

Article

Exploring the Critical Risk Factors of Public–Private Partnership City Hospital Projects in Turkey

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Abstract: Governments face challenges in delivering essential public services due to their limited funds. This has led to an increasing reliance on the Public–Private Partnership (PPP) model, an alternative financing model involving a long-term collaboration between the private and public sectors to provide public services. Turkey, as a developing country facing financial limitations, has embraced the PPP model to address urgent public needs. Over the past decade, the Turkish Government has extensively utilized the PPP model, particularly in executing city hospital projects. However, investors have faced challenges in project execution due to various risk factors. Therefore, the main objective of this study is to explore the critical risk factors associated with PPP city hospital projects in Turkey. In this context, a comprehensive literature review was conducted to identify potential risks related to PPP city hospital projects. A questionnaire survey was implemented to assess the probability of occurrence and the severity of the impact of these risk factors. The collected data underwent analysis to determine the priority of these risk factors. The findings revealed that the top five most critical risk factors in PPP city hospital projects in Turkey are “foreign exchange rate fluctuations”, “inflation rate volatility”, “high finance costs”, “fiscal issues”, and “economic crises”. Conversely, “unavailability of equipment” was identified as the least significant risk factor. The insights gained from this research can offer valuable guidance for prospective investors interested in participating in PPP city hospital projects in Turkey and other developing countries with similar conditions.

Keywords: assessment; city hospital; PPP; project; risk



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1. Introduction

One of the primary mandates of governmental entities is to fulfill the essential needs of the public. Presently, challenges in delivering these services arise due to factors such as a growing population, technological advancements, and the imperative for new investments. Despite earnest government endeavors to provide public services within their resource constraints, there exists an opportunity to explore alternative procurement models to address pressing public needs. Particularly in developing countries, there is a demand for a financing model capable of facilitating large-scale and time-sensitive investments. The strategic utilization of the financial and technical capacities of the private sector becomes pivotal in achieving these objectives. The Public–Private Partnership (PPP) emerges as a financing model wherein investments and services are carried out under public obligations, with costs, risks, and profits shared between the public and private sectors through a protracted contractual agreement [1]. This collaborative structure involves the concerted efforts of two stakeholders—the public and private sectors—to efficiently deliver relevant

public services, leveraging their distinct resources. Therefore, PPPs have been implemented worldwide as an alternative to traditional project delivery systems [2].

Various contractual models (Build–Operate–Transfer (BOT), Design–Build (DB), Design–Build–Finance–Operate (DBFO), Operation and Maintenance (O and M), Build–Lease–Transfer (BLT), Build–Operate (BO), Transfer of Operating Rights (TOR), etc.) emerge through the delineation of roles between the public and private sectors across diverse projects and sectors [3–7]. Put differently, the objectives and specifications of a project give rise to the establishment of distinct partnership models. Primarily, PPP models exhibit variability with respect to the extent of private sector engagement. Furthermore, factors such as capital assets, investment obligations, risk assumption levels, and contract duration play pivotal roles in shaping these partnerships [8].

Given the extended duration of PPP projects, they may entail numerous risk factors related to design, construction, and operation, rendering them more intricate than traditional procurement models [9]. The primary goal of partnership in investments is to enhance the overall value of the project [10]. Emphasizing the significance of an impartial, practical, and reliable risk assessment method, Chan et al. [11] posit that such an approach is crucial for achieving successful outcomes in PPP projects. The effective identification of risks from both public and private perspectives positively influences project performance [12].

As a developing country, Turkey has been hosting many examples of PPP projects. Within the realm of governmental obligations, healthcare services have been a focal point, and in the past decade, Turkey has undertaken numerous healthcare initiatives utilizing the PPP model, thereby introducing additional layers of complexity in the form of risk factors. Consequently, risk assessment in PPP projects becomes paramount, serving as a key determinant for the success of the endeavor [13]. The recent progress in Turkey's PPP sector involves notable advancements in city hospital projects as the projects are implemented through the BLT model. As a model that utilizes a collaborative effort to distribute risks between private and public entities, examining the substantial experience gained from this model may unveil valuable insights into the realm of risk assessment for PPP projects. It is noteworthy that the existing literature on studies concentrating on city hospital projects in Turkey is rather limited. Thus, this study addresses the risk assessment process for city hospital projects in Turkey as an example of a complex PPP project with specific considerations required.

Section 2 provides the research background as an overview of the PPP model and PPP city hospital projects in Turkey. Section 3 focuses on a literature review and summarizes prior studies on risk factors in PPP projects. Section 4 elucidates the methodology employed in this study, while Sections 5 and 6 present the details with results and discussion, respectively. Finally, Section 7 presents the conclusions drawn from the findings of this study.

2. Research Background

The inception of Public–Private Partnership (PPP) projects in Turkey dates back to 1984, commencing with the distribution and trade in electricity generation. Subsequent permissions were granted in 1988 for PPP models encompassing the construction, maintenance, and operation of highway projects. The start of PPP practices in the Turkish health sector dates back to 2005, and in 2013, it extended to encompass the construction, renovation, and service provisioning of facilities through the PPP model [14–16]. Turkey, therefore, has a relatively brief history of employing the PPP model in the healthcare sector. The vision of advancing health infrastructure investments in Turkey, equipped with the latest technological devices and excellent physical facilities, is notably embodied in city hospitals, the most recent and innovative reforms in the healthcare domain.

Since 2017, plans have been devised for the construction of a total of 35 city hospitals in Turkey, with the ultimate goal of achieving a collective bed capacity of 44,033 patients upon project completion. Among these, 18 of them represent city hospital initiatives intended to

be realized through the Build–Lease–Transfer (BLT) model, while the remaining projects are reported to be executed using “general budgetary resources” [4,17].

The BLT model is frequently employed when the government prefers to maintain ownership of the project instead of transferring it to the private sector. Specifically, within the BLT model, the public sector undertakes the determination of hospital location and project preparation and engages the private sector for hospital construction. In return, the public sector commits to rent payments over a 25-year term, with complete ownership of the hospital reverting to the public sector at the conclusion of this period [4,6,16,18–20]. The concessionaire is responsible for conducting essential maintenance and operating commercial service areas to ensure the continuous functionality of the facility throughout the lease period. During the contractual period, the government pays rental fees to the private sector. Compliance with specific quality standards is mandatory during the lease period, and a penalty point system is instituted for each service. The government retains the authority to deduct rent payments based on the penalty points imposed. Therefore, the operational responsibilities for the facility rest with the private sector, and upon the expiration of the contract, ownership is transferred to the public sector [6].

An additional distinctive attribute of the BLT model pertains to the allocation of risks. The effective sharing of risks, facilitated by the transfer of risks to the private sector, potentially yields benefits for the public sector [21]. The principal advantage of this approach is the transfer of the risk associated with construction completion time and cost overruns, common occurrences in the construction phase of public projects, to the private sector. Extensions of the construction period result in reduced total rental payments to the contractor. Consequently, the concessionaire is motivated to ensure both high-quality construction (as they will operate the project) and the provision of high-quality services. Failure to meet service standards outlined in the implementation contract may lead to penalty deductions from the rental fee, thereby linking payment to the private sector’s performance. Furthermore, as the concessionaire secures the construction loan with their own resources, the public is shielded from financial risks. Therefore, as exemplified, it is imperative to conduct a thorough evaluation of the various types of potential risks and their corresponding impacts before the allocation of risks is undertaken. Additionally, risk reduction is advantageous for both the public and private sectors, as it signifies a diminished financial burden for the public sector and fosters a safer investment environment for both entities. This stems from the fact that, within the model, the primary responsibility for financing the project and overseeing its construction lies with the private sector. However, it is noteworthy that the private sector assumes this responsibility not without cost, as these expenses are subsequently transferred to the public sector for fulfillment within the designated repayment period [20]. Excessive transfer of risk to the private sector, while incurring elevated costs, also poses the potential to detrimentally impact the execution of the project. Moreover, inadequate risk transfer results in diminished value for money and the failure to realize anticipated profits. The objective is to ascertain the optimal equilibrium. The optimal allocation of risk should be such that it concurrently accrues benefits to both the public and private sectors [22].

