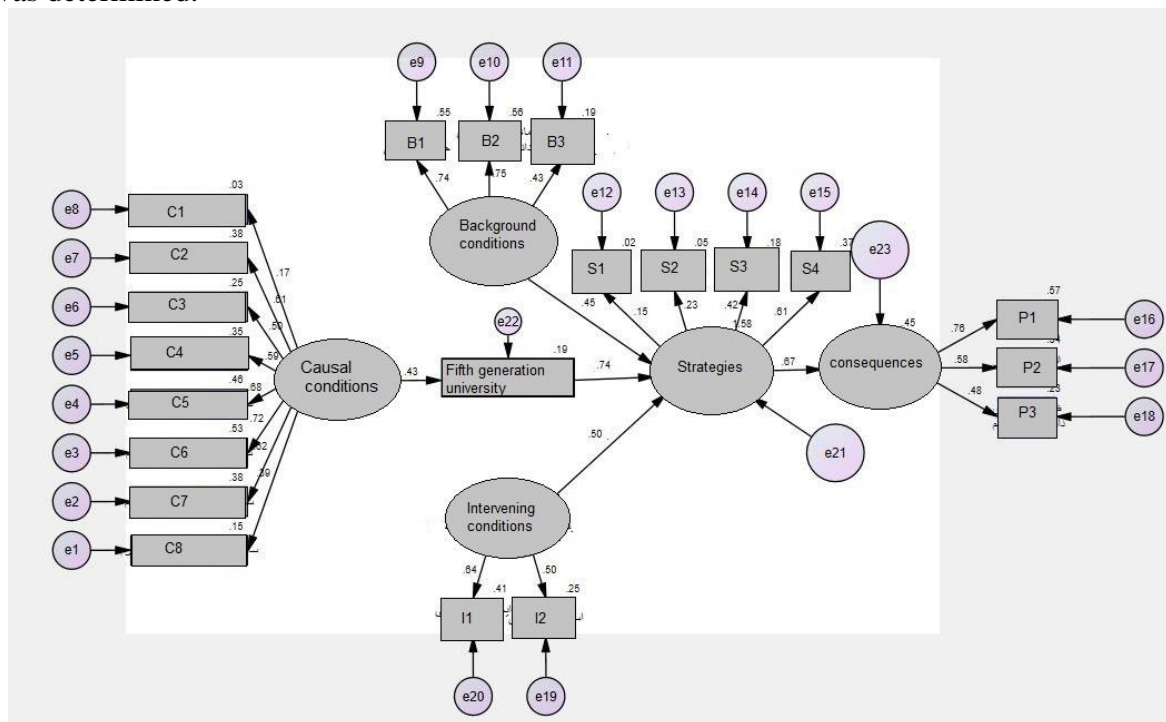In addition, the structural equation model was reported based on Figure 1.

Figure 1. Structural equation model

All factor loadings are higher than 0.3, indicating the acceptability of the model. Additionally, Bentler-Bonnet normalized fit indices are used to assess the model's fit.

Relative fit, incremental fit, adaptive indices, and perfect square have been used, and the results obtained from the model are demonstrated in Tables 2 and 3.

Table 2. Fit indices of the research model

Model	AGFI	SRMR	RFI	IFI	GFI	CFI	NFI	RMSEA	X2/df
Acceptable amount	>0.8	>0.09	>0.9	>0.9	>0.9	>0.9	>0.9	<0.1	1-3
Calculated	0.87	0.14	0.95	0.94	0.99	0.99	0.98	0.033	1.65

Based on Table 3, the factors identified in the grounded theory model have had an impact on one another. The factor load of causal factors in the main category is 0.43,

and its t-statistic is 10.191. The factor loading of contextual factors on strategies is 0.45, with a t-statistic of 9.808. The factor load of the intervening factors on the strategies is 0.50, with a t-statistic of 10.123. The factor load of the main category on the

strategies is 0.74, with a t-statistic of 19.620. Finally, the factor loading of the strategies on the results was 0.67, and its t-statistic was 17.181. Therefore, it can be said that the research model has been approved.

