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Critical Technical Competencies of Public Sector Project Managers in Developing Countries

Mohd Derus, M.[1] and Abdul-Aziz, A.-R.[2]*

[1]*Universiti Teknologi MARA (PERAK), Seri Iskandar, 32610, Perak, Malaysia*
[2]*Universiti Sains Malaysia, Minden 11800 Penang, Malaysia*

ABSTRACT

As the main public sector procurement agencies, public works departments, especially in developing countries, play a vital nation building role of providing physical infrastructure and public buildings. Their under-performance has often been criticised. Blame is often attached to their project managers for being incompetent. Yet, the technical competencies of project managers in public organisations in developing countries have been very much under-studied. Research was conducted to examine the technical competencies of project managers required by Malaysia's Public Works Department. Using the Delphi Technique to collect data from senior staff who regularly appraise their subordinates' performance, the study sought to uncover very important and always used technical competencies. By combining the two data sets, those deemed critical were isolated. Eight competencies were found to be very important, nine always used and nine critical. The critical competencies are time management, quality assurance, strategic planning, project technical capability, coordination of nominated subcontractors and utility companies, budget development, resource needs identification, project control administration, and determination of project deliverables. The findings of the study can feed into the organisation's quest to increase the level of project management performance particularly during staff selection and training exercises. Their sister organisations in other developing countries can replicate the study to uncover their own sets of requisite critical competencies which can likewise be used for targeted staff selection and training.

Keywords: Critical competencies, Delphi Technique, Malaysia, Public Works Department

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E-mail addresses:
moham266@perak.uitm.edu.my (Mohmad, M. D.),
arashid@usm.my (Abdul-Aziz, A.-R.)
* Corresponding author

INTRODUCTION

Investigations into technical competencies of project managers have been biased in

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favour of private sector organizations, particularly in developed economies (Jalocha *et al*., 2014). The lessons drawn from these studies may not be entirely suited for public sector procurement agencies in developing countries. Public sector procurement agencies in general face unique challenges including multiple layers of stakeholders with varied interests, numerous constraints imposed by administrative rules and processes, civil service protection and hiring systems which prevent easy hiring and firing, and environments that may include political adversaries (Wirick, 2009). A shortage of good project managers, a focus on constraints over results, an overlapping oversight mechanisms, and having to do more with less resources exacerbate matters. Virtanen (2000) posits that, not only must public managers be technically competent, they must also be capable of executing policies set by politicians. Under the New Public Management that has emerged in Western democracies over the last 30 years, as evinced by structural reforms such as privatisation and limited tenure, the competencies of public managers have been questioned in a profound way. What they should think and what they should believe in is being questioned in tandem with what they should be able to do. Arguably therefore, civil servants have to behave differently than project managers in the private sector (de Bony, 2010). The competence of public sector infrastructure development organisations in developing countries faces even more criticisms (Rwelamila, 2007, Ika, 2012).

The impact of national cultures on project management practices has been examined by past scholars (Barber, 2004; Chong 2008). The assumption that developed economies share a common thinking and approach to project management may even be misplaced. De Bony (2010) found that project management is differently interpreted and implemented by the Dutch and French partners to an R&D cooperative project. In China, Chen *et al.* (2008) found that whether and how the pre-defined set of knowledge embodied in the Western standards are used by local construction project managers in their workplace are preceded and determined by their conceptions of that work. With different conceptions, Chinese project managers attach different meanings to the attributes and organise the attributes into a distinctive competence in performing the work.

In Malaysia, the largest public sector procurement agency is the Public Works Department (PWD). With more than 3,000 construction management and professional personnel (PWD, 2012a), it is the largest public, and possibly private as well, construction multi-project organisation in Malaysia. As with many developing countries, PWD grew in tandem with the nation, completing ever more ambitious infrastructure and building projects as the country developed. It is probably the oldest construction multi-project organisation in Malaysia too. Established in 1872 by the British to provide physical infrastructure for its colony which was then called

Malaya, PWD continues to play its role as the main government agency responsible for planning, designing, constructing and maintaining of the nation's physical infrastructure such as highways, airports and public buildings. While many of its projects have been completed successfully, there have been the occasional high-profile failures which brought adverse publicity to the organisation, among them beam cracks on the Kepong Flyover in Kuala Lumpur that persisted between 2004 until 2008, roof collapse of the newly-constructed Sultan Mizan Zainal Abidin Stadium in Kuala Terengganu, Terengganu, in 2009, and ceiling collapses in different locations of the eight-year old Serdang Hospital in Kuala Lumpur since 2011. Such project failures reinforce the harsh public perception of PWD project managers as lazy, doing little work themselves, lacking in integrity, hiding behind the Official Secrets Act and behaving over-bearingly as "little Napoleons" (Ambrin, 2013).

Based on the rationale given above, a study was conducted to isolate technical competencies critical for PWD project managers. In order to achieve this objective, two aspects pertaining to their technical competencies have to be determined: their level of importance and frequency-of-use.

LITERATURE REVIEW

Competence studies were popularised by Boyatzis (1982) with his Job Competence Assessment approach to determine a person's underlying characteristic that would permit him to display effective or superior job performance, though credit has to be given to McClelland (1973) for introducing the term 'competence' and highlighting that work performance cannot be solely predicated on academic achievements and knowledge. Though competence studies were initially driven by human resource management scholars, they were eventually taken up by those in other disciplines such as information technology (Dutta, 2000), engineering (Skulmoski *et al*., 2000), education (Sutphin, 1981; Wadongo *et al*., 2011), public administration (Virtanen, 2000) and construction (Rwelamila, 2007; Tabish & Jha, 2011).

