



**EVALUATION OF OUTSOURCING OF E-GOVERNMENT PUBLIC
SERVICES: PALESTINE AS A CASE STUDY**

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DOCTORAL THESIS

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**GAZİ UNIVERSITY
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EVALUATION OF OUTSOURCING OF E-GOVERNMENT PUBLIC SERVICES:
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(Phd. Thesis)

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ABSTRACT

Within the framework of E-government, outsourcing constitutes a strategic mechanism for leveraging external expertise to enhance system utilization and foster innovation. The study intends to provide a holistic analysis concerning the outsourcing domain, specifically considering the process of decision-making, strategic options, determining factors, and possible risks. A framework consisting of a vigorous hybrid Multi-Criteria Decision-Making (MCDM) was implemented. The Political, Economic, Social, Technological, Environmental, and Legal (PESTEL) framework was used to determine vital determinants that are leading the decisions of e-government outsourcing. Concerning the Decision-Making Trial and Evaluation Laboratory (DEMATEL) technique, it was used to further understand the causal relationships among the influential factors. Regarding the Analytic Network Process (ANP), it was used to determine the interrelated factors' relative weights. This study also used the Fuzzy Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) for ranking and evaluating the outsourcing options. The Failure Mode and Effects Analysis (FMEA) was applied to determine the presence of any possible operational failures. Empirical results signify that privacy is the most major influential factor in the decision-making process. The outsourcing costs came as the second significant determinant, while the technical skills of workers came as third. Concerning the strategic choices, the most optimal option was found to be co-outsourcing. This option was followed by full insourcing, cloud computing, then full outsourcing. The risk analysis demonstrates that the stages related to implementation and contract execution have higher criticality than other lifecycle stages. The evaluation and decision-making phases showcase a moderate risk level. Policymakers can benefit from this research since it provides them with a set of significant criteria and a crucial roadmap of risk points during the outsourcing lifecycle. This research provides important results related to the Palestinian governmental outsourcing, helping in strategic planning, decision-making, and risk reduction associated with e-government services.

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E-DEVLET KAMU HİZMETLERİNİN DIŞ KAYNAK KULLANIMININ DEĞERLENDİRİLMESİ: FİLİSTİN ÖRNEĞİ

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ÖZET

E-devlet çerçevesinde, dış kaynak kullanımı, sistem kullanımını artırmak ve yeniliği teşvik etmek için dış uzmanlıktan yararlanmanın stratejik bir mekanizmasını oluşturmaktadır. Bu çalışma, özellikle karar verme süreci, stratejik seçenekler, belirleyici faktörler ve olası riskleri dikkate alarak, dış kaynak kullanımı alanına ilişkin kapsamlı bir analiz sunmayı amaçlamaktadır. Güçlü bir hibrit Çok Kriterli Karar Verme (MCDM) çerçevesi uygulanmıştır. E-devlet dış kaynak kullanımına ilişkin kararları yönlendiren hayati belirleyicileri belirlemek için Siyasi, Ekonomik, Sosyal, Teknolojik, Çevresel ve Yasal (PESTEL) çerçevesi kullanılmıştır. Etkili faktörler arasındaki nedensel ilişkileri daha iyi anlamak için Karar Verme Deneme ve Değerlendirme Laboratuvarı (DEMATEL) tekniği kullanılmıştır. Birbiriyle ilişkili faktörlerin göreceli ağırlıklarını belirlemek için Analitik Ağ Süreci (ANP) kullanılmıştır. Bu çalışma ayrıca, dış kaynak kullanım seçeneklerini sıralamak ve değerlendirmek için İdeal Çözüme Benzerliğe Göre Sıralama Tercihi için Bulanık Tekniği (TOPSIS) kullanmıştır. Olası operasyonel hataların varlığını belirlemek için Hata Modu ve Etki Analizi (FMEA) uygulandı. Ampirik sonuçlar, karar verme sürecinde en önemli etkenin gizlilik olduğunu göstermektedir. Dış kaynak kullanım maliyetleri ikinci önemli belirleyici faktör olurken, çalışanların teknik becerileri üçüncü sırada yer almaktadır. Stratejik seçimler açısından, en uygun seçeneğin ortak dış kaynak kullanımı olduğu bulunmuştur. Bu seçeneği sırasıyla tam iç kaynak kullanımı, bulut bilişim ve ardından tam dış kaynak kullanımı izlemiştir. Risk analizi, uygulama ve sözleşme yürütme ile ilgili aşamaların diğer yaşam döngüsü aşamalarına göre daha yüksek kritiklik gösterdiğini ortaya koymaktadır. Değerlendirme ve karar verme aşamaları orta düzeyde risk göstermektedir. Politika yapıcılar, dış kaynak kullanım yaşam döngüsü boyunca önemli kriterler ve risk noktalarına ilişkin kritik bir yol haritası sağladığı için bu araştırmadan faydalanabilirler. Bu araştırma, Filistin hükümetinin dış kaynak kullanımıyla ilgili önemli sonuçlar sunarak, stratejik planlama, karar verme ve e-devlet hizmetleriyle ilgili risk azaltmaya yardımcı olmaktadır.

Bilim Kodu : 92407

Anahtar Kelimeler : E-government, Outsourcing, MCDM, PESTEL, ANP, DEMATEL, Fuzzy TOPSIS

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LIST OF SYMBOLS AND ABBREVIATIONS

The symbols and abbreviations used in this thesis are presented in below with explanations.

Abbreviations	Descriptions
AHP	Analytical Hierarchy Process
ANP	Analytic Network Process
DEMATEL	Decision-Making Trial and Evaluation Laboratory
E-government	Electronic Government
FMEA	Failure Mode and Effects Analysis
Fuzzy TOPSIS	Technique of Order Preference Similarity to the Ideal Solution
IS	Information Systems
IT	Information Technology
MCDM	Multi-Criteria Decision-Making
MODM	Multi-objective Decision-Making
MTIT	Ministry of Telecommunications and Information Technology
NII	National Information Infrastructure
OECD	Organization for Economic Co-operation and Development
OGD	Open Government Data
PESTEL	Political, Economic, Social, Technological, Environmental, and Legal
SDLC	Software Development Life Cycle

1. INTRODUCTION

E-government, often referred to as electronic government, signifies the transformative application of information and communication technologies by public sector entities to improve service delivery and governmental processes, along with fostering greater citizen engagement (Ramaprasad et al., 2015). It has been a well-known fact that the introduction of digital tools into the functioning of governments can improve efficiency, transparency, and involvement of citizens (Abbas et al., 2024). This significant transformation is not limited to online services, making e-government a broader discipline that assesses technology's influential effect on governmental operations and communications with the public (Abdulnabi, 2024). In this conceptualization, e-government is considered to be a mechanism that is capable of influencing Information and Communications Technology (ICT), helping to improve the delivery of services and public administration (Zou et al., 2023). The "Transformational Change" reengineering approach can strengthen administrative processes, improve transparency, and increase the involvement of citizens, redefining the interaction between the government and citizens (Gupta & Chakraverty, 2008). Moreover, e-governance is related to the strategic usage of digital technologies, supporting governmental services and increasing the services' rapidity, inclusion, and efficiency through effective administration and participatory approaches (Bailey et al., 2024; Khanra & Joseph, 2019). Additionally, it allows the development of easily and rapidly accessible digital channels for the public and businesses, along with improving the transparency of governmental systems (Ali, 2023). The transformative shift is not about increasing the digital availability of governmental services, but about redefining governmental operations to optimize services based on the values and needs of citizens (Novak, 2024). The shift from a traditional approach to an advanced digital one shows the revolution in sustainable development and public administration, improving services and processes' cost-effectiveness (Tiika et al., 2024; Zhang & Kaur, 2024).

Globally, the increased application of e-government has been showing the outsourcing's strategic significance related to the efficiency in processes and delivery of the services (Mutongerwa et al., 2024; Yang et al., 2011). This trend indicates a wider shift concerning the dependence and usage of external experience correlated with IT applications, infrastructure, and major business in the Chinese public sector (Meng et al., 2007).

Worldwide, governments are adopting digital technologies in their central and municipal levels, which makes e-governance a crucial approach to understand technology's effect on governmental processes and interactions with citizens (Abdulnabi, 2024).

Concerning outsourcing, it is associated with acquiring a service that was produced externally and not internally. The model consists of three core layers, including the work, the completer, and the requester. To achieve an optimal e-governance service, many governments tend to outsource their services through the usage of other governments' services. This can be also done with businesses in the private sector of any nation, such as a neighboring one. To achieve a useful decision, the outsourcing operations should be properly studied and analyzed. Thus, governmental decision-makers must scrutinize these operations to guarantee an optimal outcome.

In the public sector, IT outsourcing has a higher complexity than in the private sector because of strict regulations and bureaucratic protocols that rule the processes of organizations. In addition, politicians further increase this complexity due to their diverse and conflicting interests (Lin et al., 2007). As a result, organizational outsourcing processes within the private sector cannot be directly used in the public sector. This is because they need to have a strategic adaptation so that they meet the uniqueness of the social, political, and legal demands of the governmental atmosphere (Gantman & Fedorowicz, 2020). Besides, Vilovsky (2008) discusses that these challenges are more exacerbated by the increased interdependence between governmental organizations and the different stakeholders' interests. Hence, strategic decision-making in e-government rises as an important factor in improving the organizational effectiveness and efficiency of the processes related to public administration (UN E-Government Survey, 2020). In the domain of information technology and information systems, outsourcing decisions are complex due to the involvement of several dimensions, such as economic, strategic, risk, quality, and management, necessitating proper considerations (Wang & Yang, 2006). This is why a systematic assessment of these dimensions is necessary to achieve a successful IT outsourcing since an insufficient examination frequently leads to unforeseen obstacles and failures (Shirdeli et al., 2018). Thus, it remains important to have a full understanding of the criteria affecting outsourcing decisions, especially in the e-government domain, along with the correlated risks (Kremic et al., 2006). While numerous studies have explored IT outsourcing in the private sector, the unique characteristics of public organizations, including ideological and

operational differences, necessitate a more focused analysis of e-government outsourcing (Felisoni et al., 2020).

With e-government outsourcing and the benefits of outsourcing, it is possible to eliminate the risk related to the tasks so that the project's success rate can increase. There were other challenges discovered, including the cost problem and the maintenance of the interaction strategies in the case of multi-vendor issue (Gröh et al., 2012). There were also some risks found, such as less skilled employees, legality of contract, inability of the customer to evaluate the worth of the outsourced product, financial stability of the provider, poor customer amalgamation (Martens & Teuteberg, 2009). Additional problems which cause hurdle in the success of outsourcing are deficiencies in project planning, project monitoring and control, risk management, and requirement management and measurement (Khan & Alam, 2012). The risks associated with outsourcing projects in e-government cannot be ignored. Risk management is a critical process to be performed by organizations and institutions to have successful business goals and objectives (Lark, 2015). As defined by Gröh et al. (2012), risks are the conditions that are associated with every process, product or business, and they completely depend on the management, such as how they define the risks associated with their tasks. Normally, the type of the sector does not matter, and organizations should have a clear vision on risk management and attempt to establish a tolerance range so that they have a better understanding to the risks and how to handle them. Moreover, risk management consists of five steps referred to as the risk management process, which involves the following: identifying risks, analyzing risks, prioritizing risks, implementing risks, and monitoring risks (Häring, 2016).

This study seeks to empower decision-makers by identifying critical outsourcing criteria, analyzing their interdependencies, and determining their respective weights. This evaluative framework serves as a strategic guide for selecting the optimal delivery model, specifically contrasting outsourcing, in-house development, and co-outsourcing alternatives.

To deal with the complexity issues that might come with e-government outsourcing strategies, this study used the Political, Economic, Social, Technological, Environmental, and Legal (PESTEL) analysis with multi-criteria decision-making approaches. This is especially effective when used to develop qualitative and quantitative requirements into an analytical system, thus enabling one to strike a balance between opposing goals and

divergent interests of stakeholders (Hasan et al., 2022). In addition, the Multiple-Criteria Decision-Making (MCDM) implementation makes it easier to have a transparent assessment of trade-offs, helping to create adaptable and vigorous decisions for the challenges associated with digital change in the public sector (Sahoo & Goswami, 2023).

Moreover, this study does not only focus on the strategic choice but also on the operational consistency using the Failure Modes and Effects Analysis (FMEA), which is a structured approach that can allow to define the possible failure points, and the effect of that failure. FMEA is used in this study to review the different stages of the IT outsourcing operation. This methodological approach is capable of producing empirical results that are significantly important in reducing and managing risks to enable the e-government systems to be safer and more successful. The approaches used in the study provide a complex and holistic model that could be used to maximize strategic decision-making and risk management related to outsourcing in e-government.

1.1. Problem Statement

The rapid digitalization of the Palestinian government has been serving as a major concern, where it has been increasing dependence on the use of e-government systems to support service delivery, transparency, and cost-effectiveness in the administration. Outsourcing has been extensively used to address the technological gaps, seek the expertise of the private sector, and increase the capability of innovation under the guidance of the Palestinian Higher Committee for E-Government. However, several outsourcing approaches failed to meet the expected performance objectives leading to cost overruns, inefficiencies in implementation, and breaches in contracts, along with underused systems. The current outsourcing choices in the Palestinian state sector are not well-crafted; they are usually disjointed without a systemic and evidence-based design that systematically examines their strategic options, takes into account all the interdependence determinants, and predicts the risks of lifecycle. As a consequence, the research problem focuses on the lack of a detailed and systematic decision-support and risk-governance framework that could direct the e-government outsourcing strategy in the Palestinian government.

1.2. Research Questions

This study aims to provide a holistic view of the factors influencing IT outsourcing decisions. The study also aims to identify the most effective delivery approach in addition to analyzing the risks related to strategic results and operational effectiveness, especially those that are in the domain of tobacco-outsourcing. Table (1.1) shows the research questions and the study's aim.

Table 1.1. The study's research questions and aims

The Main and Sub-Research Questions	Objective of the Study
Q1: What are the criteria affecting the adoption of the outsourcing in Palestinian E-government?	Identifying and analyzing the key criteria that influence the decision to adopt IT outsourcing in the context of Palestinian e-government.
Q2: What is the interrelationship between these criteria?	Exploring how different factors interact and influence each other, contributing to a holistic understanding of the outsourcing decision-making process.
Q3: What are the most important criteria influencing the outsourcing of e-government in Palestine?	Discovering the importance of each element influencing the e-government decision in Palestine to help the decision-maker.
Q4: Which is the best option among the alternatives for outsourcing e-government in Palestine?	Identifying the best option from among the multiple alternatives for the form of e-government outsourcing in Palestine.
Q5: Which failure modes are expected in the different phases of the e-government outsourcing life cycle?	Determining the possible failures that can happen in each stage of the e-government outsourcing lifecycle, in addition to identifying the necessary steps that should be early implemented.
Q6: What are the highest stages with the highest Risk Priority Numbers and their distribution?	Identifying the highest stages with the highest Risk Priority Numbers.

By addressing these research questions, this research aims to achieve a holistic comprehension of the outsourcing decisions' antecedents in the Palestinian e-government. The intention is also to provide practical data for policymakers, along with guidelines to stakeholders. This helps them tackle the probable complexities and make optimal decisions related to e-government processes and their risks.

1.3. Subject and Scope of the Research

This study explores strategic decision-making and risk management in e-government outsourcing in the Palestinian government. The study combines the strategic analysis and risk analysis with a hybrid MCDM model (DEMATEL-ANP-Fuzzy TOPSIS) and FMEA. The research is centered only on the Palestinian government sector and narrows down to outsourcing operations associated with the e-government nationwide projects. The study

evaluates five phases of the outsourcing lifecycle, namely, decision-making, selection, contract signing, implementation, and evaluation.

1.4. Research Population and Sample

The targeted group were the Palestinian Supreme Committee of Digital Transformation, which is an institution with ten senior officials representing the different ministries of the government and has the mandate of overseeing decision-making concerning outsourcing activities. A purposive sampling approach was adopted to be able to understand the phenomenon in a detailed way. This method helped to organize meetings with the ten officials as well. The participants had different technical functions, professional experience, and strategic goals, hence providing a holistic approach to the possible challenges and needs involved with regard to IT outsourcing in the Palestinian public sector. The study sample is appropriate considering the similarity in the research methodology used previously in similar studies. As an example, Kumar (2023) employed a purposive sample of eleven IT professionals to evaluate the outsourcing methods in European agencies, along with exploring the experience of cybersecurity in the processes of the activities of an Indian coal mining organization. Considering the high level of expertise in the research methods used, such as MCDM and FMEA, a sample of ten or eleven specialized professionals can be considered statistically adequate in order to provide strong results. Moreover, this is a sufficient sample size that also agrees with many other studies on MCDM. As an illustration, Modak et al. (2019) adopted a combined method to explore the scope of outsourcing decisions in relation to insourcing and strategic partnership based on the contribution of five professionals. Likewise, for renewable energy in Dubai, Al Mallahi et al. (2022) applied the TOPSIS in assessing technical cleaning alternatives in solar PV systems, based on a survey process involving seven domain experts. Also, Modak et al. (2017) involved a panel of ten experts having at least a decade-long professional tenure for evaluating financial and strategic performance in the Indian coal mining sector. In the particular context of E-governance, Mahalik (2010) also applied the Analytic Hierarchy Process (AHP) to assess optimal levels of outsourcing. By consulting a targeted group of three experts, Mahalik (2010) proposed a balanced strategy between internal and external agencies to mitigate operational inefficiencies. Therefore, these studies show that within complex MCDM atmospheres, the depth of professional expertise is frequently the primary target instead of large sample sizes so that the accuracy of the assessment process is ensured.

