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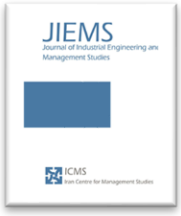

Examining the Interaction of Soft Factors Affecting the Success of Banking Software Development Projects Using Meta-Synthesis, Fuzzy Delphi, and DEMATEL (Case study: Refah Kargaran Bank)

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Abstract

Software development projects in the banking industry face numerous challenges on the path to success due to extensive stakeholder interactions, the need for change management, and technical and managerial complexities. Previous research has shown that the success of these projects depends not only on hard factors (such as budget and scheduling) but also on soft factors (such as organizational culture, team interaction, and product quality). Accordingly, the present study aims to identify and determine the soft criteria influencing the success of such projects. This exploratory, applied, and mixed-methods study, using a descriptive-survey approach, initially employed the meta-synthesis method to extract and organize the criteria; accordingly, following a systematic search in the mentioned databases, out of 62 initial articles, 25 articles related to the success of software projects were selected after a multi-stage review. Consequently, 51 sub-criteria, 11 key criteria, and 3 main domains were extracted. In the next step, through interviews with 5 academic professors and practitioners in the banking industry, the number of sub-criteria increased to 63. After screening through two rounds of Fuzzy Delphi by 11 employees of Refah Bank, 38 sub-criteria and 11 key criteria were finalized, representing a 60% retention rate. Then, using the Fuzzy DEMATEL technique, the influence and interdependence of the criteria were analyzed, and the causal diagram and network of relationships highlighted the central role of "product quality". **Additionally, using the DEMATEL technique, the influence and interdependence of the criteria finalized in the previous stage were analyzed, and 15 key relationships with a threshold of 0.548 were identified. The DEMATEL findings revealed that "product quality" was identified as the most influential criterion with an impact score of 21, followed by "project resource management" with a score of 17, "proper utilization" with a score of 13, "stakeholder satisfaction" with a score of 12, and "implementation of digital governance" with a score of 10, with the influence of "product quality" reflected by a weight of 0.67 on "project resource management," 0.66 on "development criteria," and 0.67 on "support process," indicating a cascading effect. Findings showed that "product quality", characterized by factors such as low unavailability and update time, system security, and code quality, has the greatest influence. Following that, criteria such as project resource management, digital governance realization, proper utilization, and stakeholder satisfaction were identified as key factors. These results can assist banking project managers in improving product quality and increasing the likelihood of project success.

Keywords: Project success, software development, banking industry, product quality, stakeholder satisfaction

Paper Type: Original Research

1. Introduction

Today, information technology (IT) projects function as instruments of transformation and business growth, and a great number of companies are influenced by IT to the extent that without its development, they cannot maintain their competitive advantage. It is evident that global annual investment in the IT industry is continuously increasing. It is estimated that investments in this sector reached over 4 trillion dollars in 2023 (Wirasinghe et al., 2023). These investments are aimed at supporting the achievement of organizational goals and objectives. IT enables multidimensional transformations based on the enhancement of intelligent solutions within organizations, and it is increasingly utilized in improving business operations (Alias et al., 2014). IT projects in various companies may be initiated based on business needs and then developed to address those needs. In many industries, including the financial sector—such as banking—IT projects are continuously evolving, as businesses in areas such as payments, receipts, lending, credit evaluation, and others are also under constant development. Consequently, banks must

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define and develop corresponding IT projects to meet these service demands (Bilir et al., 2021). The Project Management Institute (PMI) defines a project as "a temporary endeavor undertaken to create a unique product, service, or result." IT refers to the technology used for acquiring and processing information in order to support individual and societal goals. The term "information technology systems" is generally used to refer to complex organizations comprising hardware, software, procedures, data, and individuals, which act to address the tasks faced by individuals and groups, and are often developed within certain organizational environments. A related term, "information system (IS)," can be defined as a work system whose processes and activities are dedicated to information processing, i.e., recording and transmission, storage, retrieval, manipulation, and display of information. Therefore, an information system is a system in which human participants or machines perform work (processes and activities) using information, technology, and other resources to produce informational products or services for internal or external customers (Ahmad et al., 2022). The combination of project characteristics and IT objectives provides a definition of "IT project." IT projects are distinct and unique activities that function as vehicles for multidimensional transformations based on information technology. The International Council on Systems Engineering (INCOSE) refers to the complexity factor that characterizes technology projects. Complexity is a feature beyond the scope of a single technical system under development; it is often generated through the interaction of individuals, organizations, and environments that are part of the complex system surrounding the technical system. Information technology (IT) projects differ from other engineering projects and are potentially more challenging, as they are characterized by high complexity and a higher likelihood of failure (Adzmi et al., 2018). Certain features distinguish them from other engineering projects and increase their risk of failure. IT projects have specific characteristics that require them to achieve results in the shortest possible time, and the probability of their failure is often significantly high. In these projects, examining and identifying current processes is of great importance, and flexibility can significantly impact the feasibility of project implementation. The Standish Group reports that 31.1% of projects are classified as failed, meaning they have been abandoned or canceled, while 52.7% are completed with high costs, delays, or without delivering the promised functionality. Therefore, identifying what causes differences in project outcomes and what the key factors are is essential. The factors influencing project outcomes—those that determine success or failure—are generally divided into two categories: hard factors and soft factors. Research has shown that hard factors such as budget, scheduling, cost, and technology alone are not sufficient for project success, especially in IT projects. It is the combination of these with soft skills that leads to more sustainable success. Organizational culture and problem-solving ability are also considered critical soft factors, directly affecting stakeholder satisfaction and the maintenance of effective relationships with clients (Bilir, 2022). For this reason, there is now a greater emphasis within project management frameworks on the training and development of soft skills, enabling teams to achieve strategic goals through enhanced interaction and collaboration (Rahman et al., 2018). The banking industry is one of the sectors that makes extensive use of information technology, and without proper IT services, it cannot provide even the most basic services to its customers. Currently, software companies are striving to meet user needs by offering efficient software solutions. Specifically, banking software companies employ various strategies—such as benchmarking against leading global software, conducting analysis sessions, and utilizing agile software development teams—to increase the success rate of their projects. Nevertheless, comprehensive research aimed at identifying and presenting key success factors in this domain remains limited and requires further in-depth investigation. Previous research indicates that while numerous studies have identified key success factors for IT projects, comprehensive and inclusive research on the success of software projects, particularly in Iran's banking sector, is lacking. Most prior studies have focused on specific domains, and despite the growing importance of banking software projects, only a few have specifically addressed the banking environment. The absence of a comprehensive model for the success of these projects underscores the need for this study, which contributes to advancing knowledge and innovation by identifying key factors and analyzing their influential relationships. Given the critical role of banks in Iran's economy and the increasing pressure on the Central Bank and IT companies to develop mandatory software programs amid sanctions and financial constraints, the urgency of this study is evident. Moreover, approximately 30% of software projects face delays or fail to deliver (Verajou et al., 2022), and given the high costs and analytical needs of banking networks, such failures can weaken inter-bank competition, drive customers to rivals, reduce public trust, and disrupt banking services. Identifying and implementing these factors in banks can shift the existing hierarchical structure toward a flatter one, facilitate relationships between employees, senior managers, and clients, automate banking processes and shorten their execution time, thereby reducing the time required to deliver banking services. Additionally, this study can streamline the regulations governing the implementation of software development projects while maintaining national security and legal standards, and support their revision. This study innovatively integrates meta-synthesis, Fuzzy Delphi, and DEMATEL methods, offering a novel contribution by developing a comprehensive model that identifies key factors and analyzes their influential relationships, providing practical insights and actionable strategies for banking project managers in Iran to enhance project success and address challenges. This model, drawing on

previous studies and recent research developments in Iran's banking industry, can support the localization of findings and the expansion of knowledge in this field. Furthermore, this research can play a key role in reviewing laws and regulations related to bank software development, thereby reducing the challenges faced by the Central Bank and IT companies in formulating and communicating mandatory annual programs to banks in Iran.

