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USE OF VALUE MANAGEMENT WORKSHOPS AND CRITICAL SUCCESS FACTORS IN INTRODUCING LOCAL EXPERIENCE ON THE INTERNATIONAL CONSTRUCTION PROJECTS

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Abstract. Critical success factors can be used in value management workshops to determine the client value system, which in turn is critically important to the briefing process and the successful delivery of construction projects. This research is concerned with international construction projects. In particular, it investigates the impact of local knowledge on the client value system. Workshops were organised on 12 international projects in the western Balkans region. The initial client value system was captured by using a paired comparison exercise. Next, local knowledge information was introduced, and the EFTE (Estimate-Feedback-Talk-Estimate) technique was used to capture the revised client value system. The changes in the two sets of client value systems were analysed. The results indicate that 4 parameters (Scope, Contract-admin, Human resources and Health and Safety) out of 8 changed and that the changes were statistically significant. Local knowledge can be used to impact client value system.

Keywords: value management, briefing, critical success factors, local knowledge, international construction projects.

Introduction

Globalization has provided new opportunities to construction companies. However, international construction projects are more prone to risk than projects undertaken in the home market. Variety of additional factors impact the success of the international project such as global, country, company and project specific according to Dikmen *et al.* (2011). While Neale (1995) focuses on project technical risks, size and complexity are also identified as key risks which are confirmed by Mawhinney (2001) and Ball (2006). Gunhan and Arditi (2005) view political, financial, cultural, and legal risks as key for project success. All of these risks are dependent on local country conditions and international projects stakeholders often lack local construction market knowledge and experience.

Utilization of value management (VM) process can be an effective tool in ensuring that project requirements conform to the client's intentions for the project. This can be accomplished by defining and measuring critical success factors (CSF) and aligning them with the client understanding of what must be achieved on a project. This research has utilised CSF as a measure or client value system through series of 12 VM workshops on international projects in Design Brief stage. Local knowledge was introduced, and changes in the client value system observed. The purpose of this research is to ascertain if client value system and support to decisions making process in early stages of international projects can be impacted by local knowledge and what are potential implications.

1. Literature review

1.1. International projects and local knowledge

International construction is an important topic, especially in this era of globalization (Raftery *et al.* 1998). It has positive and adverse implications for construction industries in all countries (Ofori 2000). Many authors have investigated international projects, but always within narrow scope of individual countries and operating environments where studies have been conducted (Toor, Ogunlana 2009). Previous research has located several risks in international work, such as China's BOT projects (Wang *et al.* 1999), technology and knowledge transfers in Ghana (Osabutey *et al.* 2014), international JV's Chinese-Singaporean, Japanese-Singaporean and Chinese-Hong Kong-New Zealand (Bing, Tiong 1999) and knowledge sharing across cultural barriers in international JV's (Dulaimi 2007), cultural considerations in contractual issues with comparison of Hong Kong, London and Sydney (Chan, Tse 2003), and opportunities and threats of international construction (Gunhan, Arditi 2005). A key strat-

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egy that successful global firms adopt is to increase their capabilities for acquiring and sharing information and knowledge about each local environment (Javernick-Will, Levitt 2009). Same authors in further text quote that in real estate, without exception to be successful, you have to think and act locally. If it is not accepted by the local population, the development will be a failure due to lack of interest. Managers can learn to leverage local knowledge to create order from apparent disorder, integrate it with their global knowledge, and consequently manage their projects effectively (Ramaprasad, Prakash 2003). In summary it can be concluded that local knowledge is critical to the success of the project.