1.5. Limitations of the Research

This research faced some limitations. For example, it had limited access to the government committee because of the recent war on Palestine. Additionally, the political and economic instability might have affected the outsourcing trends throughout this research.

1.6. Definitions

1.6.1. E-government

Similar to many modern administrative paradigms, the concept of e-government has been defined by several professionals and scholars. In the center of these perspectives, there lies the usage of ICT as a strategic point of interaction between the government and its stakeholders. E-government can create an easy and multi-dimensional atmosphere where citizens and organizations are capable of interacting and performing transactions with the government through different electronic media, such as the smart cards, telephone-related systems, self-service stations, and Electronic Data Interchange (EDI) systems. This advancement exceeds the delivery of external service since it also involves a core internal restructuring of administrative regulations that are intended to optimize coordination and increase intra-governmental operations.

The interpretation is also consistent with the United Nations' vision, where e-government is defined as an organizational implementation of ICT, such as Wide Area Networks (WANs) and mobile computing, in governmental institutions to upgrade processes. In addition, the OECD (2003) highlights these technologies' functional usefulness, considering e-government as a transformative approach, especially through the internet, so that improved governance and effective public administration are achieved. Together, the definitions demonstrate that e-government is a systemic shift to an increasingly responsive, linked, and technologically involved public sector.

1.6.2. Multi-criteria decision making (MCDM)

MCDM, also known as Multiple-Criteria Decision Analysis (MCDA), structures and solves issues in planning and decisions through an integration of multiple criteria, supporting

decision-makers. In most cases, there does not exist a single optimal solution for these issues, so it is important to also use the decision-maker's preferences to distinguish the solutions (Majumder, 2015).

1.6.3. Insourcing

Insourcing or back sourcing is an organizational strategy that involves the decision to revert services or functions that have been outsourced to the organization (Berlin et al., 2022). The insourcing trend was brought about when the organizations realized the shortcomings and inefficiencies involved in long-term outsourcing agreements. This where quality of service and cost control take the center stage, especially in the public sector setting. According to research, the decision to insource is influenced by a number of factors, such as the high costs involved in contracting the services, poor quality in the delivery of services, loss of organizational control, and other contractual issues (Berlin et al., 2023). Moreover, insourcing has been used in various sectors that provide public services, such as local government administration, social care services, care services, and municipal waste management.

Although in-housing is conceptually aligned with insourcing, it has certain implications in the framework of services delivery system and corporate set-ups. In-housing is considered to be a particular practice of shifting management and delivery of services by external corporate or third-party organizations directly to entities of public administration where public services would be directly under government control and accountability (Andrews, 2024). This difference is most applicable in systems where the governments have already established independent corporate bodies to administer the public services at their distance.

1.6.4. Outsourcing

Outsourcing can be defined as the organization's procurement of services or materials from external providers. It can be divided as internal outsourcing, which means sourcing from another organization located in the same nation, and international outsourcing, which means sourcing from a foreign provider. International outsourcing, also known as offshoring, includes two types:

- *Intra-firm outsourcing*: When the foreign supplier is owned by the same company.
- *Arm's-length outsourcing*: When the supplier is an independent foreign firm.

Traditionally, outsourcing was associated with manufacturing, but it has increasingly expanded into the services sector, driven by advancements in communication technologies like the internet. This transition enables firms, largely in advanced economies, to tap into a pool of skilled and low-paid workers in the emerging world. Although the long-term economic advantages of outsourcing are compelling, there are also transition costs associated with the process of unemployment, that is a prominent one at the microeconomic level (Troacă & Bodislay, 2012).

1.6.5. Co-outsourcing

Businesses in the modern interlinked world are always after new ways of improving the allocation of resources, and improving efficiency in operations to secure competitive advantages (Outsourcing & Offshoring, 2015). In this list of strategies, co-outsourcing is seen as an advanced outsourcing model that takes outsourcing beyond the traditional transactional substitute sourcing to stages of more profound and integrated collaborations with external actors (Richards, 2011). Such an approach also reflects a move away from 'transacting tasks' to collaborative innovation whereby the customer and supplier are able to co-invest and participate in a mutual benefit by helping to deliver long-term organizational change (Hossain et al., 2024). This evolution in outsourcing halts the search for internal competencies as competitive advantage alone and makeshifts barriers to competition that, however, does not keep pace with the global economy (Silva et al., 2024). Co-sourcing emerged in the mid-2000s as a corollary, when the outsourcing market led to efficient customer management by means of blistering fast reactions to requests for information, quote, and invoicing (Fernández et al., 2023). It has opened a space where the purely cost-basis of outsourcing can be considered, and where more co-operative forms of economic organization can be modelled and appreciated as part of a wider appreciation that value co-creation through synergistic collaboration (Hätönen & Eriksson, 2009). This development is in line with the wider idea of co-creation where, instead of being mere buyersellers, companies and customers collaboratively create value, shifting from a traditional supplier-client relationship to an intertwined relationships believed to be oriented towards shared problem-solving and innovation (Burdon et al., 2016).

1.6.6. Risk management

Risk management is the practice of selecting and implementing measures to control or manage risks that pose a threat to an organization's goals. Moreover, systematic community level is a systematic manner in anticipating and recognizing risk remnants with their impact and managing it so that organizations can be more rational in their decision-making and effectively conduct their operations (Fidhien et al., 2025).



2. LITERATURE REVIEW

This section provides information on the concept of e-government, its historical development, e-government in Palestine, and outsourcing. It also provides information on relevant literature.

2.1. Literature Related to The Field of Study

Outsourcing, a popular concept in various industries, is entering into contracts with organizations to carry out activities previously done internally (Nijman et al., 2019). This approach has stimulated great interest in academic research as it is widely practiced. The range of benefits and risks, motivators, and decision factors related to it are complicated (Kremic et al., 2006). In particular, IT/IS outsourcing decisions are multi-dimensional and must take into account economic, resource, and strategic risk management and quality perspectives (Wang & Yang, 2006). The literature also observes that following sound outsourcing selection models is crucial (Mtsweni et al., 2021). Even if the phenomenon of IT outsourcing for public organizations is increasingly important, research on its own decision-making process and risk for e-government domain is still relatively less developed than that in the private sector (Felisoni et al., 2020).

Moreover, the inherent unique characteristic of public services including cultural particularities and citizen demands create a paradox, where traditional outsourcing theories may no longer directly be applicable and points to new ways for management (Felisoni et al., 2020). In these new ways, clients and vendors learn from one another (Felisoni et al., 2020). In fact, despite the laid down plans for digital government transformations, there are inherent paradoxes that come from conflicting values of different stakeholder groups in such initiatives (Wang et al., 2024). Strategic value innovations and mechanisms need to be employed to reduce these tensions and promote collaborative public value creation (Wang et al., 2024). Furthermore, effective implementations of e-governance must be able to wade through the complex maze of technology infrastructure, cybersecurity threats, and institutional reluctance for transformation (Zhang & Kaur 2024). These complexities highlight the need for decision-making processes, which are broad and encompass both technical and socio-political considerations of e-government outsourcing, a dimension frequently ignored when using conventional private-sector outsourcing models (Zhang &

Kaur 2024). According to the observational evidence of Sarvari et al. (2023), the main factors that influence the capacity of suppliers under WWC's outsourcing models are financial, judicial-legal, contractual, and managerial aspects. Relative importance is the practice of identifying, evaluating, and maintaining potential threats to an organization's objectives. It is a method for systematically anticipating the risk, perceiving its impact, and developing strategies to overcome it so that better decisions are made to efficiently improve work (Fidhien et al., 2025). These results offer critical insights into the systemic vulnerabilities of existing outsourcing procedures, facilitating a targeted approach to addressing current operational deficiencies.

According to Hodosi et al. (2023) there are seven factors that affect ITO for Cloud Computing (CC) provider and buyer, these factors are contracts, the client's degree of expertise in IT operations, measurement problems, the Swedish Public Procurement Act, provider challenges, relatedness, and ex-ante imperfection. The risk sources have been extended with storing data outside of the EU, backup for data in CC, opportunistic behavior of providers, and Locking in. Moreover, according to Yazdani et al. (2023), the three most important risks are data confidentiality, integrity, and reliability. There were 117 risk-responsiveness solutions recognized and ranked as the most appropriate remedial strategies that extensively mitigate against identified risks (Yazdani et al., 2023). For example, these solutions involve auditing the scope of access to information, using relevant techniques to control data integrity, and implementing appropriate training programs for the support team within the organization (Yazdani et al., 2023). Additionally, a 2021 study found that technical, personal, and dependability factors influence the intention to use e-Government, and they have a significant impact on the actual adoption of e-Government services in Palestine (Obaid et al., 2021). That is why the government should develop a comprehensive e-government planning model based on demographic factors. Gantman and Fedorowicz (2020) examine how IT activities are strategically aligned in the public and private sector, and they emphasize the challenges faced throughout the decision-making process related to IT outsourcing (ITO). It was found that the absence of technical expertise and cost-effectiveness are significant drivers for the adoption of IT (Gantman & Fedorowicz, 2020). The research also indicates that the access to capital funding can be a major factor that affects ITO strategic choices (Gantman & Fedorowicz, 2020).

In addition, Marco-Simó and Pastor-Collado (2020), who performed a comparative analysis, highlight the diverse practical differences affecting the efficacy of ITO application, especially in the public domain. However, some scholars discovered the possible risks of this shift. Svärd (2019) highlights outsourcing's adverse consequences, especially concerning the vagueness of information management protocols within government contracts. This indicates the need for an in-depth comprehension regarding the e-government challenges so that informed decision-making is facilitated, which is also supported by Mkude and Wimmer (2016). To resolve the gap existing between theory and practical implementation, Fatih et al. (2015) suggest a holistic framework that uses a multi-faceted analysis, consisting of the benefits, opportunities, costs, and risks, helping to guide public organizations in choosing the most suitable models of cloud deployment. Moreover, Moon et al. (2014) assert that the organizational size has a low effect on the outsourcing efforts' effectiveness in the public domain. Instead, Moon et al. (2014) propose that IT's strategic role is a primary driver for successful results in outsourcing. Different complexities complicate the implementation of e-government service delivery, including strategic problems, such as back sourcing/out-sourcing, which were majorly investigated by Samsudin et al. (2013). The literature also emphasizes that the systemic obstacles to e-government implementation are significantly engrained within political and economic factors (Samsudin et al., 2013). These factors are tremendously affecting the public organizations' performance and reduce the effectiveness of digital service delivery (Samsudin et al., 2013).

From an economic view, Girth et al. (2012) assess the market competition's role as a core rationale for outsourcing public services. The results indicate that the costs of transaction rising from non-competitive market atmospheres should be vigorously assessed following the governments' determination of the most efficient model for service delivery (Girth et al., 2012). Additionally, Cordella and Willcocks (2012) scrutinize the "Contract State" paradigm, and they challenge the dominant policies concerning IT outsourcing. These researchers argue for a more disciplined strategic approach to outsourcing, asserting that such practices should ultimately serve to generate and sustain robust public worth rather than merely reducing costs (Cordella & Willcocks, 2012).

Furthermore, a study, conducted by Ajalli et al. (2025), evaluates the key risks effective in IT outsourcing, and the binomial test (BT) approach was used to identify the final risks. The

results showed that six risks are effective in IT outsourcing (Ajalli et al., 2025). Also, the risk assessment with a weighted average (WA) showed that technical risks rank as first importance, while communicational risks rank as last importance. This study had a few limitations, such as the difficulty to find relevant and responsive experts in the field of IT outsourcing (Ajalli et al., 2025). In addition, Souqia (2011) aimed to estimate the likelihood of Open-Source Software (OSS) adoption in the Palestinian e-government program after recognizing the chances, challenges, and the expected effects of OSS adoption on the Palestinian e-government context. The Palestinian economy extremely depends on external financial support and the expected cost savings when adopting OSS, acting as the main drivers (Souqia, 2011). The results show that the Palestinian government can save money by using this technique, but there are some problems (Souqia, 2011). These problems are in the current OSS experience, government top-level leadership and support, awareness of OSS objectives, and benefits and cross-agency cooperation, along with the lack of special budgets for the software in the government (Souqia, 2011).

Yin et al. (2009) used an evaluation model of the e-government services outsourcing. The researchers discovered that promotion finding and cost and risk control in factor of the government have a large influence on e-government services outsourcing (Yin et al., 2009). As it turns out, some studies deal with the issue of challenges facing the outsourcing process in e-government, and some focus on the difference between public sector and private sector in the outsourcing process. That is why this study was conducted, helping to develop the decision-making process and solve the issue of outsourcing in e-government. The study aspires to provide a comprehensive understanding of the criteria that directly affect outsourcing decisions within the realm of e-government. Through an MCDM encompassing PESTEL analysis, DEMATEL, and ANP, the study identified and prioritized these criteria. It analyzed how these criteria interrelate and influence one another, offering a nuanced perspective on the decision-making process. This analysis was grounded in the responses of key decision-makers in the e-government public sector. Table (2.1) summarizes the studies that used the MCDM approach and are related to IT outsourcing.

Table 2.1. Previous studies

Year	Writer	Method	Topic	Application
2025	Ajalli et al.	A binomial test (BT) approach	facing the risks of IT outsourcing.	✓
2024	Chariev	Structured analyzes	Outsourcing technology in the logistics industry	×
2024	Abdurahman and Kabanda	Data analyzes	factors influencing the design and implementation of accessible e-Government services	×
2023	Sarvari et al.	Delphi survey, one-sample t-test and the Friedman test	the major factors able to increase the capacity of suppliers in outsourcing processes	✓
2023	Yazdani et al.	PMBOK model	Evaluation of cloud computing risks using an integrated fuzzy-ANP and FMEA approaches.	✓
2023	Hodosi et al.	semi structured interviewees	Risks in Cloud Computing Relationships: A Study of Large Public Buying Organizations in Sweden	×
2022	Mansour	Survey and SPSS	Study of the readiness of Palestinian ICT institutions for digital transformation	✓
2021	Obaid et al.	sampling approach	Factors contributing to an effective e-government adoption in Palestine	✓
2020	Gantman and Fedorowicz	Qualitative Comparative Analysis	Success Factors of IT Outsource	✓
2020	Marco-Simó and Pastor-Collado	proposed descriptive framework by reviewing literature	IT Outsourcing in the Public Sector	×
2019	Svärd	Interviews	Contract and Security of outsourcing	×
2018	Duhamel et al.	Case selection, interviews	Manage public-private IT outsourcing relations	✓
2016	Mkude and Wimmer	PESTELMO,DEMATEL, ANP	E-Government Challenges	✓
2015	Fatih et al.	BCOR, Entropy and TOPSIS approach	Selecting Model	✓
2014	Moon et al.	Questionnaire	IT outsourcing in public sector	✓
2013	Samsudin et al.	Cross-sectional research design through surveys	Assessing the feasibility of outsourcing	×
2012	Cordella and Willcocks	Questionnaire and interviews	Government policy, public value and IT outsourcing	×
2012	Girth et al.	Surveys and qualitative data from inter views with government managers.	-	✓
2011	Souqia	Surveys and qualitative data from e-government team members and heads of IT departments	Opportunities and Challenges of Open-source Initiatives in the Palestinian e-Government Program	✓
2009	Yin et al.	AHP	Factors of E-government Services Outsourcing	✓

This review shows that previous studies have focused primarily on the selection process in the outsourcing process. While the outsourcing process is important, the outsourcing process

begins with the decision-making process, which is an important stage in the stages of external outsourcing and has not been studied sufficiently, nor have the factors affecting it been studied to improve the outsourcing process. In addition, the process of studying outsourcing risks focuses either on one aspect of the risks, such as security, or some studies focus on the expected risks in one stage. However, in this study, outsourcing was evaluated in the different stages of the outsourcing project.

2.2. E-Government

E-government represents the public services' and operations' electronic and strategic transformation through the use of ICT to improve productivity, accessibility, transparency, and efficiency. It is a paradigm which, as a transforming interface, supports smooth transactions between citizens, markets, and governmental organizations without any temporal and financial loss (Fazil et al., 2024; Yang & Rho, 2007). The implementation of a solid e-government construction at the infrastructure level is, however, expected to be a multifaceted process that requires a "realistic integration of ICT and administrative governance" (Hu et al., 2009, p.17). Thus, the dependence on outsourcing has become a significant strategic method for obtaining the unique skills that can address the infrastructural and bureaucratic issues. The transformation toward e-governance fundamentally changes the interaction's nature between the government and the public, improving the service delivery processes and the public administration's quality (Gupta & Chakraverty, 2008; Molobela & Uwizeyimana, 2023).

2.3. Outsourcing Process

In the past two decades, there has been an important economic phenomenon, which is the shift of manufacturing processes from developed to developing nations. This practice has been integrated by large organizations to tackle the issue of constantly increasing production costs and the simultaneous increase of living standards and salaries (Troacă & Bodislav, 2012). In recent years, there has been an increased development within the resources management and services in the private and public sectors. Depending on external providers, outsourcing has been becoming a major approach for improving efficiency and decreasing costs. Several governments are choosing this model so that they can improve the public services' quality and decrease the financial burden. This phenomenon has attracted many

professionals and scholars. Moreover, multiple frameworks have arisen, describing the phases in the outsourcing operation. Generally, it is agreed that this operation involves the following: The stage of preparation, selection of the supplier, relocation, management of the relationship, and revision (Perunović & Pedersen, 2007).

