Exploratory factor analysis of skills requirement for PPP contract governance

Abdullahi Ahmed Umar
Civil Engineering and Quantity Surveying, Military Technological College,
Muscat, Oman
Noor Amila Wan Abdullah Zawawi
Universiti Teknologi Petronas, Tronoh, Malaysia, and
Abdul-Rashid Abdul-Aziz
School of Housing, Building and Planning, Universiti Sains Malaysia,
George, Malaysia

Abstract

Purpose – The purpose of this paper is to explore the skills required for effective contract management of public–private partnership (PPP) projects over their contract duration. The growing body of literature indicating the lack of expertise in managing PPP-related projects within the public sector prompted this study.
Design/methodology/approach – The study, being an exploratory one, relied on a survey of 207 survey responses from a sample of PPP experts across the globe. The data from the survey are a rich mix of responses from public policy experts, construction professionals, project finance experts, lawyers and academic researchers in PPP.
Findings – It was found through exploratory factor analysis that project management, financial engineering, negotiations, risk management, forecasting, stakeholder management and technical skills were very critical for successful contract management of PPP projects. It was also found that regional characteristics influence skills prioritisation.
Research limitations/implications – The results of this study can be validated on larger data sets in specific countries and across regions, sectors and variety of PPP projects. Currently, the authors conducted a general survey using convenience sampling.
Practical implications – The results send a clear signal to practitioners that infrastructure regulation training programs cannot be generalised. Training should be tailored to reflect regional and country-specific characteristics.
Originality/value – The increasing failures and remunicipalisations of privately financed infrastructures is a cause of concern. Little attention has been given to the complicity of PPP regulatory institutions responsible for contract governance of such projects. Studies are increasingly pointing to the absence of critical PPP skills among institutions responsible for managing PPP contracts. This lack of capacity has resulted in poor oversight of private companies providing public services resulting in poor services, and financial recklessness which threaten the sustainability of service provision.
Keywords PPP, Private sector, Public sector, Contract governance, Infrastructure regulation, PPP skills, Remunicipalisation
Paper type Research paper

1. Introduction

Policy makers are in agreement globally about the importance of infrastructures to economic growth and development. The absence of modern infrastructure has been blamed for the poor performance of economies in developing countries with its associated high rates of poverty. Even the recently agreed Sustainable Development Goals (SDGs) cannot be achieved without infrastructure. Goals 3 –health, 4 – education, 6 – water supply and Sanitation, 7 – Affordable clean energy, 9 – industry, innovation and infrastructure and 11 – sustainable cities and communities are all underpinned by the availability of good supporting infrastructures. Policy makers are also in agreement that given constrained fiscal space, the private sector through structures such as public–private partnerships (PPPs) can assist to fill the infrastructure

www.

provision gaps. For more than two decades, infrastructure provision through PPPs has been used to support governments around the world to deliver projects which would not have been possible given their fiscal challenges. PPPs have been used to deliver over 700 infrastructure and services projects in the UK alone (NAO, 2018). In other regions of the world, supported by the World Bank and other multi-lateral agencies, there has been a proliferation of PPPs in various infrastructure sectors. However, in recent years there has been a steady decline in the use of PPPs and an increase in remunicipalisation globally.

Globally, over 250 water sector PPPs were cancelled between the year 2000 and 2015 (Kishimoto *et al.*, 2015; Lobina *et al.*, 2014). In Germany, 72 privatised energy contracts were cancelled and returned to public provision (Wagner and Berlo, 2015). Similar failures and cancellations in electricity PPPs have been reported in five Sahel countries in sub-Saharan Africa (Gualberti *et al.*, 2009). The cancellation of all energy contracts in the UK is being advocated by UK labour party leader, Jeremy Corbyn. Hall (2016) argued that despite the cost of the proposed cancellations, the benefits to be derived from public energy provision were a better bargain for the UK. Almost all rail transport PPPs in the UK have been cancelled and returned to public provision. The government of Alaska in the USA has abandoned its proposed Bridge PPP across Knik Arm in favour of public provision (Hall, 2015). In continental Europe, private sector investments in infrastructure decreased by 22 per cent (EPEC, 2017). The World Bank, a major advocate and financier of PPPs globally, also reports a huge drop in PPPs. According to the bank, there was a 37 per cent decline in the value of investments and a 27 per cent decline in number of projects (World Bank, 2017). Given the appalling performance, the UK Government has had to review and reform its PFI into what it now calls PF2 (HM Treasury, 2012). However, it has recently emerged that the UK Government failed to implement its proposed reforms across the six PF2 projects signed in 2017. Among the reasons that necessitated the reform includes excessive gains by equity providers, lack of transparency, long procurement times, inefficient risk transfer, perceived inefficiency in the PFI model and lack of competitive long-term debt finance (HM Treasury, 2012; NAO, 2015; NAO, 2018; Buisson, 2013). Just this month (January 2018), one of UK's largest PPP contractor, Carillion, went bust even though it got a clean bill of health from its auditors ten months earlier.

