Demystifying Critical Success Factors for Applying Value Management in Construction Projects along the Belt and Road Regions

Focus Group Study

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Demystifying Critical Success Factors for Applying Value Management in Construction Projects along the Belt and Road Regions: Focus Group Study

Abstract

The Belt and Road (B&R) initiative creates a highly competitive and dynamic environment and cooperation network for construction projects in specific regions. By using the experience of other countries, construction professionals can be well equipped with management skills for solving intractable problems during the project management process of a construction project. Value management (VM) is a systematic team decision-making methodology used to achieve the best project value, but it is rarely applied in developing regions along the B&R. This study aims to identify critical success factors for the implementation of VM in construction projects in both developed and developing regions along the B&R. Six focus groups targeting three types of regions were conducted, including advanced VM developed regions (Regions 1), advanced VM developing regions (Regions 2), and unadvanced VM developing regions (Regions 3). Three main groups of critical success factors were identified by using contextual analysis: technical process, team behaviors, and outcomes. By comparing VM in advanced VM regions (Regions 1 and Regions 2) and traditional team decision-making in unadvanced VM regions (Regions 3), the study revealed that: (1) Regions 1 applied VM to achieve project success with a logical process and positive team behaviors, while several problems were also encountered; (2) surprisingly, in some technical respects VM practitioners in Region 2 performed better than those in Regions 1, but positive team behaviors were still not emphasized; and (3) inefficient traditional decision-making activities with illogical technical processes and negative team behaviors in Regions 3 often led to poor project outcomes. A propositional model was proposed based on the identified critical success factors and comparison results among three regions. Finally, several practical recommendations were proposed to ensure effective VM application and promotion in both developed and developing regions along the B&R.

Keywords: Belt and Road; Outcome; Team behavior; Technical process; Value management

Introduction

The Belt and Road (B&R) initiative is a combination of "The Silk Road Economic Belt" and "The 21st-Century Maritime Silk Road". This initiative was proposed by Chinese President Xi Jinping in 2013 as a co-development strategy among countries along the B&R regions, especially for those in Asian, European, and African continents (Cai, 2017; National Development and Reform Commission et al., 2015). Nevertheless, any country with the common goal of co-development can join the network of B&R economic allies (Wang and Yau, 2018). Several developed countries such as the Netherlands, Italy, South Korea, New Zealand, and so on are attracted by this influential strategy and provide support to its development.

Up to early 2022, 147 countries and 32 international institutes had signed the cooperation agreements of the B&R initiative (Liu, 2022).

To foster the economic, political, and financial development in the long run, the governments of many countries along the B&R regions allocated huge capital amounts into construction projects such as infrastructure, transportation, buildings (e.g., commercial and residential), and so on over a long period of time (Andric et al., 2019; Banihashemi et al., 2017; Othman, 2013). Due to multi-stakeholders (both national and international) from different backgrounds, these projects often face numerous difficulties that result in cost overrun, schedule delay, poor team coordination, low productivity, and so on (Long et al., 2004; Zhi et al., 1995). It is thus necessary to use effective methodologies to manage the complicated mega-projects in regions along the B&R (Long et al., 2004; Shao et al., 2018).

Value Management (VM) is a logical team decision-making methodology proposed by Lawrence D. Miles in the United States in 1947 to resolve the shortage of raw materials in the manufacturing industry (SAVE International, 2020). It has been used in the construction industry since 1963 to achieve the best project value (Dell' Isola, 1997). Within decades of development, it was internationally adopted in many *developed regions*, such as Singapore, Hong Kong, the Netherlands, Austria, South Korea, and so on (Leung, 2009). In fact, several *developing regions* along the B&R (e.g., Malaysia, Iran, and Saudi Arabia) have also realized the benefits of VM and applied it in construction projects (Al-saleh and Taleb, 2010; Assaf et al., 1996; Cheah and Ting, 2005; Jaappar et al., 2009). For example, experience proves that VM application could result in around 40% total cost savings for some construction projects in Iran and 23.53% in monetary savings from the total cost of 71 Malaysian public projects in 2011 (Jaappar et al., 2012; Shahhosseini et al., 2018). However, VM application in regions along the B&R still faces various barriers such as lack of VM awareness, insufficient government support, a dearth of VM experts, and so on (Kim et al., 2016; Sesmiwati et al., 2016; Yanita and Mochtar, 2018). Therefore, through exploring and comparing the current situation of VM and/or traditional team decision-making in both developed and developing regions along the B&R, this study aims to identify the critical success factors for applying VM in construction projects along the B&R regions.