Table 3. Investigating the impact of the identified factors of grounded theory model on each other

Impact	Factor Load	t-statistics	Significance level	Result
Causal Factors on the Main Category	0.43	10.191	0.000	Confirmation of relationship
Contextual factors on Strategies	0.45	9. 808	0.000	Confirmation of relationship
Intervening factors on Strategies	0.50	10. 123	0.000	Confirmation of relationship
The Main Category on Strategies	0.74	19. 620	0.000	Confirmation of relationship
Strategies on Consequences	0.67	17. 181	0.000	Confirmation of relationship

In this study, simulation was conducted using the Rapidminer software, with the addition of Weka algorithms to enhance its capabilities. Five training and test datasets are proposed for modeling, consisting of various reviews and multiple testing instances. The majority of the time was spent on pre-processing. The algorithm for each model is available in the RapidMiner software. Figure 2 shows an example of the software's output.
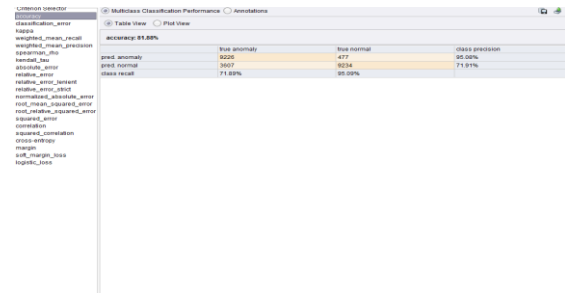

***Figure 2.** An example of the Rapidminer software output with different evaluation parameters*

In this section, we simulated and evaluated all Kernel Naive Bayesian, Naive Bayesian, and Waode algorithms in the Bayesian model using software. The evaluation results are shown in Tables 4 to 8.

-Kernel naive Bayesian algorithm

This algorithm utilizes basic Bayesian probabilistic theory with kernel density. The weight function used in the kernel employs parameter-free estimation techniques. The kernel uses random variables for estimation.

Parameter-free estimation has no fixed structure, and the goal is to obtain an estimate.

	True anomaly	true normal	class precision
pred. anomaly	9355	1144	89.10%
pred. normal	3477	8566	71.13%
class recall	72.90%	88.22%	

To simulate this algorithm, we use the third type data set.

***Table 4.** Confusion matrix of Kernel naive Bayesian algorithm*

***Table 5.** Evaluation criteria and result of Kernel naive Bayesian algorithm*

F-measure	squared error	precision	recall	accuracy
0.8033	0.202 +/- 0.397	80.12%	80.56%	79.50%

-Naive Bayesian Algorithm

This algorithm uses the simple bison probability theory and the variables must be independent of each other. To simulate this algorithm, we use the second type of data set.

***Table 6.** Confusion matrix of Naive Bayesian algorithm*

	true anomaly	true normal	class precision
pred. anomaly	8481	780	91.58%
pred. normal	4352	8931	67.24%
class recall	66.09%	91.97%	

***Table 7.** Evaluation criteria and result of Naive Bayesian algorithm*

F-measure	squared_error	precision	recall	accuracy
0.7921	0.226 +/- 0.417	79.41%	79.03%	77.24%

-WAODE algorithm

It constructs a model by calculating the average estimation of the dependency weight between the parameters. To simulate this algorithm, we utilize the second type of dataset and apply the discretization function to discretize the data.

Table 7. Confusion matrix of Waode algorithm

	true anomaly	true normal	class precision
pred. anomaly	9226	477	95.08%
pred. normal	3607	9234	71.91%
class recall	71.89%	95.09%	

Table 8. Waode algorithm evaluation criteria and results

F-measure	squared_error	precision	recall	accuracy
0.8349	0.130 +/- 0.255	83.50%	83.49%	81.88%

Based on the Waode algorithm results model, the highest accuracy rate of 81% was obtained.