2. Literature Review

2.1. Theoretical background

2.1.1. Definition of Project Management

A project is defined as a temporary endeavor to create a unique product, service, or result that has a specific beginning and end, a predetermined goal, and a set of related activities (PMI, 2017). And project management is a process that leads to the achievement of specific project objectives through planning, organizing, monitoring, and directing resources (human, financial, and material) within the constraints of time, cost, and quality (PMI, 2017). This process meets the needs and expectations of stakeholders by applying the necessary knowledge, skills, and tools. Optimizing resource allocation and integrating activities are among the most important tasks of project management, which play a key role in the success of projects, especially in complex areas such as banking software development. The application of meta-heuristic algorithms for optimizing project scheduling, as shown in a case study aimed at maximizing contractor's net present value, underscores the value of advanced tools in boosting resource management efficiency (Baradari et al., 2021). The integration of multi-criteria decision-making methods, as proposed by Ayough et al. (2022), can enhance resource allocation strategies by evaluating site-specific factors, which is relevant for optimizing banking software project management.

2.1.2. Project Success

Project success generally refers to the achievement of predetermined objectives such as time, cost, quality and performance (Bilir, 2022). However, the perception of project success varies depending on the perspective of stakeholders (owners, developers, users and the public) and a project may be considered successful by some and unsuccessful by others. According to Bekrini (1999), defining project success is challenging due to the complexity and diversity of perspectives and there is still limited consensus in this area. In the project management literature, project success is divided into two distinct concepts: 1) project management success, which focuses on the project process and the achievement of time, cost and quality objectives; and 2) project product success, which is related to the final impacts and results of the project (Rahman et al., 2018). Distinguishing between these two concepts is essential for accurately assessing project success, as an efficiently managed project may not meet final expectations or, conversely, may lead to valuable results despite delays and additional costs. This complexity becomes even more important in banking software development projects, which require coordination of multiple stakeholders and the achievement of specific objectives. An analysis of critical success factors for agile software projects using the Fuzzy Delphi method identifies key elements such as stakeholder engagement and adaptability, which are crucial for achieving success in banking software initiatives (Zhang et al., 2025). A study on critical success factors for agile transformation initiatives also emphasizes the significance of organizational culture, leadership commitment, and team autonomy in driving successful outcomes in banking software projects (Santos et al., 2025). The utility additive method, as explored by Ayough et al. (2023), offers a structured approach to prioritize success factors, which can be applied to assess stakeholder perspectives in banking software projects.

2.1.3. Software Development

Software development is a complex, multi-step process that creates, designs, programs, tests, and releases software. This process includes steps such as requirements analysis, system design, coding, quality testing, and ongoing maintenance (Sommerville, 2016). In addition to development, software engineering also includes project management, staff management, and other overhead tasks. Software development can be done sequentially (Waterfall) or iteratively (DevOps – Agile) and uses tools such as integrated development environments (IDE), version control systems, and computer-aided software engineering techniques. Choosing the right method in this process is crucial because it affects the quality, efficiency, and flexibility of the project (Pressman, 2010). In complex projects such as banking software development, this process faces challenges such as changing requirements, high security requirements, coordination of multiple stakeholders, and management of technical and organizational risks. These challenges require close collaboration between programmers, testers, project managers, and end users. In addition, factors such as tight schedules, high costs, and regulatory requirements in the banking sector increase the complexity of the process. Success in banking software development depends on the ability to overcome these challenges through careful planning, the use of flexible methods, and attention to soft factors (such as communication and organizational culture) (Hou Fang, 2020). A survey on software development and programming tools for small industries in Iran recommends adopting tailored tools and methodologies, such as integrated development environments, to enhance efficiency and adaptability in banking software projects (Eslamibidkoli et al., 2023). Hackathons as an educational strategy in software engineering have proven effective in fostering experiential learning, improving soft skills like teamwork and problem-solving, which are vital for collaborative banking software

development (Araújo et al., 2025). A systematic mapping study on soft skills in software engineering reveals a strong demand for skills such as communication and teamwork, essential for managing stakeholder interactions in banking software projects (Matturro et al., 2019).

2.1.4. Software Development Projects

Software development projects are structured efforts in software engineering to design, build, and deploy software solutions to solve specific needs or problems (Sommerville, 2016). With a defined beginning and end and a tangible deliverable (software), these projects provide a systematic approach to transforming ideas into functional products. This complex process requires the collaboration of multiple people within a specified time, budget, and resources, and usually adds significant business value to existing or new processes (Pressman, 2010). Software Development Project Management (SDPM) is a specialized discipline that combines project management principles with the specific challenges of the field. It involves planning, executing, and delivering a project on time, within budget, and in accordance with stakeholder expectations. Project managers in this field guide the development process, manage resources, and ensure quality standards. A multi-objective optimization model addressing multiple project scheduling and multi-skill human resource assignment, considering learning and forgetting effects, offers a sophisticated approach to resource management that can improve the efficiency of banking software development projects (Mousavi et al., 2021). Decision-making frameworks in software engineering highlight the importance of structured decision processes to balance competing objectives, enhancing project outcomes in banking software development (Taherdoost & Mohebi, 2025). Research into Research Software Engineering (RSE) indicates that structured methodologies and collaborative practices can significantly enhance the quality and reliability of software projects, including those in the banking sector (Felderer et al., 2025).

2.1.5. Banking system software development

Banking system software development has evolved over decades, transforming banking operations from manual processes to advanced digital platforms (Pressman, 2010). This software first emerged with the advent of computers in the 20th century to automate transaction recording, and with the introduction of core banking in the 1970s, simplified account management and payment processing (Sommerville, 2016). The advent of the Internet and mobile banking in the 1990s and 2000s improved customer access and added capabilities such as online banking, fraud detection, and data analytics. Unlike traditional systems that relied on paperwork and face-to-face interactions and were prone to errors and delays, modern software with integrated and flexible architectures enables scalability and innovation (Prasetyo, 2019). This transformation has increased operational efficiency by 20-30% and customer satisfaction by 15% (Standish Group International, 2019). Today, artificial intelligence, blockchain, and cybersecurity are shaping the future of these systems, empowering banks to meet digital needs. Hyperparameter optimization using grid search with Support Vector Machines (SVM) to detect fraud transactions in the banking industry offers a cutting-edge approach to enhancing security and reliability in banking software systems (Zare Banadkouki & Mirabi, 2024).

2.1.6. Factors affecting success

The success of projects, especially in the field of banking software development, depends on several factors that have been examined in a multidimensional manner in the project management literature. These factors can be divided into two categories: general and soft. General factors of project success include traditional criteria such as the "iron triangle" (time, cost, quality), which are recognized as key indicators of project performance (Morcov et al., 2015). These criteria, sometimes supplemented by customer satisfaction (Westerveld, 2003), emphasize delivery on time, within budget, and in accordance with requirements. Contingency theory (PCT) also links success to project characteristics such as novelty, technology, complexity, and pace (Kerzner, 2019). In software development projects, factors such as the right delivery strategy, the use of agile techniques, and the nature of the project (Ika et al., 2017), and in banking systems, capabilities such as central banking, risk management, and data analytics (Pressman, 2010) are critical. Choosing the right development methodology also enhances success by ensuring quality, reducing risk, and increasing efficiency (Sommerville, 2016). A stochastic chance constraint-based model for project supply management using metaheuristic methods provides a robust framework to manage uncertainties and optimize resource allocation, significantly boosting the success of banking software projects (Emamgholizadeh et al., 2018). Critical success factors for DevOps, including automation and continuous integration, play a key role in enhancing the efficiency and reliability of banking software projects by streamlining development and deployment processes (Azad, 2025). Soft factors affecting the success of software development projects, especially in the banking sector, generally include communication skills, leadership, collaboration, and organizational culture, which play a pivotal role in the success of software development projects, especially in the banking sector (Engelbrecht et al., 2017). Strong communication skills facilitate the transfer of information and reduce misunderstandings, which is essential in complex banking projects with multiple stakeholders (Stankovic et al., 2017). Effective leadership, by motivating and guiding the team, improves performance in the face of frequent changes in requirements. A positive organizational culture fosters trust and collaboration, which is critical in banking environments with the need for legal and security compliance (Engelbrecht et al., 2017). These factors also increase customer satisfaction (Henriksen & Pedersen, 2017). In banking projects, senior leadership support, time commitment, alignment