City hospital initiatives in Turkey exhibit variations in scale, capacity, and the spectrum of services rendered. Initiatives that are larger in size present extensive healthcare facilities, functioning as multi-disciplinary medical complexes encompassing diverse specialties and departments. Given the substantial incorporation of advanced technology and the aforementioned attributes, these undertakings necessitate focused attention in terms of risk management. Despite the gradual expansion of PPP city hospitals, existing research on this subject remains limited [11]. Therefore, this study aims to comprehensively examine and evaluate risk factors in PPP city hospital projects in Turkey to increase success potential of these projects.

3. Literature Review

This section handles risk assessment-oriented studies under two sections, being PPP projects in general and more specifically PPP projects in the healthcare field—including limited studies on city hospital projects. The presented literature lays the foundations for the identification of the risk factors.

3.1. Research on Risk Assessment in PPP Projects

Researchers on a global scale have dedicated significant efforts to conducting risk assessments across various PPP projects where some notable studies are presented in Table 1.

Table 1. Summary of the studies on risk assessment in PPP projects.

Study	Year	Research Focus	Country	Methodology	Key Findings
Bing et al. [23]	2005	Analysis of risk allocation preferences in PPP infrastructure projects	UK	Questionnaire survey	Categorized risks at three levels. Macro-level risks: external influences (e.g., political, legal, macroeconomic, etc.) Meso-level risks: inside the project system boundaries (e.g., design, construction, operation, etc.) Micro-level risks: related to risks of stakeholder relations (relationship risks and third-party risks)
Chan et al. [11]	2010	Analysis of critical success factors to conduct PPP projects	China	Empirical questionnaire survey and factor analysis	Investigated 18 critical success factors and identified five main critical success factor categories: stable macroeconomic environment, shared responsibility between public and private sectors, transparent and efficient procurement process, stable political and social environment, and judicious government control.
Ke et al. [24]	2010	Analysis of the preferred risk allocation in PPP infrastructure projects	China and the Hong Kong Special Administrative Region	Empirical questionnaire survey and comparative analysis	In China and Hong Kong: most political, legal, and social risks are retained by public sector, most micro-level risks and force majeure risks are shared; while the majority of meso-level risks are allocated to the private sector.
Chan et al. [25]	2011	Analysis of principal risks and their allocation for the delivery of PPP projects	China	Empirical questionnaire survey	Identified 34 risk factors in two main categories and ten sub-categories. Top three critical risk factors: government intervention, government corruption, poor public decision-making processes.
Ke et al. [26]	2011	Analysis of the potential risks in PPP projects	China	Two-round Delphi survey	Top ten risk factors: government's intervention, poor political decision making, financial risk, government's reliability, etc.
Li and Zou [27]	2011	Risk assessment in a PPP expressway project	China	Fuzzy Analytical Hierarchy Process (FAHP) method	Top five risk factors: planning deficiency, low project residual value, lack of qualified bidders, design deficiency, and long project approval time.
Hwang et al. [28]	2013	Analysis of critical success factors of PPP projects	Singapore	Questionnaire survey	Identified 42 risk factors with positive and negative factors. Recommended risk allocation: eight risk factors (e.g., unstable government, nationalization/expropriation, etc.) to the public sector, 19 to the private sector (e.g., geological conditions, weather, etc.), allocating 11 to both parties (e.g., inflation, interest rate, etc.), and assigning four based on specific circumstances (e.g., level of public opposition to project, delay in approvals and permits, etc.).
Sastoque et al. [29]	2016	Analysis of risk allocation in PPP social infrastructure projects	Colombia	Interviews	Identified 62 risks in 11 different categories. Private sector: natural risks, financial risks, macroeconomic indicators risks, construction risks, and operational risks. Public sector: social risks, selection project risk, and political risks. Shared: legal and legislation risks, residual risk, and relationship risk.
Akçay et al. [30]	2017	Analysis of risk factors in PPP hydropower projects for predicting investment feasibility	Turkey	Questionnaire survey	Identified 29 risk factors categorized under external and technical. External risk factors: change in law, delay in project approvals and permits, etc. Technical risk factors: problems with design, delay in construction, etc.

Table 1. Cont.

Study	Year	Research Focus	Country	Methodology	Key Findings
Sofuoglu [4]	2018	Analysis of risk allocation in PPP wastewater projects	Turkey	Comparative analysis	Risk factors listed as interest, inflation, currency, financing, cost overrun, demand guarantee, force majeure, design, political, legal, operation and maintenance-repair, expiration, performance, technology, environmental, etc.
Aladağ and Işık [12]	2019	Analysis of design and construction risks of BOT mega transportation projects	-	Focus group discussions and Fuzzy Analytical Hierarchy Process (FAHP) method	Identified and ranked 11 risk factors, with top three risks: occupational accidents, integration between design and construction phases, and excessive design variations.
Owolabi et al. [31]	2020	Analysis of criteria influencing bankability of completion risk in PPP megaprojects	-	Focus group interviews and questionnaire survey	Determined 21 reliable criteria. Key criteria: a construction contractor with years of experience of successful completion of megaprojects, the construction contractor's financial strength, the existence of tried-and-tested technology for the construction of the project, etc.
Le et al. [32]	2020	Analysis of risk perceptions in BOT transportation projects	Vietnam	Interviews and questionnaire survey	Identified significant risks: problems with land acquisition and compensation, inappropriate location of toll booths, public resistance to pay, high toll rate, and lack of cash flow.

In line with the presented studies, the emphasis of the researchers on the importance of the risk assessment process in these projects underscores the recognition of its pivotal role in ensuring effective project management and mitigating potential challenges. The comprehensive scrutiny of risks in PPP projects is indicative of the commitment to enhancing the understanding and implementation of robust risk management strategies in the realm of public–private collaborations.

3.2. Research on Risk Assessment in PPP Healthcare Projects

The studies that are focused on performing risk assessment for PPP Healthcare projects have been very limited and mainly oriented to the investigation of risk factors in different countries as follows.

As the Danish example, Vrangbæk [33] studied the implementation of the PPP model in the healthcare sector and this research indicated limited use of the PPP model in the Danish healthcare sector. Risk factors were identified based on sectors as “operator”, “regulatory”, and “resources” risks associated with the private sector; “negotiation”, “construction”, “contract”, and “business climate” risks linked to both public and private sectors; and “tax”, “regulatory”, “moral”, “political”, and “competency erosion” risks as the risks specific to the public sector.

In another study addressing critical success factors of PPP in United Arab Emirates (UAE) public healthcare projects, Abdou and Zarooni [34] highlighted “design changes by clients” as the most crucial factor for both public and private sectors in PPP healthcare projects. Additionally, significant factors included the “slow process of government approvals”, “lack of design experts”, and “lack of guidance from clients”.

As another parallel study, Mokriani and Aouam [35] investigated the benefits and risks of partnerships in PPP projects, specifically focusing on the supply chain risks of outsourcing logistics in the Moroccan PPP healthcare sector. Using a risk assessment approach, they ranked risk factors based on decision maker judgments, categorizing them into “operational”, “financial”, “technology”, “information related”, “relational”, and “internal” aspects.

In the context of studies focused on city hospital projects in Turkey, it is evident that these efforts are inclined toward specific risk factors. As the first example, Atasever et al. [20] conducted an investigation into risk factors in city hospital projects in Turkey. The study highlighted risk factors associated with the private sector, including “cost overrun”, “maintenance and repair”, “technology”, “bankruptcy”, “political”, “qualified personnel”, “security” risks, etc.

