# Completing Abandoned Public Facility Projects by the Private Sector: Results of a Delphi Survey in the Iranian Water and Wastewater Company

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**Hadi Sarvari**
Department of Civil Engineering, Isfahan (Khorasgan) Branch, Islamic Azad Univeristy, Isfahan, Iran
**Matteo Cristofaro**
Department of Management and Law, Università degli Studi di Roma Tor Vergata, Roma, Italy
**Daniel W.M. Chan**
Department of Building and Real Estate, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong
**Norhazilan Md. Noor**
Construction Research Centre, School of Civil Engineering, Universiti Teknologi Malaysia, Johor, Malaysia,
**Mohammadreza Amini**
Department of Civil Engineering, Isfahan (Khorasgan) Branch, Islamic Azad Univeristy, Isfahan, Iran

## Abstract

Completion of abandoned public facility projects is one of the major concerns of governments struggling with budget issues. Various research studies have shown that this can only be solved with the help of the private sector. Therefore, the present study attempts to investigate the capacity of the private sector to complete abandoned public facility projects through the study of Water and Wastewater Company in Iran. The Delphi survey questionnaires, which were distributed to and responded by a panel of experts – i.e., three groups of employers of the Iranian Water and Wastewater Company, consulting agents and private sector stakeholders engaging with Water and Wastewater Company projects – identified 50 critical factors allowing the private sector to carry out abandoned facility projects. These have been categorized in four components: financial capacities, management competency, knowledge and expertise, and resources and facilities. A descriptive survey method was used to determine and prioritize these factors. The survey findings indicate that, knowledge and expertise is the main important cluster of factors influencing the completion of abandoned public facility projects. The value of these results is essential in providing the sound basis for mutual trust between the private sector and the public sector for greater participation, thereby helping to complete abandoned public facility

projects. This is the first study attempting to investigate the capacity of the private sector to complete abandoned public facility projects through an empirical analysis of factors influencing their completion.

**Keywords**: Outsourcing; Privatization; Abandoned Projects; Water and Wastewater Industry, Iran

## 1. Introduction

Facility projects contribute to a major part of GDP of all countries (Kivani and Ramadani, 2016), requiring critical thinking and planning for optimal and efficient implementation (Babalola *et al*., 2019). However, sometimes, projects are not completed and remain abandoned for many reasons such as: reduction of the supervise and accountability at the project completion stage by contractors (Abednego and Ogunlana, 2006), transfer of most project risks to the private sector (Shrestha, *et al*., 2017; Gao and Liu, 2019), definition of new facility projects that take the primacy over the ones under construction (Aaltonen *et al*., 2017), political changes (Williams, 2017), appearance of new high costs due to the definition of sub-uses of the project alongside the original project use (Doraisamy *et al*., 2015b), and lack of government skills and ability to outsource the project (Sen *et al*., 2020). With regards to the given reasons, and due to the current requirements of construction industry, private sector is called assisting the public in the completion of abandoned facility projects (Ariffin *et al*., 2019) – mainly through privatization. Privatization is a process in which the government examines the possibility of transferring its duties and facilities from the public sector to the private sector and, if recognized and appropriate, makes such a transition (Balaker and Summers, 2003; Jerch *et al*., 2017). Experience has shown that the private sector can do better and more successfully than the government in implementing facility projects (Ika and Donnelly, 2017). It should be noted that the achievement of the private sector depends on the formulation of transparent rules, regulation of economic decisions, transparency in pricing, non-competition with the private sector, support

and attraction of foreign investors, beliefs of officials on the performance of the private sector and modulate private sector expectations for profit and private sector support (Delmon, 2015). However, despite the positive implications coming from studies on the support of private sector to the public on projects, few studies tried studying abandoned public facility projects and what are the capabilities of the private sector in rescuing them. Filling this gap is of high importance due to the fact that, by answering this question, governments will know when it is convenient involving private actors in recovering abandoned public facility projects and what they should do in order not to recur, always, to the private sector – such as, building and/or improving the identified capabilities.

As to give an answer, it has been considered the case of the Water and Wastewater Company in Iran, which has not been very successful in attracting private sector in rescuing abandoned facility projects. Firstly, as to identify the capabilities of the private sector in helping governments rescuing abandoned public facility projects, the existing literature has been thoroughly studied (Chan *et al*., 2010; Pheko, 2013; Hwang and Lim, 2013; Mac-Barango, 2017; Alao and Jagboro, 2017; Lemly, 2019) arriving at a list of capabilities that the private sector levers as to recover abandoned public facility projects. Then, Delphi technique was used to delineate and match the identified capabilities based on the research literature with the current situation in Iran. Finally, the final questionnaire was administered to 50 people (coordinators, civil engineers, financial managers, project managers, and site workers) and data were analyzed as to confirm these capabilities and find a hierarchy among them.

Results indicated that factors belonging to the knowledge and expertise group, resources and facilities group, managerial capability group, and financial capability group (in this order) can be considered as determinant for the completion of abandoned public facility projects. The value of these results is significant in providing the sound basis for mutual trust between the private

sector and the public sector for greater participation, thereby helping to complete abandoned public facility projects.

## 2. Theoretical background

Completion of abandoned projects and how they are financed is one of the major concerns of governments struggling with budget issues (Swedlund and Lierl, 2019). This happens because the public sector, in order accomplish projects, face macro and micro risks. Examples of macro-scale risks are lack of economic stability and security and lack of effective policies to protect private sector investors (Chan *et al*., 2010; Iranmanesh and Fathi, 2019). With regard to micro-scale risks, Keers and Fenema (2018) identified lacking a collaborative performance system, failure in determining responsibilities and authority in projects decision making, inadequate or inappropriate partnership agreements, inadequate sharing of staff among involved organizations for project management, lack of scheduling and project awareness, and lack of involvement of senior management. As to partially overcome these risks, it has been suggested implementing training programs for public and private parties involved in partnership projects (Kwak *et al*., 2009; Loosemore and Lim, 2018), developing a culture of appreciation towards talents, and enhance the level of collaboration and interaction among projects' stakeholders (Ross and Yan, 2015).