with the organization's strategy, process architecture, performance measurement, and employee empowerment are also identified as key soft factors, which contribute to team coordination and flexibility. A model aligning organizational strategies with human resource strategies highlights the critical role of leadership and organizational culture in enhancing project success, particularly in dynamic banking environments (Alias et al., 2014). Success factors of innovation management in the banking industry, identified through grounded theory, underscore the importance of collaboration and strategic alignment in achieving project goals (Mousavi et al., 2021). Essential soft skills for data scientists in software engineering, such as curiosity, critical thinking, empathy, and ethical responsibility, are vital for fostering effective collaboration and innovation in banking software projects (Leça & Santos, 2025). A study in Uruguay by software companies points to a high demand for soft skills like communication and problem-solving, which are essential for effectively managing banking software projects (Matturro, 2013). Empathy-driven approaches in software development, focusing on inclusive user experiences, improve stakeholder satisfaction and collaboration, key elements for success in banking software initiatives (Cotler et al., 2025). The utility additive method proposed by Ayough et al. (2023) provides a robust framework for evaluating soft factors, enhancing decision-making in banking software projects by integrating diverse stakeholder preferences. The interactive multi-criteria method by Ayough et al. (2022) supports the prioritization of soft factors like collaboration and user involvement, which are critical for site-specific adaptations in banking software development. Overall, the success of banking software development projects requires a balance between hard factors (such as time and cost) and soft factors (such as communication and leadership). Paying attention to these factors, especially in complex banking environments, improves project performance and ensures desired results.

2.2. Research background

In recent years, the success and failure factors of information technology and software projects in various fields, especially in the banking industry, have attracted the attention of many researchers. Domestically, (Shahabi et al., 1401) emphasized, with a case study in Qarz-ol-Hasaneh Resalat Bank, that the realization of digital governance, the formulation of a digital strategy, the development of infrastructure, and the facilitation of laws are key factors for the success of digitalization in banks (Conforto et al., 2016). Also emphasized the role of agile methodology in reducing software project failure and the importance of requirements engineering. In a study on the National Southern Oilfields Company, using hierarchical analysis, they prioritized five key factors including information strategy, processes, business strategy, information technology, and human resources. Also, Moghimi (2020) with a comprehensive approach considered organizational, strategic, risk-taking, and information technology management factors to be effective in the success or failure of projects. In the field of electronic banking, (Salehi et al., 2013) identified and prioritized three key categories including readiness for change, recognition and design, and culture building through exploratory factor analysis. In foreign studies, (Werasinghe et al., 2022) in their study of e-government procurement in Sri Lanka, cited technology infrastructure, human resource capacity, and supply readiness as key factors. (Varajão et al., 2022) emphasized the role of project management processes based on (PMBOK/ISO) standards in the success of information systems projects. (Westenberger et al., 2023) also showed that organizational and technical factors are among the main reasons for the failure of AI projects. (Bilir, 2021) in two separate studies, emphasized the importance of management support, communication, user participation, and team building in the success of IT projects, especially in agile environments. (Tom et al., 2020) showed that in agile projects, team capability and customer involvement have the greatest impact on success. Also, (Bilir et al., 2020) reviewed the literature and identified participation, commitment, soft skills, and user satisfaction as key factors for the success of IT projects. Finally, (Moghimi, 2020) in an internal study using the TOPSIS method prioritized the critical success factors in implementing business intelligence systems from three aspects: organizational, process, and technology. A hybrid Fuzzy Delphi-BWM-TOPSIS approach to assess suppliers' resilience offers a novel method for evaluating critical success factors in IT projects, applicable to banking software development to strengthen supply chain resilience (Eslamibidkoli et al., 2023). A dynamic investment model in an open innovation environment, utilizing self-organization and organizational learning, provides insights into enhancing innovation-driven success in banking IT projects (Sadeghi Moghadam et al., 2023). The development of customer relationship management (CRM) processes using MCDM techniques highlights the importance of stakeholder alignment and process optimization in achieving project success in the banking sector (Emamgholizadeh et al., 2018).

2.3. Summary and Analysis of Research Gaps

A review of domestic and foreign literature shows that numerous studies have been conducted to identify key success factors for information technology projects. Most of these studies have focused on technical, managerial, cultural, and organizational factors, but they often only focused on identifying and prioritizing factors and paid less attention to explaining the relationships between these factors and providing a comprehensive and structured model. Also, despite the increasing importance of banking software projects in Iran, few studies have focused specifically on the country's banking context. Also, qualitative (e.g. Delphi) and quantitative (e.g. AHP) methods have been used separately, but their combination has been less common. This study fills these gaps by using meta-synthesis, fuzzy Delphi, and Dematel and localizes soft factors in the banking context.

3. Research Methodology

3.1. Research Type

The present study is an exploratory and applied research that has been designed and implemented with a mixed approach (qualitative-quantitative). In terms of nature and method, this study is classified as descriptive-survey research and its aim is to identify and prioritize the soft factors affecting the success of software development projects in the banking sector. The choice of a mixed approach was made due to the necessity of combining qualitative analysis to extract criteria from sources and experts and quantitative analysis to examine the relationships between them.

3.2. Population and statistical sample

The statistical population of this research consists of professional and academic experts active in the field of banking software development. The sample is defined in three distinct groups: The first group consists of 5 experts with a PhD and at least 10 years of experience in the field of banking software development (outside Refah Bank), of which 2 were initially selected purposefully and based on expertise, and then completed using the snowball method until theoretical saturation (5 people) was achieved. The second group consists of 11 Refah Bank managers and experts with more than 7 years of experience in software project management, who were selected using a purposeful and judgmental sampling method and based on experience and accessibility criteria. The third group consists of 20 Refah Bank IT experts and managers, who were selected for quantitative analysis using a purposeful and judgmental method and based on expertise in the field of banking software. Sample size was determined based on theoretical saturation in the interview section and common recommendations in the Delphi and Dematel methods (10 to 20 people).

3.3. Data collection methods and tools

Data collection in this study was carried out through two methods: library and field. In the library method, in order to extract the initial criteria, scientific articles published between 2010 and 2023 in the databases Google Scholar, ScienceDirect, Springer, Emerald (external sources) and SID, Magiran, Noormags, Civilica (internal sources) were used. The keywords used in the search included Persian terms such as "soft projects", "banking projects", "software project success" and English terms such as "Soft projects", "Banking software", "Success of banking projects". In the field method, three tools were used: a semi-structured interview with 5 experts that included 13 open-ended questions and its validity was confirmed by 2 university professors, a closed-ended fuzzy Delphi questionnaire with 63 primary sub-criteria that was completed by 11 experts, and a Dematel questionnaire with a range of 0 to 4 and 11 questions (corresponding to key criteria) that was distributed among 20 people and its validity was confirmed by 3 people with a PhD degree with more than 15 years of experience in the field of banking software and membership in the senior committee of bank software.

3.4. Data Analysis Method

Data analysis in this study was carried out in two parts: qualitative and quantitative, and each part was carried out using standard and specific methods. The implementation process of this study is as shown in Figure 1.