The major reasons many PPP contracts are being cancelled include poor performance of private companies, under-investment, disputes over operational costs and price increases, soaring household bills, difficulties in monitoring private operators, lack of financial transparency, workforce cuts and poor service quality (Kishimoto *et al.*, 2015; Lobina *et al.*, 2014). One of the major culprits in all of these has been the institutions responsible for monitoring the private providers. Monitoring is a collective term for all activity aimed at ensuring compliance during the term of a contract, including measuring the quality of a product, compliance with restrictive covenants in debt contracts, etc. (Pretorius *et al.*, 2008). An analysis of electricity privatisation failure across five Sahel countries showed that weak regulation was a major factor (Gualberti *et al.*, 2009). In a review of five PPP projects across India, it was found that there are large competency gaps in the area of PPP project governance (Devkar *et al.*, 2013). In South Africa, it has also been reported that the poor performance of PPP was as a result of weak competencies in the public sector (Burger, 2006). Even as sophisticated as the UK PPP market is, G4S and Serco were recently fined for overcharging government on PPP contracts. A private energy provider also overcharged British customers for a period of five years without detection by Ofgem (Hawkes, 2013).

The cause of monitoring failures has been attributed to weak public sector skills set (Burger, 2006; Gualberti *et al.*, 2009; Williams, 2010; Soomro and Zhang, 2011; HM Treasury, 2012; Devkar *et al.*, 2013; Soomro and Zhang, 2013; Buisson, 2013; NAO, 2015; NAO, 2018). The latest report on PPPs from the UK found that public bodies do not have the in-house capability or expertise to effectively manage PPP contracts (NAO, 2018). The skills situation

in many PPP regulatory institutions is so bad that many of them outsource their regulatory functions (Trémolet *et al.*, 2004; Trémolet and Shah, 2005; Trémolet, 2007). Despite this situation, there seem to be a dearth of studies looking into the skills required by the public sector to effectively manage PPP contracts. Therefore, this study attempts to fill that gap by addressing the issue of skills required by PPP monitoring bodies to be able to discharge their duties effectively and reduce the growing trend of renegotiations, remunicipalisations, failures and cancellations. These failures, if left unchecked, could compromise the ability to meet the infrastructure-related SDG goals in many developing countries. Hence, the aim of this work is to explore and determine, through a global survey of PPP practitioners, the skills set required for effective PPP contract governance. Section 2 covers the duties of PPP regulators, Section 3 is the methodology, Section 4 cover results and discussions while Section 5 concludes.

2. PPP contract management: regulators and their mandates
Financing infrastructures solely through tax revenue has proven to be challenging for most governments, necessitating the use of PPP. Because the private sector could behave opportunistically by exercising monopoly power, regulatory agencies were created to monitor the private providers. Over 200 infrastructure regulators have been created in the last two decades (Brown *et al.*, 2006, p. 12). These regulatory agencies were supposed to provide confidence to businesses, protect consumers and ensure that universal service obligations were met. Despite regulatory oversight, private providers have been found to be making huge windfall profits (Vecchi *et al.*, 2013; HM Treasury, 2012; NAO, 2015; NAO, 2018). In Latin America, over 50 per cent of PPPs have undergone renegotiations (Guasch, 2004). Although, regulation by contract which presupposes the absence of a regulator has been advocated (Bakovic *et al.*, 2003), empirical evidence, however, suggests that contracts are not always a good tool for regulating PPPs, especially when projects are complex and the contract incomplete (Estache and Saussier, 2014). And there is a growing body of evidence that suggests that having regulators along with PPPs brings about increased efficiency (Makovsek and Moszoro, 2016). The duties of PPP regulators are summarised in Table I.

2.1 Skills required for effective regulation
As in any knowledge enterprise, human resources are the most important assets; the regulatory system is no different. Skills are the knowledge and experiences required by an individual to carry out a task effectively (NAO, 2011, p. 6). Stakeholders, particularly industry representatives, have argued that the quality and competency of regulatory staff has a great influence on the effectiveness of the regulatory system (External Advisory Committee on Smart Regulation, 2004, p. 66). Infrastructure regulation is not new, however, the scope of activities to be regulated has increased with the advent of PPPs. Despite the differences in the degree of regulation across sectors, there are less sectoral differences in their objectives and consequently the types of skills required. The types of skills needed for utilities regulation are special and relatively scarce (Hewitt, 2004) and this scarcity has been one of the problems of effective regulation in developing countries (Kessides, 2004, p. 88). Even in the UK getting the right skills is still a challenge (Stern, 2000, p. 9). This shortage of skills has cost the UK Government enormous sums in hiring consultants, with £904m spent in 2006–2007 and £789m spent in the years 2009–2010 (NAO, 2010). All these spending occurred due to the absence of the relevant skill mix within the in-house staff. It has also been reported that the specific design of regulation and the competence, independence and skills of its implementation agency determine the extent to which the efficiency gains achieved by reforms can be passed on to users (Estache, 2005, p. 293). In conclusion, enhancing the expertise of the regulatory entity is not only a way of resolving technical capacity constraints but also of fostering the independence of the regulator (Kerf *et al.*, 1998).