What has been said, highlights that governments have an increasingly need of the support of the private sector to accomplish projects, especially the abandoned ones, as confirmed by many other researches (Kwak *et al*., 2009; Rahbar *et al*., 2017; Wang *et al*., 2019). Among them, a relevant part of abandoned projects regard facilities – infrastructure or equipment or service designed to make possible the primary processes of an organization (Atkin and Brooks, 2015). In this regard, about the causes that can lead to abandoned facility projects there are: *i)* defining and approving plans that lack sufficient economic and environmental justification (Lemly, 2019), *ii)* initiating numerous projects without clear social objectives (Hwang and Lim, 2013); *iii)*

initiating the project with incomplete and inaccurate studies (Shaar *et al*., 2017), and *iv)* lack of ability to manage project size and dimensions during the construction period (Hwang and Lim, 2013). One of the ways to reduce the problems of such projects is to use the methods of participation or transfer of these projects to the private sector (Shi *et al*., 2019). However, these solutions are inefficient without taking complementary measures, such as project electronic trading systems, project prioritization and non-compliance elimination boards (Alao and Jagboro, 2017). Therefore, in order to be successful in completing abandoned projects, first of all, governments should detail the requirements and prerequisites for their outsourcing to the private sector (Sarvari *et al.*, 2014), while, the private sector is required to demonstrate having all available capacities to complete and successfully execute ongoing projects after being designated as a project contractor (Muleya *et al*., 2019). Considering the aforementioned, the issue of private sector capacity-building is one of the most important issues for the completion of semi-finished projects if transferred to the private sector.

## 3. Research methodology

The present study seeks to provide a clear guidance for the public sector to properly finish abandoned public facility projects by examining the capabilities of the private sector in being outsourced with these facility projects and lead them to completion. For this purpose, the capacities of private sector to accomplish abandoned public facility projects were firstly studied through literature and the list of capacities were, then, strengthen by the application of a three-round Delphi survey method – already used for similar and recent research studies (see Khosravi *et al*., 2020) (reliability and validity limits of this technique are discussed in the last section of this work). There are no strong and explicit rules on how to select and recruit experts referred as respondent of Delphi questionnaires; however, it is worth mentioning that the quality of experts is more important than their quantity (Olawumi and Chan, 2019). From that, participants of the Delphi survey are experts, critics and panelists who must have sound knowledge and abundant

experience in a same subject, ample time to participate, and effective communication skills (Yeung *et al*., 2007). Regarding the quantity of involved experts, this is usually less than 50, and often from 15 to 20 (Rowe and Wright, 2001; Olawumi *et al.*, 2018; Daniel *et al*., 2020). The number of experts depends on factors including: sample homogeneity, Delphi goal, difficulty range, quality of decision, ability of the research team, internal and external validity, time of data collection, available resources, and the scope of the problem under study (Chan and Choi, 2015; Sarvari *et al*., 2019). The study adopted a purposive sampling technique in the selection of target survey respondents as done by other scholars for similar research questions (Olawumi *et al*., 2018; Olawumi and Chan, 2019). In this regard, 50 experts were selected among Water and Wastewater Company's practitioners in Iran based on their level of knowledge and expertise in the field. The sample size of this study (50 responses) was considered satisfactory and adequate compared with other studies which have utilized similar purposive sampling techniques e.g. Osei-Kyei and Chan, 2017 with 42 responses; Chan *et al*., 2019, with 44 responses. So, the chosen sample was regarded as reliable and substantially representative of the survey population. The statistical population consists of three groups of employers of the Iranian Water and Wastewater Company, consultants and members of private sector active in Water and Wastewater facility projects; all of them were selected using census sampling method. Table 1 shows the demographic characteristics of the experts who attended the Delphi process.

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A questionnaire was initially administered to the experts; this included 50 items identified from the literature categorized in 4 clusters. Findings of the first round of Delphi are shown is Table 2; then, they were assessed and ranked in a secondary questionnaire. In order to find a ranking of

capabilities of the private sector in rescuing abandoned facility projects, a final round of Delphi was required.

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The questionnaire was validated through face and content validity, collecting the opinions of a number of experts in the field of public-private partnerships and construction management. To check the validity of the questionnaire in terms of clusters' division, a confirmatory factor analysis was implemented. Data analysis was performed using SPSS software in two levels of descriptive and inferential statistics. About descriptive statistics, statistical features such as frequency, percentage, mean and standard deviation were analysed; about inferential statistics, Kolmogorov-Smirnov test, one-sample t-test and Friedman test were used.

The prerequisite for parametric tests is the normality of the statistical distribution of the variables. In general, it can be said that parametric tests are generally based on mean and standard deviation. Therefore, if the Kolmogorov-Smirnov test results equals zero, distribution has been normal. One-sample t-test was used to explain and interpret the capacity of the private sector to carry out semi-finished facility projects in the Water and Wastewater Company. The Friedman test was used to compare the mean ratings between k variables or groups. In the present study, Friedman test was used to rank the degree of importance of the identified dimensions as the capacity of the private sector to complete half-completed facility projects.

## 4. Results of Delphi survey

The final questionnaire, coming from the three-round Delphi, consisted of two sections of general and specialized questions. General questions attempted to gather general and demographic information about respondents, including questions on: education, working experience, working sector and position. Specialized questions consisted of 50 items in 4

different dimensions that were identified by reviewing the literature of the previous research and performing triple rounds of Delphi technique. In Figure 1 are shown factor loadings for all questions.