2.3.1. Outsourcing concept

The outsourcing concept stems from the American terminology “outside resourcing”, which means the acquisition of resources from overseas. Then, this terminology was used in economic terms, referring to the usage of foreign resources for business development, that had conventionally depended on internal resources. In an article published in *The Economist*, Hendy (n.d.) discusses that outsourcing is considered to be an old phenomenon that arose in World War II, and it has been developing, especially following 1990.

Furthermore, estimates indicate that the percentage of added value to American goods and services did not surpass 20% in 1946. After fifty years, this percentage tripled to become 60%. Alders (2001) restates this view in his “Handbook of IT Outsourcing”, highlighting that outsourcing remains an old phenomenon. He indicates that fifty years ago, organizations used to outsource advertisements, legal services, production services, and maintenance (Aalders, 2001). Quelin and Duhamel (2003) argue that outsourcing is often accompanied by the transfer of material and human resources to the chosen provider. Its mission is to replace local services in medium- or long-term relationships, including an average of five to six years with the client organization.

- *Internal outsourcing:* Is when a company purchases services or material inputs from a source located in another company within the same country.
- *International offshoring:* Is defined as when a company purchases services or material inputs from a source located in another country. This term encompasses both international in-house outsourcing, where the company retains a foreign input supplier, and international remote outsourcing, where the foreign input supplier is independent of the company using the inputs. International outsourcing is part of a country's imports of goods and services (Ishizaka et al., 2019). International outsourcing is mostly used by companies in advanced economies, which outsource a portion of their work to

companies located in developing countries, particularly to reduce costs (Troacă & Bodislav, 2012).

2.3.2. E-government outsourcing

Information systems /IT outsourcing is a world-wide business that exists in the private and public sector, and this topic has received considerable attention in the last years. Particularly, e-government IT outsourcing is an important and increasing phenomenon in the public sector (Burnes & Anastasiadis, 2003). The growing complexity and broader penetration of information technology in the public sector have forced most governments to consider e-government outsourcing an important strategic action that can improve mobilization of performance and effectiveness (Mutongerwa et al., 2024). This approach allows e-governments to access external talent and resources to build, run, and maintain advanced e-government applications and infrastructure (Yang et al., 2011). In recent years, IT outsourcing in the public sector has become an accepted management practice, and a significant proportion of E-government IT projects. The term "outsourcing," while not specific to information systems (IS), is commonly used in the field of information systems and applies to everything from the use of contract programmers to outsourced facilities management. According to Mtsweni et al. (2021), IT outsourcing has been found to have both negative and positive impacts on an organization:

- Knowledge of the operating environment impacts the delivery of IT services, and their suitability for the customer. It is critical for organizations to ensure strong collaboration between the outsourced and internal teams to ensure smooth service delivery and process alignment.
- Service performance also directly impacts the performance of IT services and the organization as a whole. The organizational impact of IT outsourcing can be significant when the outsourced service is not well managed and the organization does not derive added value from the services provided by the service provider.
- It was also found that the service provider relies on the internal IT department to ensure contracts and infrastructure are in place to enable high-quality and timely service delivery to the customer. Operational misalignment between the service provider and the internal IT department negatively impacts service response time. The internal IT

department can deliver reliable, high-quality IT services to the company with the help of the external service provider.

The main reasons for outsourcing public services (Jansson et al., 2021):

- 1- *Cost Reduction:* Governments often outsource service provision to reduce costs. For instance, transferring the services of waste management to the private sector may lead to reduced costs because of the possibility to benefit from scale economies and highly efficient processes in the private sector.
- 2- *Focus on Core Competencies:* Outsourcing permits governments to shift attention to their fundamental responsibilities. For instance, when a city plans to outsource its park maintenance, it might be able to assign additional resources to the infrastructure and safety of the public.
- 3- *Access to Expertise:* Private organizations frequently have specialized expertise that is capable of improving the quality of the services. The outsourcing of IT services is an important example, where the private sector's technical experience can improve the efficiency and security of governmental data processes.
- 4- *Increased Efficiency:* The private sector's competitiveness may result in higher efficiency of service delivery. To illustrate, the outsourcing of public transportation is an important example, where the private organizations can provide services that are increasingly reliable and timely.
- 5- *Flexibility and Innovation:* Private organizations can provide innovative solutions that are not restricted by standard bureaucratic operations. An example would be the usage of app-dependent platforms to provide public services, including services of ride-sharing so that the public's transportation needs are met.
- 6- *Political and Economic Ideology:* Some governments are aiming to outsource due to their commitment to a wider ideology related to decreasing the government's size and increasing approaches of the free-market.
- 7- *Public-Private Partnerships:* These partnerships may mobilize the private investment in public initiatives, including building hospitals and highways, where a private organization might finance, construct, and operate the construction for a certain period before shifting ownership to the public domain.
- 8- *Responding to Financial Stress:* During stressful economic times, outsourcing can serve as an important approach to sustain service levels while tackling budget constraints.

This is evidenced by the financial crises, where multiple municipalities might outsource the delivery of services to lower the effect of decreasing tax revenues.

2.4. Risk Management in Outsourcing

The IT outsourcing process is a complex, multi-phased, and institutional decision that is not limited to a simple procurement activity. This strategic process involves a vigorous and constant assessment in addition to management of relationships to attain the desired results. The outsourcing lifecycle is structured into five stages, including decision-making, selection, contract signing, implementation, and evaluation.

The decision-making phase is the primary and formative stage in this lifecycle, where organizations perform a strategic analysis to identify if IT functions, that were previously internally conducted, should be externalized (Lacity & Willcocks, 2013). The main result of this phase is a formal and rationale decision to either proceed or leave the outsourcing effort, that is commonly written in a business case.

The second phase is the selection, which consists of the systematic process of identification, evaluation, and choice of an ideal vendor partner. This phase is important since it helps to tackle the risks of selecting the partner and establishes the core for the future interaction (Gonzalez et al., 2009). The selection criteria are not only restricted to the cost but also extends to the technical experience of the vendor, cultural fit, financial stability, managerial skills, and strategic consistency with the client institution.

Regarding the contract signing phase, it includes formalizing the outsourcing contract into a legally binding agreement. This contract is the core of the outsourcing relationship, which is designed to regulate the interactions and decrease possible disputes (Aubert et al., 2012). Instead of being only a service-level agreement (SLA), it becomes a relational agreement that highlights roles, responsibilities, metrics of performance, models for prices, intellectual property rights, data privacy and security rules, approaches for conflict resolution, and clauses for terminating the contract and managing the change.

Concerning the implementation phase, which is also known as the operational stage or the transition or management of relationship phase, the agreement is practically applied in this

phase. This includes the physical and managerial shift of assets, individuals, operations, and responsibilities from the client to the vendor (Kotlarsky et al., 2009). This phase is often the most challenging, as it requires active management of cultural differences, communication gaps, and resistance to change to ensure service delivery aligns with contractual expectations and business needs.

The last phase involves a constant evaluation of the outsourcing agreement's results and performance while simultaneously assessing if these results align with the set aims and standards in the previous phases (Gewald & Rouse, 2012).

2.5. E-Government in Palestine

Over the past few decades, the e-government concept has evolved and has been affected by the advancement in technology and worldwide digital shift trends. This part highlights the e-government's historical background, its origins, major developmental stages, and universal adoption, which later frame its Palestinian application. E-government's origins can be attributed to the 1960s and 1970s, where governments started to use mainframe computers to process data and perform administrative activities (Layne & Lee, 2001). However, the concept gained prominence in the 1990s with the rise of the internet, which enabled more interactive and citizen-centric services. In the 1970s and 1980s, the automation of government functions was appeared, governments started using ICT for internal operations, such as payroll processing and census data management (Heeks, 2006). The focus was on back-office automation rather than public service delivery. The Emergence of the Internet and Digital Governance was in 1990s, and the spread of the World Wide Web led to the first e-government initiatives, particularly in developed countries like the U.S. (Clift, 2004). The U.S. launched the National Information Infrastructure (NII) initiative in 1993, promoting digital access to government services (Fountain, 2004). The European Union also began integrating ICT into public administration under the E-Europe Initiative (European Commission, 2000). In the 2000s, Global Expansion and Maturity Models were found. For example, the United Nations (UN) introduced the E-Government Development Index (EGDI) to measure progress, Layne and Lee (2001) proposed a four-stage maturity model for e-government. Countries like Singapore, Estonia, and South Korea emerged as leaders in digital governance (West, 2004). From the 2010s till now, the Smart Governance and Open Data were shown. The focus shifted toward open government data (OGD), citizen engagement,

and AI-driven services (Janssen et al., 2012), along with Mobile Government (m-government), and social media became integral to public service delivery (Alryalat et al., 2017).

2.6. Research Gap

Even though there is a comprehensive literature on e-government outsourcing in public administration and information systems, the present studies demonstrate a number of theoretical and methodological gaps. To begin with, most previous studies focus on the vendor selection of the outsourcing process, or focused on evaluating one dimension of outsourcing, namely the technical dimension. However, the selection process is preceded by the decision-making process, which is considered a sensitive and important phase, and understanding it helps in determining the right decision regarding outsourcing and its strategy. Second, previous research discussed the risk in e-government outsourcing in a general and descriptive way. The literature often conceptualizes risks, such as financial, technical, or contractual risks, but does not prioritize risks in stages. There are very limited empirical studies that measure and prioritize the criticality of risks throughout the outsourcing lifecycle. Consequently, policymakers have no operational direction on what lifecycle stages need to have better governance control and mitigation measures. Third, a significant number of studies make use of single-method decision-support tools, such as AHP, cost-benefit analysis, or simple MCDM models, which are not sufficiently effective in terms of interdependency of the determinants or causal relationships between environmental, organizational, and technological factors. Additionally, there is a lack of literature that combines macro-environmental analysis, including political, legal, and regulatory pressures, along with systematic multi-criteria evaluation and risk assessment in a single framework. Fourth, there is a lack of empirical data on developing governance settings. The majority of outsourcing frameworks are based on the stable institutional settings and can be less flexible to politically bound and resource-restricted government structures like Palestine.

3. PROPOSED METHODOLOGY

This research comprised two phases. The first phase aimed to identify the criteria that affect the outsourcing decision-making process in the E-government and the best alternative among the outsourcing alternatives. The second phase evaluated the risks associated with the decision-making stages of IT outsourcing process. In the first phase, a structured multi-criteria research methodology was employed. The first step was the PESTEL analysis, which aimed to identify the criteria that affect the outsourcing decision-making process in the E-government. The second step was the DEMATEL, which aimed to explore relationships between the identified criteria, followed by the ANP method to calculate the weight for each of the identified criteria. Then, the Fuzzy TOPSIS was used to determine the optimal strategy among many outsourcing choices by ranking the alternatives. For the second phase, FMEA methodology was applied to evaluate the risks associated with the decision-making stages of IT outsourcing process. The flowchart of the suggested research process is shown in Figure (3.1):

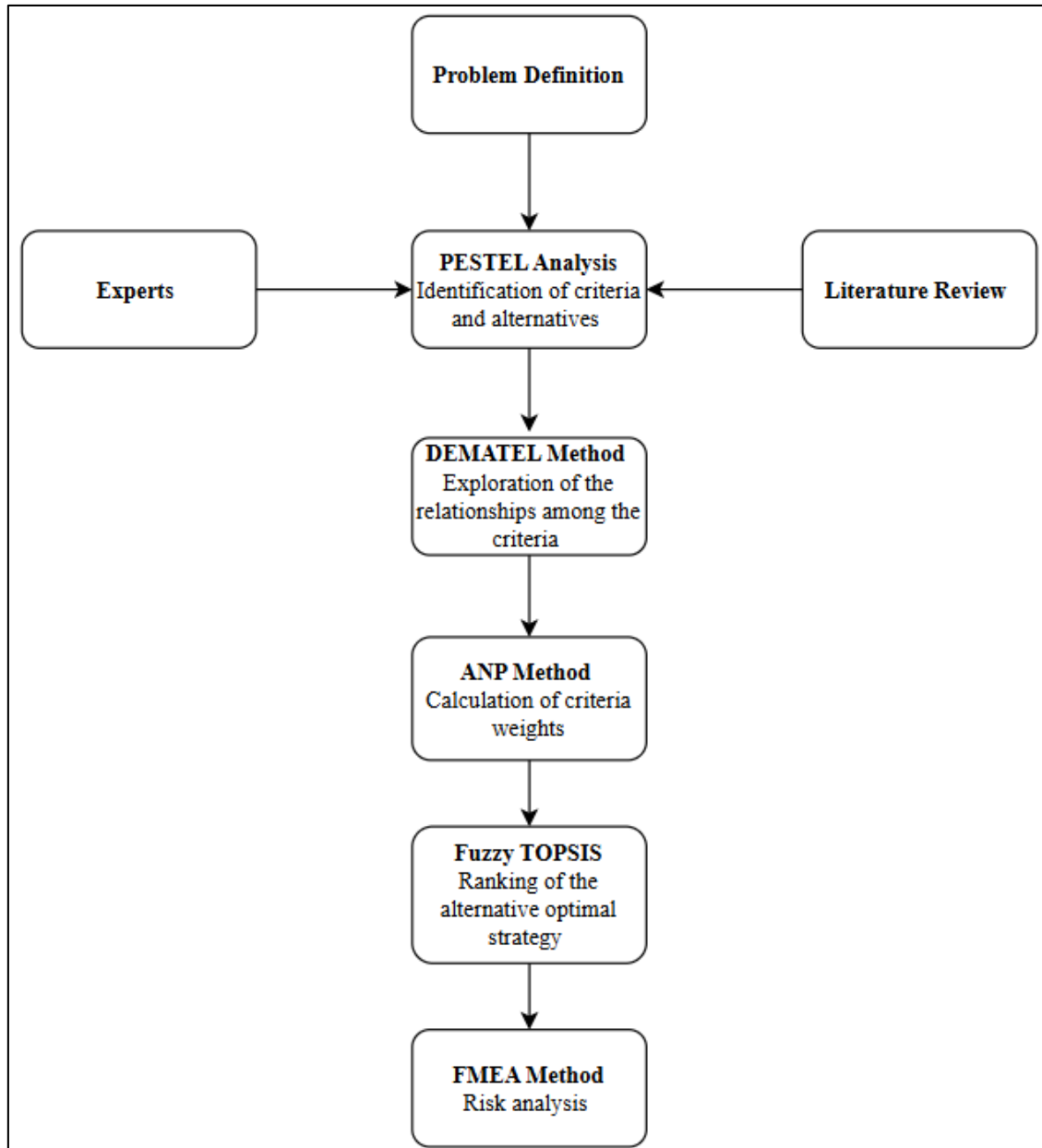


Figure 3.1. Research process flowchart (by the author)

3.1. PESTEL Analysis (Political, Economic, Social, Technological, Environmental, and Legal)

PESTEL analysis is a strategic management tool used to assess the macro-environmental factors that influence an organization, industry, or decision-making process. The acronym stands for Political, Economic, Social, Technological, Environmental, and Legal factors. This framework can help professionals and academics to systematically assess external factors that can affect processes, strategies, and long-term sustainability.

The following is a detailed discussion of each component (Pan et al., 2019):

Political factors

These refer to government policies, regulations, and geopolitical conditions that affect business and organizational decisions.

Economic factors

Economic conditions determine market viability, investment attractiveness, and consumer behavior.

Social factors

These encompass demographic, cultural, and societal trends influencing demand and workforce dynamics.

Technological factors

Technological advancements drive innovation and competitive advantage.

Environmental factors

Sustainability and ecological concerns increasingly shape business strategies.

Legal factors

These involve laws and regulations that organizations must comply with.

Moreover, the PESTEL analysis can provide a structured strategy to assess macro-environmental determinants, including legal, technological, environmental, social, political, and economic ones, that tend to affect organizational approaches (Grant, 2021). This framework is consistent with MCDM, by offering a systematic basis for weighting external criteria in complex decisions.

3.2. Multi-Criteria Decision Making

Decision-making has an important effect in determining the will, which is an essential result of a human's thought processes, and it is an action form that persons or groups constantly perform. In management atmospheres, will remains a core element that is directly associated with the process of decision-making. Will can be referred to as the person's capability to choose, make a decision, and perform this decision (Dökmen, 2006). In every aspect of life, this process remains central since it guides both individual and collaborative actions.

Intuitive and rational approaches can be used in decision-making. In some cases, a decision can be made without interpreting tacit knowledge based on past experiences and knowledge, and without subjecting it to rational evaluation. Sometimes, rational evaluation and analysis of the decisions taken are required. Roy (1981) categorized decision-making problems into four categories in his study "The Problem of Choice". Accordingly, selection problems are defined as selecting the most suitable alternative from a set of specified alternatives, and based on an evaluation conducted against criteria. Classification problems aim to classify the alternatives within a set of specified alternatives based on their attributes. On the other hand, ranking problems, aim to establish the preferred order of alternatives based on criteria. The definition problem addresses the problem of correctly defining alternatives and criteria, encompassing all of these problems (Govindan et al., 2013).