Literature Review

Traditional Team Decision-making Process

There are many decision-making points for solving various problems throughout the whole life cycle of a construction project. The traditional team decision-making process has no systematic and standardized procedure, but it usually involves the components of identifying and formulating problems, generating and evaluating alternatives, choosing the best decisions, implementing those decisions, and reviewing outcomes (Project Management Institute, 2017; Schoenfeld, 2011).

Problem formulation includes acknowledging of the existing problems (problem identification), breaking the problem into small and manageable problems (problem definition), and analyzing their root-cause (problem diagnosis; Smith, 1989). Alternatives are then proposed, evaluated, and selected to resolve specific problems. However, major components of traditional team decision-making (from problem definition to alternative selection) are usually mixed and overlapped (Jocumsen, 2002). The actual performance of selected alternatives is revealed only after they have been implemented in a practical project. To get feedback to guide them in carrying out further actions, project practitioners can monitor the performance of these alternatives through review activities (Pomerol, 2012). Due to the complexity of construction projects along the B&R regions, decision-making strategies may vary in different situations. An explicit, systematic, and analytical methodology is essential for resolving complicated problems and improving the usability of the final decisions (Dean and Sharfman, 1993; Elbanna, 2006). However, the traditional decision-making process rarely involves rational procedures with analytical approaches, and this often results in problematic decisions (Cheng et al., 2010).

Decision-making Process of VM

VM is recognized as a methodology with a systematic approach for a team to solve insurmountable problems (Male et al., 1998; Environment, Transport and Works Bureau, 2002). In developed regions such as the United States, the United Kingdom, Hong Kong, Australia, etc., the logical VM process (i.e., job-plan), which involves all major components of traditional team decision-making, is standardized in mature official guidelines and has been well applied in the practical industry (British Standard Institution, 2020; Environment, Transport and Works Bureau, 2002; SAVE International, 2020; Standard Australia, 2007). In general, the technical aspect of the whole VM process consists of three primary stages: pre-study, value study, and post-study (Dell' Isola, 1997; SAVE International, 2020). In the pre-study stage, VM studies need to be well prepared by a series of actions such as identifying VM objectives, collecting sufficient project information, selecting appropriate participants, planning systematic value study activities, and so on (Leung et al., 2014b; Kelly et al., 2015). During the formal value study stage, VM participants normally follow a systematic job plan with logical steps for sharing project information, analyzing project functions, and generating, evaluating, developing, and presenting creative ideas (SAVE International, 2020). Various techniques are used in the VM process, such as how-why logic, the function analysis system technique (FAST), Gordon techniques, paired comparison, and so on (Leung et al., 2014b). In contrast, during traditional team decision-making, only simple techniques such as brainstorming, scoring, voting, and so on are applied, while analysis techniques are often misused or even ignored (Bowen et al., 2010). In the post-study stage, project practitioners are encouraged to monitor the implementation of final VM decisions in order to validate the effectiveness of the VM results (Kelly et al., 2015; Liu, 1997; SAVE International, 2020).