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One factor that should be taken into account in evaluating the model is the one-dimensionality of the model indices. In this case, each index along with the indexes must be loaded with a single large factor load, with only one latent variable. Hyland (1991) acknowledged that a factor load of less than 0.3 is considered small and should be removed from the set of indices. As shown in Figure 1, since all factor loadings of the questions were higher than 0.3 it can be concluded that the model has acceptable reliability (Ting and Hongmei, 2015); therefore, all the questions in the questionnaire have an acceptable factor load and no questions are excluded from the research questionnaire. Reliability of the questionnaire using Cronbach's alpha is: 0.81 for financial capacities, 0.88 for management competency, 0.92 for knowledge and expertise, 0.88 for resources and facilities, 0.96 for the whole questionnaire.

*4.1 Capacities and potential of the private sector in completing the abandoned facility projects of the Water and Wastewater Company*

According to Table 3 the mean of the groups (financial capacities, management competency, knowledge and expertise and resources and facilities) for the capacity of the private sector to execute abandoned facility projects in the Water and Wastewater Company are 3.47, 3.53, 3.71 and 3.57 respectively, and 3.58 in total.

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Stemming from $p \leq 0.05$, the capacity of the private sector to execute abandoned facility projects for the Water and Wastewater Company in all four groups and in the whole questionnaire were significantly different from the test value (i.e., 3). Yet, given that the upper and lower limits of positive confidence that have been achieved, it can be concluded that all the groups underline important capabilities for the implementation of abandoned facility projects.

### *4.2 Importance of identified private sector capabilities in completing abandoned Water and Wastewater Facility projects*

Friedman test was used to rank the identified factors of the private sector capabilities for implementation of abandoned facility projects for the Water and Wastewater Company. The hypothesis for the Friedman test were the following:

$H_0$: *Average rating of private sector capabilities for implementation of abandoned facility projects are equal.*

$H_1$: *Average ratings of private sector capabilities for executing abandoned facility projects are not equal.*

Table 4 shows that the level of significance of the Friedman test is lower than the threshold of 0.05 ($p<0.05$), so it can be concluded that there is a significant difference between private sector capabilities for the completion of these facility projects in the Water and Wastewater Company.

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Based on the results of Table 5, the ranking of capabilities is the following: *1)* empowered and expert human resources (34.32), *2)* use of technical, expert and experienced personnel in the consultant firm to supervise projects (32.87), *3)* assigning tasks to project team members based

on competencies and knowledge and expertise (31.03), *4)* consultants' awareness of contract documents and obligations and rights of the parties (30.41), and, *5)* managers and experts with knowledge and expertise in the private sector (30.40). Also, the lowest rankings of private sector's capabilities to execute abandoned facility projects in the Water and Wastewater Company are: *i)* commitment to attend and participate in monthly meetings by key personnel and decision-makers (20.21), *ii)* use of economics engineering to balance adjustment factor and inflation rate (18.68), and timely consultation of the consulting firm to resolve the financial and administrative problems of the contractor (18.42).

The Friedman test results highlighted the importance of employing experts in both contractor and consultant team with adequate knowledge and expertise in the field. Achieving the best outcomes, therefore, is associated with the proper consideration on the selection and employment of personnel. Table 5 represented the results of Freidman test.

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Friedman test was, also, used to prioritize the four groups of capabilities (financial capacities, management competency, knowledge and expertise and resources and facilities). The hypothesis for this adoption of the Friedman test were the following:

$H_0$: *Average rating of private sector capabilities group for abandoned facility projects is equal*

H1: *Average rating of private sector capabilities group for abandoned facility projects is not equal*

Results of Table 6 show that the significance level is less than 0.05 ($p < 0.05$), so it can be concluded that there is a significant difference between groups among the capabilities of the private sector to carry out abandoned facility projects in the Water and Wastewater Company.

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Results of the Friedman test (Table 7) show the following ranking: *1)* knowledge and expertise (3.07), *2)* resources and facilities (2.40), *3)* management competency (2.32), *4)* financial capacities (2.21).

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The results of this study approved that the level of knowledge and expertise regarding abandoned project in the private sector is the most influencing group of capabilities followed by management competency, which can effectively direct many others. The results are presented in Figure 2.

**5. Discussion**

Abandoned facility projects can have dramatic effects on the social community, such as the disappointment of the populace, and leading to the over-stretch of (concluded) existing facilities (Alao, 2019) – with the consequence of bringing to economic and financial related issues. In this regard, Alao *et al*., (2018) demonstrated that when the period of abandonment increases by one unit, the percentage of cost overrun on construction project increases (up to 19.5%). Hence, it has been always recommended that abandoned public facility projects should be considered for completion in preference to the commission of new projects.

However, the accumulation of numerous and varied problems in dealing with abandoned facility projects over the years, such as finding enough financial resources to rescue them, has led these

abandoned public facility projects becoming a critical point in public sector management, stimulating the debate on reforming the working mechanisms of abandoned public facility projects (Alexandersson and Hulten, 2006; Kwak *et al*., 2009; Chan *et al*., 2010; Jerch *et al*., 2017; Osei-Kyei and Chan, 2017; Keers and van Fenema, 2018; Alao *et al*., 2019; Muleya *et al*., 2019). In this regard, the experience of the last two decades in different countries has repeatedly proved the need to use the market mechanism and the potential of the private sector to complete abandoned projects (e.g., Abednego and Ogunlana, 2006; Abdul-Rahman *et al.*, 2015; Alao *et al*., 2019).