The situations and problems we encounter in daily life generally involve multiple interrelated and even contradictory situations. Decisions regarding these complex problems can involve multiple objectives and criteria. MCDM is a set of models and approaches that involve identifying, evaluating, ranking, and selecting the most optimal alternatives using multiple criteria (Eş, 2013). The goal of MCDM is to create a mechanism that can manage all alternatives and criteria when making decisions, achieving the most accurate result in the easiest way (Tuğrul, 2021). In MCDM problems, some attributes may align with the goal, while others may exhibit contradictory characteristics (Çınar, 2004). An approach that prioritizes optimal evaluation at the decision point should also aim to optimize attributes possessing these characteristics. MCDM methods facilitate managers' ability to analyze, classify, combine information, and interpret the results of all these processes. This allows for optimal and realistic choices to be made in a rational decision-making process based on analytical thinking (Eş, 2013).

MCDM methods have been studied for a long time. New methods and research related to MCDM, which has a wide range of applications, are being tested. Mathematical models have been developed for MCDM methods, often using combined or improved methods. In this sense, some basic features, strengths, and weaknesses of MCDM methods have been examined and they have been differentiated in various aspects, such as the nature of the data in their application area and the characteristics of the alternatives (Tuğrul, 2021).

3.2.1. MCDM methods used in the study

After normalizing the data obtained in the study, four approaches to weighting emerge:

- **DEMATEL** (Decision-Making Trial and Evaluation Laboratory) to analyze interdependencies among the identified criteria.
- **ANP** (Analytic Network Process) to determine the prioritized weights of each criterion.
- **Fuzzy TOPSIS** (Technique of Order Preference Similarity to the Ideal Solution) is used to determine the optimal strategy among many outsourcing choices by ranking the alternatives.

3.2.2. Analytical hierarchy process (AHP)

In 1980, Saaty introduced the Analytic Hierarchy Process (AHP) as a multi-criteria decision support methodology. Subsequently, the AHP has been widely used in a variety of fields. The basic characteristic of the AHP is to decompose the decision-making process into a hierarchical structure in which the relationships of elements in different levels are independent. To meet more practical decision-making properties, the Analytic Network Process (ANP) extends the AHP to problems with dependences and feedback among the criteria by using a “super matrix” approach (Saaty, 1996).

The ANP, which was established through the “Super Matrix” strategy by Saaty (1996), shows a vigorous basis for complex decision-making in institutional and governmental domains. In contrast to traditional linear approaches, the ANP makes it easier to integrate tangible and intangible criteria, detecting the possible interrelationships and feedback mechanisms among them (Tuzkaya & Önüt, 2008). Along with the constraints of unidirectional modeling, the ANP is more sensitive and consistent in the outputs it produces

(Yıldız, 2014). Based on the structural knowledge gained in the course of PESTEL and DEMATEL analyses, this research resorts to the ANP to order the criteria weight and to set relative priorities. The fact is that the methodological convergence allows a more significant evaluation of the importance of factors and conforms to the existing norms of MCDM (Ordoobadi, 2012). Following the procedural framework outlined by Yüksel (2012), the implementation of the ANP is represented by a sequence of steps that are performed in a systematic order:

Step1: Decision problem is defined and the objective, criteria, and sub-criteria are incorporated, along with the identification of the decision-makers. These dimensions and sub-dimensions are outlined in the previous chapter.

Step 2 and 3: Network structure is established that shows the interdependencies between the criteria. It is achieved by means of the existing methodological techniques such as brainstorming, literature reviews, and consultations with professionals (Büyüközkan & Güteryüz, 2016; Büyüközkan & Öztürkcan, 2010). An influence matrix is built after identifying the internal dependencies of the network using the DEMATEL method.

Following the determination of the network's internal dependencies via the DEMATEL technique, an influence matrix is constructed. Subsequently:

Step 4: Involves the execution of pairwise comparisons derived from this matrix, employing the 1–9 preference scale proposed by Saaty (1994, 2005) to ensure consistent measurement.

Step 5: The priority weights are determined by using Analytical Hierarchy Process calculation procedures given by Çetin and Önder (2015). The comparison matrix (A), includes the elements of the pair-wise comparison questionnaire where a_{ij} denotes the relative importance of Criterion i and Criterion j , and n denotes the number of criteria. The characteristics of the elements of comparison matrix are: 1) a_{ij} and $a_{ij} > 0$; 2) $a_{-ij} = 1 / a_{-ij}$; 3) $a_{ij} = 1$, if $i = j$. The comparison matrix is obtained by using the geometric mean of the data collected from experts. Afterward, the priority vector (W) is calculated by using Equation (3.1).

$$W_i = \frac{\sum_{i=1}^n \left(\frac{a_{ij}}{\sum_{i=1}^n a_{ij}} \right)}{n}, \forall i, j = 1, 2, \dots, n \quad (3.1)$$

Step 6: The subjectivity originated from the participants may result in inconsistency. Therefore, AHP requires to check the consistency ratio. Firstly, the largest eigenvalue (λ_{max}) is calculated using Equation (3.2). Secondly, the consistency index (C.I.) is calculated by using Equation (3.3).

$$AW = \lambda W \lambda_{max} = \frac{1}{N} \sum_{i=1}^n \frac{(AW)_i}{W_i} \quad (3.2)$$

$$C.I. = \frac{\lambda_{max} - N}{n - 1} \quad (3.3)$$

In order to calculate Consistency Ratio (C.R.), the random consistency index (R.I.) given in Table (3.1) is introduced by Saaty (1994). Finally, the consistency ratio is calculated by using Equation (3.4).

Table 3.1. Random consistency index (R.I.)

n	1	2	3	4	5	6	7	8	9	10
R.I.	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

$$Consistency\ Ratio = \frac{C.I.}{R.I.} \quad (3.4)$$

Step 7: Once all the relative priority weights are obtained, the supermatrix is constructed.

Step 8: The supermatrix is constructed to encapsulate the relative priority weights of the sub-dimensions. Concurrently, pairwise comparisons are performed at the dimension level to derive their respective priority vectors. The weighted supermatrix is subsequently generated by scaling the elements within the supermatrix by the weights assigned to their overarching dimensions. In order to achieve a column-stochastic form, the weighted supermatrix is brought to a normalized state, that is all elements are divided by the sum of the respective columns. Thus, this transformation ensures that the total of the elements in any column of the resultant normalized weighted supermatrix can equal unity.

Step 9: Limit supermatrix, which shows the global priority weights of the sub-dimensions are calculated by using Equation (3.5),

$$\lim_{k \rightarrow \infty} (W)^k \quad (3.5)$$

where W represents the normalized weighted supermatrix, and “ k ” represents a value that normalized weighted supermatrix converges to the limit and reaches stability.

Decision-makers receive a thorough quantitative evaluation and measurement of the identified criteria step 9. They are provided with insights into the interdependent local and global weights of the categories, which highlight the extent of the interdependencies among these criteria. This information empowers decision-makers to develop strategies and find solutions that are more informed and well-grounded, considering the relationships between different criteria.

3.2.3. DEMATEL (Decision Making Trial and Evaluation Laboratory)

DEMATEL, which stands for Decision Making Trial and Evaluation Laboratory, is a method used for analyzing complex systems and identifying interdependencies and interrelations among various factors within the system through a causal diagram (Tzeng et al., 2007). The steps for using DEMATEL are as follows (Yüksel, 2012):

Calculating the initial average matrix

This step requires evaluation of the degree of direct influence between the identified criteria affecting outsourcing decision making in E-government by experts on a scale 0–4, where the higher value indicates greater influence. The results from each respondent then produces an $n \times n$ non-negative matrix stated as $X^k = [X_{i,j}^k]$ where n is the number of factors and $X_{i,j}$ is the degree to which the respondent thinks that factor i influences factor j ; k represents the number of respondent where $1 \leq k \leq H$. Thus $X^1, X^2, X^3, \dots, X^H$ are the matrices from H respondents.

The average matrix $A = [a_{i,j}]$ that covers all respondent experts is given in formula (3.6):

$$a_{i,j} = \frac{\sum_{k=1}^H x_{i,j}^k}{H} \quad (3.6)$$

Calculating the normalized initial direct-relation matrix

The normalized initial direct-relation matrix D is given by formula (3.7) as follows:

$$D = A \times S \text{ and } S = \frac{1}{\max_{1 \leq i \leq n} \sum_{j=1}^n a_{i,j}} \quad (3.7)$$

Where n is the total number of criteria identified and each element in matrix D falls between 0 and 1.

Calculating the total relation matrix

The total relation matrix T is given by formula (3.8) as follows, where I is an $n \times n$ identity matrix:

$$T = D (I - D)^{-1} \quad (3.8)$$

Vectors r and c , respectively, define the total rows and columns in T . r_i denotes the row sum of the i^{th} row of matrix T and shows the sum of direct and indirect effects of criteria i on the other criteria.

Similarly, to this c_j represents the total of the direct and indirect impacts that criteria j acquired from the other criteria, as well as the total of the j^{th} column of matrix T .

When $i = j$, $r_i + c_i$ gives a measure of the magnitude of influences supplied and received, in other words $r_i + c_i$ indicates the extent to which the major role is emphasized criteria i plays in the problem such that:

- If $r_i + c_i$ is positive, then criteria i is affecting other criteria.
- If $r_i + c_i$ is negative, then criteria i is being influenced by other criteria (Mkude and Peter, 2024).

Obtaining the digraph

Matrix T shows the relationship between one criterion and another. Therefore, in order to weed out insignificant impacts, a threshold value needs to be determined. In the digraph,

effects that surpass the threshold value are selected and displayed. The dataset of $(r + c, r - c)$ can be mapped to obtain the digraph.

After completion of step 4, a comprehensive visual representation of the connections and interdependencies between the criteria were created using a digraph. The digraph demonstrates the independence of one category from the others as well as the dependencies and connections between the issues both within and between categories.

3.2.4. Fuzzy TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution)

The fuzzy TOPSIS method is a popular multi-criteria decision-making method that is used in uncertainty or vague situations, and it was primarily proposed by Hwang and Yoon in 1981 (Şek & Czarnowski, 2023). The following is an in-depth discussion of the Fuzzy TOPSIS. The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is a widely recognized multi-criteria decision-making instrument employed to address ranking problems within empirical contexts. Although it is widely used, the method has often been subject to criticism as being too naively incompetent to properly capture the vagueness and imprecision of bringing the experience of human perception to precise numerical values. Personal judgments are expressed as final values in the traditional version of the formulation, but, in practice, such models are frequently defined as ambiguous in the human preference. Therefore, the decision-makers might not or cannot give the accurate value to the complex comparative judgement (Chan & Kumar, 2007; Shyur & Shih, 2006). That is why it is combined with Fuzzy. The latter is capable of working with linguistic and imprecise data, giving decision-makers the possibility to judge the criteria and options based on the understandable linguistic terms and fuzzy numbers that quantify the uncertainty (Zadeh, 1965). This becomes especially helpful in the environment of outsourcing in e-government since real-world decisions, which involve service purchase and technology adoption, may contain considerable ambiguity, expert judgment, and opinion that cannot be readily quantified in definite numerical terms.

The necessity to use crisp numbers does raise an important methodological constraint in the evaluation process. This is because decision-makers feel more comfortable making interval-based judgments rather than expressing qualitative opinions in terms of single numerical values. Certain qualitative aspects are questionable to strictly quantify, so they were often ignored on

the conventional evaluation basis, without any well-defined criteria and loss of some important information. Moreover, as models based on crisp-values, they do not embed the strong tools to manage fuzziness and epistemic uncertainty of decision-making environment: for these reasons, a more flexible set-valued method is needed.

The inherent limitations of crisp evaluation methods, which struggle to capture the ambiguities and uncertainties inherent in human judgment, necessitate the use of fuzzy set theory in complex decision-making models (Zadeh, 1965). This approach allows decision-makers to formally incorporate unquantifiable, incomplete, and partially ignorant information into the decision model (Kulak et al., 2005). Consequently, TOPSIS has been extended into a fuzzy framework to more effectively solve ranking problems under uncertainty (Büyüközkan et al., 2008; Chen & Tsao, 2007; Kahraman et al., 2007; Onüt & Soner, 2007; Wang & Elhag, 2006; Yong, 2006). This study employs triangular fuzzy numbers (TFNs) for the Fuzzy TOPSIS methodology. The selection of TFNs is justified by their intuitive application for decision-makers and computational simplicity (Xu & Chen, 2007). Furthermore, modeling with TFNs has been established as an effective method for formulating decision problems, where available information is subjective and imprecise (Chang et al., 2007; Chang & Yeh, 2002; Kahraman et al., 2004; Zimmermann, 1996). The following section outlines the fundamental definitions of fuzzy sets (Raj & Kumar, 1999), and it provides a detailed breakdown of the Fuzzy TOPSIS steps implemented in this research, as adapted from Kore et al. (2017).

Determining the criteria and alternatives

Constructing the fuzzy decision matrix

In this step, we gather the decision-makers' evaluations of the alternatives with respect to each criterion using linguistic variables, such as "low," "medium," and "high", and then these were converted into triangular fuzzy numbers.

Constructing the fuzzy weighted normalized decision matrix

In this step, we normalized the fuzzy decision matrix to make the criteria comparable. This step might involve different normalization methods depending on whether the criteria are benefit (higher values are better) or cost (lower values are better) criteria. After that weights

were assigned to each criterion, which may also be fuzzy numbers if there is uncertainty in the weights. To obtain the fuzzy weighted normalized decision matrix, the normalized fuzzy decision matrix was multiplied by the fuzzy weights.

Determine the Fuzzy Positive Ideal Solution (FPIS) and Fuzzy Negative Ideal Solution (FNIS)

FPIS (A^*) are the best possible values for each criterion (e.g., highest fuzzy numbers for benefit criteria, lowest for cost criteria) and FNIS (A^-) are the worst possible values for each criterion (e.g., lowest fuzzy numbers for benefit criteria, highest for cost criteria).

Computing the closeness coefficient for each alternative

The closeness coefficient CC is calculated for each alternative as follows:

$$CC_i = \frac{D_i^-}{D_i^+ + D_i^-} \quad (3.9)$$

Where D_i^+ is the distance of alternative i from the FPIS and D_i^- is the distance of alternative i from the FNIS. The closeness coefficient represents how close an alternative is to the ideal solution.

Ranking alternatives

In this step, alternatives are ranked based on their closeness coefficients. The alternative with the highest closeness coefficient is considered the best choice.

In step six, once the alternatives were identified, the alternatives were ranked at the end by considering the possible uncertainties and subjective judgement that fill the decision-making process. The approach allows subtle assessment of the inter-dependent relationship and relative significance of the different PESTEL variables and issues that were earlier determined and evaluated using the DEMATEL and ANP tools.

3.3. Risk Management

Risk Management activities aim to achieve the best possible outcome by systematically analyzing risks and their potential impact on various aspects of the organization, such as operations, finances, reputation, and strategic objectives. Through risk assessment, organizations can identify threats and opportunities, allowing them to develop strategies to capitalize on and mitigate the latter (Enrico et al., 2021).

Risk Management can improve the performance and responsiveness of public services (Hood, 2000; Stassart & Visscher, 2005). Risk Management frameworks and practices, started in the 80s, and this can be seen as part of the modernization drive under New Public Management (NPM). NPM is directed to make people believe in the privatization of public services (Farazmand, 2020; Lapuente & Walle, 2020). The important point of NPM is to innovate from a business mindset, by further promoting the efficiency and accountability of public managers as opposed to maximizing public service values such as equality, public participation, and fairness (Vabo, 2009). NPM allows public organizations to conduct bureaucratic reforms to improve public services for each citizen according to available resources. Based on this goal, the achievement process needs to be carried out with economic, effective, and efficient principles, and supported by management control systems, operational risk management practices, and internal control to improve public service quality. Risk management is a "vital instrument" in public administration. Risk identification and management activities can increase awareness of risks and alternatives to address them (Keban, 2017), along with emphasizing the importance of risk analysis and control in the public sector. The entire risk management process depends on known organizational objectives, and relevant risks are established concerning those objectives (Hatvani, 2015). Some important problems in public services arise because risk management is still informal, so the impact can be seen with the still fertile culture of mutual blame, lack of accountability, and expropriation of state assets by third parties. Existing resources are not managed proportionally compared to the risks to be faced. Risk control can help assess the impact of risks and ensure that risks are managed, and management is directed to mitigate these risks. Risk control interactions can ensure that the resources used have met the elements of economy, efficiency, and effectiveness (BPKP, 2006) in areas public sector agencies have a major risk in achieving the results of their program. This helps to direct resources to areas with a high risk. Poor interaction with risk management and risk control

can result in poor public services (Riso & Castellini, 2019). Therefore, it can be assumed that the successful implementation of risk management and internal control, which following frameworks such as ERM, can positively impact performance engagement in various public service institutions and overall government performance. An effective and integrated ERM framework between risk management and internal control systems can help achieve organizational objectives (Anand, 2006; Vanstapel, 2004). It is important to consider the organization when deciding on an organization's risk classification system by determining whether risks will be classified according to the source of risk, the components affected, or the consequences of realizing the risk (Keban, 2017). Organizations need to be able to manage risks effectively so that they protect themselves against any possible risks, along with reducing the effects of risks that may arise without notice.