1.2. Design brief

Decisions made in the earliest stages of a project life cycle have the largest impact on the project's ultimate success. As the project progresses, both the risk for the project failure and the opportunities for enhancing the project success are reduced. It can be argued that the highest stakes for the project success exist in its initial, pre-construction stage, prior to definition of the design brief. In order to correctly interpret the client's expectations, it is necessary to define project requirements through a design brief (Kelly *et al.* 1992; Yu *et al*. 2005; CIB 1997; Kamara, Anumba 2001; Kelly, Male 2004). Yu *et al.* (2006, 2007) confirmed in their research that value management could be a beneficial application in the formation of the brief. As an enhancement, Fan *et al.* (2010) and Luo *et al.* (2011) expand the briefing process by group decision support systems that should improve the performance of VM studies. This briefing interaction between designers and clients should produce a process of continuous improvement of client requirements. Relationships, required qualities and expectations of both sides are discussed in the literature (Yu *et al.* 2007; Tzortzopoulos *et al.* 2006; Norizan *et al.* 2012; Ryd 2004; Shen *et al.* 2013; Heylighen *et al.* 1999), and more specifically for particular local conditions (Chinyio *et al.* 1998; Yu *et al.* 2010; Cheng *et al.* 2006; Egemen, Mohamed 2006).

1.3. Value management

Value management (VM) is a process in which the functional benefits of a project are made explicit and appraised consistent with a value system determined by the client (Kelly *et al.* 2004). VM is a service in which the sponsor of a project, the client, transmits a clear statement of the value requirements of the project to the design team (Kelly, Male 1993). Male *et al.* (1998) define value intervention opportunities at four points in the development of project design: pre-brief, brief (*charette*), concept design and detail design stage. The concept of value is based on the relationship between satisfying needs and expectations and the resources required to achieve them (PD 6663:2000). In other words, the goal in VM is not merely to reduce costs but to balance performance with cost. Recent developments and practices in VM discussed in literature (Cha, O'Connor 2005; Chen *et al*. 2010; Luo *et al.* 2011; Fan *et al.* 2010; Bowen *et al.* 2010) in principle conclude that VM in construction industry is still in its developing stage.

1.4. Critical success factors

A careful measurement on the performance of VM workshops is likely to improve the success of the project. Lin and Shen (2007) quantify efficiency and effectiveness of VM workshops. Critical success factors (CSF) were introduced as a means of measuring client value system. Assigning values to particular CSF and quantifying client priorities through the pre-brief VM workshop can substantially impact the brief. CSF were used to steer the project brief in direction that will maximise the desired expectations of the client. CSF are defined by Sanvido *et al.* (1992) as factors predicting the success of projects on construction projects. Many researchers have investigated the performance parameters of VM studies (Shen, Liu 2003; Male *et al.* 1998; Fong *et al.* 2001; Kulshrestha, Deshpande 2002; Stewart 2004). Li *et al.* (2011), Lu *et al.* (2008), Kog and Loh (2012), Tabish and Jha (2011), Li *et al.* (2005) and Kulatunga *et al.* (2005) consider CSF in specific construction project settings. CSFs can also be used for whole life performance assessment, as suggested by Park (2009). In this research CSF will used to capture the client value system.

2. Research methodology

In a previous and related research study (Surlan, Cekic 2011) a set of significant value parameters (a selection model) was captured through the application of four rounds of the Delphi technique (see Appendix A for results). For the purpose of this initial research and based on an extensive literature review of different value parameters, the authors decided to adopt the CSF proposed by Park (2009) as best suited for local conditions. Park (2009) utilized a questionnaire survey to investigate a set of 188 individual factors grouped into eight critical categories: project scope, time, cost, quality, contract/administration, human resource, risk, and health and safety. These CSF parameters were determined in Surlan and Cekic (2011) to be relevant by a group of 12 experts with extensive experience in the construction industry and local market conditions in the western Balkans region, and have been used to define the client's value system in a project's initial stages.

After consideration of local western Balkans market conditions and professional capabilities, this research has decided to follow a limited SAVE (2007) methodology for VM workshops. Limited VM workshops were organised on 12 projects in the western Balkans region (Serbia with Kosovo-UNMIK, Montenegro, Croatia, and FRY Macedonia). All of the selected projects were international in nature and either had international clients or consultants involved with the project. Each project workshop was attended by 2 to 6 client representatives. Appendix B

summarizes some key characteristics of the projects selected. The selection model from Surlan and Cekic (2011) based on CSF was utilised as an organised source of local knowledge as well as a measure of client value system for this research in order to enable the continued and comparable scoring benchmark. Workshop stages were based on Nelms and Porter (1985), and are graphically represented in Figure 1. In the beginning of a workshop client value system is captured through first exercise – paired comparison method. Then, local knowledge in a form or relevant results from selection model from Surlan and Cekic (2011) were presented. Then, changes to the client value system were determined through second exercise – EFTE (Estimate, Feedback, Talk, Estimate) method that was used. Both exercises and local knowledge used scored CSF as a measure of client value system, making it more quantifiable and objective.