Therefore, the idea of purposeful and intelligent privatization for completing abandoned public facility projects is an unavoidable necessity. This is even truer for the Water and Wastewater industry, which faces many challenges and obstacles in partnering with the public sector (Parvin *et al*., 2010; Shrestha *et al*., 2017). In particular, privatization is a process of transferring or transferring ownership of a public sector property to the private sector aimed at achieving goals such as: economic development, eliminating monopoly and expanding competition, increasing efficiency, reducing government current spending, shrinking government size, increasing economic productivity, improving reliability (Abednego and Ogunlana, 2006; Keers and van Fenema, 2018). Given these goals, it is certainly helpful to the private sector to address the critical situation of abandoned projects and projects and to cover the weakness of the public sector in completing these projects.

In this regard, findings of the Delphi survey show that knowledge and expertise as well as resources (financial and instrumental) are the main important capabilities of the private sector in supporting the completion of abandoned public facility projects. These results, mainly underlining the importance of the human factors in rescuing abandoned facility projects, are in line with some studies of project management and public administration literature. In particular, the stress on the knowledge and expertise as well as on the management competency are

consistent with Doraisamy *et al.* (2015a) who, through the analysis of abandoned housing projects in Malaysia, found that having an incompetent project manager can cause the abandonment of the project (39%). The same was advanced by Kress and Finima (2018), who recently concluded that the lack of a common and collaborative operating system, the lack of attention to the issue of determining responsibilities and powers in decision-making, inappropriate or non-practical partnership agreement, inadequate commonalities among the employees of both organizations for project management, lack of scheduling, and lack of awareness and participation of senior management are the risks of public-private partnership projects, also facility ones. So, on the contrary, it can be speculated that a competent project manager is highly able to recover abandoned projects, as also advanced by Rahbar *et al*. (2017), who supported that factors such as paying close attention to talents and supporting creativity are vital for the success of public facility projects.

About the instrumental and financial resources, respectively the second and fourth clusters of capabilities, also Yuan *et al*. (2010) concluded that the private sector can provide effective support for public facility projects because of its capability to save costs during the construction and operation phases – a capability that, on the contrary, is not usually owned by the public and that bring to abandoned projects (Abdul-Rahman *et al*., 2015; Ross and Jan, 2015). Since most of the public-private partnership risks stem from the complexity of the financing, the government needs to be transparent with procedures, stabilization of policies and support partnership financing risks (Twumasi, 2014). This is aimed to significantly reduce, and thereby increase, private incentives to participate in the completion of abandoned public facility projects.

However, the two highlighted groups of clusters, i.e. *a)* knowledge, expertise, and management competency, and *b)* resources, facilities, and financial capacities, are connected each other in terms of reciprocal effects. Indeed, glitches determining abandoned projects occurring when firms have no prior experience with the partner, or when knowledge is not successfully

transferred from the partner to the firm (Tranekjer, 2016), lead to increased costs and the firm may then decide to abandon projects (Hoopes, 2001). From that, the order of capabilities emerging from the Delphi survey results can be speculated to reflect also an effect of the foremost, knowledge and expertise, to the others: the greater the presence/lack of the first cluster of competences, the more likely the presence/lack of other capabilities.

What did not emerge as primary capabilities, but that has been considered as important to rescue abandoned facility projects, are the creation of cooperatives and the acceleration of project implementation (Parvin *et al*., 2010) – also highlighted by Abdul-Rahman et al. (2015), who indicated that all relevant parties involved in the housing industry are required to have extensive cooperation and should perform systematic risk management strategies in order to mitigate the risks leading to problems associated with abandoned housing projects.

In general, results of this study agree with the ones of Wang *et al*. (2019) who, analyzing the challenges and application of public-private partnerships, concluded that, in order to regulate waste disposal performance and increase private sector participation, the government should enhance the ability to manage private sector participation facility projects; in brief, the government should expand the scope of public-private partnership activities.

## 6. Conclusions and implications

As to investigate what are the capabilities of the private sector that can help rescuing abandoned facility projects, a three-round Delphi survey was administered to a panel of 50 experts consisting of three groups of employers of the Iranian Water and Wastewater Company, consulting agents and private sector stakeholders engaging with Water and Wastewater Company facility projects. The statistical population was selected carefully in order to accurately represent all the participants to the facility project. From the Delphi study emerged that the capabilities of the private sector that can help rescuing abandoned facility projects can be

categorized in four components: financial capacities, management competency, knowledge and expertise, and resources and facilities. The influence of these components has then been ranked by experts as follows: *1)* knowledge and expertise, *2)* resources and facilities, *3)* management competency, and *4)* financial capacities.

In terms of practical implications connected with these results, in order to successfully engage the private sector in the completion of abandoned facility projects, it is recommended to respect the principles of human resource management in the work sites (e.g., retaining expert personnel, and respecting payroll justice) and employing experienced technical personnel; indeed, the clusters *a)* knowledge and expertise and *b)* management competency resulted, respectively, as the first and the third most important in completing abandoned facility projects. From that, specific training schemes to public and private personnel aimed at fostering collaboration between public and private as well as to manage abandoned projects through leveraging on these partnerships are pivotal (Kwak *et al*., 2009; Loosemore and Lim, 2018). Moreover, since most of the public-private partnership risks in completing abandoned facility projects stem from the complexity of the financing, documentation, technical details of the project, it is mandatory that governments are transparent with procedures and stabilize policies; this would increase private incentives to participate in the completion of abandoned facility projects.

Stemming from the above, governments should consider incorporating private sector tax exemptions, reducing social security insurance costs into cooperative contracts and public liability insurance to attract and encourage the private sector to complete abandoned facility projects. From their involvement, the combined use of government resources and the private sector, together with the use of investment and external financing methods, can be effective in completing and operating abandoned facility projects. This would encourage private companies to participate more in public facility projects; in this regard, the government should set out specific policies to support the private sector and control the scale of its debt to the private. One

way to implement them is having the public making a proper auditing of accounts of all abandoned projects as to help private in exploiting the financial resources needed to recover them (Alao *et al*., 2017). From that, governments not only play a key role in ensuring the proper execution of the project, but also should monitor private investment and responding promptly and appropriately when changes or conflicts arise. Therefore, governments, also when abandoned facility projects are rescued by the private sector, needs to make a continuous monitoring of the performance of the private sector in infrastructure facility projects as to ensure the success of the initiative.

