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Assessing the Barriers and Risks to Private Sector Participation in Infrastructure Construction Projects in Developing Countries of Middle East

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Abstract: In developing countries, governments are often unable to implement urban infrastructure construction projects (UICPs) on their own, mainly due to budget and financial resource limitations. The participation of the private sector, through public–private partnerships (PPPs), has been considered as an alternative effective method for increasing the efficiency and productivity of urban infrastructure development. However, in many developing countries such as those situated in the Middle East, attracting private sector investments for UICPs uncovers profound challenges that have not ever been comprehensively accounted for and prioritized. To fill this knowledge gap, this study seeks to determine and prioritize the major barriers and risks faced by governments and urban managers in attracting private sector investments through the PPP schemes launched by developing countries in the Middle East. Based on a Delphi study conducted in Iran as an example, the opinions of 60 UICPs experts in both the public and private sectors were collected and analyzed. Results show that technical and organizational barriers and risks were perceived as the most important to private sector participation, followed by economic and financial barriers and risks, and then political and legal barriers and risks.

Keywords: construction projects; public private partnership; infrastructure; developing countries

Citation: Tamošaitienė, J.; Sarvari, H.; Chan, D.W.M.; Cristofaro, M. Assessing the Barriers and Risks to Private Sector Participation in Infrastructure Construction Projects in Developing Countries of Middle East. *Sustainability* **2021**, *13*, 153. https://doi.org/10.3390/su13010153

Received: 8 December 2020
Accepted: 22 December 2020
Published: 25 December 2020

1. Introduction

Urban infrastructure construction projects (UICPs) have been widely recognized as a crucial driver of economic development [1,2]. However, lack of budget and lack of access to novel technologies has led many governments in developing countries to invite the private sector to participate in the financing of infrastructural projects, previously monopolized by the government [3]. Indeed, accelerating the economic growth process of developing countries requires the reduction of the level of government participation in non-governmental activities, which can be defined under the topic of "privatization" [4–6]. A means often used to attract private entities to sustain public projects, without losing government control, is the public–private partnership (PPP) [7]: a long-term contract between public and private organizations with the goal of financing, designing, implementing, and commissioning infrastructure and service projects [8]. PPPs allow a public body to retain governance duties and legal responsibilities while also accepting and minimizing part of the risk of the project—done in order to attract the participation of the private sector in the development of infrastructures.

From what has been reported, there is need and interest in discovering and analyzing the success factors and drivers of failure for PPPs in urban infrastructure construction projects (UICPs) in developing countries, as witnessed by the vast amount of literature produced [9–12]. However, despite these numerous studies investigating these elements [13,14] in developing countries [15,16], none has identified and ranked—in a comprehensive manner— the barriers and risks of PPPs undertaking UICPs in developing countries, especially in the Middle East. Taking interest in the Middle East specifically is necessary due to its increasing role in worldwide economics, as well as for its peculiarities that differentiate it from the rest of the world [17]. Indeed, private sector investment in the Middle East has been a foundation of development projects since the Islamic revolution and subsequent governmental changes, and the use of the capacities of the private sector in the acquisition of capital assets for projects using the PPP model has been prioritized in the Iranian national budget over the March 2018–March 2019 period [18]. With that in mind, this work tries to answer to these interrelated research questions:

RQ1a: What are the barriers and risks of applying the PPP model in UICPs in developing countries in the Middle East?

RQ1b: What is the distinctive importance of the barriers and risks of applying the PPP model in UICPs in developing countries in the Middle East?

In order to identify and rank the barriers and risks of applying the PPP model to UICPs in Middle Eastern developing counties, a questionnaire was distributed among 60 Iranian experts who had experience as an employer or as part of a contractor team involved in a PPP in a UICP. After analyzing the identified barriers and risks, the effect of these barriers and risks and their prioritizations were determined through the use of the Friedman test. Results show that technical and organizational barriers and risks were perceived as the most important to private sector participation, followed by economic and financial, and then political and legal, barriers and risks. The results of the current study can help both the public and private sectors in better decision-making and implementation of PPPs for the development of UICPs. However, due to the limited experience in Iran regarding PPPs in UICPs, it is necessary to investigate the successes and failures of other countries and use these experiences to forge a path for the success of PPPs in UICPs.

The roadmap of this study is as follows. Within the second section we offer an updated literature framework concerning the use of PPPs in UICPs, highlighting barriers and risks and success factors. Then, the methodology is presented in the third section. Within the fourth section we revealed the results of the quantitative and qualitative analysis, and in the fifth section these are discussed in the light of prior literature. Implications, limitations, and future research suggestions conclude the contribution.

2. Barriers, Risks, and Success Factors of Construction Projects

The construction sector is a significant part of the economy in many countries [19]. According to a study by the Organization for Economic Co-operation and Development (OECD), the construction sector generates up to 10% of gross domestic product (GDP) in OECD and other developing countries. An efficiently functioning construction sector is also one of the most critical investment sources. Barriers and risks should be assessed to encourage private sector participation in construction projects and make related processes more effective [20,21].

Generally, construction projects are assessed considering emerging barriers, risks, and the complexity of the structures. Projects can be classed by the type of a building, i.e., special, non-special, and simple; construction works, i.e., new construction, reconstruction, renovation or repair; or the purpose of the building under construction, i.e., residential or non-residential, industrial, commercial, historic, and special structures (Figure 1).