3.3.1. FMEA method

The number one goal of FMEA is risk prevention, where a new design process or system does not meet any of its intended requirements, either partially or entirely, under prescribed operational conditions, including defined purposes and restrictions. Through FMEA, organizations are able to evaluate the needs of customers and optimize products in addition to processes to minimize the chance of possible failures, where the main focus is put on the safety, health, and security of workers. Moreover, FMEA helps to refine, assess, and improve the design development and testing plans to remove flaws, which will eventually result in high-quality competitive product (Sharma & Srivastava, 2018).

Key benefits of employing the FMEA methodology include cost reduction, particularly in minimizing warranty claims, shortening the timeline from project initiation to product launch, and improving product quality, reliability, and operational safety. These advantages collectively contribute to greater customer satisfaction, reinforcing the organization's competitive position in the market. Types of FMEAs, based on nature of application, can be classified into two basic types (Sharma & Srivastava, 2018):

- *Design FMEA (DFMEA)*: This type of FMEA has the purpose of identification and prevention of failure modes of products, which are related to their design, in order to validate the established design parameters for a specific functional performance level, at system, subsystem or component level. The most important function of this type of FMEA is the identification in

the early stages of design development of the potential failure modes in order to eliminate their effects, select the optimal design variant and develop a documentary base to support future designs in order to minimize the risks that faulty products reach the customers.

- *Process FMEA (PFMEA)*: This type of FMEA focuses on potential failure modes of the process that are caused by manufacturing or assembly process deficiencies. Process FMEA is of two types: Manufacturing FMEA and Assembly FMEA. In Manufacturing FMEA the failure modes are generally dimensional or visual. However, in Assembly FMEA, these are generally relational dimensions, missing parts, and parts assembled incorrectly.

The Failure Mode and Effect Analysis (FMEA) methodology as described, by Ben-Daya (2009), follows the following typical steps:

step (1): Select a high-risk process.

step (2): Review the process: This step usually involves a carefully selected team that includes people with various job responsibilities and levels of experiences. The purpose of an FMEA team is to bring a variety of perspectives and experiences to the project.

step (3): Brainstorm potential failure modes.

step (4): Identify the root causes of failure modes.

step (5): List potential effects of each failure mode.

step (6): Assign severity, occurrence, and detection ratings for each effect.

step (7): Calculate the risk priority number (RPN) for each effect.

step (8): Prioritize the failure modes for action using RPN.

step (9): Take action to eliminate or reduce the high-risk failure modes.

step (10): Calculate the Resulting RPN as the failure modes are reduced or eliminated as a mean of monitoring the redesigned improved product or process:

Risk priority number is a basic method used in risk management and harm degree judgment of the product failure. Aiming at a failure mode, with the value of the severity of effect (S), the probability of occurrence (O), and the difficulty of detection (D), the RPN is calculated through the Eq. (3.10), in which the range of three factors is from 1 to 10 respectively (Fan, 2015).

$$RPN = S \times O \times D \quad (3.10)$$

According to the calculated RPN value, each failure mode is ranked to find out the biggest fault component or device. As this method is simple and easy to calculate, RPN is used more widely in the field of failure analysis and other work.



4. APPLYING THE METHODOLOGY

4.1. Methodology Steps

4.1.1. Data collection

Primary data were gathered via a structured survey administered to a purposive sample of ten high-ranking officials' instrumental to the e-government decision-making process in Palestine. These experts hold direct responsibility for the strategic implementation of outsourcing within the sector. A 100% response rate was achieved, followed by brief consultative meetings to elicit deeper qualitative perspectives on their decision-making frameworks. The subsequent correlation analysis is presented in Table 4.1:

Table 4.1. Correlations for survey

		Correlations		
		TOTAL	ODD	EVEN
TOTAL	Pearson Correlation	1	.931	.960
	Sig. (2-tailed)		.001	.000
	N	10	10	10
ODD	Pearson Correlation	.931	1	.793
	Sig. (2-tailed)	.001		.019
	N	8	8	8

Correlations analysis was performed on the information using Pearson's correlation coefficient, participants were split into two groups with odd and even numbers in sequence. Then, ANP analysis was separately carried out for the two groups, and priority weights were obtained. Therefore, results from two groups and all participants were tested for correlation with Pearson's correlation coefficient for repeatability of the results. The values presented in table (4.1) show a suitable constant coefficient for research purposes.

4.1.2. PESTEL analysis

Using the PESTEL technique, companies and decision-makers analyze their internal and external environment, and they determine the context in which the e-government plan can be implemented. The steps of PESTEL analysis method were as follows:

Identifying the criteria affecting outsourcing e-government

In this step, decision-makers identify the criteria affecting outsourcing decision-making in e-government using qualitative analysis methods, such as interviews, surveys, and desk research.

Categorizing factors

Qualitatively collected criteria affecting the outsourcing decision-making in e-government are classified to six areas: Political, economic, socio-cultural, technological, environmental, and legal.

Filtering factors

The categorized factors, given by the previous step, can encompass a wide range of factors. Contrary to the traditional PESTEL analysis method, through discussing the results with the decision-maker in the e-government, the criteria that directly affect the outsourcing decision-making process will filter out irrelevant factors.

Forming a hierarchical model of factors

The initial tier of the model comprises the model's title. The second tier comprises the primary categories. The third level encompasses the factors that were identified in step 3. This level visually represents the work accomplished in the preceding stages.

Following these four steps, decision-makers will have a hierarchical model of systematically structured criteria affecting outsourcing decision-making in e-government. These steps conclude a qualitative analysis of the criteria. Then, a quantitative analysis is performed using DEMATEL and ANP to identify interconnections between the recognized criteria and provide decision-makers with prioritized values for both the criteria and their interrelations.

Notably, the Palestinian Higher Committee on E-Government examined the PESTEL analysis, and gave an institutional response on the political, regulatory, and technological components that drove the decisions of outsourcing. Its response assisted in the confirmation of the Criteria.

4.2. Identified Criteria

This research used the PESTEL framework to determine the multidimensional criteria in the identification of outsourcing in the Palestinian e-government environment. The analysis gave a detailed macro-environment analysis by examining Political, Economic, Socio-cultural, Technological, Environmental, and Legal factors. Together with the Supreme Committee on Digital Transformation as a representative of ten government ministries, the results were integrated to show the criteria that directly influence the decision-making process as demonstrated in Figure (4.1).

Another key observation on the political aspect is the tremendous effect of the current occupation, which is a systemic barrier to the growth of Palestinian infrastructure by limiting importation of technological devices that are crucial. Outsourcing, in its turn, is a potential strategic solution to address these limitations and tackle the technological gaps created as a result of it. This can also be supported by the active role that the Palestinian government has played in promoting the outsourcing efforts, especially those that would enable the local technology companies. Along with these political reasons, an outsourcing culture is largely facilitated by the economic environment, which is motivated by the related development of the private IT and the national economy in general. This shows that the private corporates play a critical role in attracting and handling complex technology related projects.

In addition, there is a dynamic development in the legal climate to accommodate the strategic orientation of the government to e-outsourcing. The implementation of e-outsourcing legal system is a historic regulatory move, as it creates a formalized outline, which regulates the interaction between the government and business sectors, in addition to promising the preservation of stakeholders' rights. These legal and economic changes are being supported by technological drivers, and the most prominent of these is the presence of a highly skilled workforce. The resulting surplus of the human capital in both the public and business sectors serves as the technical expertise required to carry on the change towards an effective outsourcing model. Lastly, environmental and social aspects were not also clearly covered in the given text. However, it is important to take into account environmental factors because they might have a connotation in terms of sustainable and environmentally friendly outsourcing. Social factors entail the demographic and cultural elements that may affect the acceptability and efficacy of outsourcing in the public sector that include public perceptions towards outsourcing, the

demography of the workforce, and the education and skills of the prospective employees. The analysis and the viewpoints of the e-government specialists show that the factors that have a direct influence on the decision of the outsourcing process are as follows.

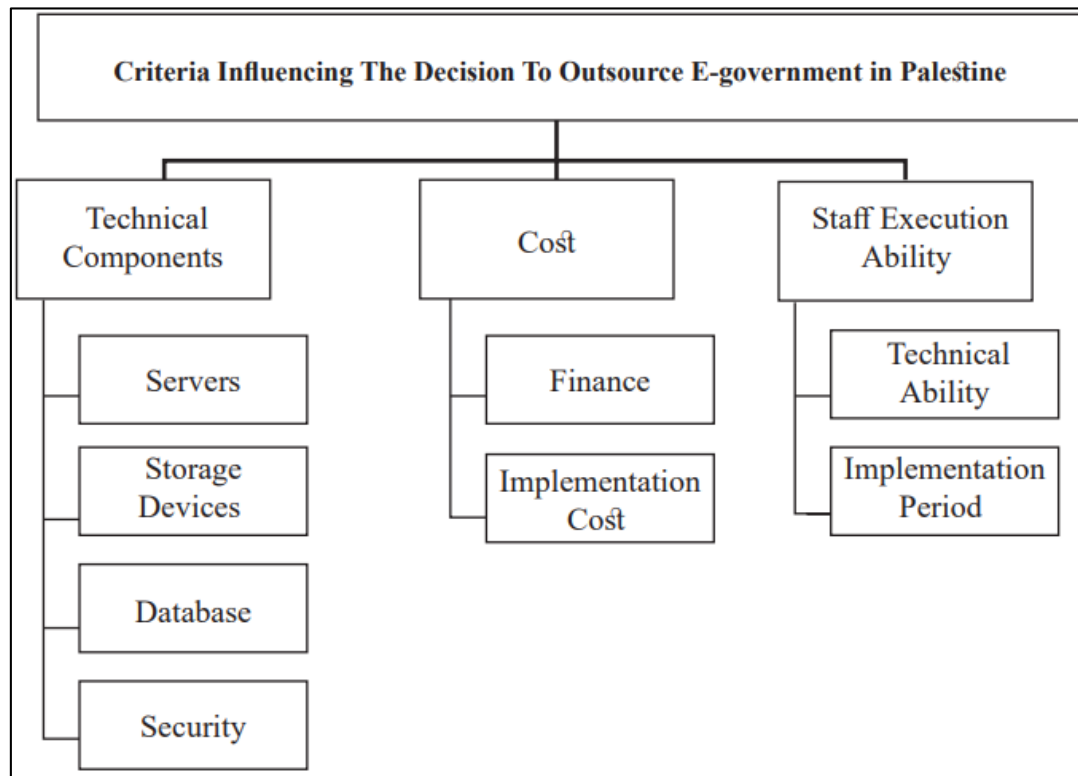


Figure 4.1. Factors affecting the Palestinian E-government's outsourcing decision (by the author)

a- *Technical components*: This dimension encompasses the foundational hardware and software infrastructure requisite for the systematic development and operational sustainability of the system. These components are categorized as follows:

- *Servers*: High-performance computing systems dedicated to resource allocation, data distribution, and the provision of essential network services.
- *Storage devices*: Specialized hardware architectures designed for secure data retention and efficient retrieval, including high-speed solid-state drives and traditional magnetic media.
- *Database*: Highly structured information repositories engineered to facilitate seamless data access, organization, and complex manipulation.
- *Security*: A comprehensive suite of tools and strategic measures deployed to ensure data integrity and fortify the system against unauthorized intrusions or multifaceted cyber threats.

b- *Cost*: The expenses involved in a project or system, and they are divided to:

- *Finance*: The management of funds and budgeting for the project.
- *Implementation cost*: Expenses related to deploying and setting up the system.

c- *Staff Execution ability*: The team's capability to successfully complete tasks, and it is divided to:

- *Technical Ability*: The team's skills and expertise in handling technical tasks.
- *Implementation period*: The time required to deploy and operationalize the system.

4.2.1. Relationships among the criteria

The potential dependences among PESTEL factors were identified and mapped via DEMATEL. Thus, the initial direct-relation matrix (A) is formed according to the views of the expert team. After PESTEL analysis, DEMATEL method helps unveil interdependencies, providing a nuanced understanding of how different factors influence each other. Direct and indirect effects among PESTEL factors are shown in table (4.2), Total Relation Matrix is shown in APPENDIX-1.

Table 4.2. DEMATEL affecting criteria(by the author)

			D	R	D-R	D+R
AFFECTING CRITERIA	Technical Components	Servers	5.38	5.18	0.20	10.57
		Storage Devices	4.45	4.79	-0.34	9.24
		Database	5.10	5.04	0.06	10.14
		Security	5.88	5.72	0.16	11.60
	Cost	Finance	5.83	6.05	-0.21	11.88
		Implementation Cost	6.30	6.17	0.13	12.46
	Staff Execution Ability	Technical Ability	5.23	5.05	0.18	10.29
		Implementation Period	4.96	5.13	-0.17	10.10

The influence of one criterion on other and relationships were ascertained with the aid of D+R and D-R values. It is acknowledged that criteria with positive D-R values have a greater influence and precedence over other criteria when the D-R values are taken into account. We refer to this category of criteria as causer. On the other hand, it is implied that criteria with negative D-R values are less important and are influenced more by other criteria. We refer to this category of criteria as receivers. The relationships between each criterion and the other criteria are indicated by the values in column D+R. Higher D+R criteria are more

closely associated with other criteria. On the other hand, criteria with low D+R values have less correlation with other criteria (Aksakal & Dağdeviren, 2010).

From the values of D-R in Table (4.2), it has been noted that the only five criteria with positive values of (D-R) are "Servers", "Database", "Security", "Implementation Cost", and "Technical Ability". This finding suggests that these five factors are significant and have a major influence when determining E-government outscoring. The elements that are influenced more by the other factors are "Storage Devices," "Finance," and "Implementation Period," with respective negative D-R values of -0.21 and -0.34. The factor "Servers," which has the highest D-R value, is referred to as the master dispatcher and is placed ahead to other factors. A master dispatcher is identified by the factor "Storage Devices" with the lowest D-R value.

When the column D+R is investigated in Table (4.2), one may conclude that the criteria for Implementation Cost, Finance, Security, Servers, and Technical Ability are more related to each other than the other criteria, whereas the remaining criteria are less related to each other. The finance component with the highest D+R value (11.88) has the strongest correlation with the other components. Furthermore, storage devices have the least relationship to the other components, with a score of 9.24. Figure (4.2) presents the dimension causal relationship network:

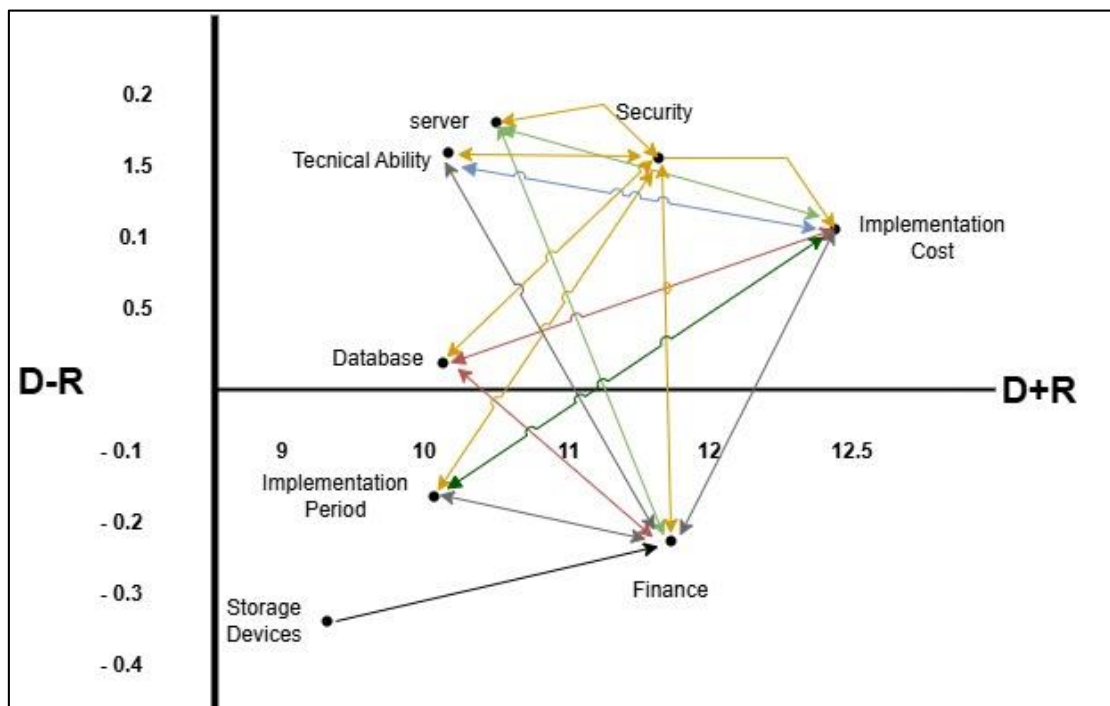


Figure 4.2. Dimension causal relationship network (by the author)

The previous figure (4.2) shows the relationships among the criteria. For example, the figure shows, for example, that the server affects the cost of implementation, security, and financing, while the duration of implementation affects the cost of implementation, financing, and security.

4.2.2. Weights of criteria

Building upon the results gained from PESTEL and DEMATEL, the research uses the ANP method for further quantitative analysis. ANP calculates weights, offering a more nuanced perspective on the significance of each factor. This method is widely recognized for its application in MCDM. Table (4.3) presents the ANP Limit matrix that has the weights of every criterion. The Normalize Supper Matrix is shown in APPENDIX-2.