Similarly, Uysal [16] directed attention to financing risk in PPP city hospital projects in Turkey, emphasizing that this risk primarily falls within the domain of the private sector. The study noted that the public sector often provides various guarantees to the capital supplied by financial institutions, and in the BLT model, the private sector assumes risks related to “project financing”, “construction”, and “operation and maintenance”.

To identify success and failure factors of PPP-integrated health campus projects in Turkey, Songur and Top [36] conducted a study on these projects, employing a survey with 97 participants. According to the results, the primary considerations for selecting the PPP model in integrated health campus projects were identified as “the infrastructure skills of the private sector” and “the efficient operation of the private sector”. Success factors for the PPP model were ranked with “appropriate risk distribution” and “well-prepared contract document” being prioritized as the main indicators of the importance of risk analysis in these projects. Concerns related to PPP integrated health campus projects were centered around “a large number of legal regulations”. Risks in these projects were investigated at the category level as “financial”, “operational”, “political”, “legal”, “market and income”, and “environmental risks”, with “financial risk” emerging as the most critical while “environmental risk” was the least critical. Key performance indicators for assessing PPP model success included “cost advantage (economic advantage)” and “resource savings”. Regarding the suitable type of PPP for integrated health campus projects, the BOT model was selected, followed by the BLT model. Therefore, it is seen that the findings of this study reveal the importance of the detailed risk assessment of city hospital projects handled with the BLT model in Turkey.

3.3. Research Gap

The increasing demand for public services driven by rapid technological advancements has necessitated a shift toward PPP projects. The literature on PPP projects has expanded with the implementation of these projects. Notably, the risk factors discussed in these studies vary based on the project’s country of implementation, environment, and services provided.

PPP city hospital projects, characterized by their complexity, demand meticulous risk assessment for project success. Despite numerous studies focusing on diverse PPP projects, the literature reveals a scarcity of research centered specifically on the risk assessment of PPP healthcare projects. Particularly in the context of Turkey, where city hospital projects represent an emerging project type, research in this area has been notably constrained. The current body of studies underlines the importance of risk analysis in these projects; however, it falls short in investigating a comprehensive list of risk factors and neglects the examination of different participant groups’ perceptions regarding the probability and impact of these risk factors.

Given the existing literature and the identified research gap, this study endeavors to make a significant contribution by presenting an extensive and meticulous list of potential risk factors for PPP healthcare projects. The focus of this contribution is a developing country, particularly drawing from the example of a context where the predominant model for executing such projects is PPP. The detailed investigation of perceptions on risk factors may facilitate the understanding of the project’s nature in terms of risk through incorporating the different perspectives of the participants. This holistic insight can reveal nuances that may have been overlooked in the initial risk assessment, thus enhancing the overall risk analysis.

4. Research Objectives and Methodology

The major aim of the study is investigating the risk factors associated with PPP city hospital projects in Turkey, wherein collaboration between the public and private sectors is employed, and examining the perceptions of the participants on these factors from different perspectives to increase the success potential of these projects. In line with this aim, objectives of the study can be stated as follows:

1. To conduct literature review on risk assessment in PPP projects to record the initial findings on risk factors,
2. To evaluate the structured form of the initial findings in the form of questionnaire through a pilot study that includes participants with expertise in city hospital projects, and
3. To perform questionnaire survey and investigate the correlation between the general characteristics of participants and their responses to individual risk factors.

Figure 1 succinctly outlines the research methodology followed to achieve the aim and objectives of the study with a summary of details in each step. The details of the methodology are presented in the following sections.

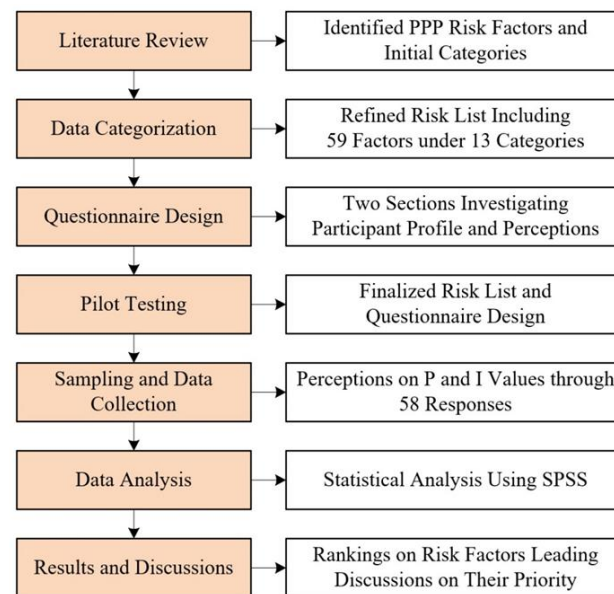


Figure 1. Research methodology.

4.1. Questionnaire Design and Pilot Testing

In the initial phase of this investigation, a comprehensive review of preceding studies was conducted to identify relevant risk factors, encompassing an exhaustive collection of articles pertinent to PPP projects. The application of specific inclusion criteria facilitated the selection of articles meeting the following criteria:

- i. Relevance to risks associated with PPP projects, particularly within the healthcare domain, and
- ii. The explicit identification or enumeration of risks associated with PPP projects in the textual content, with a specific emphasis on the healthcare sector, and the implementation of precise methodologies to ascertain and categorize these risks, either through narrative description or presentation in tabular or graphical formats.

Table 2 presents the identified risk factors and their corresponding studies from the literature. These risk factors were then categorized, eliminating duplications or similarities. Notably, risk factors with analogous meanings were excluded from the list. The risks distilled from the selected articles were categorized into 13 distinct classes, being “Natural”, “Design”, “Contractual”, “Legal”, “Economic”, “Political”, “Operation”, “Labor”, “Material”, “Equipment”, “Managerial”, “Construction”, and “Relationship”. The primary objective underlying this taxonomy was to illustrate the multifaceted nature of risk factors, thereby aiding project stakeholders in avoiding an undue concentration on specific risks. As presented in Table 2, 59 distinct risk factors likely to be entailed in PPP city hospital projects in Turkey were identified, accompanied by their respective categorization. This systematic classification serves to enhance the discernment of risk factors by aligning them with their corresponding categories.

Table 2. Risk factor taxonomy indicating references.

Risk Information		References																														
Risk Category	Risk Factors	Akintoye and MacLeod [37]	Abdou et al. [38]	Akintoye and Chinyio [39]	Bing et al. (2005) [23]	Dikmen and Birgonul [40]	Zayed et al. [41]	Kwak et al. [42]	Ke et al. [24]	Li and Zou [27]	Nieto-Morote and Ruz-Vila [43]	Hwang et al. [28]	Goh et al. [44]	Kuo and Lu [45]	Taylan et al. [46]	Boateng et al. [47]	Liu et al. [48]	Sastoque et al. [29]	Akcay et al. [30]	Tavakolan and Etemadinia [49]	Wang and Yuan [50]	Atasever et al. [20]	Beltrão and Carvalho [51]	Sofuoglu [4]	Sungur [21]	Aladağ & Işık [12]	Siraj and Fayek [52]	Gondia et al. [53]	Owolabi et al. [31]	Zhang et al. [54]	Noorzai [55]	
Natural	Weather conditions	•		•	•	•	•		•	•		•		•		•	•		•		•		•					•	•		•	
	Force majeure		•	•	•			•	•	•		•		•			•	•	•		•		•	•				•	•		•	
	Environment risk	•		•	•	•	•		•			•				•	•	•	•	•	•		•	•		•	•				•	
	Geotechnical conditions	•	•	•	•	•	•		•			•	•			•	•	•	•	•	•	•	•				•	•	•		•	
Design	Change in design		•	•	•						•		•			•	•			•	•	•	•	•	•	•		•	•		•	
	Design deficiency and errors		•	•	•	•	•		•		•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•		•	
	Delay in design					•	•						•			•	•			•	•		•	•		•	•	•	•		•	
	Inexperienced designers		•	•	•						•		•	•	•	•	•				•	•				•		•	•			•
Contractual	Vagueness of contract clauses	•		•		•	•		•								•	•		•			•	•				•			•	
	Lack of contract standards			•		•	•		•							•	•	•		•			•	•				•	•		•	
	Non-compliance with technical specifications		•		•	•		•		•									•	•	•		•	•				•	•	•		•
																				•	•						•	•				
Legal	Legal disputes between project participants				•		•			•		•								•								•	•		•	
	Lack of legal framework				•	•	•	•				•					•	•							•			•			•	•
	Import/export restrictions				•															•								•				
	Legislation change				•			•	•										•	•	•		•						•		•	
	Expropriation/nationalization				•			•	•			•					•	•		•			•	•		•		•				•
	Change in tax regulation				•		•		•	•	•	•				•	•	•	•	•	•		•	•				•				