Literature on project managers' technical competencies can be separated into two broad categories: those empirically grounded and those based on best practices. Those that are empirically grounded include Hauschildt *et al*. (2000), Dainty *et al*. (2005), Brill (2006), Ahadzie *et al*. (2008), among others. Lists of project managers' technical competencies based on prescriptions or standards have been drawn up mainly by professional bodies that include the U.S.-based Project Management Institute (2013) with its Project Management Body of Knowledge, the European-based International Project Management Association (2006) with its Competence Baseline (ICB) Version 3, the UK-based Association of Project Managers (2012) with its Association for Project Management Body of Knowledge, and the Australian Institute of Project Management (2008) with its Professional Competency

Standards for Project Management. Some governments have also come up with their own national competency standards such as South Africa's National Certificate in Project Management and New Zealand's Project Management Unit Standard. Table 1 lists the various technical competencies that have been associated with project managers. They have been clustered according to PMI's (2013) categorisation, with the exception of 'languages, techniques and equipment' which was self-devised. As each item has been well deliberated in past literature, it is unnecessary to do so here.

TABLE 1
Summary of technical competencies project managers should possess

Cluster	Technical competence	Source
Integration management	Response to risks	Simon & Murrray (2007), AIPM (2008), Crawford & Nahmias (2010), PMI (2013).
	Management of key stakeholders	Crawford (1999), Birkhead *et al*. (2000), Crawford & Nahmias (2010), Vaagaasar (2011).
	Project control administration	Meredith & Mantel (2000), Morris (2001), Lyneis & Ford (2007), Tabish & Jha (2011), PMI (2013).
	Implementation of project change controls	Meredith & Mantel (2000), Toney (2001), Lyneis & Ford (2007).
	Project constraint documentation	Cicmil (1997), Golob (2002).
	Documentation of project assumptions	Bryde (2003), Kerzner (2013).
Scope management	Project strategy interpretation	Crawford (1999), Meredith & Mantel (2000), Crawford & Nahmias (2010).
	Preparation of Work Breakdown Structure	Thamhain (1991), Toney (2001), Bresner & Hobbs (2006), PMI (2013).
	Project programme management	Frame (1999), Morris (2001), Birkhead *et al*. (2000), PMI (2013).
	Project plan activation	Chong (1997), Blackburn (2000), Morris (2001), Chen *et al*. (2008), Crawford & Nahmias (2010), PMI (2013).
Time management	Development of schedule	Thamhain (1991), Frame (1999), Meredith & Mantel (2000), Morris (2001), APM (2006), AIPM (2008), Crawford & Nahmias (2010).
Cost management	Budget development	Frame (1999), Meredith & Mantel (2000), Birkhead *et al*. (2000), AIPM (2008), Isik *et al*. (2009).
	Resource needs identification	Thamhain (1991), Cicmil (1997), Crawford (1999), Bresner & Hobbs (2006), Chen *et al*. (2008), PMI (2013).
Quality management	Quality assurance	Birkhead *et al*. (2000), Simon & Murray (2007), Isik *et al*. (2009), PMI (2013).

Table 1 (continue)

Human resource management	Development of human resource management plan	Thamhain (1991), Frame (1999), Birkhead *et al*. (2000), Morris (2001), AIPM (2008), Wirick (2009), PMI (2013).
	Conflict management and resolution	Thamhain (1991), Birkhead *et al*. (2000), Fleisher (2003), Crawford &Nahmias (2010), Fisher (2011).
	Uphold safety and health standards	Isik *et al*. (2009), Kerzner (2013).
Communications management	Project evaluation	Thamhain (1991), Morris (2001), PMI (2013).
	Implementation of corrective actions	Golob (2002), Söderholm (2008).
	Initiation of project status communication	Frame (1999), Fleisher (2003), AIPM (2008), Ochieng & Price (2010), Kerzner (2013).
Procurement management	Implementation of administrative closure	Crawford (1999), (Bryde, 2003), Crawford & Nahmias (2010), Kerzner (2013).
	Determination of project deliverables	Cicmil (1997), Morris (2001), (Bryde, 2003), Bresner & Hobbs (2006), PMI (2013).
	Project technical capability	El-Sabaa (2001), Ahadzie *et al*. (2008), Chen *et al*. (2008), PMI (2013).
	Project procurement	Frame (1999), Kerzner (2013), PMI (2013).
Languages, techniques and equipment	Application of office productivity equipment	El-Sabaa (2001), Bresner & Hobbs (2006), Simon & Murray (2007).
	Application of electronic office	El-Sabaa (2001), Bresner & Hobbs (2006), Simon & Murray (2007).
	Command of main language	DOVS (2003), Chen *et al*. (2008), Ochieng & Price (2010).
	Command of third language	DOVS (2003).

RESEARCH METHOD

The research adopted the Delphi Technique which is regularly applied by scholars in education, nursing, administration, and information technology disciplines since the 1990s, but seldom in construction management. The Delphi approach is a facilitation technique involving iterative multi-stage canvassing of opinion from a panel of experts through questionnaires until group consensus is achieved (Linstone & Turoff, 1975; Hanson *et al*., 2000). Most studies on project management competencies use either questionnaire surveys (Birkhead *et al*., 2000; Skulmoski *et al*., 2000; Golob, 2002) or interviews (Blackburn, 2000; Byrde, 2003; Dainty, 2005; Chen *et al*., 2008; Crawford & Nahmias, 2010; Ochieng & Price, 2010) to collect data. Brill *et al*. (2006) are among the few that adopted the Delphi approach.

Among the strengths of this technique are the widening of knowledge through multiple rounds (Powell, 2003) and minimisation of group conflict (Gupta & Clarke, 1996). Rowe and Wright (1999) argue that the Delphi approach can outperform alternative statistical techniques when properly conducted. The technique is not without limitations. With the multiple interactive rounds, some panel members lose interest and gradually drop out (Williams & Webb, 1994).

