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CSFs to manage risks in energy infrastructure projects by Public-private Partnerships

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Abstract. Over recent years the interest in adopting public private partnerships (PPPs) has increased internationally. Many research studies have presented positive reasons for the governments and the private sector to welcome this form of procurement, rather than continue adopting the traditional options. In this study, we interviewed 36 PPPs professionals from various project companies and perspectives, and systematically examined their subjectivity by applying the principles of Q-methodology. Our research revealed three distinct types of perspectives regarding the critical success factors in PPPs risk management initiatives. Our study also found senior management support and risk knowledge management to be the most critical success factors in such initiatives.

Keywords: public private partnerships (PPPs), Risk management (RM), Critical success factors (CSFs), Q- method

1. Introduction: CSFs of PPPs risk management

Risks are inherent in most if not all infrastructure projects, and can be defined as uncertain events or conditions that, if they occur, have positive or negative effects on a project objective [1]. Traditionally, project risks have been managed instinctively with risks remaining implicit. However, the increasing complexity projects and regulatory requirements that necessitate a formal approach to risk have created a need for an alternative approach. Thus, a number of frameworks that aims to bring structure and discipline to the process of risk management have been suggested in the literature. A methodical approach as suggested by these frameworks can assist in better identifying and assessing the risks that are relevant to a project, in focusing on the major risks for the project, and in making informed decisions regarding the control and mitigation of these risks [2].

As a main result from previous studies, successful implementation of a well-developed PPPs projects depends on identifying the critical success factors (CSFs) of risk management. Past studies have attempted to address this need by identifying a list of general CSF through interviews, case studies, and large surveys. In this paper, Q-methodology is offered as an alternative approach which provides insight into individual subjectivity through the use of factor analysis.

2. Risk management in PPPs

While the different risk management approaches described above consider the risk management process at varying degrees of detail and describe tasks using different terminology, several core elements that are common to all the approaches can be identified [3]. They are: a) risk identification, b) risk analysis, and c) risk response. Of these, risk identification can be considered as the most critical step of the risk management process as unidentified risks can wreak havoc with the success of a project, as one is forced into a reactive

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mode, as opposed to a proactive mode, should the risks occur. A qualitative characterization of likelihood and consequence using labels such as high, medium, and low serve as input to a fuzzy logic-based approached to risk analysis. Risk response involves the development of risk mitigation measures and implementing them on an ongoing basis throughout the project life cycle.

The risk management process holds special significance for infrastructure projects undertaken using alternative procurement modes such as P3s. the leeway provided in allowing a significant transfer of risk to the private sector is an oft cited advantage of P3s, along with other factors such as the additional opportunities afforded for harnessing the innovative abilities and efficiencies of the private sector. From the perspective of a private sector organization, they are faced with the tasks of identifying the greater range of risks that they would be taking on in comparison to the risks undertaken under a traditional design-bid-build mode of procurement. The private sector is also faced with making decisions as to the pricing of risks in responding to Requests for Proposals (RFPs) issued by the government, and devising responses to the risks that they would take on given that their bid is successful. Having selected a procurement mode, government must make decisions as to the allocation of risks that would optimize value for money. Value for money is optimized when program needs are met through the lowest combination of capital, operating, and maintenance costs over the life of a project [3].

The scholarly literature on the factors affecting PPPs risk management is sparse and there is a serious lack of empirical research in this area. During our study, we have therefore consulted the literature that has indentified common critical success factors to implement PPPs risk management programs in project companies, as well as factors affecting life cycle process as a whole. As stated earlier, the purpose of this study is to systematically examine human subjectivity through assessments of viewpoints, opinions, beliefs, and attitudes. These viewpoints can be used to characterize participants in the wide array of conflicts and decisions that arise in PPPs projects risk management programs in project companies. To accomplish these objectives, we have selected Q-Sort research method, and have identified 22 stimulus statements or items based on the literature review [4, 5, and 6].

3. Research methodology

3.1. Description of Q-sort research method

The Q-Sort method was originated as a technique of personality assessment [7, 8]. For personality assessments, descriptions and evaluations of a participant's personality are obtained. A series of personality description statements are typed separately on cards. Each participant is given a set of the cards and asked to consider the extent to which each statement is a characteristic of the subject topic being evaluated. Each participant sorts the cards into a prescribed number of piles ranging from least descriptive to most descriptive of the subject topic. The piles represent points along a continuum describing relevance to the subject. Each pile is assigned a numerical value which is ascribed to all statements placed in the pile. Upon completion of the sorting of statements by all participants, the values assigned to each statement are summed across each participant. A mean value is calculated for each statement to indicate the extent to which it is characteristic of the subject topic in the combined perceptions of participants. Various statistical analyses (e.g., correlation, regression, and factor analysis) are applied to the mean values to explore personality dimensions of an individual and to compare personalities of different participants.

The choice using 5 piles (i.e. the range or intervals) and a forced distribution format of the sorted items among the piles (i.e. the limits placed on the distribution) are justified. Within the forced distribution format, participants are free in placing the items in each pile, and they determine the meaning of the continuum [9]. The participants also control "the specific rank and thus the contextual significance of each item" [9].