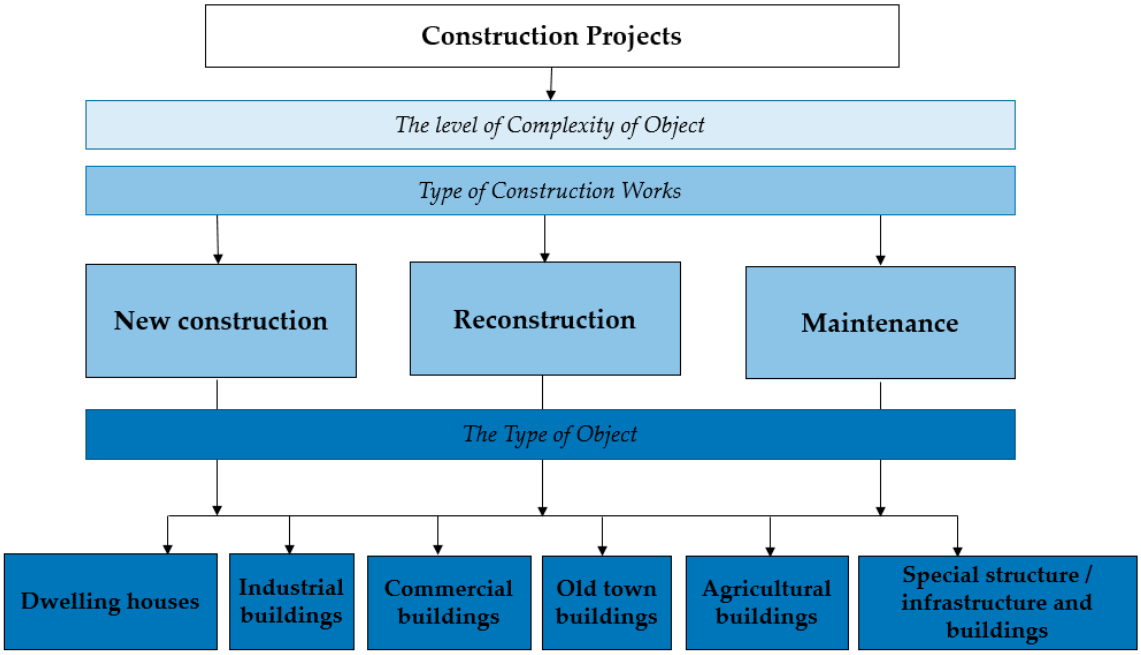

Figure 1. Main classification of construction projects.

Infrastructure projects are among the most extensive construction tasks. Apart from being large-scale, infrastructure projects also require substantial capital investment. Often, an upswing in the national economy results in a higher demand for roads, electricity, water-supply, and sewerage networks, and other types of infrastructure. Countries have found it difficult to keep up with the latest economic developments and demands for infrastructure. The pressure of infrastructure construction projects is compounded by public pressure to complete them quickly and within budget. As a result, the time allocated for the completion of an intensive project-risk analysis, especially during construction, is not always sufficient.

The construction of large-scale infrastructure projects must start from a thorough construction risk assessment. The Construction Industry Research and Information Association recommended that the awarding of a construction risk allocation contract for a specific project should be based on [20]: (1) a description of the nature, likely frequency, and extent of the risk; (2) identification of where it may occur; and (3) enforcement measures if the risks nevertheless materialize.

The most important criteria for identifying risks and barriers should be the magnitude of the potential consequences and their assessment.

The European Standard (EN) 1990 [22] also stipulates that only the most impactful structures should be subjected to extended third-party design supervision and inspections. For all other structures, normal maintenance is sufficient, which in the case of low-risk structures can be performed by the participants of the construction process. In the case of medium-risk structures, in accordance with the organizational procedures, persons other than those who were originally responsible for the preparation of the project or the execution of the construction work should undertake the role. Countries with construction control which is considered as an example of good practice have long used the private sector for such help. Depending on the country, inspections can be carried out by the participants of the construction process or by independent private sector experts, i.e., in the case of high-risk buildings. Currently, only the expertise of buildings and their projects is delegated to the private sector in Europe. Often, the entirety of the remaining process is still managed by public authorities [19,23,24].

Some important aspects to be mentioned for the risk and barrier assessment of construction projects are presented below.

2.1. Contractual Relations

Infrastructure construction projects vary by type of project organization and contracting. Possible options include fixed price, unit price, supply of an equipped object, or "plus cost" contracts. Unit price-type contracts are predominant among infrastructure construction projects in Asian countries.

Contracts of this type require detailed information on the party of ownership, as well as specific information on the legal systems, site conditions, local subcontractors and suppliers, and labor, etc.

Unit price contracts follow a strict sequence of planning and design, supply, and construction. Builders or contractors cannot influence the language or terms of the contract.

In practice, due to bureaucratic systems and government regulations, most project owners, who are government agencies, are reluctant to provide important information about previous projects for risk assessment purposes. This can affect the execution of the project and the relationship with the owner [20]. Contractual and organizational relationships within large-scale construction infrastructure projects are usually complex.

A contract for an international project usually involves several parties, and the governance model is divided into three levels. These levels reflect the direct relationship between:

A. The project owner or their representatives, and contractors (general and designated);
B. Contractors (general and designated) and subcontractors and suppliers (domestic and foreign). To avoid uncertainties surrounding costs, East Asian countries have a practice of transferring construction risk to general and nominated contractors. According to established traditions and culture, fairness is considered paramount in government-funded projects, as local contractors need to maintain good relations for the sake of future projects. Claims and disputes are usually resolved at the site or at the project level. In such cases, government organizations have the overriding right to decide what to do with claims;
C. Subcontractors (domestic and foreign) and suppliers (domestic and foreign).

These categories may overlap.

2.2. Construction Project Characteristics

In the case of construction projects the technical characteristics of the structure, such as area or height, should be considered in determining the likelihood of defects, not in isolation but rather in conjunction with the magnitude of the effects of the structure. Often, many structures can be classified as high-risk only because of the area parameters. Particular attention must be paid to infrastructure projects.

Infrastructure projects focus on the development and maintenance of services, facilities, and systems. These can be funded by private companies, public funds, or a combination of both, i.e., public–private partnerships (a form of collaboration between a government and private sector companies). Private investments can help in the management of the economic development of a city, state, or entire country.

Infrastructure projects can be grouped according to content, complexity, and size into:

- Aviation infrastructure projects, which develop and maintain airplanes and airports;
- Bridge infrastructure projects, which oversee the costs of building and maintaining bridges throughout the country. This includes heavily trafficked highway bridges that are accessed daily;
- Communications infrastructure projects, which focus on the connection between government agencies, businesses, and the nation through wireless, cable, satellite, and other technologies. Private and government sectors work together, ensuring that outages are fixed, and updates keep wireless networks streamlined;
- Power and energy infrastructure projects that deal with power, including electrical lines, power grids, and alternative energy innovations;

- Railroad infrastructure projects, which are responsible for innovating and safeguarding trains, subways, and light rail systems. This includes track layout, steel supplies, bridges, and tunnels;
- Road infrastructure projects, which focus on building new streets and fixing the existing network of streets, roads, and highways for mass transit. It also oversees the developing transportation projects that grant greater transportation access to communities.

