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Identifying Critical Success and Risk Factors of Airport Projects in Turkey Based on Public-Private Partnership[1]

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Abstract

Public-Private Partnership (PPP) is a significant procurement method for providing public service; in particular, for airport projects which constitute the most capital-demanding infrastructures with high level of risks. . Following extensive systematic literature review, Critical Success Factors (CSF), and Risk Factors (RF) were gathered based on a questionnaire for professionals and experts for PPP airport projects in Turkey, 162 experts of which 67 of them responded. Key Performance Indicators are grouped with factor analysis test based on the most important CSFs and risk factors identified within the scope of the paper.

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Türkiye'de Kamu Özel İşbirliğine Bağlı Havalimanı Projelerinin Kritik Başarı ve Risk Faktörlerinin Tanımlanması[1]

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Anahtar kelimeler:

Kamu-özel işbirliği (KÖİ), kritik başarı faktörleri , risk faktörleri, havaalanları, anahtar performans göstergesi

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Öz

Kamu-Özel İşbirliği (KÖİ), kamu hizmeti sağlamada önemli bir tedarik yöntemidir. Özellikle yüksek maliyetli, risk düzeyi yüksekaltyapıyı oluşturan havaalanı projeleri için büyük önem taşımaktadır. Kapsamlı sistematik literatür taramasını takiben, 162 profesyonel ve uzmandan 67'sinin yanıtladığı ankete bağlı olarak, Türkiye'deki KÖİ havaalanı projeleri için kritik başarı faktörleri ve risk faktörleri tanımlanmıştır.. . Makale kapsamında, tanımlanan kritik başarı ve risk faktörleri, faktör analizi testi ile değerlendirilerekgruplandırılmış ve temel performans göstergeleri ortaya konmuştur.

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Introduction

Public-Private Partnership (PPP) involve public and private sectors working together as part of a partnership in order to provide public service (Broadbent & Laughlin, 2003). There are many models of PPPs, and these models are regularly used in construction projects in developed and developing countries, where the success of these projects is the ultimate goal of practitioners and government organizations. Saving resources in many ways is the main advantage of the PPP procurement process (Cumming, 2007), also sharing risks at different stages between public and private sectors (Shen, Platten, & Deng, 2006). Furthermore, economic aspects are improved by using PPP procurements. For instance, it has been shown that the PPP strategy reduce the lifecycle project cost (Tang, Shen, & Cheng, 2010). It is, therefore, not surprising that researchers continue to study in this area of the PPP market (Osei-Kyei & Chan, 2015), which could help improve our understanding of the pros and cons of PPPs (LiYaning Tang, Qiping Shen, & Cheng, 2010). Although, many developed and developing countries have implemented PPP projects for developing their infrastructure in recent years, some of these projects have not been successful (Ismail Abdul Rahman, Aftab Hameed Memon, & Zulkiffli, 2014). Chou, Ping Tserng, Lin, and Yeh (2012) indicated that the most important Critical SuccessFactors (CSF) in PPP is the risk allocation and sharing. For this reason, risks should be taken by parties whose can manage them effectively (Hwang, Zhao, & Gay, 2013). Risk identification and management are very important factors in PPP projects (Noorzai, Jafari, Golabchi, Hamedi, & 2016). Identifying and analyzing the risk area effectively to improve the use of risk strategies are essential (Tang et al., 2010). Furthermore, development of the infrastructure is complicated issue and when some of the CSFs are not given much importance, project risks might be emerged. For instance, political risk will arise when there is a lack of political support. Proper management strategies for the appeared risk as a response to better address these CSFs in the future is crucial for project sponsors when these risks are considered major (Wang, 2015). Ke et. al, (2009), reviewed the publications of PPP research trends from 1998 to 2008. Similarly, Tang et. al, (2010) conduct a review study for PPP studies published in top six journals in field of construction, Osei-Kyei and Chan (2015), apply systematical literature review to specify the most important CSFs for PPPs in the publication from 1990 to 2013.

For delivering a service, Turkey is the most active user of PPP contracts in Eurasia in recent years. Also, it has an ambitious PPP portfolio which is being planned to be realized in the coming years (Emek, 2015). Airport projects received the highest rate of investment, with US$38.3 billion committed. An unprecedented amount of this investment went towards Turkey's İstanbul New Airport (İGA) (Worldbank, 2015). Without doubt, the recent star of the PPP sector in Turkey has been the transportation sector (Başar, Bayirbaş, & Yilmaz, 2016). The

initial target for Turkey's 2023 plans was to reach 60 fully operating airports capable of hosting 350 million passengers per year (PWC, 2017). Based on the 2023 target plan, the Turkish government is planning to increase the number of fully operating airports for domestic flights from 55 to 63 with the construction of new airports in Yozgat, Rize,Artvin, Bayburt-Gümüşhane (Salyazı), Niğde-Aksaray, Karaman, İzmir Çeşme-Alaçatı, Western Antalya and Çukurova. (PWC, 2017). For that purpose, the aim of this study is to identify and rank the CSF and Risk Factors(RF) of PPP projects, particularly for airports projects in Turkey, and to draw lessons for the effective management of these factors by investigating the relation between those factors.

RF and CSF in PPP projects in the literature.

Many researches have tried to classify PPP projects RF in various sectors of developed countries(Bing, Akintoye, Edwards, & Hardcastle, 2005; Chung, Hensher, & Rose, 2010; Hwang et al., 2013) and developing countries (Effah Ernest Ameyaw & Chan, 2015; Song, Song, Zhang, & Sun, 2013). Cheung and Chan (2011) insist that PPP projects need accurate risk factor identification and analysis that could adversely affect the project achievements. However, to achieve best project performance, successful partnership is needed between public and private sector, and understanding properly to share and allocate the risk between them (Abednego & Ogunlana, 2006). Grimsey Darrin and Lewis (2002) evaluated the risks of PPP projects and they found that most common and effective risks facing any infrastructure projects are; technical, construction, operating, revenue, financial, force majeure, political and environmental risks. In addition, airport projects are listed as one of the biggest infrastructure projects through PPPs strategy and are subjected to more risks than any other infrastructure projects.