3. Results and analysis

To capture the initial client value system (before the local knowledge was presented), the paired comparison method (comparing two parameters at the time) was used. Previous workshops have found the paired comparison approach a satisfactory method of deriving a client's value system judged by the fact that clients generally agree with the summary when it is read back to them (Kelly *et al.* 2004; Kelly 2007). Sample results from one of the projects are presented in Table 1 and the average scores for all 12 projects are presented in Table 2.

As initial step in the second leg of the workshop, local knowledge information was presented to client representatives. Printed tables of value parameters were handed out and results presented, highlighting top scoring parameters.

To capture the client value system after the local knowledge was presented the EFTE (Estimate, Feedback, Talk, Estimate) method was used. This method is also known as interactive Delphi because the process includes face-to-face open debate sessions between the two rounds of estimates. Sample results from one of the selected pro-

Table 1. Sample results of paired comparison exercise from a project in western Balkans

	B	C	D	E	F	G	H		Count Score	Weighted Score
										1–10
A	B	C	D	E	F	G	A	1. Scope	1	**2**
B		C	B	B	B	B	B	2. Time	6	**9**
C			C	C	C	C	C	3. Cost	7	**10**
D				D	D	D	H	4. Quality	4	**6**
E					F	E	E	5. Contract admin	3	**5**
F						G	H	6. HR	2	**3**
G							G	7. Risk	3	**5**
H								8. HSE	2	**3**