Difficulties in implementing infrastructure construction projects are compounded by public pressure to complete them quickly and within a pre-defined budget. As a result, the time allocated for the completion of an intensive project-risk analysis, especially during construction, is often insufficient. Therefore, prior to the construction of large-scale infrastructure projects, a thorough construction risk assessment must be performed. It is recommended that the awarding of a construction risk allocation contract for a specific project should be based on:

- A description of the nature, likely frequency, and extent of the risk;
- Identification of where it may occur; and
- Enforcement measures should risk materialize.

2.3. Risks in Construction Projects

Many researchers have tried to address risk allocation issues in construction projects [24]. It is rational to take the position that the risk should be attributed to the party best able to control it, and if both parties fail to do so, the risk should be attributed to the owner. Traditionally, the owner, as a government agency, tries to transfer almost all risk to contractors who, in turn, try to transfer part of it to subcontractors or suppliers [20].

In general, construction risk is divided into six groups:

(1) physical,
(2) competency-related,
(3) economic,
(4) political and social,
(5) construction-related, and
(6) contractual and legal.

Such grouping is considered narrow and schematic for complex construction projects. Each risk category can be assigned to a specific type of construction work to be performed by a specified party. Risk is distributed naturally, according to the work being done and the parties responsible for that work. Prior to the start of construction, the integration of the works, the types of risks, their connections, and the responsible parties must be carefully examined.

The breakdown of organization, work, and risk can be more detailed to demonstrate the potential for more accurate risk reduction. Contractors are responsible for key risks, such as underground conditions, natural disasters, and complications related to the construction site access. Risk identification is paramount when estimating works. General contractors or subcontractors may add significant contingencies to their bids in order to cover the costs of identified risks. If risks and responsibilities are not properly allocated, claims and disputes can arise during construction.

Complex construction projects often involve interdisciplinary activities and the construction of various types of structural elements, of which underground works (especially underground conditions and construction safety) are at most risk. Infrastructure projects are financially intensive and long-lasting, which poses significant financial risks.

Often, costs are exceeded due to unexpected geological findings, which is one of the problems faced by infrastructure construction projects. Due to increasing pressure from Non-Governmental Organizations (NGOs) regarding environmental issues, political and public interference is becoming yet another serious problem that can lead to the suspension or cancellation of a project even during construction. Up to a certain point, in each case,

specific and adverse events can be identified in the construction of large-scale as well as infrastructure projects.

Well-prepared contract terms should set out possible events and seek to assign risks and responsibilities to those who are best placed to control such events. Otherwise, risk-related losses result in cost overruns and a prolonged work schedule.

Four factors in this category were considered significant, namely, delays in construction works; changes in works; labor, materials and equipment resources; and delayed access to the site. The most significant risks are associated with construction delays and changes in works. The results confirm the general concern about construction risks in large infrastructure projects.

- Physical risk: Risk of geological conditions, including groundwater, safety on the construction site, etc.
- Contractual and legal risks: Negotiations on a modified order and delayed dispute resolution are significant project risks. Prolonged negotiations arising from disputes or changes in the value of construction works are an undesirable factor for many contractors.
- Risks related to the quality of works: Poor performance and productivity are the most important risk factors in this category. Low-quality work is considered a significant risk factor as it not only leads to construction delays and additional costs, but also to disputes over liability for defects. As for productivity risk, factors related to equipment are considered more important than factors relating to labor. Compared to other types of projects, progress in hydropower construction is usually determined by equipment performance.
- Financial and economic risk: Inflation and financing are significant risk factors, which can be expected given the current economic situation. Labor shortages, and rapidly rising wages and material prices pose certain risks to contractors. Changes in the market also negatively impact on the financing of construction infrastructure projects.
- Political and social risks: This category focuses on environmental risk assessment.

2.4. Comparison of Contract Conditions

One of the most important elements of a construction project contract is the conditions governing the legal aspects of the construction works; meanwhile, engineering documents, such as plans and specifications, must detail the technical side of the construction works as fully as possible.

In many infrastructure projects, uncertainties about liability usually stem from the inability to define the scope of the risk, the frequency of occurrence, and the limits of liability between the parties in the terms of the contract. This uncertainty can be reduced through clearly defined contractual terms.

Two preconditions are necessary for the successful and appropriate allocation of construction risk:

- trust among contract partners;
- clear mutual assessment of all relevant risk factors and their effects [20].

In this case, the terms of the contract can specify the definition of success, which would also distribute the construction risk factors, such as construction delays, different construction site conditions, changes in work, etc. The agreements further define the relationship and obligations of the parties. Particular attention must be paid when describing the general terms and conditions of the contract, which is the most important and often the most controversial part of all contractual documents. If written without considering the contractor's perspective, the terms of the contract can become biased and too focused on the owner's interests. Potential sources of claims and disputes (barriers) arise when the terms of the contract attribute risks which cannot be controlled to the contractor, such as access to the construction site, owner-initiated changes, and unpredictable or undisclosed terms, etc.

Social welfare, achieved through development processes, is one of the main duties of governments in the current century. Various countries aim to increase the speed of their development efforts in order to not only improve welfare in their society, but also to improve their role and position in international relations [25,26]. Achieving these aims requires the creation and development of suitable physical infrastructures. One of the most important economic development infrastructures is the development of transportation networks, especially urban transportation networks. The development of transportation networks is traditionally one of the duties of the government [27]. The high value of these infrastructures in a countries' overall development process, through their role in developing other economic sectors and their effect on the improvement of social factors due to the presence of an increased level of public services, means that governments are incentivized to move towards the development and strengthening of these infrastructures [28]. One of the possible methods to achieve this aim is through direct investment in this sector from governments. However, limitations of financial resources, long decision-making times, and the low productivity levels of government projects usually cause serious barriers and risks for the development of these infrastructures [12]. One alternative method is to use the financial and executive abilities of the private sector, including credible private companies and foreign investments as well as national and international banks, which results in better financing and higher productivity of these projects in comparison to government projects [8].

