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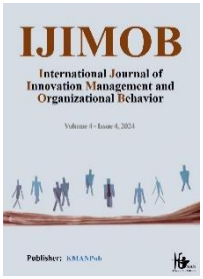

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Identifying Components and Examining Causal Relationships of Optimal Budgeting in Iran's Education System

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A B S T R A C T

Objective: The objective of this study is to identify the components and examine the causal relationships of optimal budgeting in Iran's education system.

Methodology: This research employed an applied and exploratory approach, utilizing descriptive and survey methods for data collection. Initially, the components and sub-components of optimal budgeting were identified through a review of literature, including theses, articles, and books. A designed questionnaire was then reviewed and completed by experts and specialists in the field of industrial management and academic professors using the fuzzy Delphi method. Subsequently, the causal relationships between the components were determined using DEMATEL multi-criteria decision-making methods.

Findings: The study identified three main components—Ability (ABI), Authority (AUT), and Acceptance (ACC)—as crucial for optimal budgeting in Iran's education system. The results from the Delphi fuzzy method indicated a consensus among experts, with all components having definitive means above 0.4. The DEMATEL analysis revealed that the Authority (AUT) component has the highest influence and lowest receptivity among the components, making it the most significant factor. It was found that enhancing the Authority (AUT) component can positively influence the other components, leading to improved budgeting outcomes.

Conclusion: For optimal budgeting in Iran's education system, controlling the main components—Ability (ABI), Authority (AUT), and Acceptance (ACC)—is essential. Enhancing the Authority (AUT) component can lead to better control of other components, resulting in improved budgeting with reduced costs and time. Systemic budgeting is crucial for the growth and development of countries, and it is imperative for Iran's General Directorate of Education to adopt this strategy to align with global trends.

Keywords: *Optimal Budgeting, Education System, Iran, Delphi Fuzzy Method, DEMATEL, Causal Relationships, Resource Allocation*

1 Introduction

A budget represents all government programs and activities and plays a very important role in national economic development. Historically, governments have used tools and resources to optimally allocate and redistribute resources. One of the essential tools and resources that governments annually determine and implement is budgeting. Generally, governments strive to allocate resources optimally through budgeting to reduce inequalities (Azar et al., 2014; Azar et al., 2013). The resource allocation process organizes available resources with organizational mission processes. The resource allocation process is designed to enable managers to make informed decisions quickly, without significant investment in time, money, and resources. This process helps deliver short-term benefits through a limited budget (Sim & Rogers, 2009).

Investment in education is a key factor in the development process, reflecting its growing importance since the 1960s. During this period, investment in formal and informal education and human resource development led to increased skills and the necessary awareness and mobility for economic and social development. For the past 40 years, the World Bank has been providing educational loans to developing countries. During this period, the bank has gained extensive experience in formulating educational policies and designing independent projects. These experiences emphasize the importance of investment and illustrate the complexities involved in setting educational policies and investment strategies to maximize a country's development efforts (Chukwuemeka et al., 2019; Jahanbini et al., 2022).

The quality of education has always been a major concern for education systems in most countries worldwide. Over the past two decades, education systems have faced global trends that have not only influenced their operational processes but also transformed their goals. These trends include the knowledge-based economy and information and communication technologies. According to the Organization for Economic Cooperation and Development (OECD), a knowledge-based economy is directly based on the production, distribution, and consumption of knowledge and information. In a knowledge-based economy, knowledge is the main driver of growth, wealth creation, and employment in all activities (Alio et al., 2019; Arquitt & Johnstone, 2008; Azar et al., 2014).

Human capital is a composite indicator of life expectancy, education, and income. Many theories link the increase in human capital reserves to education; the role of human capital in economic development, productivity growth, and innovation is increasingly emphasized. This justifies the allocation of government subsidies for education, skill development, and on-the-job training (Bastanipourmoghadam et al., 2021).

In an educational system, the necessary financial resources must be provided by all elements of society; public and private resources complement each other. Given the limitations of public resources and the diversity of government duties and responsibilities, governments strive for maximum participation from the private sector, which also applies to educational matters. Therefore, it is crucial to note that the extent of government intervention in education depends on the gap between the current level of private sector investment (individuals and institutions) in education and the optimal level of investment from the perspective of society as a whole. The greater this gap, the more critical and necessary government intervention becomes. The government's role is to ensure that educational needs are adequately met with the necessary efficiency and equity. This role has not been consistent over time (Azar et al., 2013; Jahanbini et al., 2022; Shabani Bahar et al., 2018). Based on statistical evidence from the past few decades across a wide range of countries, governments have financed a significant portion of educational expenditures. The key point regarding this high share is the necessity of meeting educational needs in any society. These needs must be met regardless of the situation. In areas where the private sector can operate relatively, it also provides educational services. However, the remaining educational needs are met directly or indirectly by the government. There are also areas and conditions where the private sector has no inclination to invest in education, leaving the financial burden of all educational activities on the government, which may not continuously and adequately provide the necessary financial resources to the educational institutions. Furthermore, the Ministry of Education, as the largest government ministry with approximately one million employees, has always faced financial challenges (Chukwuemeka et al., 2019). Over 95% of its budget is allocated directly to personnel salaries, leaving the remaining percentage insufficient to enhance the quality of education. This limitation effectively restricts managers and officials from making any changes or improvements. In Iran, education is state-governed and dependent on public resources. Thus, in prosperous years,