Duties of PPP infrastructure regulators	Source/reference
Licensing of operators	Ganev (2009)
Negotiations	
Environmental protection	
Ensuring sustainability of service supply	
Developing rules for connection to grids	
Issue green certificates for energy from renewable sources	
Prevent monopoly inefficiency	Crew and Kleindorfer (2002) and Kirkpatrick *et al.* (2006)
Protect consumers	
Regulate prices/tariffs	Tenenbaum (1996) and Jacobs (2004)
Monitor financial viability of operators	
Redistribution of wealth/reduce poverty	Crew and Kleindorfer (2002) and Stern (2006)
Ensure compliance with Universal Service Obligations (USOs)	
Protecting investors	Kirkpatrick *et al.* (2006) and Kessides (2004, p. 17) and Hammami *et al.* (2006, p. 8)
Encourage FDI in-flows	
Eliminate corruption	Estache *et al.* (2009) and Estache and Rodriguez-Pardina (1998, p. 7)
Regulate quality	
Social protection	Estache and Rodriguez-Pardina (1998, p. 7)
Ensure accountability	
Ensure transparency	
Ensures health and safety	
Ensuring sustainable development	
Establishing technical/service standards	Estache and Rodriguez-Pardina (1998, p. 7), Gausch (2004, p. 135) and Tenenbaum (1996)
Policy advise to government	
Advise on concession/contract design	
Compiling information on cost	
Performance management and	
Organise/advise on procurement/bidding	
Dispute resolution	
Prosecute firms for non-compliance	Kerf *et al.* (1998) and Estache and Rodriguez-Pardina (1998, p. 7)

Table I.
Duties of PPP
infrastructure
regulators

3. Methodology

After reviewing existing literature on PPP regulatory governance, a list of 31 skills were deduced and a Likert-scale type online survey questionnaire was developed. The survey method was adopted because of the exploratory nature of the study. Survey method makes it possible to reach a larger population of respondents with relative ease (Jones *et al.*, 2013). The intent of the researchers was to get as many practitioners as possible to contribute their experience in determining the most critical skills for PPP contract governance. Furthermore, surveys produce data based on real-world observations, their breadth of coverage helps obtain data based on a representative sample which can generalisable, and are less expensive than other forms of data collection methods (Kelley *et al.*, 2003). PPP practitioners in public and private sectors including PPP researchers in academia were carefully selected through referral networks, universities websites and regulatory agencies websites. The link to the online survey questionnaire was sent to them via e-mail. The online questionnaire was chosen because of its advantages of time, cost and access to remote populations (Fricker and Schonlau, 2002; Wright, 2005; Evans and Mathur, 2005). However, despite the relative advantages of this method, there is still the risk of bias against regions where the internet is difficult to access. To control against this bias, the survey was conducted for a longer period with reminders sent to potential respondents from regions which have not been adequately represented from the responses received. The experts were asked to rate the relative importance of the 31 skills on a five point Likert-scale with 1 = strongly disagree,

2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. A total of 207 responses across seven regions (Africa, Asia, Europe, Middle East, North America, South/Latin America and Oceania) were received. The responses were then analysed using IBM SPSS statistical software version 21 and the results presented below.

There was a need to reduce the 31 skills into a more manageable number, hence, the need for an exploratory factor analysis. The main goal of factor analysis is to represent those variables which are interrelated with a more general name (Salkind, 2004, p. 300). There are two main approaches to factor analysis – exploratory and confirmatory (Pallant, 2007, p. 172). This study, being of an exploratory nature because of the under-developed nature of research in the area of PPP governance skills, adopted the exploratory factor analysis. The exploratory factor analysis technique allows the software to suggest the optimum number of factors while confirmatory factor analysis is used to test or confirm specific hypothesis concerning the structure underlying a set of variables (Pallant, 2007, p. 172). The Kaiser–Meyer–Olkin for the data was 0.888 while Bartlett's test of Sphericity was significant (sig = 0.001). This result indicates good factorability of the data set (Pallant, 2007, p. 181). The factor analysis reveals that seven factors explained 66.34 of the total variance. The factors were further rotated using varimax rotation to make them clearer and easier to interpret (Pallant, 2007, p. 183).

4. Results and discussions
Analysis of the responses received shows that 83 of the respondents were from the public sector, 98 from the private sector and 26 from the academia. In terms of qualifications, PhDs holders are 47, MSc/MBA – 110, BSc – 29, diploma – 10 and other – 11. In terms of professions, construction/civil engr – 64, legal officers – 19, finance professionals – 42, mech/elect engr – 17, economists – 48 and public policy experts – 17. The profile of the respondents shows that the respondents were qualified to give valid opinions on the subject matter given the fact that 89.86 per cent had a university degree, 73.43 per cent had over five years industry experience and cover seven regions of the world as shown in Table II.