In recent times, attempts have been made to use various methods in order to take advantage of the managerial, financial, and technical capacities of the private sector for the development of economic infrastructures. The use of the private sector in the development of urban infrastructures is often due to limitations of government budgets, limited time, and increased demand for the improvement of these infrastructures [4]. In today's world, urbanization is expanding in all its dimensions and due to this increased urbanization and the necessity of achieving safe, environmentally friendly, and clean cities, urban managers attempt to answer citizens' and organizations' expectations regarding cities and urban management and make plans for managing a modern and developed urban environment [15,29]. In the past, it was possible to manage cities through government intervention and financing methods, such as taxes, due to their limited population. However, the increase of urbanization, increased demands from urban management, the necessity of implementing new programs by urban management, and ensuring the sustainability of urban services has created the need for new financial resources. Nowadays, one of the common methods used in urban management in developing countries to reduce the dependence on government support and move towards sustainable incomes is the use of new financing methods in urban management, above all PPPs [3,11,30]. The success of municipalities in this regard requires new and updated regulations, legal support from relevant organizations, and the trust of investors and citizens. It is obvious that the implementation of this method requires suitable legal and technical frameworks for systematic partnerships between public and private sectors in creating a culture of PPPs in the country [26,31]. However, unfortunately, there are currently numerous problems, barriers, and risks working against PPPs. Table 1 shows the barriers, risks, and problems faced by PPPs working on UCIPs, according to previous studies.

Table 1. Barriers and risks to private sector partnerships in construction projects according to the literature review.

Barriers and Risks	Source
Attracting internal and foreign investors	[32,33]
Reduced dependence on government funding and taxes, and identifying sustainable income sources	[32,34]
New financing methods and tools	[32,34]
Issuing bonds and banking loans	[34]
Creation of updated laws and regulations for attracting private partnership	[30,34–36]
Legal support of relevant organizations from the private sector (including the central bank, ministry of internal affairs, ministry of finance, municipalities, governors' offices, etc.)	[34]
Gaining the trust of investors and citizens	[34]
Creating legal and technical infrastructures for partnership with the private sector	[34]
Creating systematic cooperation between public and private sectors	[18,34]
Creating suitable organizational cultures in relevant organizations	[34,37]
Creating a suitable national culture	[34]
Administrative and executive barriers and risks of privatization	[33,38]
Economic and political barriers and risks	[38,39]
Reduced partnership of public and private sectors due to corruption in relevant organizations	[33]
Commitment to long-term contracts	[40]
Danger of civil war	[40]
Lack of commitment to contracts in governments	[40]
Administrative health and legal transparency	[33,38]
Importance of economic freedom with public–private partnership	[28]
Government's guarantee for return of investment with suitable profit	[12,18]
Reduction of risks and concerns of the private sector	[12,18]
Bureaucracy and extra regulations in contracts and payments	[41,42]
Lack of confidence in investment and low contract values	[28,41]
Lack of skill and knowledge in project contractors	[41]
Lack of financing skills in municipalities	[41,42]
The presence of effective organizations for reflecting public opinions	[43,44]
Miscommunication between private sector and organizations	[28,44]
Lack of independence in organizations	[43,44]
Lack of structural variation in relevant organizations	[44]
Creation of effective regulations for attracting private partnership	[43,45]
Creating a safe environment for investment	[44,45]
Transparency of mechanisms in activities	[43,46]
Trust of public opinion in municipalities (trust building)	[44,46]
Information, advertisement, and marketing for private sector partnership	[45,46]

Table 1. *Cont.*

Barriers and Risks	Source
Stability of laws and regulations	[43,44]
Ease of licensing process in municipalities	[28,34]
Long licensing processes and unsuitable work environment	[34,38]
Troubleshooting of various dimensions of investment by relevant authorities	[28,34]
Updating current laws and regulations	[34,38]
Training of authorities and government managers in order to improve their communication and cooperation skills with private sector	[34]
Implementation of projects using traditional methods	[30,35,36]
Lack of attention to cost reduction and management in contractors	[30,35,36]
Increased partnership with foreign investors and localization of new technologies	[30,35,36]
Management control in partnership contracts	[33,38]
Conclusion of projects with a suitable schedule	[30,35,36]
Flexibility in assigning of projects	[30,35,36]
Management weakness and control conflicts during changes in projects	[30,35,36,42]
Weakness in management and project control planning in government organizations	[30,35,36]
Lack of sufficient liquidity in the private sector	[30,35,36]
Lack of access to sufficient resources (skilled workforce and updated equipment) in the private sector	[30,35–37,40]
Lack of desire in the private sector for competition in project assignment due to lack of support and interference from government organizations in projects	[30,35,36]
Using public–private partnership contracts to transfer part of the risk in projects to the private sector	[30,35,36]
Lack of feasibility of projects for the private sector	[30,35,36]
Updating the project and use of novel management technologies	[30,42]

Among these studies, to provide some examples with the aim of identifying the effect of organizational environments on public–private partnerships in Canada, we used expert opinions in order to evaluate PPP projects in Alberta, Canada, between the years 2004 and 2016 [31]. Their study emphasized the role of financing and accounting in PPPs and evaluated their performance based on the nature and scale of decisions and their effects on long-term financial stability. Their results showed that political environment and organizational capacity are important factors, among others, in the success of partnership projects. In another study, Oppio and Tolrrieri focused on the advantages of the surplus created by public and private developers in urban development interventions [47]. To this end, they suggested the use of measures to ensure the fair distribution of profits between these two sectors. In this study, they used a case study of urban renovation projects in the city of Milan in order to measure potential risk prevention and uncertainty in these projects.

Regarding the barriers and risks of PPPs undertaking UCIPs in developing countries, Willoughby investigated large-scale PPP projects in several cities in South America and Eastern Asia and showed that, despite delays and mistakes in the development of many PPP projects, the overall results are still positive and promote the use of PPPs: their involvement significantly improves the development of transportation networks [48]. Yet, Mahalingam assessed—through a combination of archival sources, case studies, and insights from a roundtable discussion on PPPs—key barriers and risks that PPP projects

face in the urban Indian context and cited the following five areas: distrust between the public and private sector; a lack of political willingness to develop PPPs; the absence of an enabling institutional environment for PPPs; a lack of project preparation capacity on the part of the public sector; and poorly designed and structured PPP projects [49]. Lastly, Babatunde and Pereira assessed the barriers and risks to bond financing for public–private partnership (PPP) infrastructure projects in Nigeria using an empirical quantitative analysis [13]. Results of their study show that, among the 12 identified barriers and risks, governance and institutional capacity issues, higher issuance costs and risks, difficulties in getting approval for changes, the small size of bond markets, and stringent disclosure requirements are considered to be the most harmful for PPPs [50].