3.2. Research design

A total of 14 different project companies are selected. The organizations are selected in such a way that there is at least risk management process management. The total number of participants in this study is 36. Participants include Ph.D. students, faculty members, interns, senior executive directors, risk analysts, PPPs analysts, and PPPs managers. No participant is named in this study. Each participant remains anonymous throughout the study and the final report.

Data collection procedures include: 1) the researcher meets each participant personally to collect the data; 2) each participant is given 1 card with the research question written on it. The research question states: "Which of these 22 items can be considered essential in the success of PPPs risk management process in project companies?" 3) Each stimulus statement or item is written on a separate card. Thus, a deck of 22 separate cards is generated. Each participant is given one deck of cards consisting 22 cards; 4) each participant is asked to consider the extent to which each statement is characteristic of the question being evaluated. Each participant sorts the deck of 22 cards into a 5 piles ranging from Definitely Not, Probably Not, Neutral, Probably, and Definitely. The piles represent points along a continuum describing relevance to the question. Each pile is assigned a numerical value which is ascribed to every statement placed in the pile. Table 1 summarizes the pile names, number of cards to be placed in each pile, and the numerical value assigned to each card in the pile.

Table 1. Distribution of Q-sort cards

Pile name	Number of cards to be placed in the pile	Numerical value for each card in the pile
Definitely not	2 cards	-2
Probably not	4 cards	-1
Neutral	10 cards	0
Probably	4 cards	1
Definitely	2 cards	2

The piles do nothing more than differentiate the statements with which the participants definitely do not agree from the ones they definitely do agree as being significant to the research question. It provides no guidance in evaluating the two extremes. The distribution of values produced by the Q-Sort method is a function of the distribution that is specified in the sorting instructions, and the specification of a forced normal distribution in sorting procedures provides a normal distribution in responses [8]. 5) When a participant is done sorting the deck of cards, the researcher collects the cards from the left-most pile to the right-most pile in an orderly fashion, and stores the responses in a secured location. The responses of each participant are then entered in an Excel spreadsheet, which is readable by the PQ-Method software for factor analysis.

3.3. Data analysis

Statistical Analysis for this research involves the sequential application of two sets of statistical procedures to the Q-Sort data: factor analysis, and computation of factor scores. Factor analysis enables us finding patterns in the dataset. Significant factors are subsequently extracted and rotated. Next, a factor array or model Q-Sort is generated for each factor with the factor scores. The factor scores are compared in arriving at distinguishing Q sample items. The distinguishing Q statements are identified and the factors are interpreted contextually. The software used for this Q analysis is PQ-Method, which is a statistical program tailored to the requirements of Q studies.

The main step is to calculate factor arrays and factor scores on the basis of the defining sorts for each factor. In Q-methodology, "interpretations are based on factor arrays and factor scores rather than the loadings" [8]. A factor score is the score gained by each statement of the Q set (22 statements) as a "kind of weighted average of the scores given to that statement by the Q sorts associated with the factor". In the weighting process (of the Q sorts of different respondents associated with a particular factor) more weight is given to the Q sort scores of those participants who have higher loadings because they are more representative of the factor type. Table 2 displays the factor scores, arranged as factor arrays, showing scores obtained by each statement for each factor and reflecting an overall Q-Sample for the participants who loaded on the factor in total [7].

Based on the factor arrays presented in Table 2 and Fig. 1, we identified the distinguishing statements that were associated with each factor (3 factors were identified in this study). Thus, we began to see the pattern of thoughts that arises specific to each of the three groups.

3.3.1. Factor 1: risk knowledge management and disaster recovery

Factor 1 accounted for 12% of the total variance. We named factor 1 as risk knowledge management and disaster recovery. This grouping shared the strongest opinion (i.e. sort category = Definitely) on the

following two items: 1) integration of risk management practices with knowledge management: to identifies communication of risk knowledge management priorities to all levels of stakeholders (factor score = 2.47); 2) Contingency and disaster recovery: develop and implement adequate contingency and disaster recovery plans and procedures to ensure continuity of operations and assets of the organization (factor score = 1.34).

These participants considered as least essential (i.e. sort category = definitely not) the following two items: PPPs project requirement and pre-selection of a risk assessment methods.

3.3.2. Factor 2: managing risks & opportunities

Factor 2 accounted for 19% of the total variance. We named factor 2 as managing risks & opportunities. These participants shared the strongest opinion (i.e. sort category = definitely) on risk management priorities (factor score = 2.14), and performance monitoring/ effectiveness evaluation (factor score = 1.73). These participants also emphasized the importance of creating business impact analysis and a threat scenario that may disrupt the business processes. The perspective reflected by this grouping can be viewed as participation and contribution.

These participants considered as probably critical (i.e. sort category = probably) senior management support (factor score = 1.09), involvement of PPPs owners and technical experts (factor score = 0.98), limited scope of each assessment (factor score = 0.88), aspects of critical IT infrastructures (factor score = 0.82).