The reliability test performed on the data returned a co-efficient alpha of $\alpha = 0.936$ which falls within the "excellent" classification by Hinton et al. (2004) and Gliem & Gliem (2003). The Kolmogorov–Smirnov tests returned a non-significant p-value ($p = 0.200$) while the Shapiro–Wilk returned a significant p-value ($p = 0.001$). But the Shapiro–Wilk is a more powerful test than the Kolmogorov–Smirnov (Razali and Wah, 2011). Therefore, the result suggests that the distribution is different from a normal distribution. Given this finding, non-parametric statistics was employed for the rest of the analysis.

Since most of the categorical variables contained more than two levels within each group, Kruskal–Wallis test, the non-parametric equivalent of the ANOVA was used (Pallant, 2007, p. 226). The Kruskal–Wallis test conducted to assess if there was statistically significant

Region	Years of experience 1–5 yrs	6–10 yrs	11–15 yrs	16–20 yrs	21 and above	Total
Africa	6	4	5	6	1	22
Asia	13	4	6	6	5	34
Europe	23	21	9	10	8	71
Middle-East	5	3	4	7	1	20
North America	3	7	8	4	6	28
Latin America	3	8	3	2	4	20
Oceania	2	2	4	1	3	12
Total	55	49	39	36	28	207

Table II.
Crosstab of years of experience and region of respondents

difference across the five grouping variables (years of experience, Sector, region, profession and type of projects) revealed the results shown in Table III. The results indicate that there was no statistically significant difference between the respondents by years of experience ($p-0.374$), by sector (public, private and academia) ($p-0.264$) or type of project ($p-0.058$). However, the result showed statistically significant differences when comparison was based on profession ($p-0.000$) and region ($p-0.010$). The mean rank for the grouping variable, "Region", shows that respondents from Africa, Middle East, North America and Oceania had similar perception while respondents from Asia, Europe and Latin America were also similar in their perception. However, a further median test conducted revealed that the Asian respondents were the single most influencing group even though the reason for this was not immediately clear. It has been argued that legal, constitutional, political and historical context may influence the institutional architecture and developments of regulatory systems (ICAS, 2010). It was initially hard to see what would connect Asia and Europe, even though one can conclude that Asia and Latin America shared similar characteristics of "welfarism". In a bid to isolate the link, a re-examination of all the European respondents from the raw data file revealed the source of the similarity. A larger percentage of the European respondents were from Central and Eastern Europe (CEE countries), and these countries have similar characteristics with Asia and Latin America. This finding was consistent with an earlier assertion by Kessides (2004, p. 91) that country-specific characteristics may influence regulatory design.

In terms of the differences witnessed within the professions, the mean rank reveals economists and accountants shared similar perception while construction professionals, lawyers, mechanical & electrical engineers and public policy analysts also shared similar perceptions. This seems to clearly divide the respondents into two groups of financial sector-related respondents and non-financial sector-related respondents.

The 31 individual skills were ranked based on the responses from the respondents using their means score values. Sector-specific skills were ranked as the most important suggesting that regulatory staff need adequate knowledge of the sector being regulated. Risk identification and management was ranked in second place. Risk management has always been at the heart of the decision to involve the private sector in infrastructure provision, and an optimum level of risk allocation is a precondition for successful PPPs (Marques and Berg, 2011). PPP regulatory governance helps ensures that the risk management process is continuous throughout the duration of the contract.

Technical skills, legal skills and tariff design skills ranked in third, fourth and fifth place, respectively. Stakeholder management skills came in sixth place; and over the years the importance of this skill has manifested in Cochabamba (Bolivia) and Skye Toll Bridge (UK). A number of surprises in relation to the rankings in Table IV were witnessed. Accounting and auditing skills (27th place) did not perform well in the ranking despite its importance as asserted by Kessides (2004, p. 62). Another surprise ranking was sustainability/environmental skills (26th place) considering the growing issues of climate change and current SDGs. This indicates that environmental issues are being traded-off for profitability by private sector, and for security of service by public sector. Poor environmental practices in PPPs are one of the fundamental causes for the growth in remunicipalisation (Kishimoto *et al.*, 2015).

Test Variable	df	χ^2	Asymp. Sig.
Years of experience	4	4.244	0.374
Sector	2	2.663	0.264
Type of project	7	13.623	0.058
Region of respondent	6	16.705	0.010
Profession	5	32.977	0.000

Table III.
Results of
Kruskal–Wallis test
of grouping variables

S. No.	Skills	Mean score
1	Sector-specific skills	4.3671
2	Risk identification and management	4.2802
3	Technical skills	4.1256
4	Legal skills	4.0676
5	Tariff design skills	4.0676
6	Stakeholder management skills	4.0435
7	Economics skills	4.0338
8	Output specification skills	4.0048
9	Strategic planning/management skills	3.9952
10	Contract design skills	3.9758
11	Lifecycle skills	3.9565
12	Negotiation skills	3.9372
13	Performance management	3.9130
14	Communication strategy	3.8502
15	Project management skills	3.8502
16	*Ex-post* negotiation skills	3.8454
17	Management skills	3.8357
18	Data collection and management skills	3.8309
19	Forecasting skills	3.8261
20	Business analysis skills	3.7826
21	Procurement skills	3.7681
22	Financial engineering and modelling	3.7440
23	Engineering skills	3.7343
24	Negotiation analysis skills	3.7198
25	Political skills	3.7150
26	Sustainability/environmental skills	3.6039
27	Auditing and accounting skills	3.5556
28	Media relation skills	3.4928
29	Human capital/org assessment skills	3.4444
30	Health, safety and environment skills	3.3140
31	Facilities management skills	3.2802