With regards to construction risk and liability sharing, the extent and nature of construction risk depends largely on three factors:

1. contractual relations between project participants;
2. construction project characteristics; and
3. risk allocation.

3. Research Methodology

Since this study aims to identify and evaluate methods for increasing private sector partnership in the implementation of urban construction projects, it uses a descriptive correlational design. Furthermore, since a large group of private sector investors as well as policymakers and planners in public sector can use the result of this study, it can be considered to be an applied study. First, in order to review the literature regarding the subject of the study, necessary data and information were gathering through library study and various internet databases. Then, the initial questionnaire was designed based on the results of the literature review [13]. Then, through the use of three-rounds of the Delphi study and the distribution of a semi-structured questionnaire (containing open-ended questions), the final barriers and risks for investment from private sector were identified according to experts. In order to identify the perception of managers and the compatibility between their opinions and the literature on the subject, and in order to provide more practical suggestions along with questionnaire, structured interviews (based on open-ended questions) were used to gather the opinions of managers [51]. The study population included experts, company managers, project managers, organizations, and employers and contractors in public–private partnership projects, in addition to experts active in the field of public–private partnership projects and urban construction. In order to estimate the sample size in this population, the Cochran formula with unknown population was used, and this is explained in detail in the following section. Finally, the results obtained from the questionnaires were organized into different tables and the Kolmogorov–Smirnov test was used to determine normal distribution of data and their parametric or nonparametric nature. The analyses were carried out after determining the type of statistical tests and the results were extracted. Figure 2 shows the overall flowchart of the research method used in this study.

3.1. Survey Questionnaire

In this study, the initial questionnaire was designed in order to identify the barriers and risks for PPPs undertaking UICPs in Middle Eastern developing countries. Similar to other studies in the same field [52,53], some barriers and risks obtained through the Delphi rounds were eliminated from the initial questionnaire and some items were also added to the questionnaire. For example, in the category of financial barriers and risks, three factors were added to the list, including the financial dependence of a project to other projects during the commissioning period, a lack of certainty regarding the financial costs in the maintenance and commissioning period due to inflation, and a lack of use of novel financing tools and methods. Furthermore, according to experts' opinions, the title of financial barriers and risks was changed to economic and financial barriers and risks. The investigations regarding the reliability of the initial questionnaire and calculation

of Cronbach's Alpha also resulted in moving the "legal barriers and risks caused by stakeholders" item to the list of political and legal barriers and risks. On the other hand, human resource barriers and risks were added to the organizational barriers and risks, due to low reliability, and the title for this category was changed to technical and organizational barriers and risks.

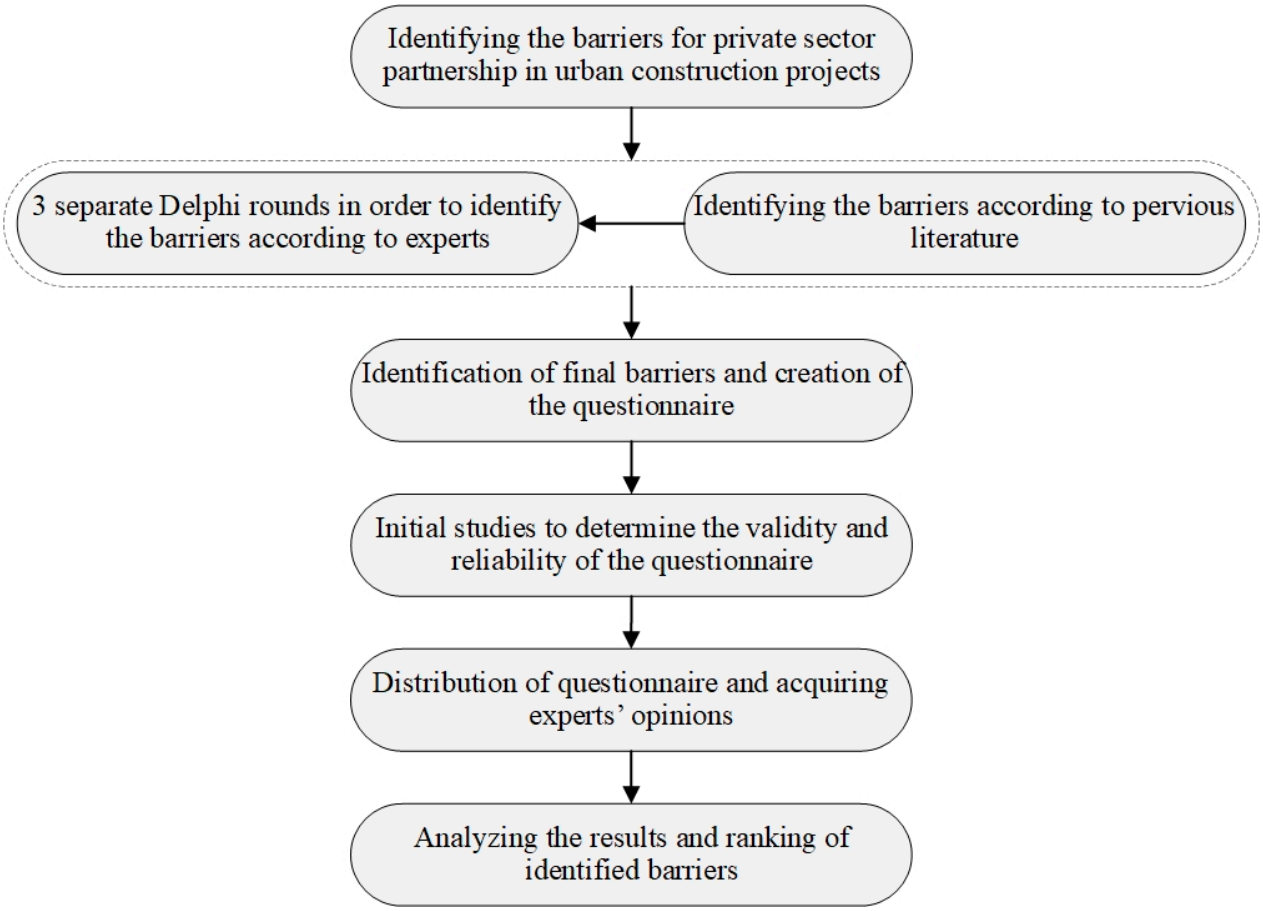

Figure 2. The research process of the study.