This research adopted the Modified Delphi Technique (Custer *et al*., 1999). Instead of soliciting possible items from the respondents through an open-ended unstructured questionnaire in Round 1 for testing in subsequent iterations, the experts were provided with a pre-selected list of items drawn up from past relevant literature for them to respond to. The advantages of this modified approach are improved response rate, avoidance of respondent fatigue and initial round based on solid grounding. Prior to circulation, the questionnaire draft for Round 1 was scrutinised by four PWD officers with an average of 17.3 years' service for relevancy, and then pilot-tested by 10 industry-experienced academicians.

There is no established criteria for the acceptable size of the Delphi panel (Sutphin, 1981); it depends on the purpose of the research (Dobbins, 1999) and available resources (Campbell & Cantrill, 2001). In the Delphi Technique, the quality of the respondents takes precedence over group size. Selection of experts is key for this technique. Rather than soliciting information from project managers as was done by El-Sabaa (2001), Ochieng and Price (2010) among others, the study followed the footsteps of Crawford (2005) in approaching their superiors who regularly conduct work performance appraisal. The opinions of those who assess are more convincing than of those being assessed. With the permission of the Director General of the PWD, 156 PWD project manager superiors at the state and district levels throughout the country were approached. They comprised of state directors, assistants of state directors, heads of assistants of state directors and district engineers. The number of Delphi iterations depends on when stability is achieved. Stability occurs when the responses obtained in two successive rounds are statistically found not to be significantly different from each other (Dajani *et al*., 1979).

Technical ccompetencies

For Round 1, the expert panel was asked to score the 28 pre-defined technical competencies (see Table 1), using the 6-point Likert scale for importance (1 = not relevant, 2 = unimportant, 3 = quite unimportant, 4 = quite important, 5 = important, 6 = very important). To avoid varying self-interpretation, each item was accompanied with a short definition. As the sample population was 60 (i.e. ≥ 35) in Round 1, consensus was deemed achieved when the standard deviation < 1.00 (Siebert, 2004). In Round 1, all 28 competencies that were tested secured a standard deviation < 1.00. However, the last-ranked item (i.e. command of third language) was dropped as its mean score was 3.63, or equivalent to 'quite important' only. In Round 1 also, panel members were invited to suggest additional competencies so that the data could be enriched. Eight suggestions were put forward, but only three were entirely different from the pre-defined list:

- Time management: The ability to manage time without increase in cost.
- Strategic planning: The appreciation and management of the inter-connectivity between time, finance, machinery, manpower and technology.
- Coordination of nominated subcontractors and utility companies: Ability to work effectively with nominated subcontractors and utility companies.

For Round 2, the 27 pre-defined competencies that successfully emerged in Round 1 were listed in the re-circulated questionnaire, together with their respective aggregated mean scores as well as the respondents' own scores for the purpose of allowing the respondents to re-score the items should they so wish. The respondents also had to give fresh scores to the three additional competencies they recommended in Round 1. As the sample population was 21 (i.e. n < 35), consensus was deemed achieved when ≥ 80% the expert responses clustered at the top two highest ratings (Pulcini *et al*., 2006), which in this case were ratings 5 and 6. All of the competencies secured mean scores of 4.95 and above (equivalent to 'important' or 'very important'). However because the last ranked item (i.e. 'management of key stakeholders secured <80% consensus (i.e. 76.2), it was taken to Round 3 for re-testing, where it secured 81% consensus, thereby fulfilling the consensus criterion. The iteration process terminated after Round 3. The final results for technical competencies according to importance are shown in Table 2.

Frequency-of-use of competencies

In the same Round 2, the expert panel was asked to score the same 30 competencies that were derived from Round 1, this time using the 5-point Likert scale for frequency-of-use (1 = not sure, 2 = not required, 3 = seldom, 4 = often, and 5 = always). Each item was accompanied with a short explanation. All of the competencies secured mean scores of 3.90 and above (equivalent to 'often' or 'always'). As the lowest ranked item (i.e. management of key stakeholders) secured < 80% consensus (i.e. 70%), it was also taken to the Third Delphi Round, where it only secured 76.0% consensus. Because it failed to achieve threshold consensus, the Consensus Stability Test (Dajani *et al*., 1979) was conducted to determine if an additional Delphi Round was required. The Pearson Correlation Coefficient Test was used to determine consensus stability (McCoy, 2001). The correlation significance level of items between Delphi rounds was set at 0.05. The test revealed a strong relationship between Round 2 and Round 3 for frequency-of-use for 'management of key stakeholders' ($r = .863$, $p<0.01$), two tailed, that is to say the feedback from the panel members did not shift significantly between the two rounds. Hence there was no need for another Delphi Round. The final results for technical competencies according to frequency-of-use are shown in Table 3. Fig.1 summarises the adopted Modified Delphi Technique.