CSF can be defined as the "few key areas of activity where favorable results are absolutely necessary for a manager to reach his/her goals" (Osei-Kyei & Chan, 2015; Rockart & Sloan, 1982). Numerous researches have been done and adopt the CSFs as a concept to understand the effective way for PPP implementation to develop the infrastructure in developed and developing countries (Liu, Wang, & Wilkinson, 2016; Osei-Kyei & Chan, 2015).The concept of CSFs has been studied in different areas of PPP sectors, including the water (Ernest Effah Ameyaw, Chan, & Owusu-Manu, 2017; Ernest Effah Ameyaw & Chan, 2016; Xianhai Meng, Qi Zhao, Qiping Shen, & M.ASCE3, 2011), telecommunications, housing (Abdul-Aziz & Jahn Kassim, 2011), energy and transportation sectors (Hemantkumar P. Bulsara, Alok Kumar, Rakesh Kumar, & Chauhan, 2016). Recently, attention has been given to study CSFs for PPP projects in developing countries such as UAE, Nigeria, Ghana and China (Ernest Effah Ameyaw & Chan, 2016; Rauda Al-Saadi & Abdou, 2016; Robert Osei-Kyei & Chan, 2016; Sanni, 2016; Solomon Olusola Babatunde, Srinath Perera, Lei Zhou, & Udeaja, 2016). Therefore, in the first

part of this study a systematically review of previous research published between the years 2000 to 2018 for CSFs of PPP projects have been reviewed as shown in Table 1. This review study aims not only to reveal CSFs and RFs of PPP projects based on international publications in the field indexed in Scopus and Web of Science, but also to define the measures needed to be taken for further PPP projects.

Material and Method

Identification of RFs and CSFs that affect PPP projects are the important key factors needed to achieve for success of projects. A comprehensive systematic review of publications in the field between the years 2000 to 2018 was carried out (Table 1). The review study was to identify and investigate the significant CSF and RF of PPP projects specific to transportation projects. These factors were carefully selected to cover significant factors that affect PPP airport projects in developing countries.

Questionnaire process

Questionnaire survey as a strategy of gathering data is considered as an effective and popular method in many area of studies (Zhang, Chan, Feng, Duan, & Ke, 2016). Several researchers have used this approach to gain a comprehensive understanding of PPP RF and their allocation as well as CSF (Effah Ernest Ameyaw & Chan, 2015; Chou & Pramudawardhani, 2015; Hsueh & Chang, 2017; Osei-Kyei, Chan, Javed, & Ameyaw, 2017; Song et al., 2013). A questionnaire is a powerful tool used to collect expert opinions. For this research a ranking-type questionnaire survey was adopted to collect accurate data. The questionnaire is composed of 4 sections. The first section was about participant information such as level of knowledge and the respondent's profile. The second part aimed to investigate the experience of precipitance with PPPs. The third part contained scale-based questions that took into consideration the importance level of CSFs and RF on PPP airport projects in Turkey. The last part contained the evaluation and the level of significance based on their effect on PPP airport project in Turkey. The questionnaire was written in both English and Turkish to avoid language barrier.. Consequently, the survey focused on institutions that have direct involvement in airport PPPs from public and private sectors. The written questionnaire was mainly distributed by hand to respondents in Turkey. Of the 162 questionnaires, 67 were retrieved, 5 of them were excluded to ensure high quality data, since the participants exhibited insufficient knowledge and incomplete answers. In total 62 questionnaires were obtained after eliminating invalid questionnaires. The rate of response was 41.3%, while the valid data response rate was 37.6% as an outcome of all the questionnaires. The respondents were asked to evaluate and rank the importance of 20 CSFs and 46 RF gathered from literature review based on 5-point Likert scale. The Likert scale has been adopted by many studies in many countries (Chou & Pramudawardhani, 2015; Roumboutsos & Anagnostopoulos, 2008). 73% of the respondents

who completed the survey have a good experience and knowledge of PPPs. Furthermore, 64% of the participants made up the public sector such the General Directorate of State Airports Authority of Turkey (DHMI), while 31% of PPP experts were from private sectors, (construction companies).

Results and Discussion

Statistical Package for Social Scientists (SPSS) 25.0, has been used for data analysis. Statistical tests such as reliability analysis, mean analysis, variance analysis (ANOVA), correlation test and factor analysis were performed on the data gathered. Reliability tests were carried out.. Cronbach alpha coefficient indicator normally used as an indicator, that when it is above 7.0 means the scale is considered acceptable and if it is more than 8.0 will be preferable (Pallant, 2016). The overall Cronbach's Alpha values for critical success factors and risk factors of PPP airport projects are 0.851 and 0.930, respectively, indicating a high internal consistency and reliability for the dataset. CSFs and RFs are ranked (1 being the most important and 5 being the least important, the order is reversed in analysis) according to respondent's views on what they consider to be the level of importance for PPP airport projects in Turkey. The mean value for each factor is ranked according to the categories; Public Sector (State), Private Sector and both sectors.

Ranking of CSFs of PPP airport projects

Ranking 20 CSFs based on their importance were asked to the survey participants according to a 5-point Likert Scale (1 being less important and 5 being extremely important) shown in Table 2. The mean values for the 20 CSFs range from 4.53 to 3.42. Therefore, mean values above 3.00 indicates the importance of that factor (Hair Jr., Black, Babin, & Anderson, 2010). Mean value of ll factors recorded more than 3. Mean values of seven of them are more than 4.00, based on the ANOVA analysis test, considering public and private sectors. Based on the survey; the most important seven CSFs are namely; available financial market, risk allocation and sharing, profitability, favorable legal framework, private consortium, effective supervision mechanism and appropriate project identification for PPP airports projects in Turkey. It is clear that there are distinctions on the opinions of the public and private experts. For example, public sector participatants chose favorable legal frame work as the most significant CSF for airports projects, while private sector particapants ranked the same factor as 16th. On the other hand, both of them ranked some factors at the same level of importance, such as risk allocation and sharing, openness and constant communication, and public support. Similarly, they ranked the availability of the financial market as the most important factor for achieving success.