Table 2. *Cont.*[illegible]

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Risk Category	Risk Factors	Akintoye and MacLeod [37]	Abdou et al. [38]	Akintoye and Chinyio [39]	Bing et al. (2005) [23]	Dikmen and Birgonul [40]	Zayed et al. [41]	Kwak et al. [42]	Ke et al. [24]	Li and Zou [27]	Nieto-Morote and Ruz-Vila [43]	Hwang et al. [28]	Goh et al. [44]	Kuo and Lu [45]	Taylan et al. [46]	Boateng et al. [47]	Liu et al. [48]	Sastoque et al. [29]	Akcay et al. [30]	Tavakolan and Etemadinia [49]	Wang and Yuan [50]	Atasever et al. [20]	Beltrão and Carvalho [51]	Sofuoglu [4]	Sungur [21]	Aladağ & Işık [12]	Siraj and Fayek [52]	Gondia et al. [53]	Owolabi et al. [31]	Zhang et al. [54]	Noorzai [55]	
Relationship	Lack of coordination/communication between subcontractors	•	•						•		•	•	•				•	•			•		•			•	•	•		•		
	Lack of coordination/communication between stakeholders	•	•	•					•		•	•	•				•	•			•		•		•	•	•	•	•		•	
	Inadequate experience in PPP projects	•		•			•				•	•			•		•				•						•	•	•	•		•
	Organization risk	•	•		•							•	•			•				•								•			•	

The list of potential risk factors for PPP city hospital projects in Turkey was integrated into an online survey through “Google Forms” aiming to reach a broad audience and elicit prompt responses. To preliminarily assess the risk factors and the questionnaire design, a pilot study involving four experts—two academicians, one public sector employee, and one private sector employee, all experienced in PPP city hospital projects—was conducted. Following the pilot study, risk categorization was finalized with very few changes in risk factors in “Labor” and “Equipment” risk categories. Table 3 presents the final risk categorization and the factors. As another outcome of the pilot study, the questionnaire was verified and completed for distribution to participants.

Table 3. Final risk taxonomy.

Risk Category	Risk ID	Risk Factor
Natural	R1	Weather conditions
	R2	Force majeure
	R3	Environment risk
	R4	Geotechnical conditions
Design	R5	Change in design
	R6	Design deficiency and errors
	R7	Delay in design
	R8	Inexperienced designers
Contractual	R9	Vagueness of contract clauses
	R10	Lack of contract standards
	R11	Non-compliance with technical specifications
Legal	R12	Legal disputes between project participants
	R13	Lack of legal framework
	R14	Import/export restrictions
	R15	Legislation change
	R16	Expropriation/nationalization
	R17	Change in tax regulation
Economic	R18	Unavailability of funds
	R19	High finance cost
	R20	Bankruptcy
	R21	Economic crisis
	R22	Inflation rate volatility
	R23	Interest rate volatility
	R24	Foreign exchange rate fluctuation
Political	R25	Corruption/Bribery
	R26	Intervention
	R27	Government stability
	R28	Fiscal risk
	R29	Delay in approval and permits
Operation	R30	Government subsidies risk
	R31	Operation cost overrun
	R32	Operational revenue risk
	R33	Operation safety risk
Labor	R34	Unavailability of labor
	R35	Poor quality of labor
	R36	Poor productivity of labor
Material	R37	Unavailability of material
	R38	Poor quality of material
	R39	Delay in delivery of material

Table 3. *Cont.*

Risk Category	Risk ID	Risk Factor
Equipment	R40	Unavailability of equipment
	R41	Poor productivity of equipment
	R42	Delay in delivery of equipment
Managerial	R43	Poor project planning
	R44	Poor project budgeting
	R45	Poor project quality management
	R46	Inappropriate inspection
	R47	Inadequate personnel training
	R48	Inadequate risk management
Construction	R49	Construction cost overrun
	R50	Construction time overrun
	R51	Construction productivity
	R52	Poor quality construction
	R53	Construction safety risk
	R54	Construction technology risk
	R55	Scope risk
Relationship	R56	Lack of coordination/communication between subcontractors
	R57	Lack of coordination/communication between stakeholders
	R58	Inadequate experience in PPP projects
	R59	Organization risk

Following the pilot study, the final questionnaire comprised two sections as follows:

- i. General Information about Participants: The first section solicited specific details encompassing participants' "working sector", "educational background", "profession", "experience period in the construction industry", "experience period in PPP projects", and "engagement in types of PPP projects".
- ii. Assessment of Risk Factors: This section delineated the finalized risk factors, organized into 13 distinct categories. Each risk category further elucidated sub-factors pertinent to the specific nature of associated risks. This systematic classification also facilitated participants in evaluating risk factors more discerningly. Within this section, participants were specifically instructed to assess project risks in terms of both their probability of occurrence (denoted as P) and their anticipated impact (denoted as I) on a five-point Likert scale, where the scale values ranged from 1 (indicating "Very low") to 5 (indicating "Very high").

4.2. Data Collection

Target participants included individuals from public sector institutions and private sector investor companies involved or previously engaged in PPP construction projects in Turkey, the majority of them having a direct or indirect connection to PPP healthcare projects. The major criterion established for participant inclusion was the possession of practical experience in PPP projects in Turkey, especially in city hospital projects.

The participant pool was deliberately diversified, encompassing practitioners from public procuring authorities, PPP project companies, and consultancy firms. Dissemination of the survey was executed through online channels such as e-mail distribution, direct sharing of the survey link, and conventional distribution of hard copy questionnaires.

A total of 58 valid responses were received, spanning within a 4-month period. The relatively modest response count in this study may be rationalized within the context of the limited research population possessing experience in PPP healthcare projects in Turkey.

The participant demographic profile is succinctly presented in Table 4. A frequency analysis, incorporating measures such as mean, standard deviation, minimum, and maximum, among others, was employed to scrutinize the survey participants' demographics.

Notably, individuals affiliated with the public sector constitute the majority, accounting for 34 individuals (58.6%), as opposed to the private sector, which is represented by 24 individuals (41.4%). The preeminent educational attainment among participants is a bachelor's degree, encompassing 52 individuals (89.7%), with approximately half of the respondents identifying as civil engineers (28 individuals, 48.3%), followed by predominantly electrical engineers (11 individuals, 19%). In terms of professional experience, 52 participants (89.7%) possess more than five years of experience while a substantial majority of participants exhibit over five years of experience in PPP projects, totaling 39 participants (67.2%). These data suggest a comprehensive understanding among participants regarding PPP city hospital projects. Concerning specific PPP project domains, the majority have been actively engaged in PPP healthcare projects (45 individuals, 77.5%), with other participants, involved in diverse fields outside PPP healthcare projects, sharing the remaining percentile with closely aligned values.

Table 4. Profile of the participants.