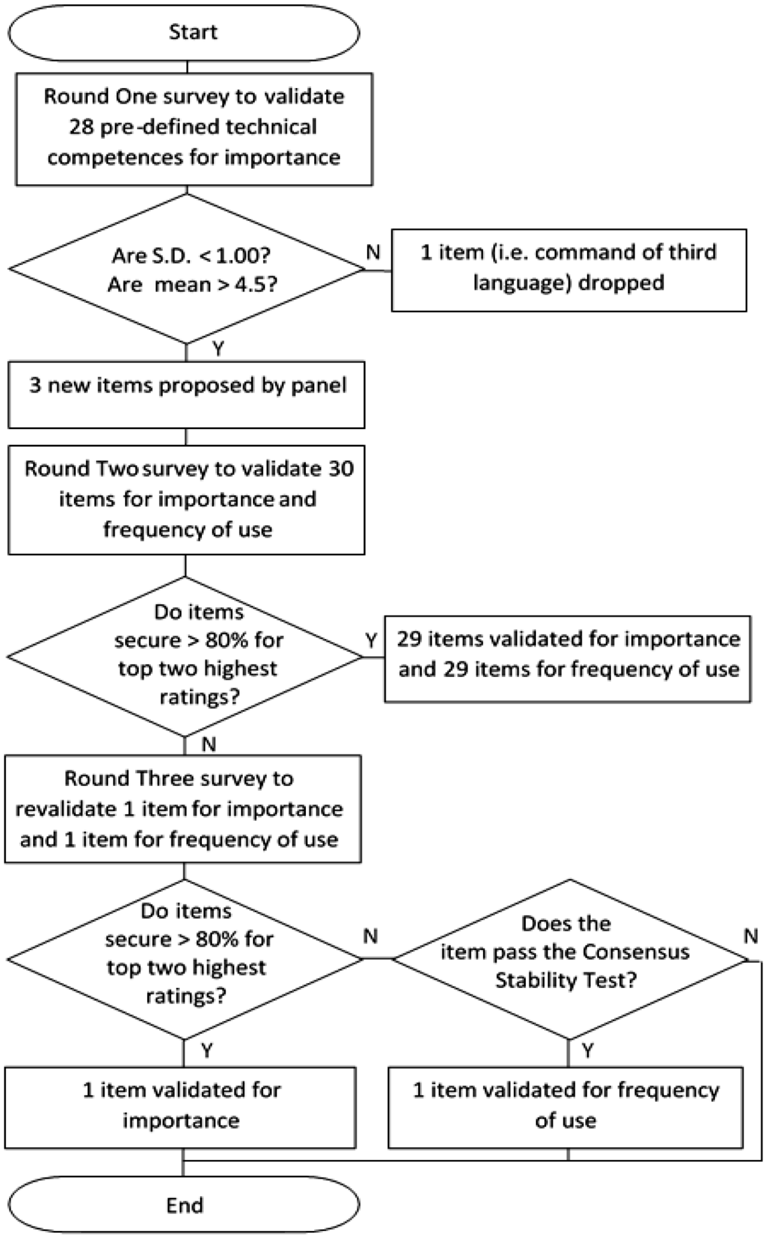

Fig.1: Flowchart of the adopted Modified Delphi Technique

Critical competencies

To isolate critical competencies, the importance and frequency-of-use mean scores for each item were multiplied to obtain the combined score (Wadongo *et al*., 2011). To ascertain the critical cut-off point, the lower limit of the highest mean scores for importance (5.55-6.0 = very important) and frequency-in-use (4.50-5.00 = always) were referred to. Hence for importance, the lower limit of the highest mean score was 5.5 while for frequency-of-use, it was 4.5. The competencies were considered critical if the product of their scores were ≥ 24.75.

FINDINGS AND DISCUSSION

In this section, the technical competencies on order of importance and frequency-of-use are tabulated. It then elaborates in the critical competencies required of JKR project managers.

Technical competencies in order of importance are listed in Table 2. One of the competencies originally tested (i.e. command of third language) was dropped. Instead, three additional technical competencies were added: time management, strategic planning, and coordination of nominated subcontractors and utility companies. These three are among the eight regarded as very important. The rest are deemed important.

TABLE 2
Technical competencies in order of importance

Technical competence	Rank+	Mean	Note
Time management	1	5.76	V. Imp.
Budget development	2	5.62	V. Imp.
Strategic planning	3	5.62	V. Imp.
Quality assurance	4	5.62	V. Imp.
Coordination of nominated subcontractors and utility companies	5	5.57	V. Imp.
Project control administration	6	5.57	V. Imp.
Determination of project deliverables	7	5.52	V. Imp.
Resource needs identification	8	5.52	V. Imp.
Project programme management	9	5.48	Imp.
Project technical capability	10	5.48	Imp.
Conflict management and resolution	11	5.38	Imp.
Development of schedule	12	5.38	Imp.
Implementation of corrective actions	13	5.38	Imp.
Project plan activation	14	5.33	Imp.
Development of human resource management plan	15	5.33	Imp.
Implementation of administrative closure	16	5.29	Imp.
Command of main language	17	5.29	Imp.
Preparation of Work Breakdown Structure	18	5.29	Imp.
Project procurement	19	5.29	Imp.
Response to risks	20	5.20	Imp.
Project evaluation	21	5.20	Imp.
Application of office productivity equipment	22	5.20	Imp.
Uphold safety and Health standards	23	5.14	Imp.
Application of electronic office	24	5.10	Imp.
Implementation of project change controls	25	5.10	Imp.
Initiation of project status communication	26	5.10	Imp.
Documentation of project assumptions	27	5.10	Imp.
Project constraint documentation	28	5.10	Imp.
Management of key stakeholders	29	5.09	Imp.
Project strategy interpretation	30	4.95	Imp.

Notes:
+ Rank according to mean
Interpretation of mean score: 1.00-1.49 = not relevant, 1.50-2.49 = unimportant, 2.50-3.49 = quite unimportant, 3.50-4.49 = quite important, 4.50-5.49 = important, and 5.50-6.00 = very important.

Technical competencies in order of frequency-of-use are listed in Table 3: Two of the competencies originally tested (i.e. command of third language and management of key stakeholders) were dropped. Instead three additional technical competencies were added: time management, strategic planning, and coordination of nominated subcontractors and utility companies. These three are among the 10 technical competencies that are always in use.