Reliability is one of the important technical characteristics of measurement scales. Reliability indicates whether the scale provides similar results under similar conditions or not. This means that if the questionnaire is used twice under the same conditions the results should be identical, if the questionnaire is fully reliable. According to Able and Frisbee, reliability is the correlation between a set of scores and another set of scores in an equivalent test which have been acquired independently for a test group. This means that the reliability can vary within a range of 0 (unreliable) to 1 (fully reliable). If the Cronbach's Alpha value is higher than 0.7, then the reliability is good, a value between 0.7 and 0.5 indicates mediocre reliability, and a value below 0.5 indicates low reliability of the questionnaire [51]. Various tools are used to calculate the reliability of a scale. In this study, Cronbach's Alpha coefficient was used to determine the questionnaire's reliability.

According to Table 2, reliability was investigated for 30 items in the questionnaire. The overall Cronbach's Alpha was calculated to be 0.801 which is higher than 0.7, indicating the good reliability of the questionnaire [51]. Table 2 shows the Cronbach's Alpha coefficient for three major categories of the questionnaire.

Table 2. Reliability test for the main categories of barriers and risks identified in the questionnaire.

Main Categories	Number of Items	Cronbach's Alpha
Economic and Financial Barriers and Risks	10	0.719
Technical and Organizational Barriers and Risks	11	0.854
Political and Legal Barriers and Risks	9	0.907
Total	30	0.801

3.2. Study Population

The population in this study can be divided into experts of both the public and private sectors. In order to calculate the sample size in this study, the Cochran formula with unknown population was used. The Cochran formula presented in Equation (1) is the most popular method for calculating the size of a statistical sample (similar to other studies [52]). This formula can be used to estimate the minimum sample size for a population. In order to estimate the sample size, it is necessary to know the variance in the population. In this equation, the value of σ^2 represents the variance obtained from the pilot study which included 20 subject-matter experts. The data obtained from the 20 experts who reviewed the survey led to a variance equal to 0.039. The value of the Z-score, $z\alpha/2$, is also a constant value that depends on the confidence interval and the error level. In this study, the error level (e_0) was set to 0.05, and thus, the confidence level is 95%. Therefore, the value of $z\alpha/2$ at the 95% confidence level is 1.96. Inserting this information into Equation (1), the sample size for the surveys is 60.

$$n = \frac{\frac{z\alpha}{2}^2 \sigma^2}{{e_0}^2} \quad (1)$$

where: $z\alpha/2 = 1.96$, and $e_0 = 0.05$, *and* $\sigma_1^2 = 0.039$.

Thus

$$n_1 = \frac{\frac{z\alpha}{2}^2 \sigma_1^2}{{e_0}^2} = \frac{3.8416 \times 0.039}{0.0025} = 60$$

4. The Risk Assessment of Individual Barriers and Risks to Private Sector Partnership Involvement in Urban Infrastructure Projects

4.1. Identifying the Barriers and Risks to Applying PPPs in UICPs in Developing Countries in the Middle East

A careful review of the previous literature and the results of the distribution of the questionnaire in the Delphi rounds was used to identify the barriers and risks for private sector partnerships in urban construction projects. Delphi rounds were used to refine the barriers and risks identified during the literature review and a number of barriers and risks were added or removed. Then, the final questionnaire regarding PPP barriers and risks was created and was distributed among experts in both the public and private sectors. Finally, the questionnaire results were analyzed. Table 3 shows the categorization of PPP barriers and risks for the implementation of urban construction projects.

In this section, the descriptive statistical indices are presented. As we know, raw data cannot be used for presenting comprehensive information and therefore data must be summarized using various indices. In this part, various indices are used to describe the data in this study.

Table 4 shows the descriptive statistical data for the three main categories of barriers and risks, including mean and standard deviation (deviation from mean) for each category. The results presented in Table 4 show that the technical and organizational barriers and risks for partnership have the highest mean of 42.26 which indicates their importance according to experts. Furthermore, the mean scores for economic and financial, and political and legal barriers are 38.25 and 35.51, respectively. In this study, the Kolmogorov–Smirnov test is used to investigate the normal distribution of data. This test is one of the fitting tests which is used to determine the compatibility of actual distribution of a factor with a certain distribution type. In this study, this test was used to investigate the normal distribution of

the data. The hypotheses in this test are as follows: (i) H_0: $p > 0.05$ Distribution is Normal, and (ii) H_1: $p \leq 0.05$ Distribution is not Normal.

Table 3. The identified main categories of and the associated individual barriers and risks to private sector partnerships in urban infrastructure projects.

Category	No.	Partnership Barriers and Risks
Financial and economic	1	Lack of financing skills in the public sector
	2	Lack of use of novel financing tools and methods
	3	Lack of suitable financial and tax support by the public sector
	4	Lack of guarantee from government for return of investment and suitable gain
	5	Financial dependence of the project to other projects in commissioning period
	6	Lack of sufficient liquidity in the private sector
	7	Lack of attention to cost reduction methods in contractors
	8	Lack of financial feasibility of project for the private sector
	9	lack of certainty in financial costs during maintenance and commissioning due to inflation
	10	Lack of certainty in investment and low contract values
Technical and organizational	11	Miscommunication between the private sector and organizations
	12	Lack of desire for competition in the private sector for projects
	13	Lack of management knowledge and control of construction projects in private companies
	14	Lack of sufficient equipment and technology in the private sector for implementation of projects
	15	Lack of possibility/ability for use of foreign experts in projects
	16	Lack/deficiency of skilled and efficient workforce in the private sector
	17	Lack of experience with regards to PPP contracts in the private sector
	18	Lack of trust between the public and private sectors
	19	Lack of organization in private sector companies
	20	Lack of systematic cooperation between the public and private sectors
	21	Lack of technical knowledge in public sector employees in relation to construction projects
Political and Legal	22	Lack of clear contracts for investment in partnership projects
	23	Lack of legal and technical infrastructures for partnership
	24	Conflicts among project's stakeholders
	25	Lack of third party (mediator) in case of conflict
	26	Lack of guarantee for long-term commitment of parties to contracts
	27	Political and legal changes in the public sector
	28	Lack of competent managers in public sector policymaking
	29	High political nepotism in project assignment
	30	Lack of proper risk distribution between different sectors

Table 4. Descriptive data for barriers and risks to private sector partnerships in urban infrastructure projects.