Item	Category	Frequency	Percentage
Sector	Public	34	58.6%
	Private	24	41.4%
Educational background	Bachelor's	52	89.7%
	Master's	5	8.6%
	Doctorate	1	1.7%
Profession	Civil engineer	28	48.3%
	Electrical engineer	11	19%
	Architect	7	12%
	Mechanical engineer	4	6.9%
	Other	8	13.8%
Years of work experience	≤5 years	6	10.3%
	6 to ≤10 years	30	51.7%
	11 to ≤15 years	13	22.5%
	≥16 years	9	15.5%
PPP projects experience	≤5 years	19	32.8%
	>5 years	39	67.2%
Types of PPP projects	Healthcare	45	77.5%
	Housing	3	5.2%
	Transportation	3	5.2%
	Defense industry	2	3.4%
	Communication	2	3.4%
	Tourism	2	3.4%
	Power and energy	1	1.9%

In light of these findings, conclusions have been drawn from the analysis of all collected data based on the outcomes of the questionnaire. The following sections elaborate on these analyses in detail.

4.3. Data Analysis

Utilizing the Statistical Product and Service Solutions (SPSS) version 24.0, the collected data underwent various analyses, encompassing frequency analysis (including mean, median, mode, and standard deviation, among others), reliability analysis (Cronbach's alpha), mean score analysis, Mann–Whitney *U* test, and Kruskal–Wallis test.

To evaluate the appropriateness of the questionnaire-derived data for analysis, the reliability and consistency of participants' responses were scrutinized. Cronbach's alpha coefficient served as a metric to assess the similarity, closeness, and consistency of responses provided in the questionnaire. The Cronbach's alpha value ranges from 0 to 1, with a value exceeding the recommended threshold of 0.7 indicating acceptable internal consistency [56].

Within the questionnaire survey, the calculated α value for the probability of occurrence (P) was obtained as 0.969, while the α value for impact (I) was determined to be 0.975. Consequently, it was affirmed that the collected data exhibited a high degree of internal consistency.

To assess the significance level of each risk factor, mean score analysis was conducted, facilitating the establishment of a ranking based on calculated scores. The mean score is derived through the application of the following formula:

$$\bar{X} = \frac{\sum X}{N} \quad (1)$$

where $\bar{X}$ = mean score, $\sum X$ = sum of all items in the population, and N = number of items in the population.

Utilizing the gathered data, the mean scores for the probability of occurrence of risk factors were computed. For each risk, the score assigned on the five-point Likert scale was multiplied by the frequency of responses corresponding to that score. The summation of all values calculated for the five scores was then divided by the total number of responses.

The mean score for the probability of occurrence of a risk is calculated through the application of the following formula:

$$\bar{P} = \frac{\sum P}{N} \quad (2)$$

where $\bar{P}$ = mean score of probability of occurrence of a risk factor, $\sum P$ = sum of each response value for the probability of occurrence of a risk factor (1, 2, 3, 4, or 5), and N = total number of responses.

Drawing from the accumulated data, the mean scores for the impact of risk factors were determined. In this process, the score attributed on the five-point Likert scale to each risk was multiplied by the frequency of responses corresponding to that particular score. Subsequently, the sum of all values calculated for the five scores was divided by the total number of responses.

The mean score for the impact of a risk is computed using the following formula:

$$\bar{I} = \frac{\sum I}{N} \quad (3)$$

where $\bar{I}$ = mean score of impact of a risk factor, $\sum I$ = sum of each response value for the impact of a risk factor (1, 2, 3, 4, or 5), and N = total number of responses.

The assessment of the probability of occurrence and impact of a risk is conducted based on the provided responses. This evaluation serves to compute the Risk Significance Value (S) for each risk factor. The S is derived by multiplying the probability of occurrence (P) and the impact (I) of the risk.

Based on the gathered data, the mean score of risk priority for each risk factor was computed. This involved determining the product of the probability of occurrence and impact values for each participant's response. Subsequently, the individual calculations for all participants were aggregated, and the sum obtained was divided by the total number of responses. The mean score of risk priority is calculated using the following formula:

$$S = \frac{\sum (P_i \times I_i)}{N} \quad (4)$$

where S = the significance of a risk factor, P_i = probability of occurrence value for a risk factor at the i th response, I_i = impact value for a risk factor at the i th response, and N = total number of responses.

After the computations, the risk priority values for each risk factor were ranked, with the highest value securing the first position. Subsequent values were then arranged in descending order, contributing to an overall rating.

Given that the collected data did not exhibit a normal distribution, the Mann–Whitney U test was applied for comparing perceptions among participants [25]. The corresponding statistical analyses were conducted at the significance level of $p < 0.05$ [56,57]. Consequently, a factor exhibiting $p < 0.05$ implies a significant difference in the perceptions of the groups. Additionally, for comparisons involving three or more groups, the Kruskal–Wallis test was utilized to assess differences in perceptions.

5. Results

Results of the study are given first by the probability of occurrence and the impact of risk factors that lead to the significance of risk factors for the total sample. Following that, differences in perceptions of the participant groups are presented.

5.1. Probability of Occurrence of the Risk Factors

Participants were tasked with assessing the probability of occurrence for each risk factor using a five-point Likert scale in order to unveil the likelihood of each risk factor manifesting in PPP city hospital projects. Subsequently, each risk factor was ranked based on its mean value where a higher mean value denotes a higher priority. The outcomes pertaining to the probability of occurrence for each risk factor are succinctly presented in Table 5.

Table 5 delineates mean values for the probability of occurrence of risks within the range of 2.41 to 4.36. According to the ranking according to the probability of occurrence, as perceived by all participants, it is evident that “Foreign exchange rate fluctuations (R24)” claims the top position as the risk factor with the highest probability of occurrence. From the collective perspective of all participants, the top five risk factors possessing the highest probability of occurrence are as follows:

1. Foreign exchange rate fluctuations (R24)
2. Inflation rate volatility (R22)
3. High finance cost (R19)
4. Interest rate volatility (R23)
5. Fiscal risk (R28)

The risk factor with the lowest probability of occurrence is identified as “Unavailability of labor (R34)”.

5.2. Impact of the Risk Factors

Participants evaluated the severity of impact for each risk using a five-point Likert scale as an indicator of the extent of impact for each risk factor in PPP city hospital projects. Results of the ranking of the risk factors based on their mean values (a higher mean value indicating a higher priority) pertaining to the severity of impact for each risk factor, as perceived by all participants, are also presented in Table 5. It shows that mean values for the severity of impact of risk factors are within the range of 2.97 to 4.50. Upon scrutinizing the ranking according to the severity of impact values, as collectively perceived by all participants, it is apparent that “Foreign exchange rate fluctuations” emerges as the risk factor with the highest severity of impact. From the collective perspective of all participants, the top five risk factors with the highest severity of impact are as follows:

1. Foreign exchange rate fluctuations (R24)
2. Economic crisis (R21)
3. Fiscal risk (R28)
4. High finance cost (R19)
5. Unavailability of funds (R18)

Results showed that the risk factor with the lowest severity of impact is “Construction technology risk (R54)”.

Table 5. Significance of the risk factors in the overall and with sector-based perceptions.