Table 1. CSFs for PPP projects from literature survey between 2000 to 2018.

CSF / Ref. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	Sum
1. Risk allocation and sharing		*	*	*	*		*	*		*		*			*			*		*			*	*					*	*		*				*	*	18
2. Strong private consortium		*	*	*	*	*			*	*			*	*				*	*							*			*							*			14
3. Available financial market				*		*	*			*	*	*			*			*			*				*	*	*	*							*				14
4. Commitment made by partners			*	*	*			*									*		*		*				*		*		*								*		13
5. Transparent procurement	*	*	*			*	*				*		*				*						*	*										*					11
6. Political support		*					*	*	*		*				*							*										*	*						9
7. Favorable legal framework	*		*				*					*										*		*	*		*								*				9
8. Community / Public support	*	*	*					*																					*										5
9. Favorable economic condition			*								*							*																					3
10. Government guarantee							*				*						*									*													4
11.Alignment with government's objective						*														*																			2
12. Revenue sustainability			*											*																				*					3
13. Cost effectiveness	*			*			*																												*				4
14. Clearly defined responsibilities and roles			*	*				*					*																						*		*		6
15. Appropriate project identification	*														*					*						*													4
16. Selection of suitable subcontractors															*																									1
17. Effective supervision mechanism	*											*								*														*					4
18. Technical feasibility of the project				*		*																	*											*					4
19. Stable macroeconomic environment																	*	*					*		*	*	*							*					7
20. Stable political and social environments																	*		*				*									*				*				5
21. National PPP unit																			*											*						*				3
22. Asset quality and social support																			*	*																*				3
23. Adequate public advisory bodies									*													*		*				*											4
24. Effective management control																*				*			*					*								*			5
25. Good governance																				*			*				*												3
26. Openness and constant communication										*																		*	*	*									4
27. Competitive tendering																				*															*				2
28. Corruption eradication																					*																		1
29. Profitability																													*	*									2
30. Adherence to time																														*			*						2
31. Meeting output specification																														*	*								2
32. Project feedback																																	*						1
33. Reliable and quality service operation																														*	*								2

Table 2. Mean ranking values of the CSFs for airport PPP projects.

	CSF	Criticality									Sign.
		Public			Private			Together			
		Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	
C01	Available financial market	4.380	0.705	1	4.530	0.697	3	4.420	0.7	1	0.443
C02	Risk allocation and sharing	4.300	0.966	2	4.580	0.607	2	4.390	0.871	2	0.254
C03	Profitability	4.300	0.853	4	4.370	0.831	7	4.320	0.84	3	0.773
C04	Favorable legal framework	4.030	1.121	12	4.740	0.452	1	4.250	1.01	4	0.010
C05	Strong private consortium	4.180	0.931	8	4.370	0.831	5	4.240	0.897	5	0.444
C06	Effective supervision mechanism	4.130	1.042	9	4.440	0.784	4	4.220	0.974	6	0.251
C07	Appropriate project identification	4.250	1.032	5	4.110	0.875	10	4.200	0.979	7	0.600
C08	Meeting output with specifications	4.300	0.791	3	3.950	0.848	16	4.190	0.819	8	0.123
C09	Reliable and quality service operations	4.200	0.853	7	4.110	0.737	12	4.170	0.813	9	0.679
C10	Adherence of time	3.980	0.974	16	4.370	0.831	6	4.100	0.941	10	0.135
C11	Political support	3.980	1.074	14	4.320	0.946	8	4.080	1.039	11	0.242
C12	Commitment made by partners	4.100	0.632	10	3.950	0.78	13	4.050	0.68	12	0.425
C13	Clearly defined responsibilities and roles	4.100	0.852	11	3.950	0.78	15	4.050	0.826	13	0.506
C14	Competitive tendering	4.200	1.067	6	3.740	1.195	19	4.050	1.121	14	0.139
C15	Effective management control	3.980	0.891	15	4.110	0.809	11	4.020	0.861	15	0.591
C16	Satisfying the need for public facility	3.900	0.955	17	4.210	0.787	9	4.000	0.91	16	0.224
C17	Stable macroeconomic environment	4.030	0.743	13	3.840	0.834	17	3.970	0.772	17	0.400
C18	Openness and constant communication	3.880	1.159	18	3.790	0.918	18	3.850	1.08	18	0.779
C19	Transparent procurement	3.700	1.114	19	3.950	1.177	14	3.780	1.131	19	0.437
C20	Community / Public support	3.330	1.163	20	3.420	1.17	20	3.360	1.156	20	0.768

The most important CSFs from both views, public and private sectors, are: available financial markets, risk allocation and sharing, profitability, favorable legal framework, private consortium, effective supervision mechanisms and appropriate project identification for PPP airport projects in Turkey. However, public-sector experts, in comparison to those from the private sector, stated that some factors were more important than the others. For instance, public experts rank favorable legal framework as the most important factor and ranks at 1st, while experts from the private sector rank it 12th out of 20, which indicates that the private sector in Turkey may not be as affected by the country's legal framework as the public sector,. Similarly, the period of time for finalizing the project is an important critical success factor for the public sector and perhaps not as important for the private sector, referred to as adherence of time . On the other hand, some factors are much more important to the private sector than to the public, such as profitability (C03), meeting output with specifications (C08) and competitive tendering (C14) (Table 2).