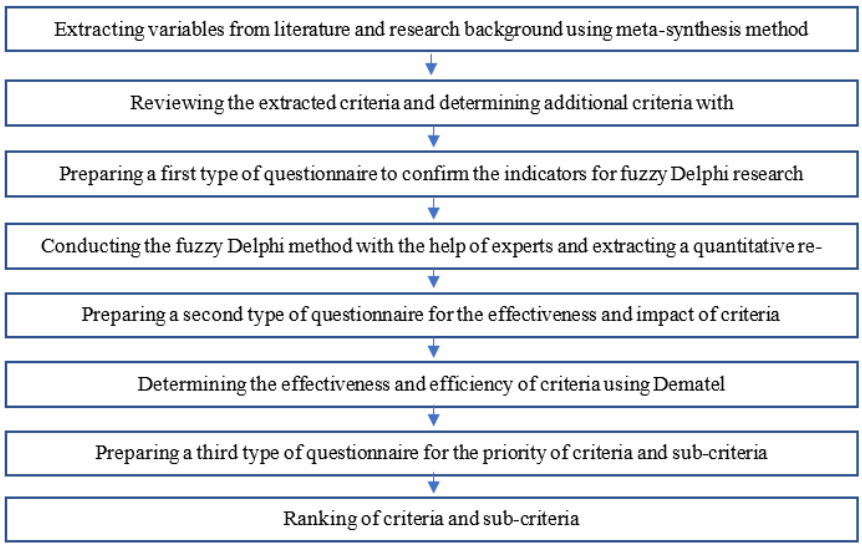

Figure 1. Research implementation process

In the qualitative section, the meta-synthesis method was first used to extract and organize the criteria. This process began with a systematic search in the aforementioned databases, and from the initial 62 articles, after a multi-stage review (Figure 2), 25 articles that had qualitative or composite criteria related to the success of software projects, were published in Persian or English, and had received at least 5 citations were selected (Paterson et al., 2001).

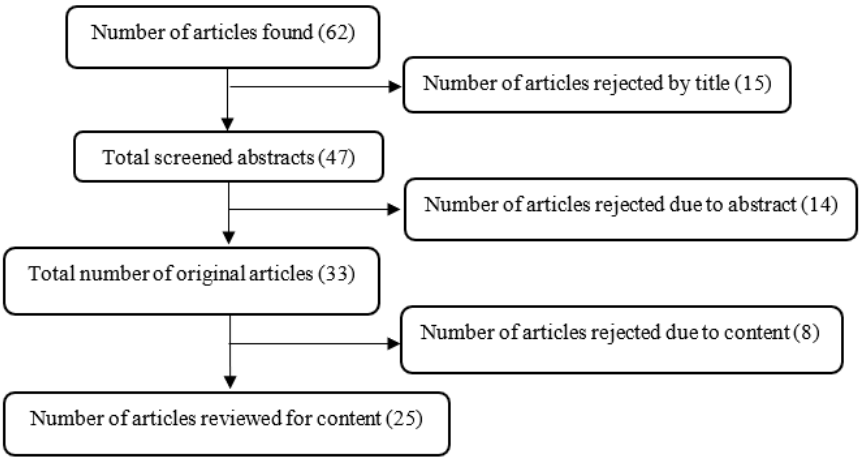

Figure 2. Review process for selecting articles for consideration

Next, the stages of qualitative data analysis and data coding were analyzed using an open and axial method based on Figure 3. (Higgins & Green, 2011)

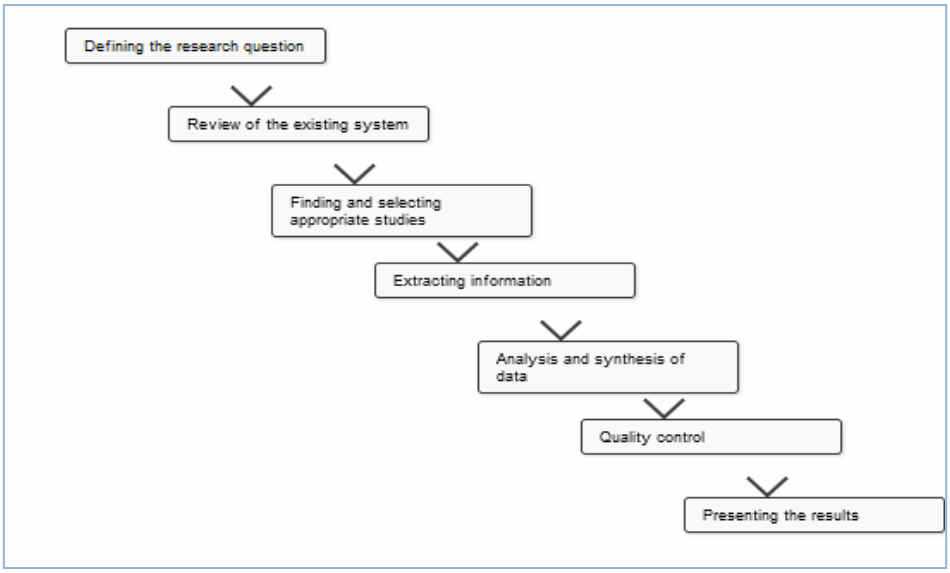

Figure 3. Steps in implementing the Meta-synthesis method

Next, a comparative analysis was conducted to examine the relationships between the criteria and sub-criteria to develop a comprehensive framework. Finally, the results were presented in the form of a preliminary model that served as the basis for the subsequent stages of the research. In the next step, semi-structured interviews were conducted with 5 experts and analyzed. At this stage, the criteria were reviewed and found to be sufficient, such that no new items were proposed. In the qualitative section, the fuzzy Delphi method was used to localize and validate the sub-criteria. This method was chosen because of its outstanding ability to manage the inherent uncertainties of qualitative data, the possibility of effectively and accurately integrating expert opinions in complex situations, and its superiority over traditional Delphi methods that operate solely with definite numbers; these features are of great importance, especially in the banking context that faces ambiguities and multi-faceted dependencies. This process began with the selection of 11 experts from Refah Bank and an explanation of the research objectives. The spectrum used is as follows:

Table 1. Trapezoidal fuzzy numbers corresponding to verbal variables

Fuzzy number	Language variable
(0,0,2,4)	Low
(3,4,6,7)	Medium
(6,8,10,10)	High

The comments were collected in two rounds and for each phase, the fuzzy mean was calculated using the following formula:

$$A^i = \left(a_1^i, a_2^i, a_3^i, a_4^i\right) \qquad i = 1,2,3,\dots,n \tag{1}$$

$$A_{ave} = (m_1, m_2, m_3, m_4) = \left(\frac{1}{n}\sum_{i=1}^{n} a_1^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_2^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_3^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_4^{(i)}\right) \tag{2}$$

In Equation (1), A^i represents the I expert's view and in Equation (2), A_{ave} represents the average of experts' views. Also, a_1, a_2, a_3, a_4represent trapezoidal fuzzy numbers. Then, the fuzzy means obtained were converted into definite numbers using the center of gravity method. Subsequently, the differences between the definite numbers derived from the two rounds were calculated using Equation (3).

$$s(A_{m2}, A_{m1}) = \left|\frac{1}{4}[(a_{m21} + a_{m22} + a_{m23} + a_{m24})[(a_{m11} + a_{m12} + a_{m13} + a_{m14})]\right| \tag{3}$$

In this method, the threshold value for confirming expert consensus was considered to be 1, and the average score required for the approval of each sub-criterion was set at 5. Given that the difference obtained for each sub-criterion was less than 1, and the sub-criteria whose average center of gravity in each round was less than 5 were eliminated, it can be concluded that a suitable level of consensus among the experts was achieved. As a result, 38 sub-criteria were approved, and the fuzzy Delphi process was concluded at this stage (Zar and Pourdarvishi, 2002). In the quantitative part, the Dematel method was used to analyze the relationships between 11 key criteria. This method was chosen because of its excellent ability to identify and model complex cause-and-effect relationships, provide a clear visual representation of interactions, and separate influential and affected factors in banking systems characterized by multi-directional dependencies. This process was carried out by distributing a questionnaire with the spectrum shown in the table below:

Table 2. Linguistic scales in Dematel

Language terms for pairwise comparisons	values
No effect	0
Very low effect	1
Low effect	2
High effect	3
Very high effect	4

The direct correlation matrix (M) was compiled and the normalized matrix (Z) was calculated with the following formula:

$$\frac{M}{\max\left(\sum_{i=1}^{n}\sum_{j=1}^{n} m_{ij},\ \sum_{j=1}^{n}\sum_{i=1}^{n} m_{ij}\right)} = Z \tag{4}$$

Then the complete matrix (T) was obtained with the following equation:

$$T = \mathrm{Z} * (I - Z)^{-1} \tag{5}$$

where I is the n×n identity matrix.