In brief, governments are asked to manage the privatization process strategically, tactically and operationally (Aktan, 1995), possibly leading to the attraction of as many contractors and stakeholder as possible for the completion of abandoned facility projects – whose divergent perceptions have been demonstrated to be beneficial for rescuing abandoned projects (Osei-Kyei and Chan, 2017). However, after having attracted contractors, it is necessary to exploit all its capacities and potentials in order to be able to respond to the trust of the state and to succeed in completing the abandoned facility projects. In view of the above, it can be derived that, for the completion of abandoned facility projects, both the public and private sectors are required to make to achieve this objective and they have to do it as soon as projects become abandoned. This because, as highlighted by Alao *et al*. (2017), the maximum threshold at which abandoned projects may be resuscitated at an economic cost is around16 months; after that period, the economy of new construction would outweigh resuscitation of abandoned projects.

In terms of theoretical implications, this study contributes to management of facilities by considering the causes of abandonment on facility projects from a quantitative perspective – which has not ever done before this study, at the best of authors' knowledge. In particular, this work advances that knowledge and expertise is the main factor that allows the private to help recovering abandoned facility projects. From that, it is argued and speculated that the public –

technically, economically, and socially responsible for the abandoned facility projects – has not the same knowledge and expertise of the private with regard to facilities' project management (Wang *et al*., 2019). From that, some future research directions for deepening the identified findings are the following: *What are the specific operational or managerial capabilities that allow the private recovering abandoned facility projects? How public-private partnership can help in fostering the exchange of capabilities between the private and public sides? What are the financing strategies that could be adopted for recovering abandoned projects? Can they be fostered only by the private or the public should operate together with it?* Future studies should also consider questioning the public about the strategic fit (that may not be always found) between the already started facilities projects with the implemented facilities' strategy (Tranekjer, 2017).

Limitations of this study are many, starting from the method adopted, i.e., the Delphi technique, that has inner reliability and validity limits. In particular, as to face the reliability problem of the Delphi study (i.e., two or more different groups of experts can lead to different results even if facing the same questions/phenomena), it has been followed – as suggested by Hasson et al. (2000) – the criteria for qualitative studies provided by Lincoln and Guba (1985) as to ensure that credible interpretations of the findings are produced. These criteria are based on the following issues: truthfulness, applicability, consistency and confirmability. However, as stated by Hasson *et al*. (2000), and supported by other methodological contributions on the Delphi technique (Keeney *et al*., 2006; 2011), following these criteria cannot totally limit that the involvement of different panels would lead to obtain the same results (Hossan *et al*., 2000). Despite that, results emerging from the Delphi study can be considered reliable as much as the best (in terms of knowledge and expertise) possible panelists are involved. About the validity problem (i.e., whether produced results are the right expression of the investigated phenomena), the involvement of a large number of respondents is the most used approach within the technique

as not to rely on few answers; in this regard, having collected 50 responses is considered satisfactory and adequate respect to other Delphi studies (Osei-Kyei and Chan, 2017; Chan *et al*., 2019; Khosravi *et al*., 2020). However, it is also true that having respondents passing three different rounds of interviews with specific questions aiming at arriving at a shared vision can lead to a forced convergence of opinions (Hasson *et al*., 2000), undermining Delphi's forecasting ability. As to avoid this problem, sampling participants – as done in this case – with knowledge and an interest in the topic, ensures the validity of the Delphi (Keeney *et al*., 2006; 2011). In this vein, stemming from the fact that the quality and characteristics of experts is pivotal in Delphi studies, their socio-demographic characteristics may have a role in directing their own attention to the identification of what are the capabilities of the private sector to complete abandoned facility projects. In this regard, it would be interesting to investigate, in a quantitative manner and building on the *Upper Echelons Theory* literature (Abatecola and Cristofaro, 2015; 2020), whether socio-demographic characteristics and/or other psychological variables are significant in the definition and evaluation of the capabilities of the private to help rescuing abandoned facility projects at the individual and group level.

Future research can foster the generalizability of the proposed results by increasing the number of facility projects to assess in the same study. Yet, as proposed by Khosvari *et al*. (2020), it would be valuable also to compare findings of more different facility projects according to the level of development of the country in which they are located, as to spot similarities and differences.

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**Table 1:** Experts' Personal Details

| Details | Respond | Numbers | % |
|---|---|---|---|
| Education | Diploma | 2 | 4 |
| | Higher diploma | 1 | 2 |
| | Bachelor | 21 | 42 |
| | Master | 23 | 46 |
| | Ph.D. | 3 | 6 |
| Working experience | Below 10 | 10 | 20 |
| | 11 - 20 | 26 | 52 |
| | Over 21 | 14 | 28 |
| Working Sector | Client | 20 | 40 |
| | Consultant | 15 | 30 |
| | Contractor | 15 | 30 |
| Position | Senior Manager | 15 | 30 |
| | Coordinator | 2 | 4 |
| | Civil engineer | 21 | 42 |
| | Financial manager | 3 | 6 |
| | Project manager | 5 | 10 |
| | Site worker | 4 | 8 |