Category	Mean	Standard Deviation
Economic and Financial Barriers and Risks	38.25	2.13
Technical and Organizational Barriers and Risks	42.26	1.08
Political and Legal Barriers and Risks	35.51	0.99

The results presented in Table 5 show that in the confidence limit, all categories have p values of less than 0.05 (zero hypothesis is rejected). Therefore, the distribution of data in various categories is not normal. Due to the non-normal distribution of data, it is necessary to use non-parametric tests for further analyses. The Kruskal–Wallis test is the non-parametric equivalent of analysis of variance (ANOVA) test, the results of which are presented in Table 6. This test is used to investigate the equality of means in three categories of barriers and risks in the questionnaire, according to three groups of experts including consultants, employers, and contractors. According to the results, the hypothesis of equal means for financial and economic partnership barriers and risks, according to three groups of experts including consultants, employers, and contractors, is rejected at the significance level of 0.05. Therefore, according to the results, these three groups of experts have different opinions regarding the importance of barriers and risks in the financial and economic category. However, there is no significant difference in means in the two other categories, technical and organizational, and political and legal barriers and risks, indicating similar opinions in different expert groups. In order to see which group of experts have a different opinion in comparison to others, the Mann–Whitney follow-up test is used.

Table 5. The results of the Kolmogorov–Smirnov test for normal data distribution of the barriers and risks to private sector partnerships in urban infrastructure projects.

Category	Significance Level (p Value)
Economic and Financial Barriers and Risks	0.000
Technical and Organizational Barriers and Risks	0.005
Political and Legal Barriers and Risks	0.000

Table 6. The results of the Kruskal–Wallis test for equality of means according to three expert groups of consultants, employers, and contractors.

Category	Significance Level	Chi-Square
Economic and Financial Barriers and Risks	0.013	8.6
Technical and Organizational Barriers and Risks	0.053	5.8
Political and Legal Barriers and Risks	0.101	4.5

The Mann–Whitney and Wilcoxon tests are the non-parametric equivalent of independent two-sided T-tests in parametric datasets. The zero hypothesis in this test is equality of opinions between two groups and if the zero hypothesis is rejected, it means that two groups have had difference of opinions regarding economic and financial barriers and risks.

According to the results of the Mann–Whitney and Wilcoxon tests presented in Table 7, it can be concluded that employers and contractors have similar opinions regarding economic and financial barriers and risks, while there has been difference of opinions between consultants and contractors, and consultants and employers.

Table 7. The results of the Mann–Whitney and Wilcoxon tests for comparison of expert groups' opinions regarding economic and financial barriers and risks for private sector partnerships.

Compare Expert Categories	Mann–Whitney	Wilcoxon	*p*-Value
Employers and contractors	183	886.5	0.341
Employers and consultants	17.5	83.5	0.002
Contractors and consultants	115.5	181.5	0.025

4.2. Identifying the Barriers and Risks to Applying PPPs in UICPs in Developing Countries in the Middle East

The results of the Friedman test were used to prioritize the main categories of barriers and risks for private sector partnerships in urban construction projects.

Table 8 shows the prioritization of the three main categories of barriers and risks. According to the results of the Friedman test, technical and organizational barriers and risks had the highest priority for private sector partnerships, with economic and financial, and political and legal barriers and risks occupying the next ranks. The barriers and risks in each category were also prioritized using the Friedman test and the results are presented in Table 9. The correlation coefficient is one of the factors used to determine the correlation between two parameters. In this study, Spearman's correlation coefficient is used to determine the relations between parameters due to the non-normal distribution of parameters. This coefficient is defined in the range of −1 to +1, with values closer to 1 indicating a stronger correlation between two parameters. The correlation coefficient is therefore capable of showing the size as well as the type (direct or inverse) of correlation, where +1 indicates a full direct correlation and 0 indicates a lack of correlation. Table 10 shows correlation coefficients with significant coefficients at levels of 0.05 and 0.01 being marked with * and **, respectively. Regression and correlation have different aims. The aim of correlation models is to investigate the relation between two or more parameters, while regression attempts to predict a parameter's values according to other parameters. Table 10 shows the pairwise correlation coefficients for the most important barriers and risks according to experts (ranked 1 to 4).

Table 8. Prioritization of the main categories of barriers and risks according to the Friedman test.

Category	Priority
Organizational and Technical Barriers and Risks	1
Economic and Financial Barriers and Risks	2
Political and Legal Barriers and Risks	3

According to the results presented in Table 10, the lack of attention given to cost reduction methods by contractors has a large direct correlation with a lack of systematic cooperation between the public and private sectors. The high correlation between these two barriers and risks can be used to conclude that, according to experts, contractor's attention to cost reduction methods can lead to better systematic cooperation between the public and private sectors. It can also be concluded that one of the reasons for the lack of systematic cooperation between the public and private sectors is due to the lack of attention to implementation methods by contractors and the use of traditional and inefficient methods in construction projects. Therefore, one of the important strategies for attracting private sector partnerships to urban construction projects involves informing contractors about novel implementation methods and providing them with suitable management methods for cost reduction in urban construction projects. The use of proper implementation methods by contractors can reduce the cost of projects, which in turn results in a higher level of desire for partnership projects in the public sector and increased private sector partnerships in urban construction projects.

Table 9. The prioritization of partnership barriers and risks according to the Friedman test results.

Barrier	Rank
Lack of management knowledge and control of construction projects in private companies	A—1
Lack of attention to cost reduction methods in contractors	B—2
Lack of systematic cooperation between the public and private sectors	C—3
Lack of use of novel financing tools and methods	D—4
High political nepotism in project assignment	5
Lack of legal and technical infrastructures for partnership	6
Lack of sufficient equipment and technology in the private sector for implementation of projects	7
Lack of certainty in financial costs during maintenance and commissioning due to inflation	8
Lack of competent managers in public sector policymaking	9
Lack of technical knowledge in public sector employees in relation to construction projects	10
Conflicts among project's stakeholders	11
Miscommunication between the private sector and organizations	12
Lack of sufficient liquidity in the private sector	13

Table 10. Spearman correlation coefficients for the most important partnership barriers and risks.