In the next step, the threshold was calculated using the following formula, which yielded a value of 0.548; values greater than θ were converted to 1 and smaller than it

$$\theta = \mathrm{t_{ij}} \sum_{j=1}^{n} \sum_{i=1}^{n} \frac{1}{n} \tag{6}$$

to 0 to identify meaningful relationships.
The values of influence and impact were extracted using the following formulas, respectively:

$$\mathrm{J_j} = \sum_{i=1}^{n} \mathrm{b_{ij}} \tag{8}$$

$$\mathrm{R_i} = \sum_{j=1}^{n} \mathrm{b_{ij}} \tag{7}$$

To ensure the quality of the research, the validity and reliability of the instruments were assessed. In the qualitative section (meta-synthesis, interview, fuzzy Delphi), the reliability criterion from the Guba and Lincoln framework was used, which included acceptability, transferability, reliability, and confirmability. Acceptability was ensured by a judgmental sampling of 5 experts (PhD, at least 10 years of experience) who added 13 sub-criteria, deleted 1

sub-criteria, and verbally edited 20 sub-criteria, and by descriptive codes, corrective comments (qualitative Delphi), and quotations. Transferability was ensured by selecting managers (at least 2 years of experience) and a comprehensive description of the research field, reliability by providing data and methods for review, and confirmability by describing data analysis and interview excerpts. In the quantitative section, the conceptual validity of the Dematel questionnaire was confirmed by the supervisor and 3 senior bank managers (PhD, over 15 years of experience, member of the software committee). Reliability was also ensured by providing unbiased explanations, confirming the results by experts at each stage, and selecting an appropriate number of experts for greater accuracy.

4. Research Findings

In the first stage, meta- synthesis analysis was conducted to extract primary criteria affecting the success of banking software development projects. After multi-stage screening of articles (Figure 1) and selection of the final 25 articles and conducting text content analysis and coding, 51 primary sub-criteria were extracted. These sub-criteria were categorized into 11 key criteria and 3 main areas and were used as a basis for the subsequent stages. The details of these findings are presented in Table 3.

Table 3. Indicators affecting project success

Source indicator	Sub-criterion	Criterion	Domain	Number
P2-P3-P7	Effective human resource allocation	Project Resource Management	Management	1
P1-P8	Budget allocation			2
P11-P17-P15	Time allocation			3
P14-P19-P21	Allocation of required software			3
P7-P11	Allocation of required infrastructure			5
P20-P18-P9	Determination of clear goals	Project Scope		6
P9-PP6-P1	Determination of impact points			7
P24-P1-P6	Determination of processes based on features			8
P25-P18-P6	Effective support			9
P4-P7-P19	Senior management support	Project Management		10
P5-P6-P16	Effective organizational policy			11
P4-P24-P20	Effective project leadership			12
P4-P6-P11-P12	Determination of a structured approach			13
P24-P13	Specified communication system			14
P8-P16-P23-P20	Specific project methodology			15
P1-P9-P17	Development of a digital strategy by senior bank managers	Implementing Digital Governance In Banks		16
P21-P23-P3	Digital culture			17
P3-P19	Development of national digital infrastructure by the Central Bank			18
P1-P16-P24-P15	Simplification of laws and removal of legal barriers to the use of digital banking			19
P8-P17-P15	Requirements for banks by the central bank and other institutions for software implementation			20
P16-P15-P10	User readiness for live	Live Fit	Behavioral	21
P4-P24-P25	Assignment of appropriate roles and processes			22
P6	Providing feedback after live			23
P15-P18	Development of features after live			24
P11-P8-P6	Stakeholder satisfaction	Satisfaction		25
P2-P13-P24-P1	User satisfaction			26
P9-P15	Customer satisfaction			27
P13-P4	Senior management satisfaction			28
P9-P11	User-friendly	Usability		29
P8-P17-P15	Help availability			30
P3-P2-P6	Effective manual availability			31
P-13-P6-P9	Effective use of IS/IT resources and their comprehensive understanding	IT Management		32
P9-P19-P35	Hardware and software selection			33
P6-P15-P19	System integration capability			34
P3-P12-P5	System quality			35
P4-P19-P24	Technological readiness			36
P6-P9-P11	Using agile methods	Development Criteria	Technical	37
P5-P17-P23-P19	Involving users during development			38
P2-P13	Pre-live testing stages			39
P18-P23-P14	Appropriate benchmarks for benchmarking			40
P1-P8	Determining product features before starting work			41
P16-P19-P8	Existence of appropriate reports in the system			42
P2	Reviewing and determining integration points with other systems			43
P4-P6-P13	Data quality	Product Quality		44
P8-P12-P16-P21	System quality			45
P3-P8-P18-P25-P19	Process quality			46
P8-P18-P21	Ticket management system	Support Process		47
P2-P10	Continuous review of bugs and features			48
P6	Existence of appropriate service level agreements (SLA) for assigning and performing tasks			49
P17-P-15	Updating the software based on bug fixing needs in the shortest possible time			50
P8-P11-P14	Effective user support			51

In the second stage, in order to review and complete the criteria extracted from the meta-synthesis, semi-structured interviews were conducted with 5 experts with PhD degrees, at least 10 years of experience in banking software development and managerial positions. These interviews were designed with 13 open-ended questions and continued until theoretical saturation was reached. Analysis of the responses showed that the experts added 13 new sub-criteria to the initial list, deleted 1 sub-criteria due to inadequacy and replaced it with a main criterion and edited 20 criteria/sub-criteria verbatim. As a result of this process, the number of sub-criteria increased from 51 to 63, indicating the completion and localization of the criteria based on the practical experience of the experts. The changes made in this stage are listed in the tables below.

Table 4. Added criteria and sub-criteria

Added criterion/subcriterion	Domain
Product Backlog Management	Management
Knowledge Management in Product Design and Development Teams	
Improvement and Customization of Capabilities and Software	Behavioral
Project Contractor Satisfaction	
Existence of Appropriate UI and UX	
Availability of technical documentation for the development team	Technical
Data migration from old system to new	
Backup and provision of alternative systems	
Having a backup copy	
Backup	Technical
Low downtime and updates	
Software system security	
Development team code quality	

Table 5. Removed criteria and sub-criteria

Criterion/subcriterion deleted	Domain
stakeholder satisfaction	Behavioral

Table 6. Verbal editing of criteria and sub-criteria

Criteria/Sub-criteria After Interview	Criteria/Sub-criteria Before Interview	Domain
Allocation of specialized human resources	Allocation of effective human resources	Managerial
Defining clear goals aligned with bank objectives	Defining clear goals	
Defining project processes based on software capabilities	Defining processes based on features	
Effective project management leadership	Effective project leadership	
Alignment of project strategy with bank policies	Effective organizational policy	
Using user feedback to develop new features	Feature development after go-live	
Defining a flexible and structured approach	Defining a structured approach	
Defining project management methodology	Specified project methodology	
Proper utilization	Proper go-live	Behavioral
Staff readiness to operationalize the system	User readiness for go-live	
Providing feedback after utilization	Providing feedback after go-live	
Stakeholder satisfaction	Satisfaction	
Availability of user and operation manuals	Availability of help	
Information Technology	IT Management	Technical
Existence of testing phases during project implementation	Existence of testing phases before go-live	
Defining product capabilities before launch	Defining product features before launch	
Identifying and defining integration points with other systems and ensuring proper connection	Reviewing and defining integration points with other systems	
Quality of IT system	System quality	
Continuous review of bugs and capabilities	Continuous review of bugs and features	
Quality of development system	System quality	

In the third stage, the fuzzy Delphi method was applied in two rounds among 11 experts from Refah Bank through a questionnaire containing 63 sub-criteria. In each round, the experts' opinions were collected using the fuzzy scale (low: (0,0,2,4), medium: (3,4,6,7), high: (6,8,10,10)), and the fuzzy mean of each sub-criterion was calculated using Equation (2). Then, the average center of gravity of each sub-criterion, referred to as avg1 and avg2, as well as the difference between the first and second rounds, were calculated using Equation (3). Since the difference was less than 1, consensus was confirmed. The results of these stages are presented in Table 7. Subsequently, sub-criteria with an average center of gravity below 5 in either round were eliminated.