**Table 2:** Results of third round-Delphi

| No | Group | Private Sector Capacities to Finish Abandoned Projects | Median |
|---|---|---|---|
| 1 | Financial Capacities | Knowledge of procurement and financing method | 3 |
| 2 | | Financial capability to participate in project monitoring and assessment | 2 |
| 3 | | Using engineering economics to balance adjustment factor and inflation rate | 3 |
| 4 | | Use of consulting device to resolve contractor financial and administrative problems | 4 |
| 5 | | Having general policies and guidelines for conducting project value engineering studies in the private sector | 4 |
| 6 | | Estimating and budgeting projects based on value engineering in the private sector is done with greater precision than the public sector | 3 |
| 7 | | Timely consultation with the contractor for financial and administrative problems | 3 |
| 8 | | Proper financial estimation and correct estimation of costs | 3 |
| 9 | | Coordinate timely distribution of project financial credits with the credentials needed for physical development in accordance with the schedule | 3 |
| 10 | Managerial Capabilities | Ability of the private sector to manage and control projects | 5 |
| 11 | | The private sector adheres to its obligations to the public sector | 4 |
| 12 | | Project supervisors' ability to prioritize, plan, coordinate, and monitor their own and supervisory tasks | 4 |
| 13 | | The private sector has more time to develop a contributory monitoring and evaluation process | 5 |
| 14 | | The existence of private sector development institutions that can act as the initiator and engine of public-private partnership projects | 4 |
| 15 | | Ability of senior private sector managers to make critical decisions based on key project performance indicators | 3 |
| 16 | | Proper organizational structure in the private sector | 4 |
| 17 | | The ability of the private sector to manage various infrastructures | 4 |
| 18 | | Lack of legal restrictions and disruptive private sector project implementation laws and procedures | 3 |
| 19 | | A serious commitment from the executive management to follow the program and provide the resources needed to execute projects in the private sector | 4 |
| 20 | | Have a clear plan and timeline for studying the value of the project and taking action in the private sector | 4 |
| 21 | | Commitment to attend in monthly meetings by key personnel and decision-makers | 3 |

| No | Group | Private Sector Capacities to Finish Abandoned Projects | Median |
|---|---|---|---|
| 22 | | The lack of conservatism in the private sector in adopting new ways to complete abandoned projects | 3 |
| 23 | | Compliance with project scheduling standards | 3 |
| 24 | | Transparency of the relationships between the actors involved in the project implementation | 3 |
| 25 | | Evaluate the continuous performance of the stakeholders involved in project implementation | 3 |
| 26 | | Coordination of the main contractor with the specialized contractors | 3 |
| 27 | | Effective and clear evaluation policy of project implementation process | 4 |
| 28 | | Timely and accurate decision making due to the fact that the project managers are given sufficient authority | 3 |
| 29 | Knowledge and expertise | Performing technical and economic studies by the private sector before accepting abandoned projects | 4 |
| 30 | | The creative solutions of the private sector are more than the public sector | 4 |
| 31 | | Managers and experts with knowledge and expertise in the private sector | 5 |
| 32 | | Empowered and expert human resources | 5 |
| 33 | | The private sector is more precise and specialized in identifying and removing the major legal challenges and risks | 5 |
| 34 | | Introducing private sector technology and innovation to government processes can produce better public services by improving operational efficiency | 4 |
| 35 | | Using experts on the subject of the project and combining the multi disciplines required in the team | 5 |
| 36 | | Synchronization and familiarity of project agents with new technologies in design and implementation | 4 |
| 37 | | Introduce senior managers, project managers, consultants and contractors to project management knowledge | 5 |
| 38 | | Use of technical, expert and experienced personnel in the consultant firm to supervise | 4 |
| 39 | | Consultants' awareness of contract documents and obligations and rights of the parties | 4 |
| 40 | | Not rushing to execute projects before completing studies | 3 |
| 41 | | Proper selection of project consultants and managers appropriate to the project's knowledge, expertise, experience and technical ability | 4 |
| 42 | | The ability and knowledge and expertise of project managers to manage project risks effectively | 5 |
| 43 | | Assign tasks to project team members based on competencies and knowledge and expertise | 3 |
| 44 | Resources and Facilities | Having sufficient authority and facilities to execute the project | 4 |
| 45 | | Providing contract documents based on accurate data and information | 4 |
| 46 | | Manage and control the project efficiently with optimal use of software and information systems | 4 |
| 47 | | Establish effective and efficient system in project management process | 4 |
| 48 | | Providing up-to-date equipment and machinery with the project | 3 |
| 49 | | Having the right facilities and planning to do the job in different climates | 3 |
| 50 | | Strong communication and information systems and equipment in place and prompt communication of all project changes to all stakeholders involved in the project | 4 |