	A	B	C	D
A	1	−0.153	−0.182	−0.2
B	−0.153	1	0.490 **	0.404 **
C	−0.182	0.490 **	1	0.866 **
D	−0.2	0.404 **	0.866 **	1

Note: ** Correlation is significant at the 0.01 level (2-tailed).

Furthermore, in a pairwise correlation comparison of the parameters, a lack of systematic cooperation between the public and private sectors has a direct and strong correlation with the lack of use of novel financing methods and tools. This shows that one of the main reasons for the lack of systematic cooperation between the public and private sectors, resulting in a reduced number of partnerships in urban construction projects, is the lack of novel financing methods and tools used by the private sector. Therefore, one of the other strategies for increasing private sector partnership is the use of novel financing methods and tools.

Finally, correlation analysis indicated a significant and direct correlation between the lack of attention to implementation methods by contractors and the lack of use of novel financing methods and tools. This means that one of the methods for increasing private sector partnerships in urban construction projects would be to increase the contractors' use of novel implementation methods for cost reduction and their use of new financing methods and tools. It is clear that if traditional methods and approaches were sufficient, the levels of partnerships between the public and private sectors wouldn't be as low as it is currently. Therefore, it is necessary to revise the current tools and methods in order to increase private sector partnerships in urban construction projects. This change requires an increase in management and control knowledge regarding construction projects in private companies. According to the experts' opinions, the most important factor affecting the low rates of partnership with the private sector is a lack of managerial knowledge and control of construction projects in private companies. Furthermore, descriptive statistical analyses indicate that the low levels of PPPs in UICPs, according to participants, are related to the

use and employment of professional managers for managing the construction projects. This means that management weaknesses in urban construction projects are the main reason for decreased private sector partnership in these projects.

5. Discussion and Conclusions

This study attempted to answer the following research questions for the implementation of PPPs in UCIPs in developing countries in the Middle East: What are the barriers and risks of applying the PPP model in UICPs in developing countries in the Middle East? What is the distinctive importance of the barriers and risks of applying the PPP model in UICPs in developing countries in the Middle East? In order to do this, a Delphi study was conducted in Iran involving 60 UICP experts from both the public and private sectors. Data have been analyzed according to inferential statistical techniques as to identify and prioritize barriers and risks.

According to the results of the current study, similar to Cui et al. [3], Osei-Kyei Chan [11], and Sinharoy et al. [30], one of the most important strategies for attracting the partnership of the private sector is the removal of barriers and risks, such as weaknesses in managerial knowledge and control of construction projects in private companies through the training and employment of better managers, in order to improve the level of planning and management knowledge in these projects. Furthermore, the lack of attention to cost reduction methods and the use of traditional and inefficient approaches by contractors, a lack of systematic cooperation between the public and private sectors, and a lack of use of new financing methods are among the most important barriers and risks for participation. However, solving these barriers and risks is now enough to increase partnership in urban construction projects. According to the results of the current study, severe political nepotism in project assignment; a lack of legal and technical infrastructures for partnerships; equipment and technological weaknesses in the private sector; a lack of certainty in the private sector regarding financing costs for maintenance and commissioning periods due to high and volatile inflation rates in Iran; a lack of competent managers in policymaking of public organizations; the implementation of wrong policies due to a lack of knowledge in employees and managers of the public sector; a lack of skill in executive managers for project control; and conflicts among project stakeholders and therefore miscommunication between the private sector and organizations are also among important barriers and risks to private investment in urban projects.

In terms of practical implications, since one of the most important factors in the success of PPPs is the selection of suitable private companies or contractors according to criteria set by government organizations as well as the size and complexity of the projects, success in these projects requires the systemic view of managers as well as the removal of barriers and risks such as severe political nepotism in project assignment. Creating a suitable environment and removing the barriers and risks identified in this study can help facilitate the increased partnership of private companies in urban construction projects.

In terms of theoretical implications, it is clear that the nature of UCIPs is different from other infrastructural projects including roads, water and wastewater, oil, gas, and telecommunication projects. Indeed, infrastructural urban projects, including bridges and urban roads; business and recreational projects; and large economic, social, and environmental projects are different from other infrastructural projects with regard to the type of services, commissioning, and return of investment guarantees [7,33,54]. With that in mind, comparative and cross-sectorial studies are needed to generalize and reinforce provided insights.

Limitations of this study are many, starting from the method adopted, i.e., the Delphi technique, that has inner reliability and validity limits. Indeed, having respondents undertaking three different rounds of interviews, with specific questions aimed at the arrival of a shared vision, can lead to a forced convergence of opinions [55] which undermines the Delphi's forecasting ability. To avoid this problem, sampling participants—as done in this study—with knowledge and an interest in the topic ensures the validity of the Delphi

technique [56]. In this vein, stemming from the fact that the quality and characteristics of the experts chosen is pivotal in Delphi studies, their socio-demographic characteristics may have had a role in directing their attention to the identification of what the barriers, risks, and solutions are in implementing PPPs for UICPs in developing countries. In this regard, it would be interesting to investigate, in a quantitative manner and building upon the Upper Echelons Theory literature [29], whether socio-demographic characteristics and/or other psychological variables are significant in the definition and evaluation of the barriers, risks, and solutions of implementing PPPs for UICPs in developing countries. Last but not least, future research can integrate the findings of the proposed work within already established models for the definition of priority lists in PPP redevelopment initiatives [57,58]; this would help in developing stronger management models of public assets within PPPs.

Author Contributions: Conceptualization: H.S., J.T.; Software: H.S.; Formal analysis: H.S.; M.C., J.T.; Investigation: J.T.; Methodology: H.S. and D.W.M.C.; Data Curation: H.S.; Writing—original draft preparation: H.S., J.T.; Visualization: H.S., J.T.; Validation: J.T. and M.C.; Resources: M.C. and J.T.; Writing—review and editing: M.C., J.T., and D.W.M.C.; Supervision: D.W.M.C., J.T.; Project administration: J.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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