Risk Factors of PPP Airport Projects

Ranking 46 RFs based on their importance were asked to the survey participants according to a 5-point Likert Scale (1 being less important and 5 being extremely important) as shown in Table 3. ANOVA analysis was used to compare the evaluation of each factor in both sectors. The mean values can be interpreted as important since most of the factors had a mean value of more than 3.0.. According to the data result, as shown in Table 3, the most important RF are indicated as; availability of finance, stability, and poor financial market. Furthermore, it was evident that, experts from the public sector concentrated on financial factors as the most important factors, similar to the private sector, which indicates that financial factors should be further studied and investigated. From another perspective, there were some differences in ranking the importance of some factors between the outlooks of public and private experts. For instance, construction overrun risk and inadequate distribution of responsibilities and risk were picked as top RF from the public sector, while the private sector do not pay attention to those factors as well as public sector. However, they classified some factors on the same level such as; availability of finance, residual risk, legislation change, strong political structure, change in tax regulation and maintenance costs that are higher than expected.

The ranking analysis in terms of the factors' importance indicates that all the factors are important. However, those such as availability of finance (R01), stability (R02), poor financial market (R03) and financial attraction of project to investors (R04) are the most crucial risk factors for these projects from both points of view, public and private, for successful airport projects in Turkey. It is clear that for both sectors the significant risk factors for these projects in Turkey are those related to finance.It may be an outcome of nations fast pace in economic development. Moreover, other risk factors like financial attraction of project to investors (R04), high finance costs (R05), construction cost overrun (R07), inadequate distribution of responsibilities and risks (R08), and inadequate experience in PPP/PFI (R24) have been ranked much important in the public sector than the private sector. Further, low operating productivity (R13), influential economic events (R15), delay in project approvals and permits (R25), and poor public decision-making process (R28) are ranked as less important (Table 3).

Table 3. Mean ranking of the risk factors for airport PPP projects.

Risk factors		Criticality									Sign.
		Public			Private			Together			
		Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	
R01	Availability of finance	4.59	.715	1	4.58	.692	3	4.59	.702	1	0.957
R02	Stability	4.38	.774	4	4.63	.597	1	4.44	.738	2	0.208
R03	Poor financial market	4.30	.911	5	4.63	.496	2	4.41	.904	3	0.144
R04	Financial attraction of project to investors	4.43	.844	2	4.21	.787	17	4.36	.826	4	0.356
R05	High finance costs	4.39	.823	3	4.26	1.284	14	4.35	.991	5	0.641
R06	Operational revenues below expectation	4.23	.862	9	4.47	.697	6	4.31	.815	6	0.277
R07	Construction cost overrun	4.26	.818	7	4.26	.991	15	4.26	.870	7	0.978
R08	Inadequate distribution of responsibilities and risks	4.30	.723	6	4.11	.994	25	4.24	.817	8	0.397
R09	Interest rate volatility	4.16	.898	13	4.39	.850	10	4.24	.881	9	0.376
R10	Operation cost overrun	4.08	.870	14	4.53	.697	4	4.22	.839	10	0.055
R11	Residual risks	4.18	.844	10	4.29	.920	12	4.21	.861	11	0.637
R12	Excessive contract variation	4.18	.813	11	4.21	.918	18	4.19	.840	12	0.881
R13	Low operating productivity	4.05	.876	21	4.47	.513	7	4.19	.798	13	0.056
R14	Inflation rate volatility	4.08	.917	15	4.39	.850	9	4.17	.901	14	0.223
R15	Influential economic events	4.03	.891	24	4.47	.697	5	4.17	.854	15	0.059
R16	Design deficiency	4.25	.840	8	4.00	1.054	31	4.17	.913	16	0.330
R17	Construction time delay	4.05	1.011	20	4.37	.684	11	4.15	.925	17	0.220
R18	Legislation change	4.08	.888	16	4.21	1.182	16	4.11	1.010	18	0.625
R19	Strong political structure	4.05	.904	18	4.16	1.015	20	4.08	.934	19	0.682
R20	Change in tax regulation	4.05	.876	19	4.16	1.119	21	4.10	.936	20	0.688
R21	Maintenance costs higher than expected	4.05	.749	22	4.16	.765	22	4.08	.749	21	0.610
R22	Level of demand for project	4.08	.694	17	3.94	.938	35	4.03	.772	22	0.556
R23	Inadequate distribution of authority in partnership	4.05	.783	23	4.00	.816	33	4.03	.787	23	0.822
R24	Inadequate experience in PPP/PFI	4.18	.712	12	3.67	1.085	42	4.02	.868	24	0.038
R25	Delay in project approvals and permits	3.83	.931	35	4.42	.838	8	4.02	.938	25	0.021
R26	Poor quality workmanship	4.03	.920	25	4.00	.943	32	4.02	.919	26	0.923
R27	Organization and co-ordination risk	3.98	.832	26	4.05	1.224	30	4.00	.965	27	0.776
R28	Poor public decision-making process	3.85	.921	29	4.28	.752	13	3.97	.894	28	0.090
R29	Lack of commitment from either partner	3.85	.864	33	4.21	.855	19	3.97	.870	29	0.138
R30	Differences in working method and know-how between partners	3.85	.893	32	4.16	.834	23	3.95	.879	30	0.212
R31	Land acquisition (site availability)	3.88	1.042	28	4.11	.963	24	3.95	1.016	31	0.418

Table 3. Mean ranking of the risk factors for airport PPP projects. (continued)