**Figure 1:** Factor loading model

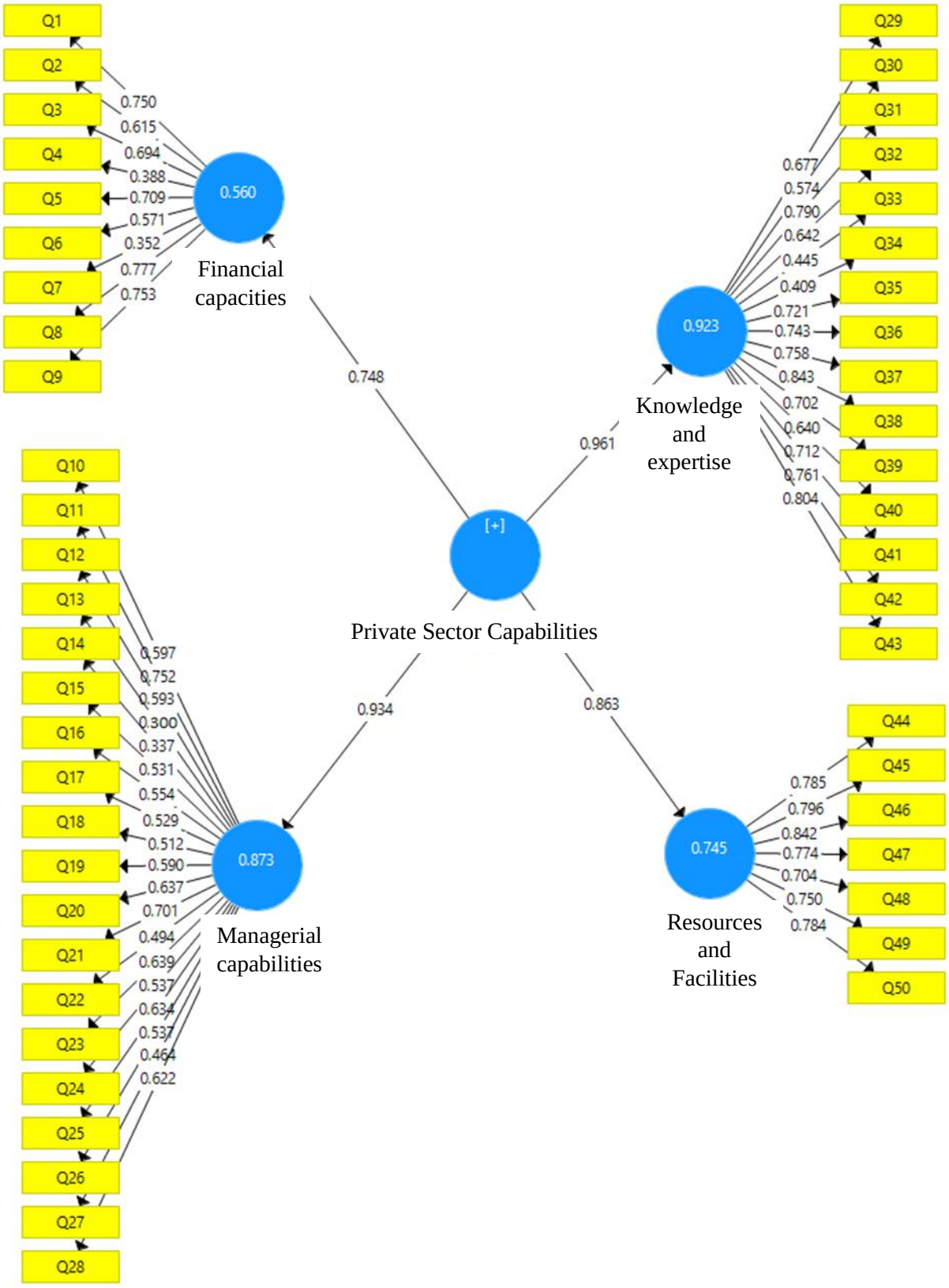


**Table 3:** Single Sample T-Test Results

| Group | Number | Average | Coefficient | Test Value = 3 | | | Lower limit | Upper limit |
|---|---|---|---|---|---|---|---|---|
| | | | | T | df | P-value | | |
| Financial capacities | 50 | 3.47 | 0.65 | 5.19 | 49 | 0.00 | 0.293 | 0.664 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Management competency | 50 | 3.53 | 0.514 | 7.38 | 49 | 0.00 | 0.389 | 0.681 |
| Knowledge and expertise | 50 | 3.71 | 0.68 | 0.524 | 49 | 0.00 | 0.524 | 0.914 |
| Resources and facilities | 50 | 3.57 | 0.79 | 5.07 | 49 | 0.00 | 0.346 | 0.799 |
| Capacities | 50 | 3.58 | 0.55 | 7.430 | 49 | 0.00 | 0.742 | 0.428 |

**Table 4:** Friedman Test Results

| $K^2$ | Df | P-value | Result |
|---|---|---|---|
| 136.804 | 49 | 0.00 | $H_0$ Rejected |

**Table 5:** Friedman Test Results for Factors

| No | Group | Private Sector Capacities to Finish Abandoned Projects | Average | Rating |
|---|---|---|---|---|
| 1 | Financial Capacities | Knowledge of procurement and financing method | 28.31 | 10 |
| 2 | | Financial capability to participate in project monitoring and assessment | 25.53 | 26 |
| 3 | | Using engineering economics to balance adjustment factor and inflation rate | 18.68 | 46 |
| 4 | | Use of consulting device to resolve contractor financial and administrative problems | 20.91 | 40 |
| 5 | | Having general policies and guidelines for conducting project value engineering studies in the private sector | 22.37 | 37 |
| 6 | | Estimating and budgeting projects based on value engineering in the private sector is done with greater precision than the public sector | 25.99 | 22 |
| 7 | | Timely consultation with the contractor for financial and administrative problems | 18.42 | 47 |
| 8 | | Proper financial estimation and correct estimation of costs | 24.78 | 32 |
| 9 | | Coordinate timely distribution of project financial credits with the credentials needed for physical development in accordance with the schedule | 25.01 | 30 |
| 10 | Managerial Capabilities | .Ability of the private sector to manage and control projects | 28.74 | 8 |
| 11 | | The private sector adheres to its obligations to the public sector | 27.91 | 12 |
| 12 | | Project supervisors' ability to prioritize, plan, coordinate, and monitor their own and supervisory tasks | 28.81 | 7 |
| 13 | | The private sector has more time to develop a participatory monitoring and evaluation process | 20.59 | 41 |
| 14 | | The existence of private sector development institutions that can act as the initiator and engine of public-private partnership projects | 20.26 | 44 |
| 15 | | Ability of senior private sector managers to make critical decisions based on key project performance indicators | 25.49 | 27 |
| 16 | | Proper organizational structure in the private sector | 25.23 | 29 |
| 17 | | The ability of the private sector to manage various infrastructures | 26.91 | 16 |
| 18 | | Lack of legal restrictions and disruptive private sector project implementation laws and procedures | 20.35 | 43 |
| 19 | | A serious commitment from the executive management to follow the program path and support and provide the resources needed to execute projects in the private sector | 27.55 | 13 |
| 20 | | Have a clear plan and timeline for studying the value of the project and taking action in the private sector | 24.76 | 33 |
| 21 | | Commitment to attend key and decision-makers in monthly meetings | 20.21 | 45 |
| 22 | | The lack of conservatism in the private sector in adopting new ways to complete abandoned projects | 22.82 | 36 |
| 23 | | Compliance with project scheduling standards | 20.99 | 39 |
| 24 | | Transparency of the relationships between the actors involved in the project implementation | 24.91 | 31 |
| 25 | | Evaluate the continuous performance of the stakeholders involved in project implementation | 21.91 | 38 |
| 26 | | Coordination of the main contractor with the specialized contractors | 26.63 | 20 |