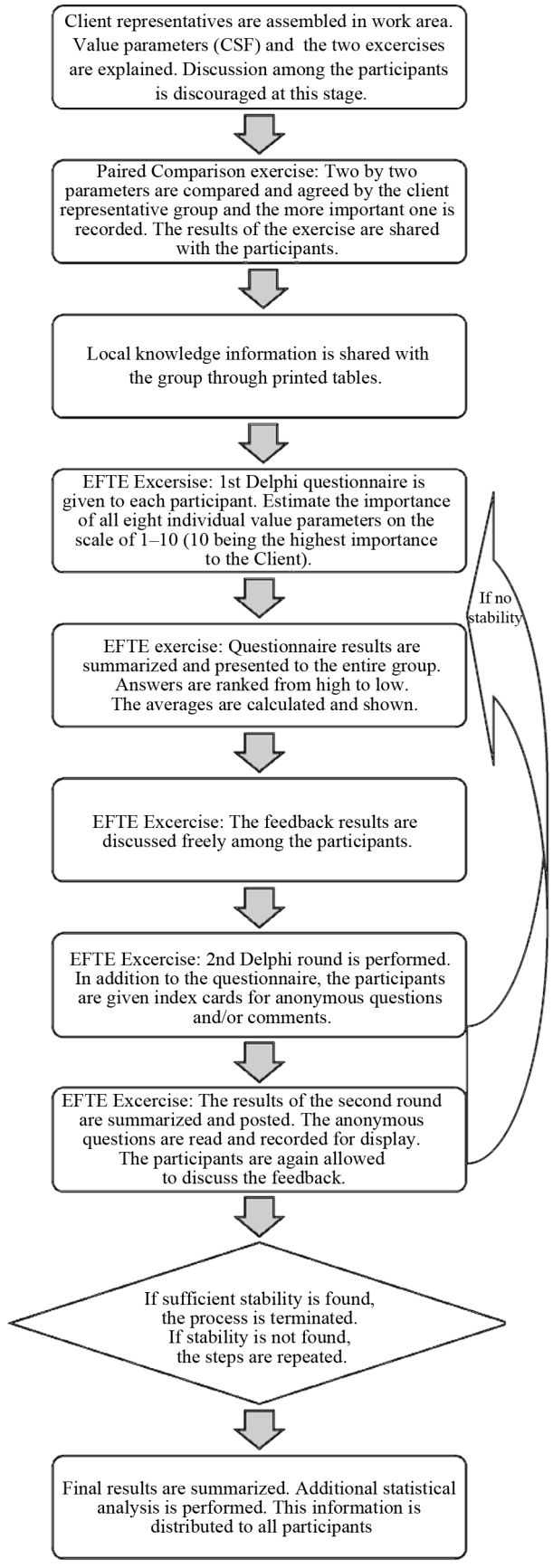

Fig. 1. Workshop process

Table 2. Summary of average scores from the paired comparison exercise

Parameter / Project no.	1. Scope	2. Time	3. Cost	4. Quality	5. Contract-admin	6. Human resource	7. Risk	8. Health and safety
Project no. 1	6	8	10	9	2	2	3	3
Project no. 2	10	10	10	4	2	2	5	5
Project no. 3	6	8	10	9	0	2	5	3
Project no. 4	8	6	10	6	0	2	8	3
Project no. 5	5	8	10	9	0	2	6	3
Project no. 6	6	8	10	9	2	0	5	3
Project no. 7	2	10	9	8	3	3	5	3
Project no. 8	6	9	10	8	2	2	3	3
Project no. 9	6	9	10	8	2	2	3	3
Project no. 10	4	10	10	7	0	2	10	5
Project no. 11	2	9	10	6	5	3	5	3
Project no. 12	5	10	9	10	5	2	4	4
Average	5.5	8.75	9.83	7.75	1.92	2	5.17	3.42

jects are shown in Table 3 and the average scores for all projects are shown in Table 4.

Kendall's W or coefficient of concordance is a non-parametric statistic (does not assume the data have any characteristic structure or parameters) and it represents a normalization of the Friedman test. Kendall's W can be used for assessing agreement among study participants. The larger the W, the better is the consistency among the experts. Schmidt (1997) presents a method to conduct ranking-type Delphi surveys, perform analysis, and report results. Utilising statistical software SPSS (version 19) (2014) Kendall's W – coefficient of concordance – was verified for the level of agreement between client representatives for both rounds of the EFTE exercise. Individual scores were converted to scores on a 1–8 scale (8 being the number of parameters being examined), the average ranks were calculated, the deviations were established, and the values for the Kendall's W coefficient were determined. Zero value corresponds to a situation with no consensus, and 1 corresponds to a situation with full consensus. As it can be seen from Table 5, W coefficient values for all of the projects in both rounds were high, with notable increases in the second round of the EFTE exercise. This suggests that sufficient agreement was reached among the workshop participants – clients' representatives.

Table 3. Sample results of the EFTE exercise from one of the selected projects (5 participants)

	Workshop Participants – 5 persons						
	1st Delphi round scores						
Value parameters	1	2	3	4	5	avg	rnd
1. Scope	2	2	3	2	3	2.4	2
2. Time	9	9	8	8	9	8.6	9
3. Cost	10	10	10	10	10	10	10
4. Quality	7	6	6	8	6	6.6	7
5. Contract-admin	5	4	5	4	4	4.4	4
6. Human resource	3	4	3	4	4	3.6	4
7. Risk	5	5	5	5	5	5	5
8. Health and safety	3	4	3	3	4	3.4	3
	2nd Delphi round scores						
Value parameters	1	2	3	4	5	avg	rnd
1. Scope	2	2	2	2	3	2.2	2
2. Time	9	9	9	8	9	8.8	9
3. Cost	10	10	10	10	10	10	10
4. Quality	6	6	6	7	6	6.2	6
5. Contract-admin	5	5	5	4	4	4.6	5
6. Human resource	4	4	3	4	4	3.8	4
7. Risk	5	5	5	5	5	5	5
8. Health and safety	3	3	3	3	4	3.2	3

Table 4. Results of EFTE (mini-Delphi) exercise

Parameter / Project no.	1. Scope	2. Time	3. Cost	4. Quality	5. Contract-admin	6. Human resource	7. Risk	8. Health and safety
Project no. 1	7	8	10	8	6	4	5	5
Project no. 2	10	10	10	6	2	2	5	6
Project no. 3	7	8	10	9	4	4	5	4
Project no. 4	8	7	10	7	4	3	8	4
Project no. 5	6	8	10	9	4	5	7	5
Project no. 6	7	8	10	9	3	3	5	3
Project no. 7	4	10	9	8	5	4	5	4
Project no. 8	8	9	10	9	2	3	4	4
Project no. 9	7	9	10	9	1	4	4	2
Project no. 10	7	10	9	8	2	4	10	5
Project no. 11	2	9	10	6	5	4	5	3
Project no. 12	6	10	9	10	5	4	4	5
Average	6.58	8.83	9.75	8.17	3.58	3.67	5.58	4.17