TABLE 3
Technical competencies in order of frequency-of-use

Technical competence	Rank+	Mean	Note
Project technical capability	1	4.75	Always
Time management	2	4.70	Always
Quality assurance	3	4.70	Always
Resource needs identification	4	4.65	Always
Coordination of nominated subcontractors and utility companies	5	4.65	Always
Strategic planning	6	4.65	Always
Budget development	7	4.60	Always
Project control administration	8	4.60	Always
Determination of project deliverables	9	4.55	Always
Development of schedule	10	4.50	Always
Development of human resource management plan	11	4.45	Often
Project plan activation	12	4.45	Often
Preparation of Work Breakdown Structure	13	4.45	Often
Initiation of project status communication	14	4.40	Often
Implementation of corrective actions	15	4.40	Often
Project programme management	16	4.40	Often
Implementation of administrative closure	17	4.35	Often
Project evaluation	18	4.35	Often
Project constraint documentation	19	4.35	Often
Implementation of project change controls	20	4.30	Often
Command of main language	21	4.25	Often
Project procurement	22	4.25	Often
Uphold safety and Health standards	23	4.25	Often
Response to risks	23	4.25	Often
Project strategy interpretation	25	4.25	Often
Conflict management and resolution	26	4.20	Often
Documentation of project assumptions	27	4.20	Often
Application of office productivity equipment	28	4.15	Often
Application of electronic office	29	4.15	Often

Notes:
+Rank according to mean
Interpretation of mean score: 1.00-1.49 = not sure, 1.50-2.49= not required, 2.50-3.49 = seldom, 3.50-4.49 = often, and 4.50-5.00 = always.

By combining the results of Tables 2 and 3, nine technical competencies were found to be critical for PWD project managers (see Table 4). As described below, nearly all of these critical technical competencies have been articulated by PWD's top echelons at some point in time, either orally or in writing, thus affirming their critical status.

TABLE 4
Technical competencies that are critical

Rank	Technical competency	Combine score value	Annotation
1	Time management	27.07	Critical
2	Quality assurance	26.41	Critical
3	Strategic planning	26.13	Critical
4	Project technical capability	26.03	Critical
5	Coordination of nominated subcontractors and utility companies	25.90	Critical
6	Budget development	25.85	Critical
7	Resource needs identification	25.67	Critical
8	Project control administration	25.62	Critical
9	Determination of project deliverables	25.12	Critical

The most critical technical competence is time management. The panel member that suggested this item described time management as the ability to manage time without increase in cost. PWD ex-Director General divulged that under the 8th Malaysia Economic Plan which stretched from 2001-2005, 78% of the projects could not be handed over on schedule (Judin, 2008). Average length of delay for these projects was 171 days, which was abysmal. Of course PWD could not take the blame for all the delays. Project time performance has improved since then (see Table 5). The previous Minister of Works advised its PWD project managers to help the contractors by coming up with a realistic Recovery Plan for the contractors falling behind time (Shaziman, 2012). If all efforts fail, he recommended that the contractors be terminated without hesitation. Two years later, the current Minister yet again reiterated the importance of time management (Fadillah, 2014).

TABLE 5
Performance of PWD, 2011-2013 (in percentage)

Criteria	2010	2011	2012
Project on-time completions	94.7	96.4	89.4
Client satisfaction	94.1	90.4	90.2
On-cost completions	94.4	94.4	86.1

Source: PWD Annual Reports (2011, 2012a, 2013).

Quality assurance is the next highest critical technical competence. It refers to the ability to ascertain performance criteria using services specification, technical expertise and standards to ensure the expected level of performance and client expectations are always met, and that the subsequent analytical processes follow on from that (Birkhead *et al*., 2000; Simon & Murray, 2007; Isik *et al*., 2009; PMI, 2013). To ensure quality is upheld, PWD came up with a quality management system (i.e. Q-Plan) which encompasses the design (Project Design Plan or D-Plan) and construction (Construction Quality Plan or C-Plan) stages. PWD's own record shows that client satisfaction was high in recent years (see Table 5). In 20014, the current Minister of Works in her speech at the annual meeting of senior officers reminded everyone to produce quality output (Fadillah, 2014).

The third highest ranked critical technical competence is strategic planning. As the panel member that suggested it explained, strategic planning is about the appreciation and management of the inter-connectivity between time, finance, machinery, manpower and technology. PWD's Director-General said that wrong project implementation strategies were one factor which led to project failures under the 8th Malaysia Economic Plan (Judin, 2008). A study elsewhere found that poor strategic planning compromised the achievement of project strategic goals (Young *et al*., 2012).

Having project technical capability is the fourth highest critical technical competence. Project technical capability is the ability to appreciate and truly understand the essence that makes project run smoothly (El-Sabaa, 2001; Ahadzie *et al*., 2008; Chen *et al*., 2008; PMI, 2013). The previous Minister of Works acknowledged that upon promotion, technically competent JKR project managers conventionally become administrators, which to him was a waste of expertise. Under his instruction, his ministry looked into how these people could be redeployed to take charge of big projects under the 10th Malaysia Plan (Chan, 2010). Swan *et al*. (2010) found that even in highly project-oriented organisations that harness knowledge codification and knowledge dissemination tools, new knowledge acquired at the project level remain as accumulated experience among those involved and only transferred on a limited scale to others in the wider organisations. The issue of how to incorporate professionals such as engineers into bureaucratic organisations has long been deliberated (Mignonac & Herrbach, 2003). One suggestion is the parallel dual-career ladders, though technical employees may not subscribe to fearing that upward mobility only comes by moving into administrative ranks (Gomez-Mejia *et al*., 1990). In May 2013, this minister's successor introduced the Cross Fertilisation Programme to allow government officers appointed by one public agency to be temporarily inserted elsewhere to enhance effectiveness and instil a high performance culture (Fadillah, 2013).

The next highest ranked critical competence is the ability to coordinate nominated subcontractors and utility companies, which was not foreseen prior to data collection. Since utility companies hold the monopoly over connection of services to the mains, the PWD project managers have no recourse but to coordinate well with them to avert costly project delays.