Table 4.3. ANP limit matrix(by the author)

		Criteria Importance Weight		Arrangement
Technical Components	Servers	0.0643	6.43%	7
	Storage Devices	0.0069	0.69%	8
	Database	0.0879	8.79%	5
	Security	0.3021	30.21%	1
Cost	Finance	0.1020	10.20%	4
	Implementation Cost	0.2039	20.39%	2
Staff Execution Ability	Technical Ability	0.1670	16.70%	3
	Implementation Period	0.0660	6.60%	6

4.3. Ranking of Alternatives

At the end, the alternatives are evaluated and the best alternative among the alternatives is ranked through Fuzzy TOPSIS. Table (4.4) presents the Fuzzy TOPSIS Ranking Decision matrix, where Co-Sourcing was found to be the best alternative, the weighted decision matrix is shown in APPENDIX-3.:

Table 4.4. Fuzzy TOPSIS ranking decision matrix

	CLOSENESS COEFFICIENT	RANKING
Insource	0.0799	2
Outsource	0.0606	4
Cloud Computing	0.0630	3
Co-Sourcing	0.0994	1

The decision-maker's preference was for e-government development processes to be carried out jointly between the government and the private sector, which is known as Co-

outsourcing. This is followed by the process of building systems internally, which is interconnected with the protection element being an important element for the decision-maker, followed by the process of benefiting from cloud services, and finally the complete outsourcing of services. This gives an indication that the decision-maker in e-government would prefer to be present in the process of developing government systems and not completely be separate from it.

4.4. Risk Management in E-government Outsourcing Process

In the same context, FMEA methodology was applied to evaluate the risks associated with the decision-making stages of the e-government outsourcing process. The steps for this methodology were applied as follow:

4.4.1. Definition of the phase and scope

The analysis focused on the risk assessment of the five stages of outsourcing process. This is crucial as it lays the foundation for subsequent actions in the outsourcing lifecycle. As we know, all the phases of the outsourcing, software development life cycle (SDLC), are potential sources of risks. We applied it to five basic stages of software lifestyle to see the risks of these stages in projects like e-government project, which are: risks of the decision-making stage, risks of the selection stage, risks of the contract signing stage, risks of the execution stage, and risks of result evaluation stage.

4.4.2. Scoring failure modes using standard FMEA criteria

Each identified failure mode was assessed using the standard FMEA scoring criteria, which includes:

- Severity (S): The seriousness of the failure's effect if it occurs.
- Occurrence (O): The frequency or probability of the failure occurring.
- Detection (D): The likelihood of detecting the failure before it impacts the system.

Each factor was rated on a scale from 1 (least critical) to 10 (most critical), following Stamatis (2003).

4.4.3. Calculating the risk priority number (RPN)

The Risk Priority Number (RPN) for each failure mode was calculated using the traditional FMEA formula:

$$RPN = Severity \times Occurrence \times Detection$$

This numeric value helps to quantify the risk level and prioritize failure modes accordingly.

4.4.4. Classification of RPN levels

The evaluation panel consisted of twelve subject-matter experts who were selected out of the policy, legal, and technical fields in the e-government program, and who had at least five years of experience in the field. Failure modes that are pertinent to each lifecycle stage were identified by experts separately, and a rating of S, O, and D were allocated based on the anchors mentioned earlier. The reconciliation of divergent assessment was carried out in a facilitated session with the ultimate score of each of the items determined as the median of the post-discussion rating.

To interpret the results, RPN values were categorized into three levels, categorization levels for RPN values were according to Silva et al. (2015):

- *Low (1–200)*: Acceptable risk.
- *Medium (201–500)*: Requires attention and improvement.
- *High (above 500)*: Requires urgent and immediate treatment.

Risk levels were further divided into Low (1-200), Medium (201-500) and High (>500) which agrees with the panel judgement and current practice in the use of failure-mode and effects analysis (FMEA). A sensitivity analysis, in which cutoffs were changed by 50 and quartile-based cutoffs were used, returned the same set of top-priority items.

4.4.5. Ranking and prioritization

Failure modes were ranked in descending order based on their RPN values. This ranking helped in identifying the most critical risks requiring immediate attention or strategic

intervention. Our research evaluates five stages through the lens of IT outsourcing risks as follow:

Risks of the decision-making stage, risks of the selection stage, risks of the contract signing stage, risks of the execution stage, and risks of result evaluation stage.

First Stage: Risks of the Decision-Making Stage

Failure modes related to decision-making stage were defined by experts and each failure mode has different potential effects and possible causes, RPN values for each failure mode were calculated depending on equation (3.10) as shown in table (4.5):

Table 4.5. Potential failure modes, potential effects - decision making stage

Potential Failure mode	Potential effects	Severity (S)	Occurrence (O)	Detection (D)	RPN
Making the wrong decision	Later Related Work	10	10	10	1000
An inability to accurately describe the problem that prompted the outsourcing decision.	Insufficient or inaccurate information provided to the management level to prepare the overall plan or prepare for the next phase.	10	10	9	900
Delaying decision-making	Service Outage	10	6	10	600
Inadequate Risk & Feasibility Assessment	Conflicting bids due to a lack of clarity regarding requirements. Major system failures. Recurring problems with partial delivery of the system from the service provider.	9	9	4	324
Failure to comply with the analysis	Inappropriate product	9	9	4	324
Unable to determine the time and duration of implementation	Difficulty completing tasks within a specified timeframe	7	8	6	468
Rushing to make an outsourcing decision	Process Failure	8	2	4	64
Unclear or Poorly Defined Requirements	Lack of clarity or a lack of understanding of requirements, leading to implementation errors or inaccurate results.	10	9	2	180

For the first stage, we have different types of failure modes, failures related to this stage, and the RPN levels shown in Table (4.6) can affect the process. It is an important stage because one wrong decision can have damaging effects on many levels, and it can be noticed at a late time.

Table 4.6. Failure modes and RPN levels - decision making stage

Failure Mode	RPN
Making Wrong Decision	High
Inability to Accurately Describe the Problem	High
Delay in Decision Making	High
Inadequate Risk & Feasibility Assessment	Medium
Failure to comply with the analysis	Medium
Unable to determine the time and duration of implementation	Medium
Rushing to make an outsourcing decision	low
Unclear or Poorly Defined Requirements	low

High-risk failure modes (RPN 500-1000), as identified, manifest through erroneous decisions or imprecise problem definition, often stemming from cognitive biases, insufficient stakeholder engagement, or inadequate evaluation frameworks. The high impact failure modes also require timely corrective measures through systematic decision-making methods like multi-criteria analysis or use of expert review panels to prevent the expensive project failures. This observation is supported by the observations made by Lacity and Willcocks (2017), who found that the outsourcing of services by the public sector is often flawed by one of the so-called optimism bias. In this bias, officials undervalue complexity and overestimate the ability of an external vendor. MCDA is another tool that is recommended and which Belton and Stewart (2002) believe should be applied to reduce the effect of subjective biases and create transparency in the process of public procurement.

The medium-risk failures (RPN 200-500) in the decision-making phase include ambiguous technical requirement, the mismatch of contract-client requirement, or rush decisions in the outsourcing process. These are usually the result of inappropriate planning, poor requirements analysis, or absence of feasibility studies. In order to solve these problems, organizations are supposed to adopt iterative requirement validation, pilot test, and stakeholder congruence workshops to create clarity and reduce the risk of operation. These are phenomena that are well explained in the Transaction Cost Theory (TCT). Williamson (1985) shows that the probability of the opportunism in contracts is augmented by the limited rationality and information asymmetry between the government and the vendor. The results are reminiscent of Oshri et al. (2015), who postulate that scope creep is common when the requirements of the client are not matched with those of the vendor. The offered mitigation, such as iterative requirement validation, may be regarded as a part of the Agile Governance Movement, as Mergel (2016) suggests; iterations in the governmental sector permit an organization to obtain feedback continuously, which decreases risks associated with inflexible and waterfall contracts.

Limited IT infrastructure preparedness or inappropriate leadership-technical team coordination are low-risk failures ($RPN < 200$) that indicate systemic or organizational flaws. These will not pose an immediate threat to projects, but they can lead to more serious problems in the long run. The mitigation measures must include periodic audits of IT systems, competency schemes training, and better governance framework to refine inter-departmental communication and preparedness. Interestingly, the lack of IT infrastructure and collaboration between the leadership team and other organizations were rated as lower risks, which is a considerable departure in the context of previous e-government literature. Such as Dada (2006), who placed infrastructure as the major obstacle in developing settings. This transition implies the shift to the post-adoption risks. According to Bannister and Connolly (2012), with the maturation of government agencies technologically, the critical path to the success shifts its focus to soft governance rather than hard infrastructure. Although these risks can be classified as low at the moment, they constitute a systemic weakness that can turn into a cumulative failure effect over time, so they need proper and regular IT audits.

This categorization can be related to the existing risk-management standards like ISO31000 (Hutchins, 2018), which shows that failures in the decision phase are often a result of organizational and procedural gaps and do not rely on any technical inadequacies. It is possible to significantly decrease the probability of failure by implementing proactive measures, such as the incorporation of risk-assessment control points, increased stakeholder engagement, and gradual implementation of decision-making. By continual working on these failure patterns, organizations can maximize the results of outsourcing and increase the success of projects.

Second Stage: Risks in Selection Stage

The possible effects of the failure modes associated with the selection stage, as demonstrated in Table (4.7) are different; RPN values of each failure mode were obtained based on Equation (3.10):

Table 4.7. Potential failure modes, potential effects in the selection stage

Potential Failure mode	Potential effects	Severity (S)	Occurrence (O)	Detection (D)	RPN
Inability to prioritize computing	Duplicate processes	10	10	5	500
Poor access to implementing companies	The company is unable to implement	10	10	5	500
Poor Process & Criteria Definition	The company is unable to implement the project	8	8	4	256
Overemphasis on Cost & Financial Bias	Choosing based on low cost rather than value, quality, or fit.	10	10	2	200
Poor Technical & Qualification Assessment	Failure to select companies from the supplier list	10	8	2	160
Bias, Favoritism & Non-Transparent Selection	Producing a poor product that doesn't meet the organization's needs	7	8	2	112

The application of FMEA in the vendor selection stage of the outsourcing process in e-government revealed several critical insights into the nature and distribution of risks associated with this stage. The results of the survey were shown in table (4.8):

Table 4.8. Failure modes and RPN levels – selection stage

Failure Mode	RPN Level
Inability to prioritize computing	High
Poor access to implementing companies	High
Poor Process & Criteria Definition	Medium
Overemphasis on Cost & Financial Bias	Low
Poor Technical & Qualification Assessment	Low
Bias, Favoritism & Non-Transparent Selection	Low

Two failure modes had the largest possible RPN values (500), which implies severe and urgency risks. Such risks point to the root cause of the problem with the selection process. Namely: The absence of structured availability of qualified vendors and the insufficiency of prioritization strategies at an early decision-making stage. These issues can result in a mismatch between the needs of the project and the capabilities of the vendor, and eventually, this will jeopardize the project. This deviation proves the accuracy of the results made by Hui et al. (2011), where there was an absence of a pre-qualification phase, and the threat of the project being abandoned was much greater.

Most of the failure modes were in the medium-risk category. Such distribution indicates that most of the problems are not necessarily disastrous right now, but their combination will have serious consequences when left unattended. These are generally process risks, which

are a pointer of standardization deficiencies, evaluation systems, and procedural maturity in governmental or institutional systems.

A number of failure modes in the medium and low-risk category were linked to the prioritization of financial factors over technical or strategic factors. The terms of falling into the trap of the lowest cost, choosing by the price alone and financial preference as the major condition were often used. This pattern represents what Lacity and Willcocks (2017) describe as the so-called cost-focused outsourcing, which usually leads to a decrease in service quality and an increase in long-term costs with unknown consequences. With respect to e-government, the focus on financial considerations instead of technical merit is a leading cause of technical debt and systemic instability. This is in line with the Value-for-Money (VfM) model which holds that the most inexpensive short-term does not translate to the most cost-effective during the projects' lifecycle. Schapper et al. (2006) assert that a shift towards Transparency-by-Design is the only way to go during the process of transition towards traditional procurement to e-government procurement. The results indicate that the government can be exposed to vendor lock-in and ineffective resource allocation in the absence of formal competitive appraisal procedures.

Lack of clear, competitive, and structured evaluation systems was another theme that replicated. A number of failure modes indicated:

- Favoritism.
- Lack of competition.
- Poorly defined selection criteria.

These highlight institutional and governance-related vulnerabilities that increase the likelihood of biased or inefficient vendor selection.

The findings indicate the need for reforms at the institutional level and capacity-building strategies:

- Development of standardized vendor classification systems.
- Training procurement officers on technical evaluation beyond financial metrics.
- Implementation of transparent, competitive, and criteria-based selection procedures.

In future outsourcing projects, tackling these gaps can majorly decrease the failure modes' possibility and severity.

Stage Three: Contract Signing Stage

Failure modes related to contract signing stage are shown in table (4.9). Each failure mode has different potential effects, and RPN values for each failure mode were calculated depending on equation (3.10):

Table 4.9. Potential failure modes, potential effects in the contract signing stage

Potential Failure mode	Potential effects	Severity (S)	Occurrence (O)	Detection (D)	RPN
Incomplete Contractual Elements	Disagreement between the parties regarding the required completion-program components or the completed items.	10	10	5	500
Irregular contract	Project failure	10	10	5	500
Absence of security and data protection clauses.	failure to deliver the project according to the required requirements	9	7	8	504
Unclear or Ambiguous Contract Terms	Labor disputes during project phases over vague, non-measurable, and non-implementable clauses	9	7	3	192
Contract Management & Compliance Issues	Out of service	9	8	3	216
Absence of Legal Protections & Penalties	Lack of concern for proper implementation or on-time delivery	10	8	1	80

This stage needs significant attention and knowledge, especially in IT projects like e-government outsourcing. As shown in table (4.10), failure modes related to this stage are defined by experts:

Table 4.10. Failure modes and RPN levels – contract signing stage

Failure Mode	RPN Level
Incomplete Contractual Elements	High
Irregular contract	High
Absence of security and data protection clauses	High
Contract Management & Compliance Issues	Medium
Unclear or Ambiguous Contract Terms	Low
Absence of Legal Protections & Penalties	Low

The analysis of failure modes in the contract signing stage revealed several high-risk areas that pose significant threats to project delivery, quality, and sustainability when outsourcing government IT projects.

Three failure modes were identified as high risk with $RPN \geq 500$ as shown in table (4.9), including: Incomplete Contractual Elements ($RPN = 500$), Absence of security and data protection clauses, ($RPN = 504$), and Irregular contract ($RPN = 500$).

Such findings suggest that there are grave procedural and structural flaws in contract-making procedures. Specifically, omitting post-deployment services, such as maintenance, implies a problem of shortsightedness, which could compromise system continuation and performance. This result is consistent with Aubert et al. (2005), who identify such failures as contractual inadequacy. High switching cost and dependence on vendor, including vendor lock-in, are caused by short-sightedness.

Additionally, the lack of specific development milestones and deliverables leads to uncertainty, lack of fit, and ineffective control over projects, a factor that is one of the key risk areas in large-scale government outsourcing contracts.

An interesting trend under medium and high-risk categories is the lack of legal regulation:

- Failure to involve legal consultants ($RPN = 392$)
- Lack of legal protection clauses
- Absence of data security provisions ($RPN = 504$)

This points to a systemic undervaluation of legal risk in public sector contract formation. In sensitive governmental projects, omitting such clauses exposes the institution to data breaches, liability gaps, and disputes with vendors. According to Belanger and Carter (2008), "Trust" is the currency of e-government. The findings indicate a systemic vulnerability, where the legal framework fails to protect data of the citizens. This reflects the warnings of Yildiz (2007), who argued that administrative complexities in the public sector can frequently lead to "policy silos", where IT departments and legal departments fail to communicate, resulting in the "systemic undervaluation of the legal risk" identified.

When it comes to highly sensitive governmental programs, the lack of essential contractual provisions endangers the institutions with the risk of data breaches, absence of liability, and conflict with the suppliers. According to Belanger and Carter (2008), trust is the currency of e-government. Therefore, the current findings indicate that there is a structural weakness in the nature of which the legal system lacks sufficient protection of the citizens' information. This can be explained by the fact that Yildiz (2007) warns that administrative complexities in the public sector often create these policy silos, where IT and legal departments are isolated to create the systemic undervaluation of legal risk identified in this study. The repetitive pattern of missing or lacking technical documentation, vague roles, schedules, and quality of service represent a weak base to contractual liability. These tools play a critical role in terms of anchoring expectations and supporting monitoring during the implementation of the project. Willcocks and Lacity (2012) note that successful outsourcing requires "informed incumbency," where the client maintains enough internal expertise to monitor and control the vendor through precise Service Level Agreements (SLAs) and milestones.

Their lack shows a limited readiness of the project or immaturity in contract management operations, which is a common problem in establishing public procurement systems.

In the 200 to 500 RPN range, several failure modes show fixable gaps, including:

- Poor milestone definitions
- Vague financial/time obligations
- Lack of service continuity guarantees

These suggest an urgent need for institutional standardization, including:

- Use of contract templates with mandatory clauses
- Mandatory legal and technical review cycles
- Capacity-building for contract managers and procurement officers

The contract signing phase represents a crucial control point in outsourcing risk management. The existing failure modes that have been identified suggest that the contracts are often ill-generally designed, do not include necessary legal and technical provisions, and do not predict the future maintenance and quality guarantee requirements. To governments and other institutions in the society, this highlights the significance of:

- Legal compliance
- Contract standardization
- Capacity building
- Cross-functional review prior to signing

Doing so would significantly reduce the probability and impact of outsourcing failure.