Table IV.
Mean score ranking of
PPP governance skills

Table V shows the result of the exploratory factor analysis using the principal component analysis extraction method with varimax rotation method converging in 12 iterations. The following factors were extracted:

(1) Project management skills: this skill accounted for 34.80 per cent of the total variance indicating its degree of importance. Adhering to project management methods and strategies reduces risks, cut costs and improves success rates (PMI, 2010).

(2) Financial engineering skills: this skill accounted for 9.00 per cent of the total variance indicating it as the second most important factor. Owing to the long duration of PPP projects and the huge debt-equity ratio of 90–10 per cent, financial engineering instead of civil engineering has become the key to the success of PPP projects (Haley, 1992, p. 65).

(3) Negotiation skills: this skill accounted for 6.26 per cent of the total variance making it the third most important factor. Mehra (2005) reports that poor negotiation skills led to the failures in Canada's Nova Scotia Schools PPP, Bruce Nuclear plant PPP and UK's Cumberland infirmary PPP in Carlisle.

(4) Risk management skills: this skill accounted for 5.42 per cent of the total variance making it the fourth most important factor. Good procurement skills helped the public to ring-fence UK's Wessex water and Oregon's PGE from the parent company, Enron; hence, they were not affected by the collapse of Enron (Byatt, 2013).

Table V.
Result of exploratory factor analysis

Factor clustering/groupings	Eigenvalues	% of variance explained	Result of exploratory factor analysis[a] Factor name	PPP projects/SPVs affected by lack of identified skills	Remarks
Health, safety and environment skills	0.697		Project management skills	London underground	Williams (2010)
Management skills	0.706	34.80		Glasgow schools	Mehra (2005)
Facilities management skills	0.725				
Project management skills	0.770				
Strategic management skills	0.740				
Legal skills	0.525		Economics and financial engineering skills		
Economics skills	0.748				
Engineering skills	0.562			Enron	Baker (2003)
Tariff design skills	0.724	9		Confederation Bridge Canada	Mehra (2005)
Lifecycle skills	0.698			Carillion	
Financial engineering and modelling	0.559				
Auditing and accounting skills	0.522				
Negotiation skills	0.682		Negotiations skills	Water tariffs Ukraine	OECD (2003, p. 9)
Negotiation analysis skills	0.800	6.26		Bruce Nuclear, Canada	Mehra (2005)
Ex-post negotiation skills	0.736			Nova Scotia Schools Canada	
Media Relation skills	0.604				
Risk identification and management	0.766		Risk management skills	Wessex water	Byatt (2013)
Procurement skills	0.678			Welsh water	
Performance management	0.583	5.42		Oregon's PGE	Berthélemy et al. (2004, pp. 103-104)
Output specification skills	0.563			AES Senegal and Cameroun power projects	
Sustainability/environmental skills	0.501		Technical skills	Palestine water authority	Trémolet (2007, p. 5)
Technical skills	0.768	4.14		Cumberland infirmary	Mehra (2005)
Sector-specific skills	0.593			Swan Hill MSW	

(*continued*)

Result of exploratory factor analysis[a]

Factor clustering/groupings	Eigenvalues	% of variance explained	Factor name	PPP projects/SPVs affected by lack of identified skills	Remarks
Forecasting skills	0.617	3.49	Forecasting skills	Danish Bridges and Tunnels Sidney Cross city Tunnel Hong Kong Western Harbour Leeds PFI Museum	Skamris and Flyvbjerg (1996) Froud (2003)
Stakeholder management skills	0.648	3.23	Stakeholder management skills	Cochabamba water project, Maputo water project	Jimenez-Redal et al. (2014)
Total variance explained		66.34			

Notes: Extraction method: principal component analysis; rotation method: varimax with Kaiser Normalisation. [a]Rotation converged in 12 iterations

Table V.

(5) Technical skills: this skill accounted for 4.14 per cent of the total variance making it the fifth most important factor. The skills clustered under this factor include technical, sector-specific and environmental skills. Lack of adequate technical skills on the part of the public sector led to poor vetting of the design for the UK's Cumberland Infirmary in Carlisle. This resulted in high temperatures which caused expanded hot air to blow out two windows, showering a consultant and a nurse with glass. Mehra (2005, p. 32) also reports of science laboratory benches constructed facing the walls instead of the teachers.

(6) Forecasting skills: this skill accounted for 3.49 per cent of the total variance making it the sixth most important factor. The skill was assigned as a factor of its own by the factor analysis. Poor forecasting skills have been responsible for the failure of many toll roads where the private sector inflates car numbers when submitting bids. Research shows that private sector forecast often turned out lower than actual demand by 20–60 per cent (Skamris and Flyvbjerg, 1996).