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greater government assistance is expected, and vice versa. However, the budgeting method remains relatively unchanged. Therefore, one of the primary complaints of many education managers and ministers has always been the financial problems of the organization. Additionally, the Program and Budget Organization, due to its nature of dealing with all departments and ministries, faces a high volume of requests for budget increases. In this context, departments with stronger connections and more influence in the organization are more successful (Azar et al., 2014; Shabani Bahar et al., 2018; Sim & Rogers, 2009; Zare Bidoki et al., 2022). Given the lack of attention from governments to education and its lack of priority, education does not have strong advocates in the Program and Budget Organization, making a transformative view and a significant budget increase unlikely. Increasing the share of education from the public budget requires a national resolve to view education as an investment, transforming public culture and making it a primary demand of the people, while also changing the officials' perspective from a consumption view to an investment view. This transformative view must specifically take shape among the officials of the Program and Budget Organization and the members of parliament. Therefore, the Ministry of Education has the responsibility to clarify this important issue and must focus on it. Additionally, attention to the legal status of higher-level documents and the general policies communicated by the Supreme Leader is necessary, with measures in place to make neglecting these documents during annual budget drafting illegal and costly. Thus, referring to these documents can serve as a good basis for increasing the education budget share. Moreover, given the shift in the country's budgeting approach from program-based to operational budgeting from the fourth program, there is an opportunity for the Ministry of Education to explain its actual needs and persuade the officials of the Program and Budget Organization for a reasonable increase in the education budget. However, appropriate mechanisms for this do not yet exist, and one of these mechanisms is conducting scientific and field research to identify the causal relationships in Iran's education system, which is the goal of the present study.

2 Methods and Materials

This study aims to provide a model for optimal budgeting in the education system. Therefore, it can be considered an applied and exploratory research in terms of its objective. Additionally, in terms of data and information collection, the research method is descriptive and survey-based. In the first stage of this research, the components and sub-components of optimal budgeting in Iran's education system were identified by reviewing the literature, including theses, articles, and books.

Then, the designed questionnaire was reviewed and completed by experts and specialists in the field of industrial management and university professors, using the fuzzy Delphi method to identify influential factors. Subsequently, the causal relationships between the components and sub-components of optimal budgeting in Iran's education system were determined using DEMATEL multi-criteria decision-making methods.

The statistical population of this research includes all experts specialized in industrial management and university professors. Based on the available resources, a sample of 10 to 20 experts is sufficient, and 16 experts were selected for this study. The sampling method used in this study is purposive sampling. For data collection, a pairwise comparison questionnaire was used after identifying the components and sub-components of optimal budgeting in Iran's education system.

3 Findings and Results

In this study, we identified the components and sub-components influencing optimal budgeting in Iran's education system through a review of literature, including theses, articles, and books. The identified components and sub-components are presented in Table 1.

Table 1

Components and Sub-components of Optimal Budgeting in Iran's Education System

Components	Sub-components
Ability (ABI)	Performance Evaluation Ability (DEA)
	Human Resource Ability (HUM)
	Technical Ability (TEC)
Authority (AUT)	Organizational Authority (CRG)
	Procedural Authority (PRO)

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Acceptance (ACC)	Legal Authority (LEG) Political Acceptance (POL) Managerial Acceptance (MAN) Motivational Acceptance (MOT)

Initially, the experts completed the questionnaires, and qualitative variables were converted to quantitative fuzzy values. Verbal variables were converted to triangular fuzzy numbers as follows: Strongly Agree (1, 1, 0.9), Agree (1, 0.9, 0.7), Neutral (0.7, 0.5, 0.3), Disagree (0.3, 0.1, 0), and Strongly Disagree (0.1, 0, 0).

In the first round, the counts of responses were: Ability (ABI) - Strongly Agree: 12, Agree: 3, Neutral: 0, Disagree: 0, Strongly Disagree: 1; Authority (AUT) - Strongly Agree: 10, Agree: 5, Neutral: 0, Disagree: 1, Strongly Disagree: 0.

The fuzzy means were defuzzified using the center of gravity method, resulting in defuzzified means of 0.897 for Ability (ABI) and 0.891 for Authority (AUT).

In the second round, the response counts were: Ability (ABI) - Strongly Agree: 9, Agree: 5, Neutral: 1, Disagree: 1, Strongly Disagree: 0; Authority (AUT) - Strongly Agree: 8, Agree: 6, Neutral: 1, Disagree: 1, Strongly Disagree: 0; Acceptance (ACC) - Strongly Agree: 10, Agree: 4, Neutral: 2, Disagree: 0, Strongly Disagree: 0.