Risk ID	Risk Factors	Probability of Occurrence			Severity of Impact			Significance (Priority)									Differences in Perception of Risk Significance				
								All Participants			Public Sector			Private Sector			Mean Rank		M-W U	Z Score	Asymp. Sig. (2-Tailed)
		Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Public Sector	Private Sector			
R1	Weather conditions	3	1.12	45	3.07	1.2	57	9.84	6	53	8.85	5.1	55	11.3	6.9	49	26.93	33.15	321	−1.4	0.161
R2	Force majeure	3.24	1.2	35	3.83	1.13	24	13	7.3	36	13.3	8.4	31	12.5	8	41	30.72	27.77	367	−0.66	0.508
R3	Environment risk	3.21	0.74	36	3.4	0.84	44	11.3	4.8	44	10.6	4.3	46	12.3	5.4	44	27.44	32.42	338	−1.15	0.25
R4	Geotechnical conditions	3.52	1.05	18	3.55	1.17	39	13.1	6.5	35	13.5	6.2	28	12.6	7.1	40	31.1	27.23	354	−0.87	0.384
R5	Change in design	3.86	0.95	6	4.12	1.03	10	16.4	6.6	8	17.5	6.1	3	14.8	7.1	21	32.35	25.46	311	−1.56	0.119
R6	Design deficiency and errors	3.71	1.04	10	3.86	1.24	22	15.1	7.6	14	16.4	7.9	8	13.3	6.8	32	32.19	25.69	317	−1.47	0.142
R7	Delay in design	3.55	1.1	15	3.66	1.09	33	13.7	7.1	26	14.1	7.4	21	13.1	7.3	35	30.51	28.06	374	−0.55	0.582
R8	Inexperienced designers	3.53	1.05	16	4.14	1.26	9	15.8	8.2	11	14.9	8.3	15	17	8.2	7	28.03	31.58	358	−0.81	0.419
R9	Vagueness of contract clauses	3.74	1.02	8	4.07	0.93	11	15.9	6.4	10	15.5	6.5	11	16.4	6.3	12	28.87	30.4	387	−0.35	0.726
R10	Lack of contract standards	3.72	1.06	9	4.03	1.04	14	15.7	7.2	12	15.2	7	13	16.4	7.5	13	28.68	30.67	380	−0.45	0.651
R11	Non-compliance with technical specifications	3.45	1.23	20	3.97	1.12	15	14.5	7.2	19	15.3	7.2	12	13.3	7.4	33	31.81	26.23	330	−1.26	0.208
R12	Legal disputes between project participants	3.34	1.02	28	4.07	1.01	12	13.8	5.7	25	14.3	5.4	18	13	6.2	36	31.34	26.9	355	−1	0.316
R13	Lack of legal framework	3.36	1.28	27	3.93	1.17	18	14.2	7.9	22	14.6	8.3	17	13.5	7.3	30	30.44	28.17	376	−0.51	0.607
R14	Import/export restrictions	2.83	1.23	53	3.22	1.24	51	10	7.1	52	8.68	7.1	56	12	6.9	45	25.93	34.56	287	−1.95	0.052
R15	Legislation change	3.34	1.32	29	3.62	1.09	35	13.2	7.8	33	14.1	8.3	22	11.9	7	46	31.31	26.9	346	−1	0.318
R16	Expropriation/nationalization	2.83	1.34	54	3.09	1.42	56	9.53	6.4	55	9.06	5.4	54	10.2	7.7	54	29.32	29.75	402	−0.1	0.924
R17	Change in tax regulation	2.95	1.46	48	3.17	1.26	53	11	8.5	48	11.3	8.4	42	10.6	9.1	53	30.46	28.15	37.5	−0.52	0.603
R18	Unavailability of funds	3.66	1.28	13	4.34	0.98	5	16.4	7.7	7	15.8	7.2	10	17.3	8.5	6	28.06	31.54	359	−0.8	0.424
R19	High finance cost	4.05	0.98	3	4.36	0.95	4	18.3	6.6	3	17.1	6.6	5	20	6.3	2	26.62	33.58	310	−1.6	0.11
R20	Bankruptcy	3.16	1.37	39	4.31	1.14	7	14.2	7.6	23	12.3	6.1	34	16.7	8.2	10	25.9	34.6	286	−1.95	0.051
R21	Economic crisis	3.86	1.02	7	4.41	0.94	2	17.5	6.4	5	16.6	6	7	18.8	6.9	4	26.69	33.48	313	−1.54	0.124
R22	Inflation rate volatility	4.16	0.99	2	4.33	0.98	6	18.6	7	2	18.5	6.4	2	18.7	8	5	28.93	30.31	389	−0.32	0.746
R23	Interest rate volatility	3.95	1.1	4	4.19	1.12	8	17.2	7.5	6	17.4	6.9	4	16.9	8.3	8	29.87	28.98	396	−0.2	0.839
R24	Foreign exchange rate fluctuation	4.36	0.74	1	4.5	0.71	1	19.9	5.4	1	19.5	5.2	1	20.5	5.6	1	28.29	31.21	367	−0.68	0.496
R25	Corruption/Bribery	3.69	1.42	11	3.71	1.55	32	15.2	9.3	13	14.2	9.5	19	16.7	9.1	11	27.78	31.94	350	−0.96	0.337
R26	Intervention	3.59	1.38	14	3.76	1.07	27	14.9	8.5	15	14.8	8.4	16	15.1	8.8	18	29.01	30.19	392	−0.27	0.79
R27	Government stability	3.41	1.23	21	3.95	1	16	14.8	8.5	16	15.1	8.9	14	14.5	8.1	23	30.1	28.65	388	−0.33	0.742
R28	Fiscal risk	3.93	1.01	5	4.38	0.9	3	17.9	6.8	4	17	6.3	6	19.1	7.6	3	27.09	32.92	326	−1.34	0.181
R29	Delay in approval and permits	3.53	1.35	17	3.95	1.37	17	14.7	6.9	17	14	6.7	23	15.8	7.1	16	27.34	32.56	335	−1.18	0.239
R30	Government subsidies risk	3	1.21	46	3.43	1.29	42	11.4	7.4	42	10.4	6.6	48	12.9	8.3	38	27.68	32.08	346	−1	0.317
R31	Operation cost overrun	3.4	1.08	24	3.76	1.2	28	13.6	7.4	29	12.7	7.7	32	14.9	6.9	20	27.35	32.54	335	−1.17	0.244
R32	Operational revenue risk	2.97	1.21	47	3.36	1.32	47	11.2	7.6	45	10.3	7.5	50	12.5	8.1	42	27.25	32.69	332	−1.22	0.223
R33	Operation safety risk	3.03	1.32	44	3.26	1.32	49	11.4	8.1	43	10.5	8.1	47	12.7	8.1	39	27.35	32.54	335	−1.16	0.245
R34	Unavailability of labor	2.41	1.35	59	3.26	1.57	50	9.12	7.6	57	8.62	7.1	57	9.83	7.9	57	28.69	30.65	381	−0.44	0.661
R35	Poor quality of labor	3.38	1.21	25	3.64	1.25	34	14.1	8.7	24	11.6	7	39	16.8	8.4	9	25.68	34.92	278	−2.09	0.036
R36	Poor productivity of labor	3.31	1.13	32	3.62	1.24	36	12.9	6.9	37	12.1	6.8	36	14	6.9	27	27.85	31.83	352	−0.91	0.365
R37	Unavailability of material	2.55	1.19	57	3.19	1.38	52	9.01	6.6	58	8.26	6.4	59	10.1	7	55	27.62	32.17	344	−1.02	0.309
R38	Poor quality of material	3.17	1.3	38	3.72	1.37	31	13.2	8.1	34	13.3	7	30	13	7.9	37	29.29	29.79	401	−0.11	0.911
R39	Delay in delivery of material	2.9	0.97	50	3.41	1.16	43	10.7	5.9	51	10.1	5.7	51	11.4	6.2	48	28.22	31.31	365	−0.7	0.487
R40	Unavailability of equipment	2.48	0.96	58	3.16	1.34	55	8.63	5.4	59	8.44	5	58	8.92	6.1	59	29.38	29.67	404	−0.06	0.949
R41	Poor productivity of equipment	2.93	1.26	49	3.33	1.33	48	11.2	7.8	46	10.7	7.4	45	11.8	8	47	29.03	30.17	392	−0.26	0.798
R42	Delay in delivery of equipment	2.88	1.2	51	3.4	1.36	45	11.1	7.1	47	11.1	7	43	11.1	7.5	50	29.68	29.25	402	−0.1	0.924

Table 5. Cont.