Fourth Stage: Implementation Stage

Failure modes related to the implementation stage are shown in table (4.11). Each failure mode has different potential effects, and RPN values for each failure mode were calculated depending on equation (3.10):

Table 4.11. Potential failure modes, potential effects in the implementation stage

Potential Failure mode	Potential effects	Severity (S)	Occurrence (O)	Detection (D)	RPN
Failure to meet financial obligations	This threatens to halt the project or slow down implementation and adherence to the agreed-upon timeline.	10	10	10	1000
Knowledge transfer problems	Constant reliance on an external supplier	9	10	10	900
Interference by unqualified senior officials within the organization, both technically and administratively.	Unintended work interruption	10	9	9	810
Poor quality	bad product	10	6	10	600
Implementation in violation of the agreement	Labor dispute and arbitration by technical committees	9	7	8	504
Deviation from agreed-upon implementation	not having project goal	8	7	9	504
Lack of application infrastructure	This delays project implementation within the actual work environment.	8	8	6	384
Timeline & Schedule Failures	delay in delivery	10	10	2	200
Poor communication between government agencies and suppliers	Delayed decision-making or poor understanding of requirements	8	7	7	392
Process & Procedural Ambiguity	Frequent modifications, changes, or undoing of decisions	9	9	2	162
Most companies lack specialized personnel for systems analysis.	Repetition of work, cost overruns	8	8	3	192

Several RPN values exceeded 500, signaling critical concerns in the execution stage as shown in table (4.12):

Table 4.12. Failure modes and RPN levels in the implementation stage

Failure Mode	RPN Level
Failure to meet financial obligations	High
Knowledge transfer problems	High
Interference by unqualified senior officials within the organization, both technically and administratively.	High
Poor quality	High
Implementation in violation of the agreement	High
Deviation from agreed-upon implementation	High
Poor communication between government agencies and suppliers	Medium
Timeline & Schedule Failures	Low
Process & Procedural Ambiguity	Low
Most companies lack specialized personnel for systems analysis.	Low

The problems highlight both structural and human aspects that cause significant project integrity violation. The lack of financial security signifies poor governance of the project and budget. At the same time, top-down interference and poor knowledge transfer indicate organizational immaturity and lack of transition management. The observed multiple failure modes (RPN = 504) indicate the inconsistency with the contractual anticipations in terms of quality, execution, and adherence to schedule, indicating that there was poor translation of planning to controlled implementation. In many cases, the discrepancy was because of the lack of clarity in responsibilities or poor enforcement of the contract. Medium-high RPN levels are related to the absence of communication between the stakeholders, especially between the governmental institution and the vendor. Incomplete understanding of the scope blurred the execution procedures and led to an ineffective milestone monitoring, indicating a detached implementation setting incited by a weak joint governance or steering committee model. A number of the answers also expressed that institutions give critical functions to the vendors and as a result, ownership can be lost, and there are ambiguous requirements. The ability to track their activities internally can also be lost. Willcocks and Lacity (2012) emphasize that the skills held in-house to deal with the vendor is more important than the capabilities of the vendor. Otherwise, the institution is left with a weakened sense of ownership that makes them unable to hold anyone accountable. This is an extreme threat in the public domain setting, where accountability and traceability are the key issues. There were low RPN values in some failure modes, including the slow delivery of resources, change resistance, or late resource reassignments. They are not as dangerous individually, but add to the operational drag and wear on the agility, which is supported by Oshri et al. (2015), who rank “Knowledge Retention” as the most significant factor in the success of long-term outsourcing. The implementation phase is the phase that shows the largest concentration of the high-risk failure modes among all other preceding phases, and that

is not surprising since implementation transforms abstract plans into real systems. In the case of outsourcing, in order to reduce implementation risks, it is important to:

- Strengthen institutional capacity to manage vendors through trained projects and contract managers.
- Establish robust communication frameworks, such as regular coordination and shared dashboards.
- Create enforceable governance mechanisms that limit unqualified interference and promote accountability.
- Mandate structured knowledge transfer processes and clear documentation requirements.

The general phase indicates that there is a great demand in the capacity building, internal involvement, and proactive monitoring to make sure that the implementation process is in accordance to the planned design and it matches the expectations of the population sector.

Fifth Stage: Results Evaluation Stage

Failure modes of the results evaluation stage are presented in table (4.13). The failure modes are different, and the potential impact of each failure mode is different, and the RPN was also estimated based on equation (3.10):

Table 4.13. Potential failure modes and effects within the results evaluation phase

Potential Failure mode	Potential effects	Severity (S)	Occurrence (O)	Detection (D)	RPN
Failure to complete the required work	Not implementing the new software.	10	10	10	1000
Biased reports	Misleading and unclear decisions	9	8	7	504
Poor adherence to technical and timelines for implementation	Delayed implementation	9	8	7	504
Incomplete evaluation of the system and the validity of its outputs.	The possibility of irreparable material or moral losses that may result in the loss of rights.	6	6	8	288
Lack of a consulting body to evaluate implementation	It is not possible to determine whether the project is complete or not.	8	7	8	448
Post-Implementation Transition & Adoption Issues	Not working with all features of the new software.	8	8	4	256
Weak local staff to manage the project after delivery.	Possibility of service interruption after a period of time + additional costs with the service provider to continue monitoring the system after delivery.	8	7	6	336
Technical & Quality Defects	Dispute between the parties	9	8	4	288
A gap in communication between the ministry and the company	Significant damage to the final product and its delivery time	6	7	3	126

Three failure modes reached high-risk thresholds ($RPN \geq 500$) as shown in table (4.13).

- Incomplete delivery of required components ($RPN = 1000$)
- Absence of system stress testing evaluation ($RPN = 504$)
- Biased or manipulated reporting ($RPN = 504$)

Table 4.14 Failure modes and RPN levels within the results evaluation stage

Failure Mode	RPN Level
Failure to complete the required work	High
Biased reports	High
Poor adherence to technical and timelines for implementation	High
Incomplete evaluation of the system and the validity of its outputs.	Medium
Lack of a consulting body to evaluate implementation	Medium
Post-Implementation Transition & Adoption Issues	Medium
Weak local staff to manage the project after delivery.	Medium
Technical & Quality Defects	Medium
A gap in communication between the ministry and the company	Low

These results are evidence of a severe lack of validation and closure processes of outsourcing projects. Failure to deliver it completely demonstrates problems in project governance and accountability of the vendor. Lack of stress testing is an issue of concern regarding resilience of the system and its preparedness to be deployed in the real world. Also, biased reports undermine decision-making and hide failures, thus postponing remediation. This is referred to as Post-Contractual Opportunism in the literature. Vendors can take advantage of the fact that the government has a lack of technical specialists to conceal the flaws or avoid very costly stress testing. Seddon et al. (2010) state that post-implementation reviews are needed to determine the success of the IT project. The current evidence indicates that the post-implementation reviews are either absent or corrupted before the actual load testing of the project. Although there are many types of failure mode that can be found in the medium-risk category, some of them are:

- Lack of external evaluation ($RPN = 448$)
- Weak institutional capacity, such as staff unable to manage the system post-handover
- Misuse by untrained users
- Weak support documentation and maintenance planning

These risks point to institutional unpreparedness for post-deployment ownership of the system. Long-term sustainability, which includes the support, adapting, and continued

review of the outsourced systems, is not planned in many of the institutions of the public. This goes in line with the Organizational Readiness to e-government. Ebrahim and Irani (2005) argue that the skill sets needed in the operational phase of consulting are quite different in comparison to the ones needed in the development phase. In this case where the staff members cannot cope with the system or they fail to interpret the outputs, the organization goes through a process of deskilling whereby the government will be in total reliance on the vendor to perform the basic operations within the organization. The determined weak documentation can be taken as a major source of high Total Cost of Ownership (TCO) because every little change triggers a new payable interaction with the vendor. Some of these failure modes are related to the duties of the vendors after the handover, including:

- Weak technical support
- Missing or insufficient maintenance documentation
- Inability to adapt to changes

This underscores the importance of post-delivery SLAs, contractual enforcement mechanisms, and a culture of performance tracking beyond project closure.

Some low to medium risks consisted of human factors including:

- Employee resistance to new systems or workflows (RPN = 240)
- Staff lacking the skill to interpret system outputs or operate the platform (RPN = 210)

These concerns highlight the importance of effective change-management plans, extensive capacity development, and continuous training programs. Operational failure may follow subsequent technical deployments that may be considered successful, in cases where there is not sufficient end user adoption.

The post-delivery stage presents a different range of risks, and they are not related to the technical implementation. They focus on sustainability, integration into the current systems, and institutional assimilation. High scores in RPN demonstrate a dire need:

- Mandate external and internal performance evaluations.

- Enforce delivery completeness and performance guarantees.
- Train staff and ensure proper handover procedures.
- Establish feedback loops to refine and adapt systems over time.

Without properly developed follow-up mechanisms, even strongly adopted systems are vulnerable to obsolescence or organizational abandonment. Therefore, it is a critical step, both in the termination of contracts in outsourcing and in ensuring their sustainability.

Empirical findings show that the implementation phase is the most crucial consummation point in the lifecycle of outsourcing. This stage summarizes six high-risk failures, the largest one being the failure to fulfill financial commitments (RPN = 1000), which may cause the overall project crashing. Other essential obstacles comprise knowledge-transfer inefficiencies, and the infiltration of technically or administratively incompetent senior management, which serve as significant stressors.

Likewise, the contract signing phase is very sensitive. Any mistakes made during this phase may have ripple effects and impact on other phases. The findings highlight the lack of robust security and data-protection clauses, thus subjecting governmental authorities to extreme data breaches, areas of liability, and contract breaches.

On the contrary, the decision-making phase is characterized by an average level of risk profile. Although such issues as strategic miscalculations and incorrect problem definition are classified as high risk, the factors that do not exceed the medium-to-low risk spectrum are the ones related to inadequate feasibility assessment. The selection stage was found to carry the lowest risk relative to other phases. Finally, the evaluation stage serves as the terminal point where latent errors from preceding phases often manifest. Key failure modes identified include the inability to complete the required scope of work (RPN=1000), biased reporting (RPN=504), and the lack of independent oversight (RPN=448). Consequently, the mitigation of failures in the final stage is fundamentally dependent on the proactive rectification of errors during the earlier four phases. The figure illustrates the hierarchy of risk for each stage of outsourcing in Figure (4.3).

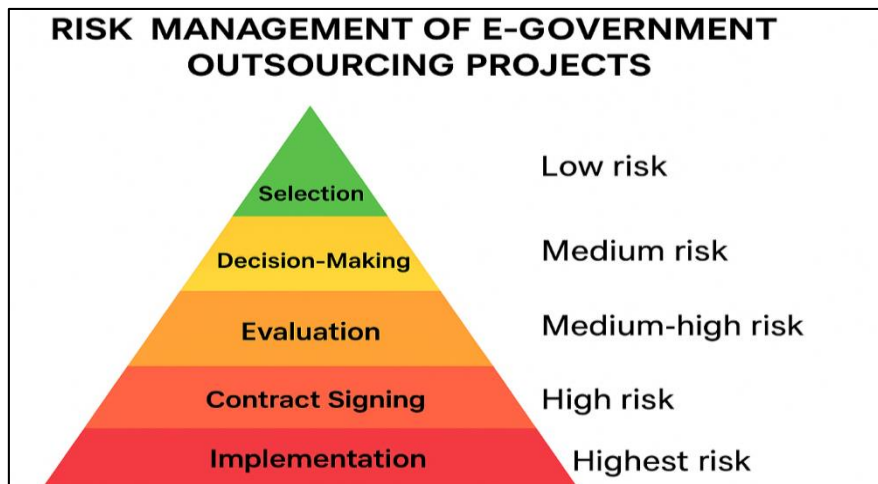


Figure 4.3. The figure illustrates the degree of risk for each stage of outsourcing (by the author)

To optimize the success rate of outsourcing initiatives, proactive identification and management of potential piracy risks are necessary. Finding failure modes in the beginning of outsourcing lifecycle will assist organizations to avoid operation fault by taking preventive action. The flowchart above, Figure (4.4), illustrates a structured process of Outsourcing FMEA from the identification of possible failure modes, their root causes in external contracts 2. It uses a quantitative risk analysis with calculation of the Risk Priority Number (RPN) according to the Severity, Occurrence, and Detection scores. The framework requires formal documentation, reporting, and assignment of actions to responsible individuals when the RPN is greater than a certain value. This process is also only complete once all types of failures have been reviewed and regularly monitored for ongoing improvement. Finally, a structured governance method to reduce operational risks and ensure quality in outsourcing relations is offered by this model. Figure (4.5) applies the framework where it reduces risk, but it was an application start point.

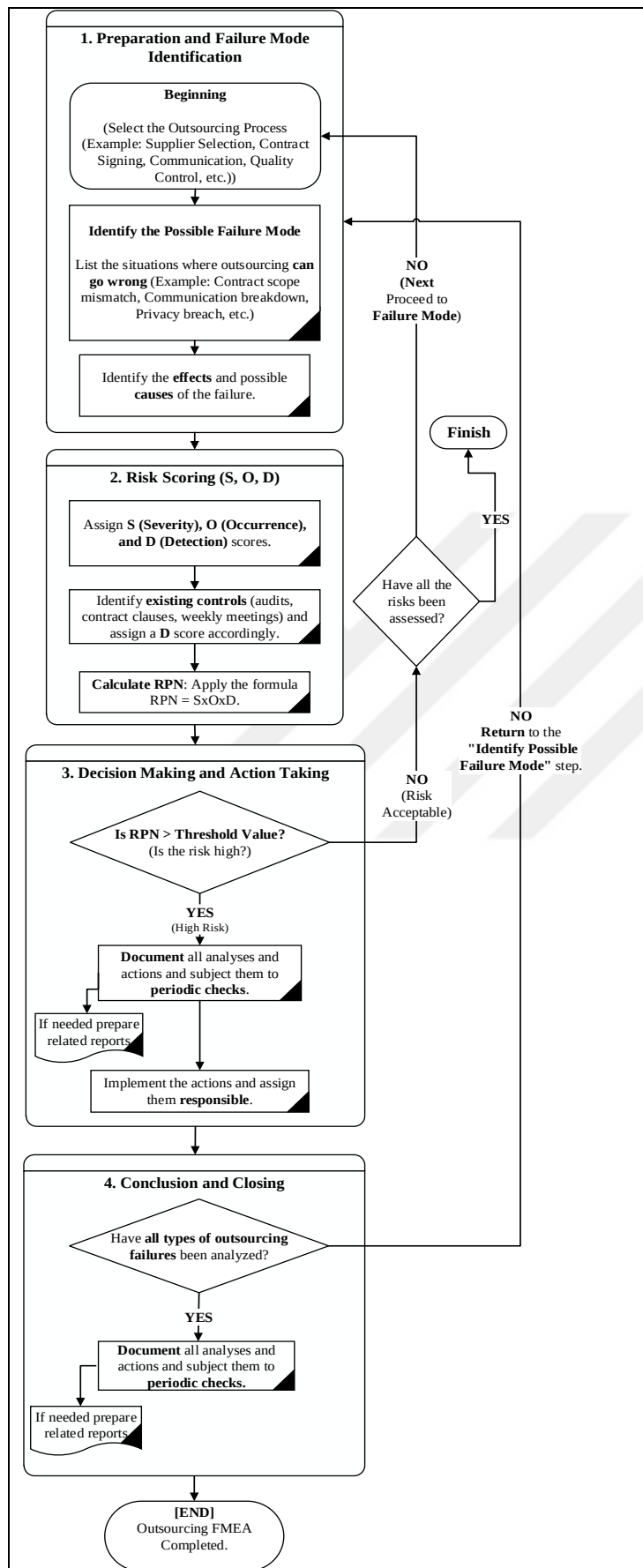


Figure 4.4. Flowchart for Risk management in E-government outsourcing projects

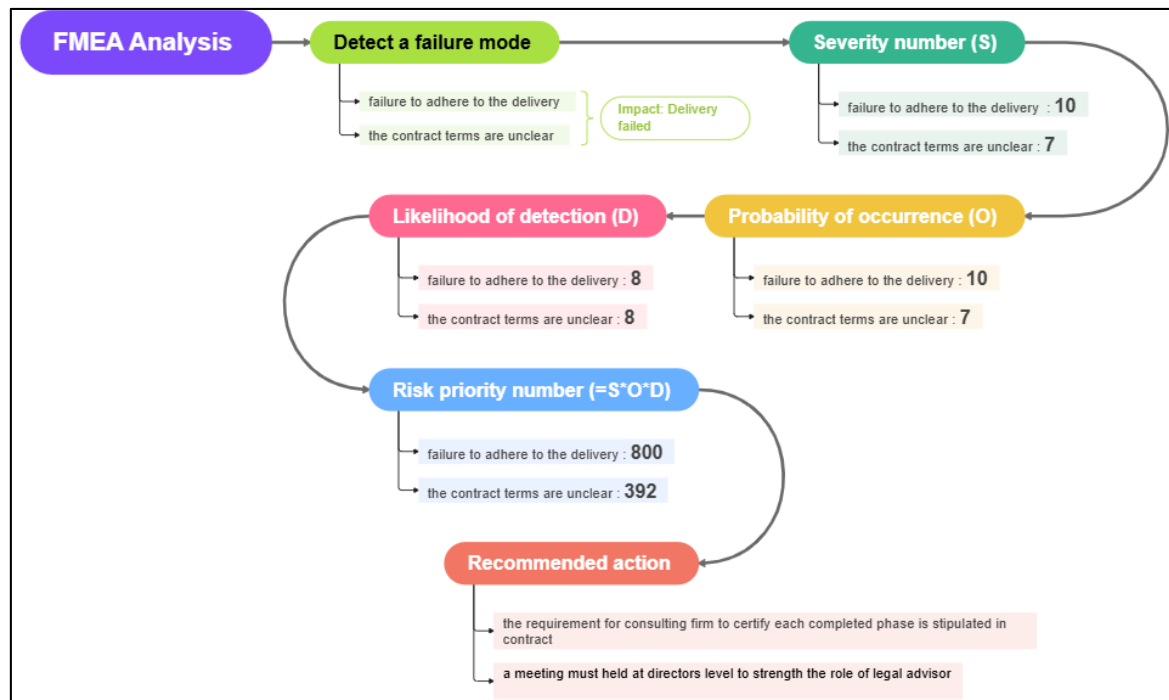


Figure 4.5. Example illustrating FMEA Risk analysis

The provided figure shows the FMEA framework, which is a quantitative model to rank risk reduction using the Risk Priority Number (RPN). The risk is calculated as a product of three dimensions: S, O and D. Illustrated examples analysis: Not Respecting a Delivery Date and all the Deliverable Generating this configuration contributed to 800 RPN, which corresponds to catastrophic on project throughput. The proposed mitigation is a clause in a contract with an engineering company, requiring certification of the progress. Lack of Understanding Contract Terms: The mode scored a medium-high RPN an equivalent to 392, indicating a major legal risk. This action can further reinforce the legal sooner level by legal advisors so that the contracts are meticulously fulfilled. Finally, the model illustrates how conversions to quantitative indicators of qualitative foci enables evidence-based policy-making in e-government governance.