| No | Group | Private Sector Capacities to Finish Abandoned Projects | Average | Rating |
|---|---|---|---|---|
| 27 | | Effective and clear evaluation policy of project implementation process | 22.82 | 36 |
| 28 | | Timely and accurate decision making due to the fact that the project managers are given sufficient authority | 25.27 | 28 |
| 29 | Knowledge and expertise | Performing technical and economic studies by the private sector before accepting abandoned projects | 27.19 | 14 |
| 30 | | The creative solutions of the private sector are more than the public sector | 29.78 | 6 |
| 31 | | Managers and experts with knowledge and expertise in the private sector | 30.40 | 5 |
| 32 | | Empowered and expert human resources | 34.32 | 1 |
| 33 | | The private sector is more precise and specialized in identifying and removing the major legal challenges and risks | 24.18 | 34 |
| 34 | | Introducing private sector technology and innovation to government processes can produce better public services by improving operational efficiency | 26.04 | 21 |
| 35 | | Using experts on the subject of the project and combining the multi-disciplines required in the team | 26.88 | 17 |
| 36 | | Synchronization and familiarity of project agents with new technologies in design and implementation | 27.00 | 15 |
| 37 | | Introduce senior managers, project managers, consultants and contractors to project management knowledge | 26.73 | 19 |
| 38 | | Use of technical, expert and experienced personnel in the consultant firm to supervise with rating average | 32.87 | 2 |
| 39 | | Consultants' awareness of contract documents and obligations and rights of the parties | 30.41 | 4 |
| 40 | | Not rushing to execute projects before completing studies | 25.76 | 25 |
| 41 | | Proper selection of project consultants and managers appropriate to the project's knowledge, expertise, experience and technical ability | 28.68 | 9 |
| 42 | | The ability and knowledge and expertise of project managers to manage project risks effectively | 25.49 | 27 |
| 43 | | Assign tasks to project team members based on competencies and knowledge and expertise | 31.03 | 3 |
| 44 | Resources and Facilities | Having sufficient authority and facilities to execute the project | 28.18 | 11 |
| 45 | | Providing contract documents based on accurate data and information | 26.79 | 18 |
| 46 | | Manage and control the project efficiently with optimal use of software and information systems | 25.77 | 24 |
| 47 | | Establish effective and efficient system in project management process | 20.49 | 42 |
| 48 | | Providing up-to-date equipment and machinery with the project | 25.79 | 23 |
| 49 | | Having the right facilities and planning to do the job in different climates | 23.59 | 35 |
| 50 | | Strong communication and information systems and equipment in place and prompt communication of all project changes to all stakeholders involved in the project | 25.49 | 27 |

**Table 6:** Friedman Test Results

| $K^2$ | Df | P-value | Results |
|---|---|---|---|
| 13.569 | 3 | 0.004 | $H_0$ rejected |

**Table 7:** Friedman Test Results for Groups

| No. | Group | Average | Rank |
|---|---|---|---|
| 1 | Financial capacities | 2.21 | 4 |

| | | | |
|---|---|---|---|
| 2 | Management competency | 2.32 | 3 |
| 3 | Knowledge and Expertise | 3.07 | 1 |
| 4 | Resources and facilities | 2.40 | 2 |

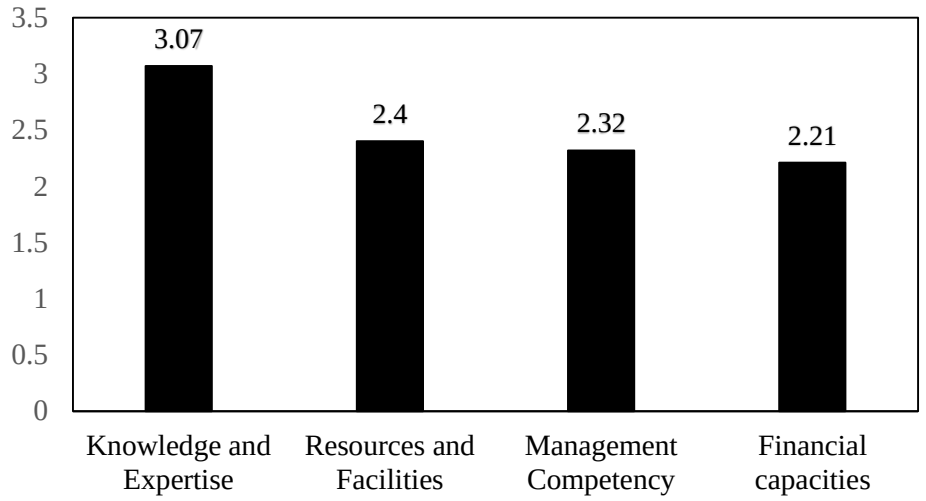


**Figure 2:** Group Ranking in the Private Sector's Capacity to Execute Abandoned Projects in the Water and Wastewater Company by Friedman Test