Risk ID	Risk Factors	Probability of Occurrence			Severity of Impact			Significance (Priority)									Differences in Perception of Risk Significance				
								All Participants			Public Sector			Private Sector			Mean Rank		M-W <i>U</i>	Z Score	Asymp. Sig. (2-Tailed)
		Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Public Sector	Private Sector			
R43	Poor project planning	3.47	1.26	19	3.93	1.17	19	14.6	7.8	18	13.8	7.7	25	15.9	8.1	15	27.94	31.71	355	−0.85	0.395
R44	Poor project budgeting	3.41	1.26	22	3.9	1.31	21	14.5	7.7	20	14	7.4	24	15	8.4	19	28.76	30.54	383	−0.4	0.69
R45	Poor project quality management	3.29	1.16	33	3.79	1.21	25	13.5	7.5	31	13.3	6.9	29	13.9	8.2	29	29.5	29.5	408	0	1
R46	Inappropriate inspection	3.12	1.38	40	3.74	1.35	30	12.9	8	38	11.7	7.9	38	14.6	8.1	22	26.88	33.21	319	−1.42	0.156
R47	Inadequate personnel training	3.33	1.07	30	3.78	1.24	26	13.7	7.4	27	13.6	7.2	27	14	7.7	28	29.16	29.98	397	−0.18	0.855
R48	Inadequate risk management	3.38	1.36	26	3.93	1.2	20	14.4	7.5	21	14.1	7.1	20	14.3	7.9	24	29.32	29.75	402	−0.1	0.924
R49	Construction cost overrun	3.33	1.16	31	3.84	1.12	23	13.7	6.6	28	12.3	6.6	35	15.7	6.9	17	25.66	34.94	278	−2.09	0.037
R50	Construction time overrun	3.67	1.28	12	4.05	1.13	13	16	7.6	9	16	7.4	9	16.1	8.1	14	29.03	30.17	392	−0.26	0.796
R51	Construction productivity	3.19	1.19	37	3.52	1.25	40	12.6	7.8	39	11.9	7.5	37	13.5	8.1	31	28.06	31.54	359	−0.78	0.434
R52	Poor quality construction	3.07	1.14	41	3.59	1.36	37	12.5	8.3	40	11.3	8.1	41	14.2	8	25	26.99	33.06	323	−1.36	0.173
R53	Construction safety risk	2.86	1.15	52	3.38	1.31	46	10.7	7.4	50	10.4	6.9	49	11.1	8.1	51	29.25	29.85	400	−0.14	0.892
R54	Construction technology risk	2.62	1.31	56	2.97	1.4	59	9.12	7.4	56	9.15	7.5	53	9.08	7.9	58	30.16	28.56	386	−0.36	0.72
R55	Scope risk	2.79	1.09	55	3.02	1.29	58	9.58	6.6	54	9.35	6.5	52	9.92	6.8	56	29.07	30.1	394	−0.23	0.816
R56	Lack of coordination/communication between subcontractors	3.07	1.23	42	3.17	1.42	54	11	7.3	49	10.9	7.1	44	11.1	7.8	52	29.16	29.98	397	−0.18	0.854
R57	Lack of coordination/communication between stakeholders	3.26	1.24	34	3.76	1.38	29	13.3	7.5	32	12.6	7.3	33	14.1	7.9	26	28.12	31.46	361	−0.75	0.453
R58	Inadequate experience in PPP projects	3.41	1.42	23	3.59	1.43	38	13.6	8.3	30	13.7	8.7	26	13.3	7.9	34	29.56	29.42	406	−0.03	0.974
R59	Organization risk	3.07	1.38	43	3.52	1.3	41	12	7.4	41	11.6	8.5	40	12.4	8	43	28.75	30.56	383	−0.41	0.685

5.3. Significance of the Risk Factors in the Total Sample

The significance of each risk factor is evaluated through mean score ranking, a widely employed technique for analyzing the importance of risk factors [32,58]. A risk factor with a high mean value of risk significance indicates a higher priority. The outcomes of the risk significance analysis from the collective perspective of all participants are concisely presented in Table 5. Given in the table, mean values for the significance of risk factors range between 8.63 to 19.9. Upon inspecting the ranking according to risk significance values, as perceived by all participants, it is evident that “Foreign exchange rate fluctuations” claims the top position as the most significant risk factor. From the collective viewpoint of all participants, the top five most significant risk factors are obtained as follows:

1. Foreign exchange rate fluctuations (R24)
2. Inflation rate volatility (R22)
3. High finance cost (R19)
4. Fiscal risk (R28)
5. Economic crisis (R21)

Conversely, the risk factor identified as the least significant is “Unavailability of equipment (R40)”.

Moreover, in cases where risk factors exhibit identical mean values, prioritization is determined based on their standard deviation values. A higher standard deviation value implies that the data inputs deviate more from the average, signifying a distribution with greater volatility. Consequently, risks with identical mean values are accorded higher priority when accompanied by a smaller standard deviation.

5.4. Significance of the Risk Factors among Groups according to Sector

Table 5 also provides a comprehensive summary of the risk significance comparison between the public and private sectors. The mean values for the significance of risk factors within the public sector range from 8.26 to 19.5, while those within the private sector fall between 8.92 and 20.5.

From the standpoint of the public sector, the top five most significant risk factors are identified as: “Foreign exchange rate fluctuations (R24)”, “Inflation rate volatility (R22)”, “Change in design (R5)”, “Interest rate volatility (R23)”, and “High finance cost (R19)”. Conversely, for the private sector, the top five most significant risk factors include: “Foreign exchange rate fluctuation (R24)”, “High finance cost (R19)”, “Fiscal risk (R28)”, “Economic crisis (R21)”, and “Inflation rate volatility (R22)”.

In terms of the least significant risk factors, the public sector designates “Unavailability of material (R37)” as the lowest, while the private sector identifies “Unavailability of equipment (R40)” as the least significant.

Observations reveal that the most significant risk factor for both sectors is “Foreign exchange rate fluctuations (R24)”, and it can be inferred that these highly significant risk factors predominantly fall under the “Economic” category.

Moreover, distinctions in perception between the public and private sectors regarding the significance of risk factors are evident. The Mann-Whitney *U* test results in Table 5 indicate significant disagreements on the significance of two risk factors, namely “Poor quality of labor (R35)” and “Construction cost overrun (R49)”. Notably, the private sector assigns a mean value of 16.8 for “Poor quality of labor (R35)”, while the public sector assigns a mean value of 11.6. Similarly, for “Construction cost overrun (R49)”, the private sector assigns a mean value of 15.7, in contrast to the public sector’s mean value of 12.3. Consequently, it can be deduced that the private sector perceives “Poor quality of labor (R35)” and “Construction cost overrun (R49)” as more significant.

5.5. Significance of the Risk Factors among Groups according to Profession

With respect to calculations on differences in perceptions according to profession, notably, civil engineers identify “Foreign exchange rate fluctuations (R24)” as the most significant risk factor, while electrical engineers consider “Lack of contract standards

(R10) to be the most significant. Architects, on the other hand, perceive “High finance cost (R19)” as the most significant risk factor. Industrial engineers attribute the highest significance to multiple risk factors, namely “Change in design (R5)”, “Poor quality of material (R38)”, “Construction time overrun (R50)”, “Lack of coordination/communication between subcontractors (R56)”, and “Inadequate experience in PPP projects (R58)”.