R32	Maintenance more frequent than expected	3.90	.995	27	4.05	.848	29	3.95	.944	32	0.562
R33	Unproven engineering techniques	3.85	.949	30	4.05	.911	27	3.92	.934	33	0.441
R34	Force majeure	3.83	1.13	34	4.05	1.353	26	3.90	1.199	34	0.500
R35	Material/labour availability	3.83	.874	36	4.05	.911	28	3.90	.885	35	0.360
R36	Late design changes	3.85	.802	31	3.89	1.049	37	3.86	.880	36	0.857
R37	Environment	3.70	1.203	38	3.95	1.026	34	3.78	1.146	37	0.443
R38	Geotechnical conditions	3.60	1.215	42	3.89	1.150	36	3.69	1.198	38	0.380
R39	Level of public opposition to project	3.73	.987	37	3.58	1.17	43	3.68	1.041	39	0.619
R40	Expropriation or nationalization of assets	3.63	1.03	40	3.74	.933	39	3.66	.974	40	0.690
R41	Insolvency/default of sub-contractors or suppliers	3.55	1.154	44	3.89	1.049	38	3.66	1.124	41	0.275
R42	Industrial regulatory change	3.63	.774	41	3.68	1.003	41	3.64	.848	42	0.804
R43	Third Party Tort Liability	3.70	.939	39	3.53	1.264	44	3.64	1.047	43	0.556
R44	Weather	3.55	1.239	43	3.74	1.240	40	3.61	1.232	44	0.591
R45	Lack of tradition of private provision of public services	3.50	.847	46	3.44	1.097	45	3.48	.922	45	0.834
R46	Staff Crises	3.53	1.281	45	3.21	1.228	46	3.42	1.262	46	0.376

Factor Analysis of the CSFs and Risk factors

Lingard and Rowlinson (2006) (as cited in Osie-Kyei et al. 2014), proposed a sample size of the ratio 1:5 (variable involved to sample size) for considering the suitability of factors analysis for this research. However, studies conducted by (Bing et al., 2005; Hardcastle, Edwards, Akintoye, & Li, 2005; Li, Akintoye, Edwards, & Hardcastle, 2005; Robert, Dansoh, & Ofori – Kuragu, 2014) with sample size (61 respondents) and (Robert et al., 2014) with 45 respondent were accepted even it is not with the suggested sample size ratio and satisfied all statistical tests (C., Lam, ASCE, Cheung, & Ke, 2010). For that, it can be decided that factor analysis test can proceed with full confidence and reliability for this study. Factor Analysis of 20 CSFs and 46 RFs for PPP airport projects are carried out to identify the dimensions that are latent. Correlations among variables are calculated using the SPSS V 25 software. A traditional correlation matrix (correlations among variables) is produced. Most correlations are medium positive correlations. Correlation between CSF total score and risk factors total score is strongly positive, $p < .001$. Each data matrix has sufficient correlations to justify the application of factor analysis for both scales.

Monte Carlo PCA test criterion

This test is taken from parallel analysis, which was introduced by Horn, Çokluk and D. Koçak (Horn, 1965; Ömay Çokluk & Koçak, 2016). In Monte Carlo simulation test factors, be importance when Eigen Value is more than the mean value of those obtained from the random uncorrelated data. Eigenvalues obtained with the latent root criterion method are compared with eigenvalues obtained from the random uncorrelated data. Monte Carlo PCA test criterion results indicated that the CSFs scale is represented by four components that explain 55,885 of variance and Risk Factors scale is represented by five components that explain 55,777 of variance. We can see that the fifth scale eigenvalue in the CSFs scale is less than the corresponding Monte Carlo value and the sixth scale eigenvalue in the RFs scale is less than the corresponding Monte Carlo value. Table 4 shows the comparison of scales eigenvalues with Monte Carlo PCA random eigenvalues for both scales.

Table 4. Comparing Scales Eigen values with Monte Carlo PCA random eigenvalues

Scales	Eigen Values	1	2	3	4	5	6
CSFs	CSFs Values	5.5530	2.2300	1.7920	1.6240	1.2790	1.145
	Monte Carlo values	2.1703	1.9233	1.7599	1.6092	1.4711	1.3439
RFs	Risk Factors values	12.343	4.637	3.141	3.094	2.442	2.063
	Monte Carlo values	3.2032	2.9220	2.6870	2.5274	2.3724	2.2223

Based on the Monte Carlo PCA test criterion results mentioned above, factor analysis test was run again with four factors for CSFs and five factors for RFs. One criterion is used in interpreting the factor; factor loading which it is the correlation of the variables and the factors (Hair Jr. et al., 2010). "The criteria loadings of ±.50 or greater are considered practically significant and for criteria loading ±.30 to ±.40 are considered to meet the minimal level for interpretation of structure" (Joseph F. Hair JR., William C. Black, Barry J. Babin, & Anderson, 2010). Table 5 shows the structure matrix of factor loadings for each factor of the CSFs scale and indicates the result of the principal factor for 20 identified CSFs for PPP airport projects. It clear that, the total Eigen values for the three factors retained ranged from 2.032 to 3.337. The percentage of variance explained by the 1st factor is 27.703%, the 2nd factor is 11.130%, the 3rd factor is 8.946% and the 4thfactor is 8.106%. The 4 CSFs component are represented as: Effective planning and strategy, Transparent management, Project and process quality and Stability.

Table 5. CSFs for PPP airport projects grouping after rotated factor matrix

CSFs Groupings		Factor Loading	Total	% 0f variance explained	Cumulative % of variance explained
CSFs Groups 1: Effective planning and strategy			3.337	27.703	27.703
C06	Effective supervision mechanism	.780			
C16	Satisfying the need for public facility	.732			
C07	Appropriate project identification	.635			
C03	Profitability	.585			
C17	Stable macroeconomic environment	.516			
C02	Risk allocation and sharing	.446			
CSFs Groups 2: Transparent Management			3.961	11.130	38.833
C15	Effective management control	.777			
C20	Community / Public support	.758			
C04	Favorable legal framework	.743			
C13	Clearly defined responsibilities and roles	.647			
C19	Transparent procurement	.613			
C10	Adherence of time	.610			
CSFs Groups 3: Project and Process Quality			3.558	8.946	47.779
C08	Meeting output with specifications	-.831			
C14	Competitive tendering	-.824			
C18	Openness and constant communication	-.700			
C09	Reliable and quality service operations	-.694			
CSFs Groups 4: Stability			2.032	8.106	55.885
C05	Strong private consortium	.696			
C11	Political support	.654			
C12	Commitment made by partners	.594			
C01	Available financial market	.484			
	Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.				