Table 7. Mean difference between the first and second questionnaires

Consensus result	Difference of opinion	Round 2 result	avg2	Round 1 result	avg1	Criteria
There is consensus.	-0.64	Criteria is approved	5.32	Criteria is approved	5.95	Allocating specialized human resources
There is consensus.	0.32	Criteria is approved	6.27	Criteria is approved	5.95	Allocation of budget
There is consensus.	-0.64	The criterion cannot be confirmed.	5.00	Criteria is not approved	4.64	Allocation of time
There is consensus.	-0.32	Criteria is approved	5.64	Criteria is approved	5.95	Allocation of required software
There is consensus.	0.00	Criteria is approved	8.50	Criteria is approved	8.50	Allocation of required infrastructure
There is consensus.	0.32	Criteria is approved	6.91	Criteria is approved	6.59	Product backlog management
There is consensus.	-0.64	Criteria is not approved	3.73	Criteria is not approved	4.36	Setting clear goals that are in line with the bank's goals
There is consensus.	0.32	Criteria is approved	5.32	Criteria is not approved	5.00	Determining impact points

Consensus result	Difference of opinion	Round 2 result	avg2	Round 1 result	avg1	Criteria
There is consensus.	0.00	Criteria is approved	8.50	Criteria is approved	8.50	Determining project processes based on software capabilities
There is consensus.	-0.95	Criteria is not approved	4.68	Criteria is approved	5.64	Managing knowledge available in product design and development teams
There is consensus.	0.00	Criteria is approved	6.27	Criteria is approved	6.27	Effective support
There is consensus.	0.64	Criteria is approved	5.32	Criteria is approved	5.68	Senior management support
There is consensus.	0.00	Criteria is approved	7.23	Criteria is approved	7.23	Alignment of the project strategy with the bank's policy
There is consensus.	0.32	Criteria is not approved	4.68	Criteria is not approved	4.36	Effective project management leadership
There is consensus.	-0.32	Criteria is not approved	3.09	Criteria is not approved	3.41	Determining a flexible and structured approach
There is consensus.	0.32	Criteria is not approved	3.73	Criteria is not approved	3.41	A defined communication system
There is consensus.	0.00	Criteria is approved	7.86	Criteria is approved	7.86	Determining a project management methodology
There is consensus.	0.00	Criteria is not approved	3.09	Criteria is not approved	3.09	Development of a digital strategy by senior bank managers
There is consensus.	0.00	Criteria is not approved	4.68	Criteria is not approved	4.68	Digital culture
There is consensus.	0.00	Criteria is not approved	4.68	Criteria is not approved	4.68	Development of national digital infrastructure by the Central Bank
There is consensus.	0.00	Criteria is approved	5.95	Criteria is approved	5.95	Simplification of laws and removal of legal barriers to the use of digital banking
There is consensus.	0.00	Criteria is approved	8.18	Criteria is approved	8.18	Banks are required by the Central Bank and other institutions to implement the software
There is consensus.	0.32	Criteria is approved	5.95	Criteria is approved	5.64	Employee readiness to operate the system
There is consensus.	-0.32	Criteria is not approved	4.68	Criteria is not approved	5.00	Using user feedback to develop new features
There is consensus.	0.64	Criteria is not approved	4.32	Criteria is not approved	4.68	Assigning appropriate roles and processes
There is consensus.	0.00	Criteria is not approved	4.68	Criteria is not approved	4.68	Providing feedback after operation
There is consensus.	0.00	Criteria is approved	8.50	Criteria is approved	8.50	Improving and ordering capabilities and software
There is consensus.	-0.32	Criteria is approved	5.64	Criteria is approved	5.95	Project contractor satisfaction
There is consensus.	-0.32	Criteria is approved	6.59	Criteria is approved	6.91	User satisfaction
There is consensus.	-0.32	Criteria is not approved	3.09	Criteria is not approved	3.41	Customer satisfaction
There is consensus.	0.00	Criteria is approved	7.86	Criteria is approved	7.86	Senior management satisfaction
There is consensus.	0.00	Criteria is approved	5.64	Criteria is approved	5.64	Appropriate UI and UX
There is consensus.	-0.32	Criteria is not approved	4.05	Criteria is not approved	4.36	Easy to use
There is consensus.	0.00	Criteria is not approved	2.14	Criteria is not approved	2.14	Existence of user guide and guidance
There is consensus.	0.00	Criteria is approved	7.86	Criteria is approved	7.86	Existence of effective handbook
There is consensus.	-0.32	Criteria is approved	5.32	Criteria is approved	5.64	Existence of technical documentation for the development team
There is consensus.	0.00	Criteria is approved	5.32	Criteria is approved	5.32	Data migration from old system to new system
There is consensus.	0.32	Criteria is not approved	4.68	Criteria is not approved	4.36	Effective use of IS/IT resources and their comprehensive understanding
There is consensus.	-0.32	Criteria is not approved	5.00	Criteria is approved	5.32	Hardware and software selection
There is consensus.	0.00	Criteria is approved	5.32	Criteria is approved	5.32	System integration and integration capability
There is consensus.	0.32	Criteria is not approved	4.68	Criteria is not approved	4.36	Quality of IT system
There is consensus.	0.00	Criteria is approved	8.18	Criteria is approved	8.18	Technological readiness
There is consensus.	0.32	Criteria is not approved	5.00	Criteria is not approved	4.68	Backup and provision of alternative systems
There is consensus.	0.64	Criteria is approved	6.27	Criteria is approved	5.64	Use of agile methods
There is consensus.	-0.64	Criteria is approved	7.23	Criteria is approved	7.86	Involving users during development
There is consensus.	0.64	Criteria is not approved	4.64	Criteria is not approved	4.00	Existence of testing phases during the project implementation stages
There is consensus.	0.64	Criteria is approved	6.91	Criteria is approved	6.27	Appropriate benchmarks for benchmarking
There is consensus.	-0.64	Criteria is not approved	4.68	Criteria is approved	5.32	Determine product capabilities before starting work
There is consensus.	0.64	Criteria is approved	6.91	Criteria is approved	6.27	Existence of appropriate reports in the system
There is consensus.	0.00	Criteria is approved	7.86	Criteria is approved	7.86	Identify and determine integration points with other systems and communicate with them correctly
There is consensus.	0.00	Criteria is approved	5.95	Criteria is approved	5.95	Have a backup copy
There is consensus.	0.00	Criteria is approved	6.27	Criteria is approved	6.27	Backup
There is consensus.	0.64	Criteria is approved	6.91	Criteria is approved	6.27	Ticket management system
There is consensus.	-0.64	Criteria is not approved	3.09	Criteria is not approved	3.73	Continuous review of bugs and capabilities
There is consensus.	0.00	Criteria is not approved	4.36	Criteria is not approved	4.36	Existence of appropriate service level agreements (SLA) for assigning and performing tasks
There is consensus.	0.32	Criteria is not approved	5.00	Criteria is not approved	4.68	Updating the software based on the needs of fixing bugs in the shortest possible time
There is consensus.	0.00	Criteria is approved	8.18	Criteria is approved	8.18	Continuous and effective support for users
There is consensus.	0.00	Criteria is approved	5.95	Criteria is approved	5.95	Low downtime and updates
There is consensus.	0.64	Criteria is approved	7.55	Criteria is approved	6.91	Software system security
There is consensus.	0.64	Criteria is approved	6.59	Criteria is approved	5.95	Development team code quality
There is consensus.	0.64	Criteria is approved	5.95	Criteria is approved	5.32	Data quality
There is consensus.	0.64	Criteria is approved	7.23	Criteria is approved	6.59	Development system quality
There is consensus.	0.00	Criteria is approved	5.95	Criteria is approved	5.95	Process quality

The results in Table 8 led to the confirmation of 38 sub-criteria out of the initial 63 sub-criteria. These sub-criteria represent key soft factors related to the success of banking software projects in the context of the study, which indicates careful screening and selection of the most important sub-criteria.