It is also critical for PWD project managers to be able to develop budgets within which the main contractors must work, a point which echoes with past studies (Frame, 1999; Meredith and Mantel, 2000; Birkhead *et al*., 2000; AIPM, 2008; Isik *et al*., 2009). Under the 8th Malaysia

Plan, 2,541 projects suffered cost overruns of RM8.037 billion, which was equivalent to 3.6% of total value (Judin, 2008). Again, performance has improved since then (see Table 5).

Being able to identify resource needs is the seventh highest critical technical competence. Thamhain (1991), Bresner and Hobbs (2006) and Chen *et al*. (2008) are among the past researchers who have highlighted this competence which project managers should possess. The ex-Director General of PWD lamented that one of the contributions to delays under the 8th Malaysia Plan was lack of equipment, material and manpower (Judin, 2008). He added that inadequate resource planning persisted under the 9th Malaysia Plan which lasted from 2006-2010. In 2014, the current Minister of Works acknowledged that limited budget pose a challenge for sourcing resources (Fadillah, 2014).

Administering project controls and determination of project deliverables are the last two identified critical competencies. The former refers to the ability to administer project controls by preparing targets, plans and performance measurement tools, and to take corrective actions if necessary (Meredith & Mantel, 2000), Lyneis & Ford, 2007; Tabish & Jha, 2011), while the latter refers to the ability to work with project stakeholders in the course of realising project needs and specifications (Crawford, 1999; Birkhead *et al*., 2000; Crawford & Nahmias, 2010; Vaagaasar, 2011).

CONCLUSION

Crawford and Pollack (2007) point out the paradox of projects being unique endeavours and yet requiring the use of generic knowledge on and standardised practices for managing projects. What this study has done is to highlight those critical for PWD project managers. They are time management, quality assurance, strategic planning, project technical capability, coordination of nominated subcontractors and utility companies, budget development, resource needs identification, project control administration, and determination of project deliverables. PWD has long made project management a legitimate management discipline. Its strategic plan for 2012-2015 articulated its intention to increase the level of project management practices by assimilating them in its organization-wide work culture (PWD, 2012b). When project-based methodologies are fully utilised, the PWD hopes to be more flexible and high-performing (Hodgson *et al*., 2011). By extension, project management competencies have to be further developed. The research findings can be fed into PWD's staff selection and management training programmes as part of its drive to become an excellent asset management, project management, and engineering services provider by 2020. Special emphasis should be given to the identified critical competencies.

Further research is however required in order to determine whether in practice, the critical technical competencies are indeed played out in similar fashion as in the private sector of developed economies, which as highlighted at the beginning of this paper may not be the case (Chen *et al*., 2008). For this, a qualitative approach involving direct observations is suitable to detect the possible nuances that may exist.

One source roughly estimates that between 2010-2020, an average of 7% of developing countries' GDP need to be invested in infrastructure for their rapid growth (World Bank, 2011). Public sector procurement agencies of developing countries hold a tremendous responsibility, not only in terms of the amount of public funds involved, but also the accompanying public trust and aspirations. It has been identified, for example, that Pakistan needs to improve its project management performance (Ahmed & Mohamad, 2014). This research can serve as inspiration for other developing countries to improve the performance of public sector project management, beginning with identifying what critical competencies are expected of their project managers so that targeted manpower selection and training can likewise be conducted.

REFERENCES

Ahadzie, D. K., Proverbs, D. G., & Olomolaiye, P. (2008). Towards developing competency-based measures for construction project managers: should contextual behaviours be distinguished from task behaviours, *International Journal of Project Managers*, *26*(6), 631-645.

Ahmad, R., & Mohamad, N. A. (2014). Performance of projects in public sector of Pakistan: developing a framework for future challenges. *Serbian Project Management Journal, 4*(1), 3-12.

Ambrin Buang (2013). *The Professional Engineer in Public Service.* Paper presented at the Senior PWD Malaysia 2013 in Terengganu, 27-29 May.

Association of Project Managers (2012). *The Association for Project Management Body of Knowledge*. Buckinghamshire, UK: Princes Risborough.

Australian Institute of Project Managers (2008). *Professional Competency Standards for Project Management*. Sydney, Australia.

Birkhead, M., Sutherland, M., & Maxwell, T. (2000). Core competencies of project managers. *South African Journal of Business Management*, *31*(3), 99-106.

Barber, E. (2004). Benchmarking the management of projects: a review of current thinking. *International Journal of Project Management,* 22, 301-307.

Blackburn, S. K. (2000). *Recognising an excellent project manager*. Project Management Congress 2000, Association for Project Management, High Wycombe.

Besner, C., & Hobbs, B. J. (2006). The perceived value and potential contribution of project management practices to project success. *Project Management Journal, 37*(3), 37-48.

Boyatzis, R. E. (1982). *The Competent Manager: A Model for Effective Performance*. New York: John Wiley & Sons.

Brill, J. M., Bishop, M. J., & Walker, A. E. (2006). The competencies and characteristics required of an effective project manager: a web-based Delphi study. *Educational Technology Research and Development*, *54*(2), 115-140.

Byrde, D. J. (2003). Project management concepts, methods and application. *International Journal of Operations and Production Management*, *23*(7), 775-793.

Campbell, S. M., & Cantrill, J. A. (2001). Consensus methods in prescribing research. *Journal of Clinical Pharmacy and Therapeutics*, *26*, 5-14.

Chan, L. L. (2010). Saving on cost of projects. *The Star*, June 8th.

Chen, P., Parlington, D., & Wang, J. N. (2008). Conceptual determinants of construction project management competence. A Chinese perspective. *International Journal of Project Management*, *26* (6), 655-664.

Chong, E. (1997). *A Comparative Study of the Managerial Competencies and Performance of British Managers and Singaporean Public Sector Managers*. Henley-on-Thames: Henley Management College.

Chong, E. (2008). Managerial competency appraisal: a cross-cultural study of American and East Asian Managers. *Journal of Business Research, 61*(3), 191-200.