The obtained results also reveal that mechanical engineers attribute the highest mean values for risk factors “Geotechnical conditions (R4)”, “Poor productivity of labor (R36)”, “Poor quality of material (R38)”, “Construction time overrun (R50)”, “Construction productivity (R51)”, “Poor quality construction (R52)”, “Construction technology risk (R54)”, “Lack of coordination/communication between subcontractors (R56)”, “Lack of coordination/communication between stakeholders (R57)”, and “Inadequate experience in PPP projects (R58)”. Consequently, it can be deduced that mechanical engineers perceive these risk factors as more significant than other professions. Electrical engineers, on the other hand, assign the highest mean values for risk factors “Vagueness of contract clauses (R9)” and “Organization risk (R59)”, indicating that these factors are deemed more significant by electrical engineers. Architects allocate the highest mean value for “High finance cost (R19)”, highlighting that architects perceive this risk to be more significant than other professions. In summary, mechanical engineers generally attribute greater significance to numerous risk factors compared to other professions.

6. Discussion

In this study, the participants identified the top five most significant risk factors in PPP city hospital projects in Turkey as follows: “Foreign exchange rate fluctuations (R24)”, “Inflation rate volatility (R22)”, “High finance cost (R19)”, “Fiscal risk (R28)”, and “Economic crisis (R21)”. Notably, four out of these five significant risk factors fall within the “Economic” category, while the remaining risk factor “Fiscal risk (R28)”, belongs to the “Political” category.

- i. Foreign Exchange Rate Fluctuations Risk (R24): Participants have identified foreign exchange rate fluctuation risk as the most critical factor in PPP city hospital projects in Turkey. This risk entails the adverse effects of fluctuations in exchange rates on project finances, which is especially pertinent in countries that are heavily dependent on importing medical devices using foreign currencies [4]. In Turkey, where around 75% of medical devices are imported for city hospital projects, addressing this risk is of paramount importance [20]. Despite the government sharing a portion of this risk with investors, the existing sharing mechanism is perceived as inadequate. To mitigate this risk, enhancing governmental responsibility and promoting the local production of medical devices can be the suggested strategies.
- ii. Inflation Rate Volatility (R22): Inflation rate volatility has been recognized by participants as the second most critical risk factor. This risk is linked to unforeseen fluctuations in local inflation rates arising from adverse economic conditions [26]. Notably, an escalation in the inflation rate contributes to a rise in material prices [28,59]. However, inflation rate volatility is deemed as a macroeconomic condition that is inherently unavoidable. Given that it lies beyond the control of investors, the government assumes a pivotal role in risk management [28]. One initial strategy, akin to the approach taken with foreign exchange rate fluctuation risk, involves an increased level of governmental responsibility. Additionally, for investors dealing with this uncontrollable risk factor, factoring in the effects of inflation rate volatility when determining bidding prices can be recommended.
- iii. High Finance Cost (R19): High finance costs, characterized as a risk factor contingent on financial resources acquired from credit institutions or lenders [21,22], have been identified as the third most critical risk factor. In PPP projects, investors typically contribute a portion of the project cost internally and secure the majority through external financing sources. In the context of PPP city hospital investments in Turkey, the private sector is obligated to contribute a minimum equity amount of 20% of

the total investment [7,60]. Consequently, projects requiring substantial capital face challenges in securing funding, as significant loans and debts associated with large investments entail considerable risk, particularly in terms of factors such as fluctuations in interest rates, exchange rates, and financial market crises [22]. While perceived as an investor-centric risk, it also presents challenges for the public sector through increasing rental fees stemming from higher project costs. To mitigate this risk, investors can negotiate agreements with creditor institutions to secure project loans at a predetermined interest rate for a specified future date [22].

- iv. **Fiscal Risk (R28):** Participants have identified fiscal risk as the fourth most critical factor. This risk revolves around the insufficiency of available financial resources or the inability to attain a specific income level [61]. In the BLT model of PPP city hospital projects, the private sector's income is contingent upon rental fees, which are susceptible to government fiscal obligations. While governmental tax increases to fund rental fees may alleviate public debt, they can lead to fiscal unsustainability [62]. The IMF's PPP Fiscal Risk Assessment Model (P-FRAM) is recommended for evaluating fiscal risks and shaping risk mitigation strategies. This guidance is applicable to PPP projects of all sizes, with a particular emphasis on larger projects, aiding in the assessment of systemic risks, macroeconomic impacts, and the formulation of an effective risk mitigation strategy [63].
- v. **Economic Crisis Risk (R21):** The risk associated with economic crises has been identified as the fifth most significant risk factor. This encompasses pronounced economic fluctuations, currency devaluation, and elevated inflation levels [64]. Economic crises, characterized by rising inflation rates and fluctuations in exchange rates, exert adverse effects on key project success criteria, such as time and cost [51]. Given that governments possess the authority to influence conditions such as inflation rates and exchange rates, the development of policies for economic advancement becomes a strategic approach to mitigate the risk of an economic crisis. Furthermore, potential challenges in obtaining material, labor, and equipment resources may arise due to economic crises. Such crises often lead to currency devaluation and significant inflation. Consequently, project investors may experience heightened anxiety and a diminished trust in the country, potentially prompting them to withdraw their investments. To address this uncontrollable risk factor, the private sector is advised to consider the likelihood of an economic crisis when establishing bid prices during the tender stage, thus mitigating potential adverse effects.

In summary, effectively managing these substantial risk factors necessitates a collaborative approach involving both the public and private sectors. The government, in particular, holds a pivotal role in mitigating risks and fostering an environment conducive to the sustainable success of PPP projects in the healthcare sector.

7. Conclusions

Each project possesses unique characteristics, encompassing its size, structure, and complexity. This distinctiveness is particularly evident in PPP projects, which inherently tend to be more intricate compared to traditional projects, primarily due to their complex nature. In Turkey, a developing country, the PPP model is extensively employed to execute various infrastructure projects. The increasing population in Turkey has led to an increased demand for healthcare services, necessitating the construction of new healthcare facilities. However, financial constraints pose challenges for the Turkish government in undertaking this construction. To address these challenges, the Turkish government has adopted the PPP model to realize city hospital projects.

The PPP city hospital projects encompass various risk factors due to their distinctive features, and these factors can adversely affect project goals throughout its entire lifecycle. Therefore, conducting a thorough risk assessment is crucial to ensure the success of the project. This study specifically focuses on determining the priority of risk factors in PPP city hospital projects in Turkey. Initial discussions delved into the major risk factors

inherent in the employed PPP model within the healthcare sector. In alignment with the objectives, a questionnaire survey was devised based on insights from literature reviews and discussions with relevant stakeholders. The study primarily focused on identifying, evaluating, and ranking risks influencing the performance of PPP city hospital projects, while also investigating divergent risk perceptions between the public and private sectors.

The small sample size could be considered as a limitation of this study, especially for the results according to different professions. The constraint arises from the limited participants experienced in PPP city hospital projects, making it challenging to assemble a diverse participant pool. The anticipated expansion of PPP city hospital projects across a broader geographical area in Turkey over time is expected to lead to an increased number of individuals involved in the PPP city hospital model. This growth in participation holds the potential to facilitate the gathering of a more extensive and diverse dataset, thereby enhancing the robustness and realism of the findings. In this context, a larger participant pool is seen as crucial in obtaining more realistic data.

In conclusion, this research serves as an explanatory and valuable exploration of the risk factors associated with PPP city hospital projects in Turkey. Its significance lies in shedding light on the challenges and intricacies inherent in these projects, thereby contributing to a better understanding of the involved processes. The findings of this study are poised to address the existing research gap and provide valuable insights for both scholars and industry practitioners seeking a comprehensive reference on PPP project risks. Findings can lead both public and private stakeholders engaged in such ventures to more informed decisions and better project planning with particular interest to risk mitigation strategies. Unfolding differences in perceptions may provide better participant alignment that may reduce conflicts and ensure safe project execution. Additionally, this study caters to the needs of domestic and international stakeholders interested in participating in PPP city hospital projects in Turkey and in countries with similar conditions and comparable PPP projects. Further research endeavors could focus on different types of PPP models and PPP healthcare projects across various countries. Additionally, there is a prospect to undertake factor analysis studies within this specific context.

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