Table 8. Introduction of soft factors affecting the success of bank software development projects

Sub- Criteria	Criteria	Domain
Allocating expert human resources	Project Resource Management	Managerial
Allocation of budget		
Allocation of required software		
Allocation of required infrastructure		
Product backlog management	Project Scope	
Determining project processes based on software capabilities		
Effective support	Project Management	
Senior management support		
Alignment of the project strategy with the bank's policy		
Determining the project management methodology		
Simplifying the rules and removing legal obstacles to the use of digital banking	Implementing Digital Governance in Banks	
Requirements for banks by the Central Bank and other institutions to implement the software		
Employee readiness to operate the system	Proper Use	Behavioral
Improvement and ordering of capabilities and software		
Project contractor satisfaction	Stakeholder Satisfaction	
User satisfaction		
Senior management satisfaction		
Appropriate UI and UX	Usability	
Effective brochure		
Availability of technical documentation for the development team	Information Technology	Technical
Data migration from old system to new		
System integration and integration capability		
Technological readiness		
Using agile methods	Development Criteria	
Involving users during development		
Appropriate benchmarks for benchmarking		
Appropriate reports in the system		
Identifying and determining integration points with other systems and communicating with them correctly		
Having a backup copy	Support Process	
Backups		
Ticket management system		
Continuous and effective user support		
Low downtime and updates	Product Quality	
Software system security		
Development team code quality		
Data quality		
Development system quality		
Process quality		

In the final stage, the Dematel method was developed after collecting the comments of the direct relationship matrix (M). In the next stage, the normalized matrix (Z) was calculated with equation (4) and the matrix of direct and indirect relationships called the complete matrix (T) was calculated using equation (5). Finally, the threshold (θ=0.548) was obtained with equation (6) and values greater than θ were converted to 1 and smaller than it to 0 to determine the meaningful relationships. As a result, the values of influence (Ri) and influence (Rj) were extracted using equations (7) and (8) according to Table 9.

Table 9. Impact and impactability of criteria

Naming criteria from A to K	Dimensions	R	J	R+J	R-J
A	Project Resource Management	9.0000	8.0000	17.0000	1.0000
B	Project Scope	0.0000	1.0000	1.0000	-1.0000
C	Project Management	7.0000	5.0000	12.0000	2.0000
D	Implementation of Digital Governance in Banks	8.0000	2.0000	10.0000	6.0000
E	Proper Operation	8.0000	5.0000	13.0000	3.0000
F	Stakeholder Satisfaction	6.0000	6.0000	12.0000	0.0000
G	Usability	1.0000	7.0000	8.0000	-6.0000
H	Information Technology	3.0000	6.0000	9.0000	-3.0000
I	Development Criteria	2.0000	8.0000	10.0000	-6.0000
J	Support Process	7.0000	4.0000	11.0000	3.0000
K	Product Quality	11.0000	10.0000	21.0000	1.0000

After sequentially naming the criteria in the above table from A to K, a causal diagram and relationship matrix were drawn. Analysis of the causal diagram (Figure 4) showed that if the R−J value is positive, some criteria have a causal (influential) role and if it is negative, they have a consequential (affected) role, which greatly contributed to understanding the structure of interactions between criteria.

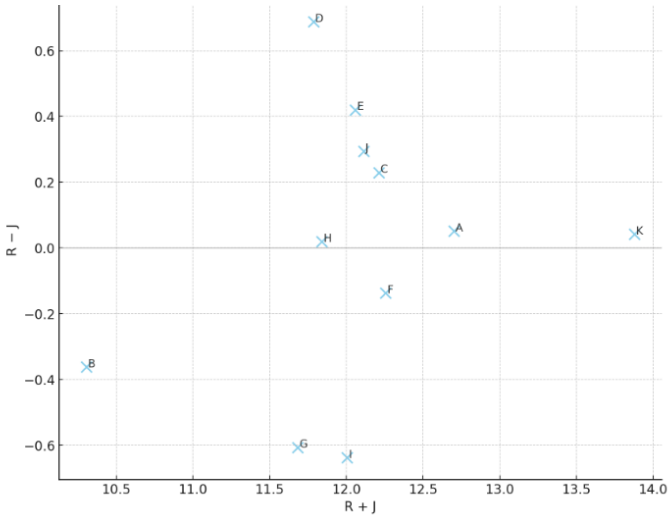

Figure 4. Diagram of causal relationships of criteria in the Dematel method

Figure 5 is drawn using the total matrix (T) which includes direct and indirect relationships between factors. In this graph, the direction of the arrows indicates the influence of one factor on another, and the weight of the edges (numbers on the lines) indicates the intensity of this influence. In this study, for greater clarity, only the relationships with an impact intensity greater than 0.58 were depicted in the network of relationships. This threshold was selected to reduce the complexity of the graph and to focus on the most significant interactions among the criteria. Accordingly, nodes that did not have a strong direct or indirect influence on other criteria, or did not receive a significant effect from them, were not included in the final diagram. For this reason, the criterion "B (Project Scope)" was also excluded from the illustrated figure, as it had no relationship with an intensity higher than 0.58 with any of the other criteria.

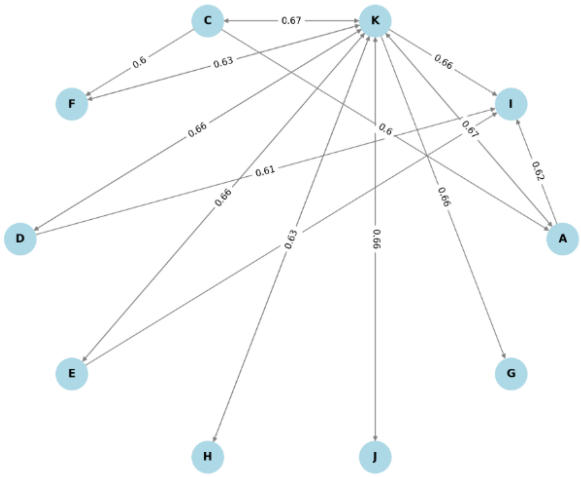

Figure 5. Relationship network resulting from the DEMATEL method

In the final stage of the research, the Dematel analysis, by exploring the cause-and-effect relationships between eleven key criteria, clarified the dynamics of soft factors affecting the success of the software projects of the Refah Kargaran Bank. According to Table ۹, product quality criterion with the values of Ri=11, Jj=10 and the intensity of interaction Ri+Jj=21, showed the greatest impact and was identified as the main focus in the relationship network (Figure 5). This criterion plays a pivotal role in the success of projects with features such as reduced downtime, system security, code quality, data management, and process improvement. The criteria "Project Resource Management" with Ri+Jj=17, "Proper Utilization" with Ri+Jj=13, "Implementation of Digital Governance in Banks" with Ri+Jj=10, and "Stakeholder Satisfaction" with Ri+Jj=12 also have a significant impact on other factors. The causal diagram (Figure 4) showed that "Implementation of Digital Governance" with Ri−Jj=6 above the Y=0 line is a strong driver, while "Usability" and "Development Criteria" with Ri−Jj=−6 were identified as effectors.
The relationship network (Figure 5) using the full relationship matrix (Table 9) and the threshold θ=0.548 revealed the influence of "product quality" on "Project Resource Management" (weight 0.67), "development criteria"

(weight 0.66), and "support process" (weight 0.67), indicating a cascading effect of this criterion. In contrast, "usability" and "information technology" with more input arrows have a high dependence on other criteria.