Cicmil, S. J. K. (1997). Critical factors of effective project management. *The TQM Magazine, 9*(6), 390-396.

Crawford, L. (1999, Oct 25-27). In search of the competent project manager. In *Proceedings of the Australian Institute of Project Management National Conference*. Melbourne, Australia.

Crawford, L. (2005). Senior management perceptions of project management competence. *International Journal of Project Management*, *23*(1), 7-16.

Crawford, L., & Nahmias, A. H. (2010). Competencies for managing change. *International Journal of Project Management*, *28*(4), 405-412.

Crawford, L., & Pollack, J. (2007). How generic are project management knowledge and practice? *Project Management Journal, 38*(1), 87-97.

Custer, R. L., Scarcella, J. A., & Stewart, B. R. (1999). The modified Delphi technique – a rotational modification. *Journal of Vocational Training and Technical Education*, *15*(2), 1-10.

Dainty, A. R. J., Cheng, M.-I., & Moore, D. R. (2005). A comparison of the behavioral competencies of client-focused and production-focused project managers in the construction sector. *Project Management Journal*, 36(2), 39-48.

Dajani, J. S., Sincoff, M. Z., & Talley, W. K. (1979). Stability and agreement criteria for the termination of Delphi Studies. *Technological Forecasting and Social Change, 13*, 83-90.

De Bony, J. (2010). Project management and national culture: a Dutch-French case study. *International Journal of Project Management*, *28*(2), 173-182.

Department of Veterinary Services (2003). *Kamus Kompetensi Jabatan Perkhidmatan Haiwan: Mengurus Prestasi Melalui Kompetensi* (trans: *Veterinary Services Competency Dictionary: Manage Performance through Competency*). Putrajaya, Malaysia.

Dobbins, T. R. (1999). *Clinical Experiences for Agricultural Teacher Education Programs in North Carolina, South Carolina, and Virginia.* (unpublished Ph.D' dissertation). Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Dutta, S. K. (2000). *Assessing the Critical Competencies of Information Technology (IT) Project Managers at Southern California Edison.* (unpublished Ph.D' dissertation). University Southern California.

El-Sabaa, S. (2001). The skills and career path of an effective project manager. *International Journal of Project Management, 19*(1), 1-7.

Fadillah Haji Yusof (2013, May 27*). Officiating Speech. 2013 PWD Senior officers meeting.* Terengganu Equestrian Resort, Kuala Terengganu. Retrieved from: http://www.kkr.gov.my/public/Teks%20Ucapan%20Perasmian%20YB%20Menteri%20SOC%202013.pdf

Fadillah Haji Yusof (2014, June 8). *Officiating Speech*. 2015 PWD Senior officers meeting. Johor Bahrum Darul Takzim. Retrieved from https://www.jkr.gov.my/var/files/Teks%20 Perasmian% 20SOC%202015%20Oleh%20 YB%20Menteri%20Kerja%20Raya.pdf

Fisher, E. (2011). What practitioners consider to be the skills and behaviours of an effective people project manager. *International Journal of Project Management*, *29*(8), 994-1002.

Fleisher, C. S. (2003). The development of competencies in international public affairs. *Journal of Public Affairs,3*(1), 76-83.

Frame, J. D. (1999). *Project Management Competence: Building Key Skills for Individuals, Teams, and Organisations*. Josseys-Bass, San Francisco.

Golob, M. (2002). *Implementing Project Management Competencies in the Work Place*. (Unpublished PhD's Dissertation). Capella University.

Gomez-Mejia, L.R., Balkin, D.B., & Milkovich, G.T. (1990). Rethinking rewards for technical employees. *Organizational Dynamics, 18*(4), 62–75.

Gupta, U. G., & Clarke, R. E. (1996). Theory and applications of the Delphi Technique: a bibliography (1975-1994). *Technological Forecasting and Social Change*, *53*(2), 185-211.

Gupta, A. K., & Wilemon, D. L. (1990). Accelerating the development of technology based new products. *California Management Review, 32*(2), 24-44.

Hasson, F., Keeney, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing*, *32*(4), 1008-1015.

Hauschildt, J., Keim, G., & Medcof, J. W. (2000). Realistic criteria for project manager selection and development. *Project Management Journal*, *31*(3), 23-32.

Hodgson, D., Paton, S., & Cicmil, S. (2011). Great expectations and hard times: the paradoxical experience of the engineer as project manager. *International Journal of Project Management*, *29*(4), 374-382.

Hughes, R. (2003). Competencies for effective public health nutrition practice: a developing consensus. *Public Health Nutrition, 7*(5), 683-691.

Ika, L. A. (2012). Project management for development in Africa: why projects are failing and what can be done about it. *Project Management Journal, 43*(4), 27-41.

International Project Management Association (2006). *Competence Baseline.* Nijkerk, The Netherlands.

Isik, Z., Arditi, D., Dikmen, I., & Birgonul, M. T. (2009). Impact of corporate strengths/ weaknesses on project management competencies. *International Journal of Project Management, 27*(6), 629-637.

Jalocha, B., Krane, H. P., Ekambaram, A., Prawelska-Skrzypek, G. (2014). Key competencies of public sector project managers. *Procedia – Social and Behavioral Sciences, 119*, 247-256.

Judin Abdul Karim. (2008). *Strategies of project delivery system.* Paper presented at the Seminar on Best Practices in Construction Industry, 17-18 December, Universiti Teknologi Malaysia. Retrieved from http://seminar.spaceutm.edu.my/ bpci2008/download/BPCI%20SPEAKER%20 SLIDE/Dato%20Judin.ppt.

Kerzner, H. R. (2013). *Project Management: A Systems Approach to Planning, Scheduling, and Controlling* (11th ed.). New Jersey: John Wiley and Sons.