5. DISCUSSION AND CONCLUSION

5.1. Discussion

The present research explored e-government outsourcing in the Palestinian public sector through evaluating decision criteria, governance frameworks, and risks throughout the lifecycle of outsourcing using a multi-method approach. It also analyzed the role of strategic priorities, financial limits, human capacity, and interdependencies of risks on outsourcing effectiveness, tackling the gaps in terms of limited phase coverage and inadequate risk-oriented empirical focus by previous studies.

Foremost, among the established criteria was the overarching concern for security and data privacy with the ANP showing that the weight of decision is best concentrated on security (30.21%). This finding, while intuitive given the sensitive nature of government data, is of such paramount importance that it acts as a non-negotiable and foundational constraint upon which all other considerations are overlaid. This aligns with the work of Smith (2019), who argues that for public sector entities, data sovereignty and security are not only operational risks but also fundamental matters of public trust and national interest. The government's role as a custodian of citizen data elevates security from a technical checklist item to a core strategic principle that fundamentally shapes the permissible scope and structure of any outsourcing arrangement. Any potential efficiency gain is immediately subordinate to the imperative of maintaining data integrity and confidentiality. These results also reinforce the argument of Han and Li (2009) that information security is the condition that plays the most significant role in outsourcing settings that deal with sensitive governmental information.

Moreover, cost and financial modeling showed a significant effect, where the ANP demonstrated that the weight of decision is secondly concentrated on cost, mainly the implementation cost (20.39%). This criterion highlights the profound budgetary limitations and strategic financial dilemmas confronting government decision-makers. Unlike private sector firms that may outsource primarily for cost reduction or access to capital, the government's financial considerations are uniquely bound by public accountability, fixed budgetary cycles, and the political implications of funding models. The concern is not only with the absolute cost but also with the type of financing. In the same vein, Badampudi et al. (2016) showed cost to be a determining factor in the outsourcing of IT among the

population under fiscal responsibility. Similarly, in another research, implementation cost was identified as a factor for outsourcing sustainability in the literature (Cox et al., 2012).

Additionally, the weighted decision was thirdly concentrated on staff technical ability (16.70%). This weightiness also confirms the results of another study, where it was demonstrated that internal knowledge is essential in the context of outsourcing agreements (Estember & Jacob, 2019). This also supports informed incumbency as defined by Willcocks and Lacity (2012). Accordingly, the primary impediment to successful outsourcing is not technological obsolescence, but a deficit in human capital and the managerial competencies required to architect, negotiate, and oversee complex outsourcing contracts. This finding extends the work of Willcocks and Lacity (2016), who emphasize that effective outsourcing is contingent on retaining strong internal “core capabilities”. The current study underscores that in the government context, these core capabilities specifically around vendor management, contract negotiation, and technical specification are perceived as weaker than the physical IT assets themselves.

Furthermore, the change of infrastructure-focused issues to the problem of governance and operational capacity limitation is evident in this distribution. The relatively small weights of storage devices (0.69%) and implementation period (6.60%) also indicate that physical infrastructure preparedness is no longer the major obstacle. Instead, managerial capacity and institutional trust form a predominant factor of thought.

In addition, the cause-effect analysis showed that the servers, database, security, cost of implementation, and technical capability have causal power with all of them having positive D-R values. This demonstrates their position as driving requirements that affect the general outsourcing ecosystem. The relational intensity of finance ($D + R = 11.88$) is high, meaning that it is closely connected to the rest of the criteria, which implies that the financial considerations do not act only as external constraints but also as systemic moderators of various dimensions of decisions. The causal saliency of the servers is consistent with the results reported by Aksakal and Dagdeviren (2010), who argued that the foundation infrastructure factors can be subject to cascading effects of the cost, security, and operation aspects. The high interdependence that is evident between security and finance supports the study performed by Aragao and Fontana (2023), which revealed that financial constraints directly affect cybersecurity investment in outsourcing projects.

Besides, the co-sourcing option, followed by internal development and full outsourcing, was the most favored option based on the results of the Fuzzy TOPSIS. This trend has been an adaptation of a hybrid approach of governance that focuses on risk reduction through an institutionalized intervention. The preference implies that decision-makers attempt to make an offset between the efficiency of the private sector and the accountability of the public sector, especially the aspects that concern the data safety and the availability of the services. This is in line with Lacity and Willcocks (2017) who discovered that hybrid sourcing models tend to offer better governance flexibility in the context of the public sector. Co-sourcing allows the government to retain ultimate oversight and control, particularly over security-critical functions, while selectively leveraging private sector efficiencies, innovation, and specialized skills. It is a direct manifestation of the desire to mitigate the risks of total outsourcing, including loss of control and security vulnerabilities, while overcoming the limitations of internal capabilities, including skills gaps and resource constraints. This model aligns with the concept of a “relational” contract, which emphasizes partnership and shared governance over a purely transactional relationship (Kern & Willcocks, 2000). Moreover, Oshri et al. (2015) also emphasized that partial outsourcing is also a method that allows maintaining knowledge and decreasing the risk of dependency, which is also reflected in the implementation risks of this study.

Concerning the FMEA analysis, it showed that the exposure to risks depends greatly on the various outsourcing stages, and the implementation stage has the highest density of critical risks. The most critical threats are failure to meet that of financial obligations (RPN = 1000), knowledge transfer issues (RPN = 900), and organizational interference (RPN = 810). These results reveal weaknesses in the structure of transition management, maturity in governance, and budget discipline. The issue of knowledge transfer is in favor of Oshri et al. (2015), who found that knowledge retention is a major factor in long-term outsourcing effectiveness. Likewise, the reported governance intrusion can be related to Bannister and Connolly (2012), who claimed that the difficulty in managerial coordination often harms the endeavors of the population to transform digitally. High-risk failure modes that were identified during the stage of contract signing were incomplete contractual elements (RPN = 500) and the lack of security clauses (RPN = 504). These results signal institutional underpricing of legal risk and the lack of standardization of the contract. Aubert et al. (2005) defined this inadequacy in the contractual form as one of the primary contributors to vendor lock-in and long-term dependency, whereas Yildiz (2007) viewed administrative fragmentation as one of the

contributing factors to legal oversight in the public sector's IT projects. The occurrence of medium-risk areas regarding the management of the contract and milestone definition also indicates problems in the institutional capacities of governance of procurement, which Belanger and Carter (2008) emphasized as the basic conditions of effective implementation of e-government.

The critical outsourcing governance errors in the decision phase, including wrong choices (RPN = 1000) and failure to specify the problems correctly (RPN = 900), are also highlighted by the high-risk failures in the stage. These findings are consistent with Lacity and Willcocks (2017), who found the presence of optimism bias as a very frequent reason behind the failure of outsourcing. Belton and Stewart (2002) provide the argument that structured decision-making mechanisms increase transparency and make decisions less subjective, which is relevant with the application of MCDA methods as mitigation mechanisms. Additionally, the high-risk issues identified during the selection stage, including the lack of prioritization and the availability of vendors, validate the research of Hui et al. (2011), who proved that the lack of prequalification mechanisms is a high-risk factor for project failure. Also, the identified bias toward cost-based selection is consistent with the results of Schapper et al. (2006) regarding the lack of transparency in the framework of public procurement. The evaluation phase had extremely high risks associated with untimely project delivery (RPN = 1000) and biased reporting (RPN = 504), which shows the lack of performance control and accountability systems. The findings support the ISO31000 views on risk governance, where continuous assessment is a significant control measure within the complex outsourcing setup.

Nevertheless, the results of the study are inconsistent with He and Lu (2017) who determined that contract stage can be the riskiest period of outsourcing. This study shows that implementation is the point of maximum concentration of the critical risks, implying a change of context to post-contract governance issues in emerging e-government settings. This difference could be attributed to institutional differences in maturity and changing practices of outsourcing. Additionally, the findings are consistent with those of Dada (2006) and Bannister and Connolly (2012), who emphasized the change in the infrastructure barriers into governance and managerial issues as digital transformation moves forward. This post-adoption risk shift is confirmed by the relatively low importance assigned to the factors of infrastructure in this study.

5.2. Implications

5.2.1. Theoretical implications

This thesis has several key theoretical contributions. Firstly, it contributes to the e-government outsourcing research by illustrating how Multi-Criteria Decision-Making (MCDM) methods can be used to decompose and rank decision factors which was not well researched in the studied domain. Secondly, the study assesses the risks of outsourcing based on the discussion of experts. The FMEA application to the five critical stages, such as Decision-Making, Selection, Contract Signing, Implementation, and Results Evaluation provides value by helping to address the discontinuous approach that separates the phase evaluation. This simultaneous and progressive risk profiling fosters a conceptual framework of risk interplay in interphase, in addition to the importance of tackling risks throughout the whole project. Lastly, the review suggests a hybrid approach. A more mutually acceptable and holistic view of the outsourcing process, both in terms of its initiation and the final result, can be realized by considering the FMEA tools of risk analysis and the MCDM tools of decision analysis.

5.2.2. Practical implications

The practical consequences of this combined analysis are actionable and can be beneficial to the e-government policymakers and project managers:

1. **Informed Decision-Making:** The prioritized criteria offer a clear-cut structure of measuring the outsourcing decisions. Such considerations as security and costs can take a back seat and be a priority for leaders with confidence, hence a tendency towards a collaborative model like co-outsourcing can be justified.
2. **Targeted Risk Mitigation:** FMEA outcomes provide an accurate risk map to guide the efforts of mitigation resources. Organizational structures county on exceptionally strong project management and oversight and governance structures, especially in the implementation phase, which is the weakest point. This involves introducing formal governance systems, like steering committees, in order to be accountable.
3. **Improving the Ignored Phases:** The decision-makers are not supposed to overlook the final stages. The major risks that are found during the Contract-Signing and Results-Evaluation phases imply the necessity of increasing legal examination, improving

performance parameters, and increasing organizational auditing processes to ensure contractual performance and value realization.

4. Contextual Application: The results are particularly relevant in the context of the bureaucracy of the public sector, where Palestine is similar in bureaucracy, legal regulations, and political influence. The implemented methodologies provide a disciplined way of moving around such complicated institutional complexities.

5.3. Recommendations and Future Research

The research provides a number of practices that should be recommended to be applied in the Palestinian public sector and identifies future research directions. In the case of the Palestinian practice of the public sector, the formal introduction of a co-outsourcing model to the executive level is recommended, which corresponds to the main priorities of security and control of the state. In order to alleviate the acute failure modes which will be exhibited in the high-risk implementation stage, the latter model should be supported by a vigorous governance: A cross-functional steering committee, along with specific vendor-management functions. Moreover, there is no standard security procedure and contract templates, thus institutionalization of the best practices of data protection is needed to address critical gaps that might act as deal-breakers when bonding on Contract Signing.

Moreover, there should be an investment in building the in-house human capacity to manage the strategy of the vendors and projects, thus putting governments into a better position of monitoring the operations that have been outsourced. The proposed risk-mitigation measures can be proved in the future with the help of longitudinal case studies or other alternatives like ISM, which will clarify complex dependencies between decision variables. These findings need to be put into perspective through cross-national comparative study, and combination of quantitative project data might assist in the development of predictive risk models. Lastly, additional research must include the service provider angle, providing a better understanding on inter-organizational relationship in a business outsourcing relationship, and giving both sides an equal footing in the contractual accommodation. The implementation of these recommendations will help Palestinian organizations to be better prepared to face the issues related to e-government outsourcing, and will also provide researchers with the opportunity of refining the integrated decision- and risk-management framework presented.

6. CONCLUSION

This research found that security and fiscal limitations are the major motivators of outsourcing, thus creating a strategic tendency towards co-outsourcing patterns is important. Whereas the initial phases are characterized by moderate risk, the implementation phase, under FMEA analysis, is the most sensitive point with the highest risk of systems failure. The results show that there is a cumulative risk factor, where the mistake at the initial stage of work develops into a disastrous mistake at the final assessment. Finally, the study highlights that project viability is determined by active risk management, especially in the levels of contract and execution. The study provides a coherent system, which allows for improved control in e-government outsourcing projects as it follows the failure modes throughout the whole lifecycle.



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APPENDIX

Appendix 1. Total Relation Matrix

			Technical Components				Cost		Staff Execution Ability	
			Servers	Storage Devices	Database	Security	Finance	Implementation Cost	Technical Ability	Implementation Period
AFFECTING CRITERIA	Technical Components	Servers	0.56	0.60	0.63	0.72	0.79	0.80	0.64	0.64
		Storage Devices	0.55	0.43	0.54	0.57	0.68	0.67	0.51	0.51
		Database	0.60	0.59	0.51	0.71	0.72	0.74	0.62	0.61
		Security	0.72	0.65	0.71	0.67	0.83	0.85	0.73	0.72
	Cost	Finance	0.74	0.67	0.69	0.78	0.71	0.85	0.68	0.72
		Implementation Cost	0.78	0.72	0.75	0.85	0.90	0.78	0.75	0.76
	Staff Execution	Technical Ability	0.64	0.58	0.62	0.73	0.72	0.75	0.53	0.66
		Implementation Period	0.60	0.55	0.59	0.69	0.70	0.72	0.61	0.51

Appendix 2. Normalize Super Matrix

		Technical Components				Cost		Staff Execution Ability	
		Servers	Storage Devices	Database	Security	Finance	Implementation Cost	Technical Ability	Implementation Period
Technical Components	Servers	0.00	0.00	0.00	0.11	0.08	0.11	0.00	0.00
	Storage Devices	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00
	Database	0.00	0.00	0.00	0.20	0.08	0.10	0.00	0.00
	Security	0.58	0.00	0.58	0.00	0.21	0.23	0.63	0.63
Cost	Finance	0.25	0.00	0.14	0.06	0.07	0.11	0.10	0.17
	Implementation Cost	0.17	1.00	0.28	0.17	0.19	0.16	0.28	0.20
Staff Execution Ability	Technical Ability	0.00	0.00	0.00	0.36	0.17	0.19	0.00	0.00
	Implementation Period	0.00	0.00	0.00	0.11	0.12	0.10	0.00	0.00

Appendix 3. Weighted Decision Matrix

WEIGHTED DECISION MATRIX																									
		Servers			Storage Devices			Database			Security			Finance			Implementation Cost			Technical Ability			Implementation Period		
WEIGHT		0,064			0,007			0,088			0,302			0,102			0,204			0,167			0,066		
AGGREGATION		l	m	u	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
	Fully Insource	0.02	0.03	0.05	0	0	0.01	0.04	0.06	0.08	0.12	0.22	0.28	0.02	0.05	0.08	0.0658	0.1315	0.1907	0.06	0.1	0.15	0	0.011	0.02933
	Fully Outsource	0.01	0.02	0.04	0	0	0	0.01	0.02	0.05	0.04	0.1	0.2	0.03	0.06	0.09	0.0592	0.1184	0.1841	0.01	0.05	0.1	0.022	0.0385	0.05316
	Cloud Computing	0.02	0.03	0.05	0	0	0.01	0.02	0.04	0.07	0.05	0.11	0.2	0.03	0.06	0.09	0.0395	0.0789	0.1381	0.04	0.08	0.12	0.01833	0.03666	0.05316
	Co-Sourcing	0.04	0.05	0.06	0	0.01	0.01	0.04	0.07	0.09	0.17	0.25	0.3	0.05	0.08	0.1	0.0921	0.1513	0.2039	0.09	0.14	0.17	0.03483	0.05316	0.06599



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