Table 5. Values of W – Kendall's coefficient of concordance for 12 Projects in western Balkans

Parameter / Project no.	W	α	Monte Carlo	W	α	Monte Carlo
	1st round			2nd round		
Project no. 1	0.939	0.069	0.005	0.981	0.056	0.001
Project no. 2	0.987	0.054	0.001	0.991	0.054	0.001
Project no. 3	0.899	0.009	0	0.951	0.006	0
Project no. 4	0.828	0	0	0.974	0	0
Project no. 5	0.781	0	0	0.907	0	0
Project no. 6	0.857	0.012	0	0.956	0.005	0
Project no. 7	0.712	0	0	0.828	0	0
Project no. 8	0.919	0.001	0	0.936	0	0
Project no. 9	0.997	0.052	0	1	0.051	0
Project no. 10	0.966	0.005	0	0.985	0.004	0
Project no. 11	0.97	0	0	0.982	0	0
Project no. 12	0.927	0.073	0.008	0.988	0.054	0.001
Average	0.899	0.023	0.001	0.957	0.019	0

Statistical significance is the probability that the result is not likely due to just chance alone. "Test of significance" describes statistical hypothesis tests that are used to determine which outcomes of a study would lead to a rejection of the null hypothesis based on a pre-specified threshold known as p-value. This can help facilitator to decide if a result contains sufficient information to cast doubt on the null hypothesis. p-values are often coupled to significance or alpha (α) level usually valued at 0.05 or 5% (Schlotzhauer 2007). If a p-value was found to be less than 0.05, then the result would be considered statistically significant and the null hypothesis would be rejected. The asymptotic significance (α) values suggest that we cannot reject the null hypothesis H_0 for four projects (1, 2, 9, and 12). However, because of the small sample size (only 2–6 client representatives), this conclusion should be verified with an exact test, or we must rely on a Monte Carlo significance estimate of the exact p-value, based on 10,000 random permutations of the original two-way layout of mid-ranks (Mehta, Patel 2011; Lin 1989).

Monte Carlo statistical test for hypothesis: H_0 (W = 0), "Kendall's coefficient W is statistically insignificant (equal to 0)", was performed. All of the Monte Carlo test results in round 2 are less than 0.01, suggesting that we can reject the null hypothesis with 99% confidence and that consensus was indeed achieved. Even though W coefficients for three projects (5, 7, and 8) are below 0.95, the Monte Carlo significance confirms that consensus was achieved.

When verifying the statistical significance of results achieved before and after the introduction of local knowledge, the first step is to determine if data obtained from 12 projects follow normal distribution for every parameter. Shapiro-Wilk test tests the null hypothesis that a sample x_1, x_2, ..., x_n came from a normally distributed population (Shapiro, Wilk 1965) and was utilized to accomplish that goal. Of the 16 variables (8 parameters x {before, after}) 9 did not follow a normal distribution. It was concluded that parametric tests for comparison of the values before and after the introduction of local knowledge were not adequate. Consequently, the nonparametric Wilcoxon test was used in which individual value parameters were separately examined to verify if there was a statistically significant change in their scores before and after the introduction of local knowledge. The results of this analysis are shown in Table 6.

The results shown in Table 6 suggest that value parameters 1 (Scope), 5 (Contract-admin), 6 (Human resources) and 8 (Health and Safety) changed significantly after the introduction of local knowledge, as indicated by their respective p-values of 0.006, 0.019, 0.003 and 0.021.