Team Behaviors of VM

Due to the increasing complexity of the construction projects along the B&R regions, multiple participants (e.g., clients,

consultants, contractors, government authorities, and end-users) from different countries with various cultures, political systems, and languages may participate in a single project (Leung et al., 2014a, Othman, 2013). Normally, each participant has different wants and requirements (i.e., values), which guide their behaviors in interpersonal interactions during the team decision-making process (Leung and Liu, 2003). In traditional team decision-making, negative team behaviors, such as fraud, insufficient cooperation, poor communication, and so on are not uncommon (Long et al., 2004; Othman, 2013). Positive team behaviors emphasized in VM create a platform for multi-stakeholders to interact with each other for clarifying their values (Liu and Leung, 2002). Meanwhile, the differences in personal values manifest conflicts among VM participants (Leung et al., 2002). An ineffective conflict management mechanism in traditional decision-making possibly resulted in excessive conflicts that are hard to resolve. However, an effective VM process may keep conflicts at an optimum level and resolve them constructively, particularly for complicated projects along the B&R regions (Leung et al., 2004). A clear understanding of goals could be achieved through a systematic and interactive VM process (Leung et al., 2014b). Finally, project practitioners may be more willing to implement the project goals made by VM than those made by traditional team decision-making (Leung and Chan, 2007; Wright and Kacmar, 1994).

VM Outcomes

The outcomes of construction projects consist of both tangible (e.g., cost, time, and quality) and intangible aspects (stakeholder satisfaction, learning, etc.) (Leung and Yu, 2014). In reality, low project performances, such as cost overrun, time delay, and so on bedevil many construction projects along the B&R regions (Shehu et al., 2014; Sohail and Cavill, 2008). VM practitioners along the B&R regions would like to maximize project value (e.g., enhancing value for money and optimizing project design) by conducting team decision-making activities systematically and logically through methods like VM (Green, 1994). Stakeholder satisfaction is regarded as a critical measurement of project success, which may be difficult to achieve through the traditional decision-making (Leung et al., 2004). The execution of VM is expected to increase the satisfaction of multiple stakeholders and gain a win-win situation for all (Leung et al., 2014b). Through a proactive discussion, VM practitioners may learn new knowledge with an openminded and logical mindset for innovative ideas from other team members. As a result, their desire for professional growth is expected to be improved (Dension et al., 1996; Hoegl et al., 2001).

Research Methods

Focus Group Method

The focus group method is a popular tool used worldwide to explore with qualitative data the range of phenomena in a particular topic (Boddy, 2005). It allows interactive team discussions between participants through questioning each other, commenting or supplementing others' opinions, and so on (Lambert and Loiselle, 2008; Krueger et al., 2019). As an

organized team discussion, it is coordinated by an experienced moderator or moderator team that is familiar with the goals of discussed topics, has intrinsic interests in the research topics, and is competent to lead team discussions. The moderator needs to encourage participants to share their opinions, beliefs, feelings, experiences, and so on openly and respectfully (Masadeh et al., 2012; Prince and Davies, 2001). Through the interactive process, rich opinions are stimulated on specific topics without the limitation of individual bias (Krueger and Casey, 2000; Morgan et al., 1998). On the other side, a homogenous team may not unveil diverse opinions and perspectives and can even lead to invalid results, while the differences among team members may result in excessive negative conflicts, and contributions may be diminished (Dreachslin, 1999; Masadeh et al., 2012). Therefore, the level of the team homogeneity should be arranged at an optimized level to ensure the quality of contributions.

Focus Groups

In total, six focus groups were conducted based on specific countries along the B&R regions and were further classified into different groups of regions (i.e., two groups for each group of regions), including Hong Kong and the Netherlands groups as the *advanced VM developed regions* (R1), Malaysia and Iran groups as the *advanced VM developing regions* (R2), and the Brunei and Philippines and Sri Lanka groups as the *unadvanced VM developing regions* (R3).