(7) Stakeholder management skills: this skill accounted for 3.23 per cent of the total variance making it the seventh and final factor. The skill was also extracted as a factor by the principal component analysis. Poor stakeholder management led to the failure of the Cochabamba water concession which resulted in violent protests in Bolivia. On the other hand, good stakeholder management ensured the success and continued operation of the Maputo water supply PPP (Jimenez-Redal *et al.*, 2014).

The above seven factors adequately summarise and explain the larger data set of 31 skills and could be classified as the major competencies required for effective PPP contract management. Determining the required skills set is one half of the solution to ensuring PPPs regulatory agencies deliver on their mandates. However, an efficient way to deliver these skills still remains a challenge. One of the first steps in this direction would be to ensure a minimum level of educational qualification for would-be regulatory staff. This is hinged on the fact that increasing individual's education level by 10 per cent would lead to productivity increases of 8.6 per cent (Stanford, 2010). Another effective method is coaching and on-the-job training for regulatory staff (Trémolet and Shah, 2005).

5. Conclusions

Private involvement in infrastructure provision has generated more controversies than the problems it was meant to solve, especially as it relates to the use of private finance, risk transfer, risk pricing and private control of commonwealth. Infrastructure regulatory institutions were created among others things to protect infrastructure end users from monopoly exploitations, ensure sustainability of provision, ensure environmental safety, provider profitability and prevent market failures. However, the growing remunicipalisation across hitherto privatisation strongholds like France and the USA is giving cause for concern about the effectiveness of regulatory agencies. Infrastructure regulators have not delivered on their mandates. The premise upon which this study was based is the fact that the performance of any task effectively is dependent on the competency of those mandated with its performance. Before assessing whether the regulators are skilled enough, it is important to first identify the type of skills needed for effective regulation. This is especially important given the diverse objectives of infrastructure regulation. This study cannot boast of filling the gap in identifying the diverse sets of skills required, but can serve as a good background to build upon, given the diverse respondents drawn from seven regions across the globe who willingly shared their perception with regards to the study. An equally important finding of this study is the sector consensus on the ranking of skills which would make it easy for resource constrained countries to adopt a multi-sector regulation approach

such as is practiced in Jamaica. Even though regional differences were found in the rankings, it was instructive that such differences could be explained based on the country-specific characteristics. Finally, further research would be encouraged to further expand the study using a larger sample size to see if the findings would differ significantly from what was obtained in this study.

6. Implications for practice

While infrastructure regulation is seen as a wholly compact concept, outcomes are dependent on country-specific objectives, hence, the regional differences found in this study. The results should send a clear signal to PPP stakeholders such as the World Bank, IMF and other practitioners to tailor PPP training and capacity building according to country-specific characteristics rather than the current generalised approach being advocated across developing countries. Equally important is the need for PPP regulators to put stronger emphasis on environmental issues as it relates to PPP infrastructures.

References

Baker, R.C. (2003), "Investigating Enron as a public–private partnership", *Accounting, Auditing and Accountability*, Vol. 16 No. 3, pp. 446-466.

Bakovic, T., Tenenbaum, B. and Woolf, F. (2003), "Regulation by contract: a new way to privatize electricity distribution?", Energy and Mining Sector Board Discussion Paper No. 7, The World Bank Group and Energy and Mining Sector Board, Washington, DC.

Berthélemy, J.-C., Kauffmann, C., Valfort, M.-A. and Wegner, L. (2004), *Privatisation in Sub-Saharan Africa: Where Do We Stand?*, Development Centre of the Organisation for Economic Co-operation and Development (OECD), Paris.

Brown, A.C., Stern, J., Tenenbaum, B. and Gencer, D. (2006), *Handbook for Evaluating Infrastructure Regulatory Systems*, The World Bank, Washington, DC.

Buisson, A. (2013), *From PF1 to PF2: The Reform of the Public-Private Partnership Model in the UK*, Sl., Norton Rose Fulbright.

Burger, P. (2006), *The Dedicated PPP Unit of the South African National Treasury*: OECD and the Intervención General de la Administración del Estado (IGAE), Madrid.

Byatt, I. (2013), "The regulation of water services in the UK", *Utilities Policy*, Vol. 24, pp. 3-10.

Crew, M.A. and Kleindorfer, P.R. (2002), "Regulatory economics: twenty years of progress?", *Journal of Regulatory Economics*, Vol. 21 No. 1, pp. 5-22.

Devkar, G.A., Mahalingam, A. and Kalidindi, S.N. (2013), "Competencies and Urban public private partnerships projects in India: a case study analysis", *Policy and Society*, Vol. 32 No. 2, pp. 125-142.

EPEC (2017), *Review of the European PPP Market in 2016: Market Update*, European Investment Bank (EIB) and European PPP Expertise Centre (EPEC), Luxembourg.

Estache, A. (2005), "Latin America's infrastructure experience: policy gaps and the poor", in Nelli, J. and Birdsall, N. (Eds), *Reality Check: The Distributional Impact of Privatization in Developing Countries*, Center for Global Development, Washington, DC, pp. 281-294.