Table 6 shows the Structure Matrix of factor loadings for each factor of the RFs scale. It is indicated that the total Eigen values for the five grouped factors ranged from 4.847 to 8.937. The percentage of variance explained by the five factors are 26.833%, 10.080%, 6.828%, 6.727% and 5.309% respectively. Similarly, the cumulative percentage of variance explained by the extracted five factors. It is noticeable that the risk factors of PPP airport projects are grouped into five sufficient component factors. Therefore, it can adequately represent the data of the five risk factors groupings. The five risk factors component are represented as: Construction risks, Environmental and force majeure risks, Operating risks, Legal framework and regulatory risks and Finance risks.

Table 6. Risk factors for PPP airport projects grouping after rotated matrix

Risk Factors Grouping		Factor Loading	Total	% 0f variance explained	Cumulative % of variance explained
Risk Factors Groups 1: Construction Risks			8.937	26.833	26.833
R21	Maintenance costs higher than expected	.816			
R13	Low operating productivity	.786			
R32	Maintenance more frequent than expected	.785			
R10	Operation cost overrun	.773			
R06	Operational revenues below expectation	.746			
R36	Late design changes	.744			
R17	Construction time delay	.660			
R35	Material/labor availability	.649			
R26	Poor quality workmanship	.605			
R07	Construction cost overrun	.558			
R33	Unproven engineering techniques	.547			
R12	Excessive contract variation	.545			
R28	Poor public decision-making process	.448			
Risk Factors Groups 2: Environmental and Force Majeure Risks			7.138	10.080	36.914
R44	Weather	-.844			
R38	Geotechnical conditions	-.819			
R37	Environment	-.817			
R34	Force majeure	-.710			
R11	Insolvency/default of sub-contractors or suppliers	-.682			
R46	Staff Crises	-.678			
R41	Residual risks	-.667			
R29	Lack of commitment from either partner	-.569			
R31	Land acquisition (site availability)	-.559			
Risk Factors Groups 3: Operating Risks			5.980	6.828	43.742
R30	Differences in working method and know-how between partners	.778			
R08	Inadequate distribution of responsibilities and risks	.729			
R27	Organization and co-ordination risk	.710			
R02	Stability	.627			
R24	Inadequate experience in PPP/PFI	.622			
R23	Inadequate distribution of authority in partnership	.616			
R19	Strong political structure	.594			
R15	Influential economic events	.547			
Risk Factors Groups 4: Legal Framework and Regulatory Risks			5.123	6.727	50.469
R18	Legislation change	.783			
R20	Change in tax regulation	.765			
R42	Industrial regulatory change	.751			
R39	Level of public opposition to project	.617			
R45	Lack of tradition of private provision of public services	.532			
R43	Third Party Tort Liability	.519			

Table 6. Risk factors for PPP airport projects grouping after rotated matrix (continued)

Risk Factors Groups 5: Finance Risks			4.847	5.309	55.777
R14	Inflation rate volatility	.863			
R09	Interest rate volatility	.852			
R03	Poor financial market	.652			
R01	Availability of finance	.649			
R04	Financial attraction of project to investors	.585			
R05	High finance costs	.566			
	Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization				

Conclusion

The increasing demand for public services and the need to bridge huge infrastructural gaps have pushed governments around the world to face major challenges in order to provide quality services with PPP strategy. In this regard, researchers in developed and developing countries have conducted several research covering both risk and critical success factors for implementing policies.. This research, therefore, aims to examine and identify RFand CSF within case of Turkey. This research started with an extensive review of the literature to identify most common and important CSFs and RF that affect PPP projects. Papers published in the field were reviewed through popular research engines such as, Scopus and Web of Science between the years 2000-2018. Following the literature review, an empirical questionnaire survey tested the relative importance of these potential factors in Turkey. The data for this study was gathered through structured surveys distributed to 162 experts of whom of which 67 experts from both the public and private sector in Turkey on PPP based airport projects. Regarding the relevance of data analysis, the reliability tests for factors suggest high internal consistency and reliability of the data with values for these factors at 0.851 and 0.930, respectively.

Public and private sectors think that, the most important critical success factors for airports projects in Turkey are: available financial markets(C1), risk allocation and sharing(C2), profitability(C3), favorable legal framework(C4), private consortium(C5) which mostly overlap with the literature review. On the other hand, public sectors interpretations differ than private sector in some cases. For instance, the public sector believes that factors like meeting output with specifications (C08) and competitive tendering (C14) as an important factor, although private sector ranks them less important. This indicates that project specification and tendering competitive factors should be taken into the account for public sectors in developing countries. Similarly, factors such as availability of finance (R01), stability (R02), poor financial market (R03) and financial attraction of project to investors (R04) were ranked

as the most significant risk factors from both sectors but with different ratios. Within case of Turkey, public sector identifies finance as the most significant risk factor, while private sector defines stability as the most important factor. Consequently private sector considers stability to be the most important risk that must be taken into account, especially the political stability of the state, while the public sector considers finance as the most important risk to be considered.

Factor analysis test was conducted to determine the principle factor grouping of critical success and risk factors. This revealed four and five factors grouping accounting for about 55.885% and 55.777% of all overall variances between CSFs and RFs respectively. Those grouping factors combined together in terms of 9 KPIs and listed as; construction risks, environmental and force major risks, operating risks, legal framework, and regulatory risks, financial risks, project planning and strategy, transparent management, project and process quality and stability. These KPIs therefore represent the basic elements of critical and risk factors for airport projects and should be considered by the public sector for shaping their PPP policy development.