5. Discussion and Conclusion

5.1. Discussion

The present study was conducted with the aim of identifying and prioritizing soft factors affecting the success of banking software development projects, and the findings were obtained in four stages of meta-synthesis, interview, fuzzy Delphi and Dematel. The results of the meta-synthesis showed that 51 sub-criteria in three main areas of "managerial", "behavioral" and "technical" affect the success of these projects, which is in line with the findings of previous studies such as Paterson et al. (2001) and Indra et al(2021). These studies have also emphasized the importance of managerial and technical factors in software projects, although in the present study, the behavioral area was highlighted as a key dimension that can be attributed to localization in the banking context. Semi-structured interviews emphasized the need to adapt the criteria to the operational conditions of banks by adding 13 new sub-criteria (such as "product backlog management" and "software system security"), deleting 1 sub-criteria and transferring it to the main criterion ("stakeholder satisfaction"), and verbally editing 20 sub-criteria. These findings indicate the importance of paying attention to specific organizational and technical needs in banking projects that have been less addressed in previous studies. For example, the addition of "data migration from old to new system" reflects operational challenges in digital banking that were not generally addressed in Tam (2020) research. In the Fuzzy Delphi stage, the confirmation of 38 sub-criteria out of the initial 63 showed that criteria such as "expert human resource allocation", "user satisfaction" and "development team code quality" had a higher priority. This screening with the center of gravity method increased the accuracy and focus of the research and is consistent with the results of Cheng & Lin (2002) who emphasize the importance of expert consensus in conditions of uncertainty. It is noteworthy that some sub-criteria such as "time allocation" were omitted, which may have occurred due to its dependence on other factors (such as resource management). The Dematel analysis clarified the causal relationships between 11 key criteria. The criterion "product quality" with the highest impact (Ri=11) and interaction (Ri+Jj=21) was identified as the core of project success, which is in line with Zimmer's (2006) findings on the importance of quality in software systems. Also, "realization of digital governance in banks" with Ri−Jj=6 was identified as a key causal factor, indicating the role of macro policy in project success. In contrast, "developmental criteria" and "usability" with negative values (Ri−Jj=−6) appeared as causal factors dependent on other criteria. The causal diagram (Figure 4) and the relationship network (Figure 5) visually reinforced these findings and showed that "product quality" plays a pivotal role in this ecosystem with extensive interactions and chain effects, which is consistent with the complexity of integrated management in banking projects.

5.2. Managerial Insights

Determining and examining the interactions of soft factors affecting the success of software development projects in the banking industry has clarified the main pathways of influence in this domain, providing a foundation for offering practical managerial recommendations. In this section, managerial insights are presented for the key criteria identified with significant interaction intensity, emphasizing their role in the success or failure of projects.

Product Quality as the Strategic Anchor of Project Success:

The DEMATEL analysis indicated that product quality, with the highest influence and the greatest interaction intensity, plays a central role in project success. This criterion directly impacts Project Resource Management, Development Criteria, and Support Process. Therefore, product quality should be considered the backbone of software projects. Enhancing software system security, reducing low downtime and updates, improving development team code quality, data quality, development system quality, and process quality, and implementing CI/CD processes are among the essential actions. Internationally, banks are increasingly utilizing automated testing tools and AI-based quality assurance to ensure stable performance and user satisfaction.

Digital Governance as a Facilitator of Structural Innovation:

Implementation of Digital Governance in Banks was identified as a key causal factor. Rigid laws and restrictive structures are among the fundamental barriers to the successful execution of digital projects. Facilitating regulations such as digital account openings, remote identity verification (e-KYC), and online loan approvals requires regulatory review. The use of regulatory sandboxes, which have been successful in leading countries such as the UK and Singapore, can allow banks to implement their software innovations in a secure and flexible environment.

Smart Resource Management as the Key to Effective Delivery:

Project Resource Management, with high interaction intensity and direct influence from product quality, is a pillar of project success. Targeted allocation of expert human resources, allocation of budget, allocation of required software, and allocation of required infrastructure is essential for timely and successful project delivery. High-quality software systems optimize resource consumption and prevent cost wastage. The use of cloud platforms like Azure and resource management tools can enhance efficiency in banking projects, as is common in successful digital banks worldwide.

Employee Readiness as a Factor in Reducing Execution Risks:

Proper Operation, with notable influence, highlights the essential behavioral and knowledge readiness of employees for the effective use of the new system. If internal users are not prepared for change, even the best software solutions will fail due to organizational resistance. Managers should establish comprehensive training programs, interactive classes, and targeted content prior to system deployment. In advanced banks, gamified learning and microlearning modules are used to improve adoption rates. Additionally, the direct influence of product quality on Support Process indicates that stable, low-downtime systems reduce the workload on support teams, allowing them to focus on effectively addressing requests.

Stakeholder Satisfaction as Requiring Continuous Adjustment and Dynamic Review:

Stakeholder Satisfaction underscores the importance of simultaneously managing the needs of users, project contractor satisfaction, user satisfaction, and senior management satisfaction. System design should involve stakeholders, incorporate continuous feedback, and utilize appropriate UI and UX design. Neglecting this factor leads to reduced trust, increased resistance, and ultimately project failure. Internationally, metrics like the Net Promoter Score (NPS) are used for real-time user satisfaction assessment; these tools can be actively integrated into project communication strategies.

Usability and Agile Development as Outcomes of Cross-Team Interaction and User Involvement:

Usability and Development Criteria, which exhibit high dependency, succeed when agile development and effective user interaction are embedded in the development cycle. Forming cross-functional teams, involving users during development, conducting periodic UX testing, and analyzing user feedback all contribute to enhancing this area. Combining these factors increases user satisfaction and reduces costly redesigns.

Scope Management as a Dynamic, Prediction-Based Process:

Project Scope was excluded from the relationship network due to its low interaction intensity. This exclusion should not be interpreted as diminishing its importance but rather indicates that traditional scope management methods are no longer effective. In the digital banking landscape, Project Scope must be managed dynamically and flexibly. Employing product backlog management, predictive analytics tools to identify scope changes, and rapidly adapting to emerging market needs are approaches that should be prioritized by software project managers.

User Support as a Competitive Advantage in Software Service Sustainability:

Support Process, heavily influenced by product quality, should evolve from a reactive role into a competitive advantage. Implementing smart ticket management systems, continuous and effective user support, real-time issue monitoring, and detailed process documentation can reduce response times, enhance user trust, and alleviate pressure on technical teams. Essentially, Support Process should transition from a purely technical function to a strategic competitive edge.

6. Conclusion

This study aimed to identify and prioritize soft factors affecting the success of banking software development projects and showed that the success of these projects depends on a combination of managerial (such as resource allocation), behavioral (such as stakeholder satisfaction), and technical (such as product quality) factors. The DEMATEL analysis indicates that "product quality" and "digital governance implementation" are the main drivers, while "usability" and "development criteria" are affected by others as causal factors. By combining a mixed approach and using the Fuzzy Delphi and DEMATEL methods, this study added to the richness of the existing literature on soft factors and emphasized the importance of localizing criteria in specific contexts. By focusing on enhancing product quality, allocating expert human resources, and supporting digital governance, banking project managers can improve project success and increase user acceptance by focusing on stakeholder satisfaction and proper utilization. These results provide a comprehensive framework for improving software development processes in banks that can be used as a basis for future research and management decisions. However, the research faced some limitations, including the limited number of experts (5 in interviews and 11 in the fuzzy Delphi) that may have affected the diversity of views, the focus on the context of Refah Bank, which makes the generalizability of the findings to other banks or industries cautious, and the lack of access to long-term time data to assess the stability of the results. For future research, it is suggested that this study be repeated in other banks or similar industries to examine the generalizability of the results and that other mixed methods (such as ANP or SEM) be used to analyze more complex relationships between the criteria. Also, bank managers can design training programs to improve the technical and managerial skills of the teams and strengthen digital infrastructure in cooperation with regulatory bodies.

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