Estache, A. and Rodriguez-Pardina, M. (1998), *Light and Lightning at the End of the Public Tunnel: The Reform of the Electricity Sector in the Southern Cone*, The World Bank, Washington, DC.

Estache, A. and Saussier, S. (2014), *Public Private Partnerships and Efficiency*, Chaire Economie des Partenariats Public-Privé, Paris.

Estache, A., Goicoechea, A. and Trujillo, L. (2009), "Utilities reforms and corruption in developing Countries", *Utilities policy*, Vol. 17 No. 2, pp. 191-202.

Evans, J.R. and Mathur, A. (2005), "The value of online surveys", *Internet Research*, Vol. 15 No. 2, pp. 195-219.

External Advisory Committee on Smart Regulation (2004), *Smart Regulation: A Regulatory Strategy for Canada*, Government of Canada, Ontario.

Fricker, R.D. Jr and Schonlau, M. (2002), "Advantages and disadvantages of internet research surveys: evidence from the literature", *Field Methods*, Vol. 14 No. 4, pp. 347-367.

Froud, J. (2003), "The private finance initiative: risk, uncertainty and the state", *Accounting, Organizations and Society*, Vol. 28 No. 6, pp. 567-589.

Ganev, P. (2009), "Bulgarian electricity market restructuring", *Utilities Policy*, Vol. 17 No. 1, pp. 65-75.

Gliem, J.A. and Gliem, R.R. (2003), *Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales*, The Ohio State University, Ohio.

Gualberti, G., Alves, L., Micangeli, A. and Carvalho, M.d.G. (2009), "Electricity privatizations in Sahel: a U-turn?", *Energy Policy*, Vol. 37 No. 11, pp. 4189-4207.

Guasch, L.J. (2004), *Granting and Renegotiating Infrastructure Concessions: Doing it Right*, The World Bank, Washington, DC.

Haley, G. (1992), "Private finance for transportation and infrastructure projects: a view", *International Journal of Project Management*, Vol. 10 No. 2, pp. 63-68.

Hall, D. (2015), *Why Public–Private Partnerships Don't Work: The Many Advantages of the Public Alternative*, Public Services International (PSI), Ferney-Voltaire.

Hall, D. (2016), *Public Ownership of the UK Energy Systems-Benefits, Costs and Processes*, PSIRU, London.

Hammami, M., Ruhashyankiko, J.-F. and Yehoue, E. (2006), *Determinants of Public Private Partnerships in Infrastructure*, Sl, IMF, Paris.

Hawkes, S. (2013), "British gas could have overcharged customers for five years, say Ofgem", available at: www.telegraph.co.uk/finance/newsbysector/energy/10125755/British-Gas-could-have-overcharged-customers-for-five-years-says-Ofgem.html (accessed 18 June 2013).

Hewitt, A.E. (2004), *The Search for Optimal Institutional Design for Utilities Regulation: Is the Multi-Sector Model Still Viable?*, Organization of Caribbean Utility Regulators, Montego Bay.

Hinton, P., Brownlow, C., McMurray, I. and Cozens, B. (2004), *SPSS Explained*, Routledge, New York, NY.

HM Treasury (2012), *A New Approach to Public Private Partnerships*, HM Treasury, London.

ICAS (2010), *Regulatory Governance in Developing Countries*, International Finance Corporation (IFC), Washington, DC.

Jimenez-Redal, R., Parker, A. and Jeffrey, P. (2014), "Factors influencing the uptake of household water connections in Peri-Urban Maputo, Mozambique", *Utilities Policy*, Vol. 28, pp. 22-27.

Jones, T., Baxter, M. and Khanduja, V. (2013), "A quick guide to survey research", *Annals of the Royal College of Surgeons of England*, Vol. 95 No. 1, pp. 5-7.

Kelley, K., Clark, B., Brown, V. and Sitzia, J. (2003), "Good practice in the conduct and reporting of survey research", *International Journal for Quality in Health Care*, Vol. 15 No. 3, pp. 261-266.

Kerf, M., Gray, D.R., Irwin, T. and Levesque, C. (1998), *Concessions for Infrastructure: A guide to their Design and Award*, The World Bank, Washington, DC.

Kessides, I.N. (2004), *Reforming Infrastructure Privatization, Regulation, and Competition*, World Bank/Oxford University Press, Washington, DC.

Kirkpatrick, C., Parker, D. and Zhang, Y.-F. (2006), "Foreign direct investment in infrastructure in developing countries: does regulation make a difference?", *Transnational Corporations*, Vol. 15 No. 1, pp. 144-171.

Kishimoto, S., Lobina, E. and Petitjean, O. (2015), *Our Public Water Future*, Transnational Institute, Amsterdam.

Lobina, E., Kishimoto, S. and Petitjean, O. (2014), *Here To Stay: Water Remunicipalisation as a Global Trend*, Public Services International Research Unit (PSIRU), London.