5. Discussion

This research was conducted to propose a data-oriented model for fifth-generation universities in Islamic Azad Universities. The administrators of Islamic Azad University should take the necessary steps to achieve the goals outlined in the Vision Document through data-driven decision-making. For this purpose, it is necessary to utilize the educational data mining process to effectively navigate this path and overcome the challenges that lie ahead. Today's academic system must continuously adapt to the scientific and social environments through data-oriented strategies and maintain a dynamic balance with the ever-changing society.

Zanellati et al. (2023) considered the intelligence of the university to be essential, based on knowledge extraction and awareness. Yacoub et al. (2023) stated that higher education, as one of the subsystems of society, plays a prominent role in identifying and responding to the needs of society using advanced technologies. Such an institution, which is self-developing, has an urgent need for deliberate and data-driven internal development. The internal development of higher education requires transformation and the utilization of tools and solutions that enable higher education institutions to avoid stagnation and achieve sustainable development.

Developing this model in higher education can provide remarkably suitable solutions for many university problems and help universities achieve their goals. This model has a significant responsibility in various fields, including scientific, cultural, political, social, and economic. It aims to achieve vital and sensitive goals and implement policies such as promoting science production, fostering a scientific spirit within the university, enhancing the culture of learning science, emphasizing religious culture and deepening religious knowledge, developing skills in political and social education, ensuring justice, and designing and developing technological discourse.

Llerena-Izquierdo et al. (2023) demonstrated the significance of transitioning to a smart university and embracing the fifth generation through their research utilizing the educational data mining method.

The participants mentioned effective strategies in the establishment of the fifth-generation university, such as changing the educational approach, environmental reengineering, improving academic effectiveness, and developing the architecture.

The establishment of fifth-generation universities in higher education is of special importance due to the crucial role universities play in training specialized human resources required by various sectors of society.

Islamic Azad University is transitioning from being solely an education-oriented institution to becoming a civilization-building university. The collective efforts of this group are focused on creating the necessary platform for such activities.

In the meantime, it should be noted that the development and implementation of comprehensive research activities depend on thorough planning. Therefore, researchers, professors, and students should strive to develop knowledge-based research programs.

Because increased research activities in the country lead to development, progress, self-sufficiency, and true independence.

One of the main tasks of universities and higher education centers is the production and dissemination of scientific knowledge, the training of specialized human resources, and the provision of specialized services to society. The optimal performance of each of these tasks depends on having basic, applied, and developmental research, as well as preparing researchers who are capable of conducting this research.

Most of the participants in this research believed that the activities and research projects of universities should be focused on serving the needs of society and have a strong practical aspect. They argued that universities should not allocate funds for research that does not address at least one of the current problems faced by society.

Modern economic development necessitates the expansion of traditional educational and research activities in universities due to the growing social and economic responsibilities. However, current universities lack the capacity to meet these demands and must undergo changes (Lukovics & Zuti, 2017). As the catalyst for change and progress, a university that creates value, advances civilization, and nurtures individuals must possess the requisite efficiency and effectiveness to fully accomplish its assigned missions, goals, and tasks. And this is important only with the cooperation and consensus of customers, both internal customers (teachers, staff, and students) and other stakeholders (university, society, industry, and government).

6. Conclusion

The establishment of a fifth-generation university in higher education can lead to the optimization of resource allocation behavior among various stakeholders and prevent the waste of resources, such as financial resources and students' time and lives. This, in turn, enhances the overall effectiveness of the university and contributes to the development of civilization.

In order to achieve the level of new generation universities, it is suggested to create databases that are appropriate for the current situation of universities. These databases would collect information, assess the supply and demand of applied research in universities based on the needs of the country, and promote the culture and awareness of opportunities and characteristics of civilization. We provide educational and informational services to inform, prepare, and support faculty members in matters related to civilization. We also establish organizational units in collaboration with specific organizations to manage civilization-related issues. Additionally, we offer practical training for professors on behalf of university educational management.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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