3.3.3. Factor 3: PPPs policy and strategic framework

Factor 3 accounted for 17% of the total variance. We named factor 3 as PPPs policy and strategic framework. These participants shared the strongest opinion (i.e. sort category = definitely) on PPPs policy and strategy (factor score = 1.93), and PPPs projects requirements (factor score = 1.84). These participants also emphasized the importance of cooperation between the PPPs leaders and the risk management team, and prioritization of the PPPs requirements. The perspective reflected by these participants can be viewed as internal support and cooperation.

These participants considered as probably critical (i.e. sort category = probably) involvement of PPPs owners and technical experts (factor score = 1.19), roles, responsibilities, and accountability (factor score = .74), corporate culture (factor score = .52), and an ongoing process (factor score = .46).

Table 2. Factor Q-sort values for each statement

No.	Statement	Factor arrays		
		1	2	3
1	Senior management support	1	1	0
2	Defined procedures	0	0	-2
3	Keeping knowledge up to date	0	-1	0
4	Involvement of PPPs owners and technical experts	-1	1	1
5	Roles, responsibilities, and accountability	0	0	1
6	Limited scope of each assessment	0	1	-1
7	Documentation and maintenance of PPPs risk	1	0	-1
8	PPPs policy and strategy	1	0	2
9	Knowledge policy and strategy	1	-1	0
10	PPPs projects requirements	-2	0	2
11	Training and awareness program	0	-1	-1
12	Interaction, collaboration, team work	-1	0	0
13	Competence of team members	-1	-1	-1
14	Contingency and disaster recovery	2	0	0
15	Risk management priorities	0	2	0
16	Integration of risk management practices with knowledge management	2	0	0
17	Compliance	0	0	0
18	Corporate culture	0	-2	1
19	Aspects of critical IT infrastructures	-1	1	0
20	An ongoing process	0	0	1
21	Pre-selection of a risk assessment method	-2	-2	-2
22	Performance monitoring/ effectiveness evaluation	0	2	0

4. Conclusions

Since Iran is currently undergoing rapid urban development and construction, this has placed tremendous productivity-economic pressure on the government's budget. As a result the findings revealed that the drivers rated higher by Iranian respondents were risk-related, drivers higher. This paper, Q-methodology is applied as an alternative approach which provides insight into individual subjectivity through the use of factor analysis; for identifying the critical success factors (CSF) of PPPs risk management. As significant findings, although different perspectives could be identified, there was in fact a lot of agreement. Ensuring "senior management's commitment, support, and active participation" and "Integration of risk management practices with knowledge management" were considered as most essential for success of a PPP's risk management program in different types of perspectives. Also "documentation and maintenance of PPPs risk", "keeping knowledge up to date", and "knowledge policy and strategy" that are suitable for the specific needs of a PPP were considered next essential across all three perspectives. Pre-selecting a risk management method that is suitable for the specific needs of an organization was considered least essential across all perspectives. This can be explained due to the fact that these organizations did not strictly follow any method, and they customized the risk management process according to their needs. Only an executive director from a for-profit organization and a student considered this to be probably critical.

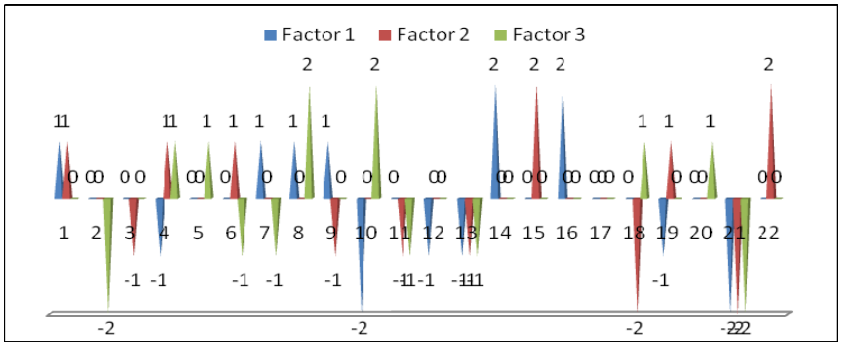

Fig. 1. Chart of factors Q-sort values for each statement

The findings established which knowledge management (KM) processes might have a positive impact on risk management (RM). Many activities can carry some amount of uncertainty, thus several relationships will exist between the RM process and the internal or external project environment. These complex interdependencies and relationships require dealing with a substantial amount of information. Therefore, the use of a RM knowledge base is essential. Also, the needed RM information can be obtained from a large number of available resources, such as expert judgment, sessions and brainstorming, data from current and prior projects, commercial databases containing infrastructural and environmental data. Consequently, having an up-to-date repository that can be used by project team to obtain the most relevant risks information can be beneficial during project execution. In fact, Rodriguez-Montes & Edwards (2008) state that the lack of knowledge access can create failures. Weak means of transferring knowledge can provide insufficient knowledge of the operation, poor assessments of the lessons learned and poor understanding of the present and forecasts through risk knowledge.

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