The defuzzified means were 0.861 for Ability (ABI), 0.855 for Authority (AUT), and 0.891 for Acceptance (ACC).

In the third round, the counts were: Ability (ABI) - Strongly Agree: 10, Agree: 5, Neutral: 0, Disagree: 1, Strongly Disagree: 0; Authority (AUT) - Strongly Agree: 7, Agree: 8, Neutral: 1, Disagree: 0, Strongly Disagree: 0; Acceptance (ACC) - Strongly Agree: 12, Agree: 3, Neutral: 1, Disagree: 0, Strongly Disagree: 0.

The defuzzified means were 0.891 for Ability (ABI), 0.895 for Authority (AUT), and 0.927 for Acceptance (ACC). The differences between the second and third rounds were less than the threshold (0.1), indicating consensus among experts.

To determine the causal relationships between components, the fuzzy DEMATEL method was employed. The normalized direct impact matrix and the total impact matrix were calculated.

Table 2

Normalized Direct Impact Matrix

Components	Ability (ABI)	Authority (AUT)	Acceptance (ACC)
Ability (ABI)	0.000	0.111	0.067
Authority (AUT)	0.444	0.000	0.317
Acceptance (ACC)	0.333	0.214	0.000

The total impact matrix was then defuzzified. The results indicated that "Authority (AUT)" has a significant influence on the other two components but does not receive a net effect from them.

Table 3

Defuzzified Total Impact Matrix

Components	Ability (ABI)	Authority (AUT)	Acceptance (ACC)
Ability (ABI)	0.368	0.250	0.297
Authority (AUT)	0.726	0.295	1.012
Acceptance (ACC)	0.279	0.281	0.566

Table 4 shows the degree of influence and importance of each component.

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Table 4

Influence and Importance of Components

Components	D	R	D-R	D+R
Ability (ABI)	0.915	1.875	-0.960	2.790
Authority (AUT)	2.034	0.826	1.208	2.860
Acceptance (ACC)	1.125	1.373	-0.248	2.499

The findings indicate that the "Authority (AUT)" component has the highest influence (2.034) and the lowest receptivity (0.826), making it the most crucial factor in the study. This component also has the highest total connection (1.208) and importance (2.860), highlighting its significant role in the budgeting process for Iran's education system.

The Delphi fuzzy method and DEMATEL analysis revealed that the "Authority (AUT)" component plays a pivotal role in optimal budgeting for Iran's education system, influencing both "Ability (ABI)" and "Acceptance (ACC)" without being significantly influenced by them. This underscores the need for robust organizational, procedural, and legal authority to achieve effective budgeting outcomes in education.

4 Discussion and Conclusion

By reviewing the literature in theses, articles, and books, the main components and sub-components influencing optimal budgeting in Iran's education system were identified. The main components include Ability (ABI), Authority (AUT), and Acceptance (ACC). These components were further examined using the Delphi fuzzy method, taking into account expert opinions. The results indicate that, following the first round of the survey, the defuzzified means of the components were presented to the experts. Since the experts agreed with the indices and the definitive means of all components were above 0.4, the second round of the survey included previous expert opinions to allow comparison and recording of new opinions regarding the influential components for optimal budgeting in Iran's education system. Additionally, the Acceptance (ACC) component was added in the second questionnaire based on expert feedback.

The results of the second round indicated that the experts agreed with all components since the definitive means of all indices were above 0.4. In the final round, the defuzzified means were obtained, showing that all components had means greater than 0.4. Comparing the third round results with the second round revealed that the differences between the definitive means of the components were less than the low threshold (0.1). Thus, the survey process was stopped, and the experts agreed on the identified components as influential for optimal budgeting in Iran's education system. These components were validated using the Delphi fuzzy technique.

Furthermore, the DEMATEL fuzzy method was used to determine the causal relationships between the components of optimal budgeting in Iran's education system. The results showed that the Authority (AUT) component has a net impact on the other two components but does not receive a net effect. Conversely, the Acceptance (ACC) component only has a net effect on the Ability (ABI) component. The Authority (AUT) component has an impact score of 2.033, the highest among the components, and a receptivity score of 0.826, the lowest among the components. It also has the highest total connection (1.207) and importance score (2.859), making it the most significant component in this study.

To achieve optimal budgeting in the education system, the three main components—Ability (ABI), Authority (AUT), and Acceptance (ACC)—must be controlled. The study's results indicate that enhancing the Authority (AUT) component can influence the other components, leading to improved budgeting with significantly less cost and time. Focusing on the Ability (ABI) component is the best strategy for dynamic system-based budgeting in Iran's education system.

In general, systemic budgeting is considered a factor that can significantly influence the growth and development process of countries. Many developed and developing countries have achieved significant success in optimal resource allocation by employing this type of budgeting. Therefore, it is essential for the General Directorate of Education in Iran to pay special attention to this important issue to keep pace with the growing global strategy.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

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Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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