Linstone, H. A., & Turoff, M. (1975). *The Delphi Method: Techniques and Applications*. Reading, MA: Addison-Wesley Publishing Company.

Lyneis, J., & Ford, D. N. (2007). System dynamics applied to project management: a survey assessment, and directions for future research. *System Dynamics Review, 23*(2/3), 157-189.

McCoy, R. W. (2001). Computer competencies for the 21st century information systems educator. *Information Technology, Learning, and Performance Journal*, *19*(2), 21-35.

Meredith, R., & Mantel, S. J. Jr. (2000). *Project Management: A Managerial Approach with Microsoft Project* (4th ed.). New York: Wiley and Sons.

Morris, P. W. G. (2001). Updating the project management bodies of knowledge. *Project Management Journal, 32*(3), 21-30.

Ochieng, E. G., & Price, A. D. F. (2010). Managing cross-cultural communication in multicultural construction project teams: the case of Kenya and UK. *International Journal of Project Management*, *28*(5), 449-460.

Powell, C. (2003). The Delphi Technique: myths and realities. *Journal of Advanced Nursing, 41*(4), 376-382.

Project Management Institute (2007). *Project Manager Competency Development (PMCD) Framework*. Newport Square, PA: Project Management Institute.

Project Management Institute (2013). *A Guide to the Project Management Body of Knowledge (PMBOK)* (5th ed). Newport Square, PA: Project Management Institute.

Public Works Department (2011). *2010 Annual Repor*t. Kuala Lumpur. Retrieved from https://www.jkr.gov.my/var/files/File/ laporan/annualreport2010.pdf

Public Works Department (2012a). *2011 Annual Report*. Kuala Lumpur. Retrieved from https://www.jkr.gov.my/var/files/File/dokumen/laporan_tahunan_jkr_2011.pdf

Public Works Department (2012b). *JKR Strategic Framework 2012-2015*. Kuala Lumpur. Retrieved from https://www.jkr.gov.my/ var/files/File/dokumen/jkrStrategicFramework_Final.pdf.

Public Works Department (2013). 2012 *Annual Report*, Kuala Lumpur. Retrieved from https://www.jkr.gov.my/var/files/File/ laporan/laporan_tahunan_jkr_2012.pdf.

Pulcini, J., Wilbur, J., Allan, J., Hanson, C., & Uphold, C. (2006). Determining criteria for excellence in nurse practitioner education. Use of Delphi technique. *Nursing Outlook, 54*(2), 102-110.

Rowe, G., & Wright, G. (1999). The Delphi technique as a forecasting tool: issues and analysis. *International Journal of Forecasting*, *Vol. 15*, 353-375.

Rwelamila, P. W. D. (2007). Project management competence in public sector infrastructure organizations. *Construction Management and Economics*, 25, 55-66.

Seibert, J. M. (2004). *The Identification of Strategic Management Counseling Competencies Essential for the Small Business and Technology Development Centre: A Modified Delphi Study*. (Unpublished Ph.D Dissertation). North Carolina: Graduate Faculty of North Carolina State University,

Shaziman Abu Mansor (2012). *Speech at the Award Ceremony, 2011 Excellent Service*, *May 24th*. Retrieved from http://www.kkr.gov.my/ public/APC_-_KKR_2012.pdf.

Simon, P., & Murray, R. (2007, May 11-14). Hard plus soft equals success; from theory to practice. *Project Manager Today*.

Skulmoski, G., Hartman, G., & DeMaere, R. (2000). Superior and threshold project competencies. *Project Management, 6*(1), 10-15.

Söderholm, A. (2008). Project management of unexpected events. *International Journal of Project Management, 26*(1), 80-86.

Sutphin, H. D. (1981). *Positions Held by Teachers, Teacher Educators, and State Supervisors about Selected National Issues in Agriculture Education.* (Unpublished Ph.D's Dissertation). Columbus, Ohio: Ohio State University,

Swan, J., Scarborough, H., & Newell, S. (2010). Why don't (or do) organizations learn from projects? *Management Learning*, *41*(3), 325-344.

Tabish, S. Z. S., & Jha, K. N. (2011). Identification and evaluation of success factors for public construction projects. *Construction Management and Economics, 29*(8), 809-823.

Thamhain, H. J. (1991). Developing project management skills. *Project Management Journal*, *22*(3), 39-44.

Toney, F. (2001). *The Superior Project Manager: Global Competency Standard and Best Practices*. New York: Marcel Dekker, Inc.

Udo, N., & Koppensteiner, S. (2004) *What are the core competencies of a successful project manager?* Paper presented at the *200*4 PMI Global Congress, April 19-21, Prague, Czech Republic.

Vaagaasar, A. (2011). Development of relationships and relationship competencies in complex projects. *International Journal of Management Projects in Business*, *4*(2), 294-307.

Virtanen, T. (2000). Changing competencies of public sector managers: tensions in commitment. *International Journal of Public Sector Management, 13*(4), 333-341.

Wadongo, B., Kambona, O., & Odhuno, E. (2011) Emerging critical generic managerial competencies: A challenge to hospitality educators in Kenya. *African Journal of Economic and Management Studies*, *2*(1), 56-71.

Williams, P. L., &Webb, C. (1994). The Delphi Technique: a methodological discussion. *Journal of Advanced Nursing*, 19, 180-186.

Wirick, D. W. (2009). *Public-Sector Project Management: Meeting the Challenges and Achieving Results*. New Jersey: John Wiley and Sons.

World Bank (2011*). Supporting Infrastructure in Developing Countries*. Committee on Development Effectiveness, Washington. Retrieved from http://www.boell.org/downloads/Supplemental_Note_ Infrastructure.pdf.

Young, R., Young, M., Jordan, E., and O'Connor, P. (2012). Is strategy being implemented through projects? Contrary evidence from a leader in New Public Management*. International Journal of Project Management, 30* (8), 887-900.