Makovsek, D. and Moszoro, M. (2016), *Private Sector Participation in Infrastructure: Can the Price of Risk Transfer be Efficient?*, International Transport Forum and OECD, Paris.

Marques, R.C. and Berg, S. (2011), "Risks, contracts, and private-sector participation in infrastructure", *Journal of Construction Engineering and Management*, Vol. 137 No. 11, pp. 1-16.

Mehra, N. (2005), *Flawed, Failed, Abandoned, 100 P3s: Canadian and International Evidence*, Ontario Health Coalition, Ontario.

NAO (2010), *Central Government's use of Consultants and Interims*, National Audit Office, London.

NAO (2011), *Identifying and Meeting Central Government's Skills Requirements*, National Audit Office, London.

NAO (2015), *The Choice of Finance for Capital Investment*, National Audit Office (NAO), London.

NAO (2018), *PFI and PF2*, National Audit Office, London.

OECD (2003), *Key Issues and Recommendations for Consumer Protection: Affordability, Social Protection, and Public Participation in Urban Water Sector Reform in Eastern Europe, Caucasus and Central Asia*, Organisation for Economic Co-operation and Development (OECD), Paris.

Pallant, J. (2007), *SPSS Survival Manual*, 3rd ed., McGraw-Hill, Berkshire.

PMI (2010), *The Value of Project Management*, Sl, Project Management Institute (PMI).

Pretorius, F., Chung-Hsu, B.-F., McInnes, A., Lejot, P. and Arner, D. (2008), *Project Finance For Construction & Infrastructure: Principles & Case Studies*, Blackwell Publishing, Singapore.

Razali, N.M. and Wah, Y.B. (2011), "Power comparison of Shapiro–Wilk, Kolmogorov–Smirnov, Lilliefors, and Anderson-darling tests", *Journal of Statistical Modelling and Analytics*, Vol. 2 No. 1, pp. 21-33.

Salkind, N.J. (2004), *Statistics for People Who (Think They) Hate Statistics*, 2nd ed., Sage Publications Inc, Thousand Oaks, CA.

Skamris, M. and Flyvbjerg, B. (1996), "Accuracy of traffic forecasts and cost estimates on large transportation projects", *Transportation Research Record*, Vol. 1518 No. 1, pp. 65-69.

Soomro, M.A. and Zhang, X. (2011), "An analytical review on transportation public–private partnerships failures", *International Journal of Sustainable Construction Engineering & Technology*, Vol. 2 No. 2, pp. 62-80.

Soomro, M.A. and Zhang, X. (2013), "Failure links between public and private sector partners in transport public private partnerships failures", *Journal of Traffic and Logistics Engineering*, Vol. 1 No. 2, pp. 116-121.

Stanford, H.W. (2010), *Effective Building Maintenance: Protection of Capital Assets*, Fairmont Press, Lilburn.

Stern, J. (2000), "Electricity and telecommunications regulatory institutions in small and developing countries", *Utilities Policy*, Vol. 9 No. 3, pp. 131-157.

Stern, J. (2006), *Evaluating Infrastructure Regulators Developing UK And International Practice*, Centre for the study of Regulated Industries (CRI), London.

Tenenbaum, B. (1996), "Regulation: what the Prime Minister needs to know", *The Electricity Journal*, Vol. 9 No. 2, pp. 28-36.

Trémolet, S. (2007), "Outsourcing regulation: when does It make sense and how do we best manage it?", Working Paper No. 5, Public-Private Infrastructure Advisory Facility (PPIAF), Washington, DC.

Trémolet, S. and Shah, N. (2005), "WANTED !good regulators for good regulation » an evaluation of human and financial resource constraints for utility regulation", a report by Environmental Resource Management (ERM) and Tremolet Consulting for the World Bank, World Bank, London.

Trémolet, S., Shukla, P. and Venton, C. (2004), *Contracting Out Utility Regulatory Functions: Report by Environmental Resources Management for the World Bank*, World Bank, Washington, DC.

Vecchi, V., Hellowell, M. and Gatti, S. (2013), "Does the private sector receive an excessive return from investments in health care infrastructure projects? Evidence from the UK", *Health Policy*, Vol. 110 Nos 2-3, pp. 243-270.

Wagner, O. and Berlo, K. (2015), "The wave of remunicipalisation of energy networks and supply in Germany – the establishment of 72 new municipal power utilities", European Council for an Energy Efficient Economy (ECEEE), Toulon/Hyères, pp. 559-569.

Williams, T. (2010), "Analysis of the London underground PPP failure", *Proceedings of EPOC 2010*, November 4-7, *South Lake Tahoe, CA*.

World Bank (2017), *2016 Private Participation in Infrastructure (PPI) Annual Update*, The World Bank, Washington, DC.

Wright, K.B. (2005), "Researching Internet-based populations: advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services", *Journal of Computer-Mediated Communication*, Vol. 10 No. 3, available at: https://doi.org/10.1111/j.1083-6101.2005.tb00259.x

Corresponding author

Abdullahi Ahmed Umar can be contacted at: abdulproject@yahoo.com