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References

Abdul-Aziz, A. R., & Jahn Kassim, P. S. (2011). Objectives, success and failure factors of housing public–private partnerships in Malaysia. *Habitat International, 35*(1), 150-157. doi:10.1016/j.habitatint.2010.06.005

Abednego, M. P., & Ogunlana, S. O. (2006). Good project governance for proper risk allocation in public–private partnerships in Indonesia. *International Journal of Project Management, 24*(7), 622-634. doi:10.1016/j.ijproman.2006.07.010

Ameyaw, E. E., & Chan, A. P. C. (2015). Evaluation and ranking of risk factors in public–private partnership water supply projects in developing countries using fuzzy synthetic evaluation approach. *Expert Systems with Applications, 42*(12), 5102-5116. doi:10.1016/j.eswa.2015.02.041

Ameyaw, E. E., Chan, A. P. C., & Owusu-Manu, D.-G. (2017). A survey of critical success factors for attracting private sector participation in water supply projects in developing countries. *Journal of Facilities Management, 15*(1), 35-61. doi:10.1108/jfm-06-2016-0027

Başar, B., Bayirbaş, B. N., & Yilmaz, A. Z. (2016). The Public-Private Partnership Model in Turkey: Heavy Infrastructure Projects. *The Turkish Commercial Law Review*, (2, 2).

Bing, L., Akintoye, A., Edwards, P. J., & Hardcastle, C. (2005). The allocation of risk in PPP/PFI construction projects in the UK. *International Journal of Project Management, 23*(1), 25-35. doi:10.1016/j.ijproman.2004.04.006

Broadbent, J., & Laughlin, R. (2003). Public private partnerships: an introduction. *Accounting, Auditing & Accountability Journal, 16*(3), 332-341. doi:10.1108/09513570310482282

C., A. P., Lam, P. T. I., ASCE, D. W. M. C. M., Cheung, E., & Ke, Y. (2010). Critical Success Factors for PPPs in Infrastructure Developments: Chinese Perspective. *Journal of Construction Engineering and Management 136*(5). doi:DOI: 10.1061/ ASCECO.1943-7862.0000152

Cheung, E., & Chan, A. P. C. (2011). Risk Factors of Public-Private Partnership Projects in China: Comparison between the Water, Power, and Transportation Sectors. *Journal of Urban Planning and Development, 137*(4), 409-415. doi:10.1061/(asce)up.1943-5444.0000086

Chou, J.-S., Ping Tserng, H., Lin, C., & Yeh, C.-P. (2012). Critical factors and risk allocation for PPP policy: Comparison between HSR and general infrastructure projects. *Transport Policy, 22*, 36-48. doi:10.1016/j.tranpol.2012.05.009

Chou, J.-S., & Pramudawardhani, D. (2015). Cross-country comparisons of key drivers, critical success factors and risk allocation for public-private partnership projects. *International Journal of Project Management, 33*(5), 1136-1150. doi:10.1016/j.ijproman.2014.12.003

Chung, D., Hensher, D. A., & Rose, J. M. (2010). Toward the betterment of risk allocation: Investigating risk perceptions of Australian stakeholder groups to public–private-partnership tollroad projects. *Research in Transportation Economics, 30*(1), 43-58. doi:10.1016/j.retrec.2010.10.007

Cumming, D. (2007). Government policy towards entrepreneurial finance: Innovation investment funds. *Journal of Business Venturing, 22*(2), 193-235. doi:10.1016/j.jbusvent.2005.12.002

Emek, U. (2015). Turkish experience with public private partnerships in infrastructure: Opportunities and challenges. *Utilities Policy, 37*, 120-129. doi:10.1016/j.jup.2015.06.005

Ernest Effah Ameyaw, & Chan, A. P. C. (2016). Critical success factors for public-private partnership in water supply projects. *Facilities, 34*(3/4), 124-160. doi:10.1108/F-04-2014-0034

Grimsey Darrin, & Lewis, M. K. (2002). Evaluating the risks of public private partnerships for infrastructure projects. *International Journal of Project Management, 20*, 107-118.

Hair Jr., J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis: A Global Perspective* (7th Edition ed.): Pearson Education, Upper Saddle River.

Hardcastle, C., Edwards, P. J., Akintoye, A., & Li, B. (2005). *Critical Success Factors for PPP/PFI Projects in the UK Construction Industry: A Factor Analysis Approach*. Paper presented at the One day Conference on Public Private Partnerships, Opportunities and Challenges. The University of Hong Kong and Hong Kong Institution of Engineers.

Hemantkumar P. Bulsara, Alok Kumar, Rakesh Kumar, & Chauhan, K. A. (2016). Principle Factors for Success of Traditional vs. PPP Road Projects in India. *I J A B E R, 14*(6), 3575-3590.

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrica, 30*(2), 179-185.

Hsueh, C.-M., & Chang, L.-M. (2017). Critical success factors for PPP infrastructure: perspective from Taiwan. *Journal of the Chinese Institute of Engineers, 40*(5), 370-377. doi:10.1080/02533839.2017.1335619

Hwang, B.-G., Zhao, X., & Gay, M. J. S. (2013). Public private partnership projects in Singapore: Factors, critical risks and preferred risk allocation from the perspective of contractors. *International Journal of Project Management, 31*(3), 424-433. doi:10.1016/j.ijproman.2012.08.003

Ismail Abdul Rahman, Aftab Hameed Memon, & Zulkiffli, N. S. M. (2014). Failure Reasons of PPP Infrastructure Projects: Case Study of Kuala Lumpur LRT Project. *Life Science Journal, 11*(7), 238-246.