Parameters 5 (Contract-admin), 6 (Human resources) and 8 (Health and safety) are typically perceived as low-priority parameters in local construction industry practice. Contract-admin low ranking is surprising as this factor is frequently put in relation to improving productivity, reducing cost and increasing profits. However, in local conditions, due to un-sophisticated construction market, there has been little effort put into this area. Local knowledge highlighted this issue. Health and Safety is an important factor internationally, as safety of individuals on site is highly valued coupled with potentially high insurances and increased premiums in case of accidents. The emphasis is placed by strict health and safety regulations. In local practices, there is significant space for major improvement in this area. Again, local knowledge pointed the importance of this factor. Contract-admin and Health and Safety are particularly neglected on local construction projects. That realization perhaps prompted client representatives to increase the values for these parameters, as the additional care needs to be taken to minimise that potential source of risk. Potential reason for low scoring could be attributed to adversarial relationship between customer and contractor, which constitutes a multilevel complexity in which parties operate simultaneously and collaborate within groups of networks (Kärnä 2004).

Table 6. Wilcoxon test to establish statistical significance of introduction of local knowledge

Project	Average parameters for Paired comparison exercise (before)	Average parameters for EFTE – Delphi exercise (after)	Z	Asymptotic Significance (2-tailed)
1. Scope	5.50	6.58	0. 006	–2.754
2. Time	8.75	8.83	0. 317	–1.000
3. Cost	9.83	9.75	0. 317	–1.000
4. Quality	7.75	8.17	0. 096	–1.667
5. Contract-admin	1.92	3.58	0. 019	–2.345
6. HR	2.00	3.67	0. 003	–2.980
7. Risk	5.17	5.58	0. 059	–1.890
8. HSE	3.42	4.17	0. 021	–1.890

Human-related factors are variables with growing importance in the literature (Yong, Mustaffa 2012). Based on the findings and discussions of the Yong and Mustaffa (2012) study, it is recommended that more emphasis should be given on improving the human-related factors. Leadership and team management must be visible and all participants need to provide strategic vision and leadership to encourage teams to collaborate and network to achieve well-developed and coordinated communication between parties (Park 2009). The Human resource issues are also challenging as the regional construction market is lacking well trained "western-style" managers capable of steering projects through the local conditions. The increase in value for parameter 1 (Scope) can probably be explained by the client's realization that the scope creep is very common on projects executed in this particular market, so additional care is warranted.

The changes for the remaining four parameters, 2 (Time), 3 (Cost), 4 (Quality), and 7 (Risk) were not

statistically significant perhaps because client representatives had initially valued them high and their opinion did not change. Project management success is usually measured against the widespread and traditional measures of time, cost and quality (Yong, Mustaffa 2012).

4. Limitations of the research and way forward

There are many difficulties in the reported research. International projects are far more complex than domestic construction projects, VM as a system is still in its relatively initial stages of development with many new perspectives and construction projects will vary in their technical uniqueness and contextual difference.

This study was undertaken in the western Balkans region, and reflects particular experience of that local market. Due to the regional clients' general lack of understanding of the VM process, only limited VM workshops, in which an exercise in determining client value system through value parameters is conducted, were possible.

It is suggested that more encompassing VM workshops are organised in future research, taking into account VM competitiveness level. Also, follow-up of the 12 international projects outcome should be organised, using system similar to Gateway review (2013), to ascertain project success rate.

Discussion and conclusions

Similar to Thyssen *et al.* (2010) the work reported in this paper focuses on a research project aimed to test a VM workshop method in which client values are captured and improved with local knowledge. An analysis of the VM workshops undertaken on 12 international projects indicates good results from applying the proposed method, and concrete results achieved. There has been an impact of local knowledge on client value system indicated through definite and statistically significant changes in CSF. These improvements of CSF, and alignment with local conditions should make projects more successful.

Success has always been the ultimate goal of every activity and a construction project is no exception. There is no industry-accepted or standardised definition of project success because the fact is that individual project teams find themselves in unique situations, implying that their definition of success will differ from that of another project team (Gudienė *et al*. 2013), similar to conditions that will vary when considering international projects performed in various backgrounds. Gudienė *et al.* (2013) considers these CSF's to be of great significance both to researchers and industry practitioners and indicate clearly that project manager and project management team have the most significant role in supporting the successful implementation of construction projects.

In previous studies there is a lack of effort to contextualise the findings into local context where the structure, culture and maturity of the concerned organisations are different (Yong, Mustaffa 2012). Purely applying previously practiced activities in new and unknown environments and markets without consulting with local knowledge could result in declining success rate of projects. Objective of the further study of Yong and Mustaffa (2013) was to gain a renewed understanding of the emerging trends of CSF's considered by various stakeholders in the local industry. Local knowledge was used to re-examine CSF's and re-direct construction industry objectives in order to improve performance and success of the projects. Such adopted principle is in line with this research, and confirms its validity.

Also, similar to this research, Rai *et al.* (1996) propose two staged approach to usage of local knowledge. Initially, generate local knowledge that supplements international manager's global knowledge or in other words, learn local knowledge. Following that manager is to dissipate and translate into action, such local knowledge in conjunction with the global knowledge or in other words, to act on local knowledge. Again, this confirms the validity of the study approach.

The benefits of this research are manifold. Initially, defining CSF through VM workshops will assist clients in improving the understanding of local market conditions and fill the areas of experience which they lack. Through such proposed method, the gap between the client's expectations and the expectations of other local project participants will be minimized. The local knowledge supplement to the client's value system, as expressed through CSF, should help the client steer the project in the more favourable direction under the local market conditions. Successful projects, in turn, will contribute to the economic engine of the region as clients may opt for repeat business.

Introduction of local knowledge can be seen as a contribution of within the field of research – value management. Contribution is partly theoretical as introduces addition of local knowledge to client value system on international projects in a VM field of research and partly empirical as it reports on real international project application with concrete results that indicate the necessity for this inclusion.

Similar to Javernick-Will and Levitt (2009, 2010) and Javernick-Will and Scott (2010) this study endeavours to add to the theoretical knowledge within the international project-based literature. This will assist international companies to take a strategic view and actively engage in complementing their own knowledge and expectation with locally available knowledge. This will improve project success rate and make international projects more successful.

Due to the complexity of the VM workshop and client representatives previous knowledge on VM, the need for a skilled process facilitator should be stressed. Testing of the model on 12 international projects was sufficient compared to Kelly (2007) on 9 projects to provide substantial base for testing of the results.

EFTE as a method has been proven as satisfactory as it produces results on much shorter periods of time compared with standard Delhi technique. Application of EFTE technique in VM workshop is an addition to present knowledge base. It has been proven that this seldom used technique can be applied in VM. In particular markets where no reliable source for historical databases can be obtained, where it is a challenge to obtain key local stakeholders cooperation and where questioner survey would require longer periods of time, EFTE method can be used to obtain more certain data. Fewer participants are required than in standard questioner survey. The EFTE procedure offers a significant addition to established opinion capture techniques (Nelms, Porter 1985), and this research supports such findings. Practical implication of proposed workshop system can be used on any unknown market, procedure is versatile, robust and applicable to various construction scenarios.

This research has tried to develop an objective method in defining value on international construction project. Client value was initially converted into scored CSF and knowledge was transferred into an explicit generalizable form. Complementing this form with local knowledge slightly shifted the value focus. This now explicit knowledge can be used in defining project briefs better suited to local construction market conditions thus increasing the chances of project successful completion. International companies can use as a tool to identify, prioritize, complement and transfer the knowledge need for international projects.

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Appendix A

Table A.1. Selection model

	Utility Factors				W	α
	Business (Office)	Residential (Apartments)	Hotels	Shopping malls	Kendall's W	Asymptotic Significance
Critical factors						
1. Scope						
Clarity of contract	74.17	77.92	91.67	76.67	0.402	0.002
Effective preplanning	69.17	71.67	95.83	88.33	0.688	0.000
Project levels of decision making	74.17	55.83	89.17	93.33	0.803	0.000
Understanding of project requirements	80.83	63.33	97.08	94.58	0.928	0.000
2. Time						
Project time constraints	70.83	83.33	84.58	94.17	0.652	0.000
Constraint by government regulations	61.67	78.33	79.17	85.83	0.688	0.000
Rapid decision making	68.33	80.00	88.33	81.67	0.656	0.000
Overrun duration	61.67	71.67	87.50	77.50	0.703	0.000
Adequacy of time	60.00	68.33	85.83	74.17	0.678	0.000
3. Cost						
Rapid decision making	65.83	81.25	80.83	92.92	0.621	0.000
Cash flow certainty	75.00	95.00	85.42	83.33	0.422	0.002
Precise project budget estimate	94.17	76.67	82.08	91.67	0.361	0.005
Over budget possibility	80.00	56.67	79.17	83.33	0.531	0.000
4. Quality						
Material quality	80.00	66.67	91.67	75.00	0.580	0.000
Construction quality plan	65.00	75.00	93.33	85.00	0.666	0.000
Contracted work quality	71.67	80.83	95.83	90.42	0.810	0.000
5. Contract-admin						
Mutual-trusting relationships	60.00	70.00	85.00	75.42	0.672	0.000