Joseph F. Hair JR., William C. Black, Barry J. Babin, & Anderson, R. E. (2010). *Over view of Multivariate Data Analysis* (7th Edition ed.). England: Pearson Education Limited.

Li, B., Akintoye, A., Edwards, P. J., & Hardcastle, C. (2005). Critical success factors for PPP/PFI projects in the UK construction industry. *Construction Management and Economics, 23*(5), 459-471. doi:10.1080/01446190500041537

Liu, T., Wang, Y., & Wilkinson, S. (2016). Identifying critical factors affecting the effectiveness and efficiency of tendering processes in Public–Private Partnerships (PPPs): A comparative analysis of Australia and China. *International Journal of Project Management, 34*(4), 701-716. doi:10.1016/j.ijproman.2016.01.004

LiYaning Tang, Qiping Shen, & Cheng, E. W. L. (2010). A review of studies on Public–Private Partnership projects in the construction industry. *International Journal of Project Management, 28*, 683-694. doi:10.1016/j.ijproman.2009.11.009

Noorzai, E., Jafari, K. G., Golabchi, M., Hamedi, S., & (2016). Selecting an Appropriate Finance Method of PPP for railway project in Iran throgh AHP Method *International Journal of Structural and Civil Engineering Research, 5*(1). doi:10.18178/ijscer.5.1.74-79

Ömay Çokluk, & Koçak, D. (2016). Using Horn's Parallel Analysis Method in Exploratory Factor Analysis for Determining the Number of Factors. *Educational Sciences: Theory & Practice, 16*(2), 537-551. doi:10.12738/estp.2016.2.0328/April

Osei-Kyei, R., & Chan, A. P. C. (2015). Review of studies on the Critical Success Factors for Public–Private Partnership (PPP) projects from 1990 to 2013. *International Journal of Project Management, 33*(6), 1335-1346. doi:10.1016/j.ijproman.2015.02.008

Osei-Kyei, R., Chan, A. P. C., Javed, A. A., & Ameyaw, E. E. (2017). Critical success criteria for public-private partnership projects: international experts' opinion. *International Journal of Strategic Property Management, 21*(1), 87-100. doi:10.3846/1648715x.2016.1246388

Pallant, J. (2016). *SPSS Survival Manual*. New York.

PWC. (2017). *Capital Project and Infrastructure Spending in Turkey Outlook to 2023*. Retrieved from

Rauda Al-Saadi, & Abdou, A. (2016). Factors critical for the success of public–private partnerships in UAE infrastructure projects: experts' perception. *International Journal of Construction Management*. doi:10.1080/15623599.2016.1146110

Robert, O. K., Dansoh, A., & Ofori – Kuragu, J. K. (2014). Reasons for adopting Public–Private Partnership (PPP) for construction projects in Ghana. *International Journal of Construction Management, 14*(4), 227-238. doi:10.1080/15623599.2014.967925

Robert Osei-Kyei, & Chan, A. P. C. (2016). Implementing Public–Private Partnership (PPP) Policy for Public Construction Projects in Ghana: Critical Success Factors and Policy Implications. *International Journal of Construction Management*. doi:10.1080/15623599.2016.1207865

Rockart, J. F., & Sloan, W. (1982). Information Systems Executive: A Critical Success Factors Perspective.

Roumboutsos, A., & Anagnostopoulos, K. P. (2008). Public–private partnership projects in Greece: risk ranking and preferred risk allocation. *Construction Management and Economics, 26*(7), 751-763. doi:10.1080/01446190802140086

Sanni, A. O. (2016). Factors determining the success of public private partnership projects in Nigeria. *Construction Economics and Building, 16*(2), 42-55. doi:10.5130/AJCEB.v16i2.4828

Shen, L.-Y., Platten, A., & Deng, X. P. (2006). Role of public private partnerships to manage risks in public sector projects in Hong Kong. *International Journal of Project Management, 24*(7), 587-594. doi:10.1016/j.ijproman.2006.07.006

Solomon Olusola Babatunde, Srinath Perera, Lei Zhou, & Udeaja, C. (2016). Stakeholder Perceptions on Critical Success Factors for Public-Private Partnership Projects in Nigeria. *Built Environment Project and Asset Management, 6*(1), 74-91. doi:10.1108/BEPAM-11-2014-0061

Song, J., Song, D., Zhang, X., & Sun, Y. (2013). Risk identification for PPP waste-to-energy incineration projects in China. *Energy Policy, 61*, 953-962. doi:10.1016/j.enpol.2013.06.041

Tang, L., Shen, Q., & Cheng, E. W. L. (2010). A review of studies on Public–Private Partnership projects in the construction industry. *International Journal of Project Management, 28*(7), 683-694. doi:10.1016/j.ijproman.2009.11.009

Wang, Y. (2015). Evolution of public–private partnership models in American toll road development: Learning based on public institutions' risk management. *International Journal of Project Management, 33*(3), 684-696. doi:10.1016/j.ijproman.2014.10.006

Worldbank. (2015). Transport Sector Global PPI1 Update. *Washington DC: World Bank publication*.

Xianhai Meng, Qi Zhao, Qiping Shen, & M.ASCE3. (2011). Critical Success Factors for Transfer-Operate-Transfer Urban Water Supply Projects in China. *Journal of Management in Engineering, 27*(4), 243-251. doi:10.1061/

Yongjian Ke, ShouQing Wang, Albert P. C. Chan3, & Cheung4, E. (2009). Research Trend of Public-Private Partnership in Construction Journals. *Journal of Construction Engineering and Management, 135*(10), 1076-1086. doi:10.1061//asce/0733-9364/2009/135:10/1076

Zhang, S., Chan, A. P. C., Feng, Y., Duan, H., & Ke, Y. (2016). Critical review on PPP Research – A search from the Chinese and International Journals. *International Journal of Project Management, 34*(4), 597-612. doi:10.1016/j.ijproman.2016.02.008

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