Continued Table A.1.

	Utility Factors				W	α
	Business (Office)	Residential (Apartments)	Hotels	Shopping malls	Kendall's W	Asymptotic Significance
6. Human resource						
Team communication	76.67	67.08	95.83	92.50	0.937	0.000
Leadership-team management	64.58	77.50	92.50	79.17	0.787	0.000
Motivation for project	66.67	54.58	84.17	84.17	0.797	0.000
Monitoring and feedback	58.33	68.33	92.50	77.50	0.805	0.000
Skilled personnel	70.00	62.50	91.67	89.17	0.695	0.000
7. Risk						
Risk identification	82.08	61.67	96.67	88.33	0.816	0.000
Risk response	74.17	67.50	96.67	92.08	0.840	0.000
Coordination with subcontractors	64.58	75.00	94.17	81.67	0.750	0.000
Risk management techniques	68.33	57.50	84.17	77.50	0.576	0.000
Financial stability of client	70.00	85.83	76.67	85.00	0.450	0.001
8. Health and safety						
Management of work safety on site	80.00	85.00	95.00	87.50	0.409	0.002
Hazard identification	72.50	80.00	88.33	81.67	0.310	0.011
Health and safety records	58.75	73.33	65.42	69.17	0.384	0.003
Management responsibility	65.83	78.33	74.17	72.50	0.326	0.008

Appendix B

Table B.1. Summary of projects that were used in study

	Client	Sector	Client Representatives
Project No. 1	Government and Private-international	Industrial (Factory) – Reconstruction and new construction	(1) Project Manager, (2) General Manager
Project No. 2	Private-international corporation	Commercial (Bank) – New construction	(1) Project Manager, (2) Head Real Estate Department
Project No. 3	Private-international corporation	Commercial (Office buildings) – New construction	(1) Owner, (2) Managing Director, (3) Authorized Representative
Project No. 4	Private-international & local joint venture	Commercial (Apartments & Offices) – New construction	(1) Executive Director, (2) Project Director, (3 Project Manager, (4) Owner representative, (5) Tenant coordinator
Project No. 5	Private-international & local joint venture	Commercial (Hotel and Medical resort) – New construction	(1) Executive Director, (2) Project Director, (3 Project Manager, (4) Owner Representative, (5) Tenant Coordinator
Project No. 6	Government and Private-international	Commercial (Tourist ski resort Hotels) – New construction	(1) Financial director, (2) Managing Director for Implementation of the Project, (3) Director
Project No. 7	Private-international corporation	Commercial (Hotel resort) – Reconstruction, Cultural Heritage	(1) Project Manager, (2) Project Director, (3) Administration Manager, (4) Financial Manager, (5) Hotel General Manager, (6) Hotel Operations Manager
Project No. 8	Private-international	Commercial – Demolition, New construction	(1) Owner, (2) Project Manager, (3) Head of Financial Depart. (4) Head of Legal Depart.
Project No. 9	Private-international	Commercial – Demolition, New construction	(1) Project Manager, (2) Cost Manager
Project No. 10	Private-international	Commercial – Demolition, New construction	(1) Project Manager, (2) Design Director, (3) Project Manager
Project No. 11	Private-local	Commercial (Shopping mall) – Reconstruction	(1) Executive director, (2) Financial director, (3) Technical services (FM), (4) Operator, (5) Operator
Project No. 12	Private-local	Commercial (Shopping mall) – New construction	(1) Owner, (2) Managing Director

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