Table 1 Classification of the Six Focus Groups in the Three Regions

R.	Development level	VM application level	FG	Countries	VM standard	Mandatory requirement	VM institution
1	Developed	Advanced	1	Hong Kong	Environment, Transport and Works Bureau Technical Circular No. 35/2002	HK$ 200 million	The Hong Kong Institute of Value Management (HKIVM)
			2	Netherland	European Standard 12973:2020	–	Dutch Association of Cost and Value Engineers (DACE)
2	Developing	Advanced	3	Iran	Outdated standards (Fard et al., 2013)	–	Iranian Society of Value Engineering (SIVE)
			4	Malaysia	Public Works Department of Malaysia, JKR29300-0012-13	RM 50 million	Institute of Value Management Malaysia (IVMM)
3	Developing	Unadvanced	5	Brunei	–	–	–
			6	Philippines	–	–	–
			6	Sri Lanka	–	–	–

Note: R. = Regions, FG = Focus groups

In R1, VM has been well embraced for decades with mandatory requirements (e.g., projects with a budget above the HK$ 200 million needed to conduct VM,), mature VM guidelines (e.g., Environment, Transport and Works Bureau Technical Circular No. 35/2002 in Hong Kong and British Standard BS EN 12973:2020 in European countries), and influential VM institutions (e.g., HKIVM and DACE) (Environment, Transport and Works Bureau, 2002; British Standard Institution, 2020). The information revealed in R1 is expected to provide the critical success factors for VM application in the

developed regions along the B&R, which can be referenced by VM practitioners in the developing regions. On the other hand, Iran and Malaysia were selected as the leading countries in VM application among the developing regions along the B&R (i.e., R2), where the application of VM has been increasing in recent years. As in R1, VM is promoted in R2 by the proposal of mandatory requirements (e.g., VM for all Malaysian public projects with budgets of RM 50 million or more), publishing the local VM guidelines (e.g., Public Works Department of Malaysia JKR29300-0012-13), and establishing VM institutions (i.e., IVMM and SIVE in 2000 and 2002, respectively) (Fard et al., 2013; Public Works Department of Malaysia, 2013). It is expected that the critical success factors of VM application and the difficulties encountered in developing regions can be explored from qualitative data collected from the respondents of R2. The majority of developing countries categorized as R3 in this study joined in the B&R network belonging to regions with limited VM knowledge and applications. For instance, in Brunei, the Philippines, and Sri Lanka, there are no VM mandatory requirements, standards, and institutions at present. Since VM covers all major components of traditional team decision-making, the qualitative data of this group were collected based on the R3 respondents' traditional team decision-making experience in construction projects instead of limited to VM application, particularly for those countries without VM execution.

Samples

The participants in this study were chosen by the purposive-sampling method for high data quality (Adams and Schvaneveldt, 1985; Leung et al., 2014a). Participants were selected if they: (1) had basic knowledge of VM; (2) were construction professionals; (3) belonged to countries/regions along the B&R; and (4) had VM or team decision-making experiences in countries along the B&R regions. There is no strict rule for the number of participants within a group, while a focus group discussion can work effectively with 3–14 participants (Gill et al., 2008). However, a "small-sized" group with 4–9 participants is recommended by researchers to achieve optimum expression of various opinions among participants (Prince and Davies, 2001; Liang et al., 2018). To ensure the productivity of team discussion and avoid chaos, the size of each focus group in this study was arranged as 4 for Brunei, 3 for Hong Kong, 5 for Iran, 4 for Malaysia, 3 for the Netherlands, and 5 for the Philippines and Sri Lanka. Among the 24 participants, 12.5% of them worked for the developer, 45.8% for the consultant, 16.7% for the contractor, 16.7% for the government departments, and 8.3% for other organizations. In total, 37.5% of the participants had not participated in any VM workshops, 25.0% participated in 1–5 workshops, 18.8% in 5–10 workshops, 6.2% in 10–15 workshops, and 12.5% in more than 15 workshops.

Data Collection

Prior to conducting the formal focus group discussion, brochures with a detailed description of the current study were prepared and distributed to all participants in order to clarify the objectives, questions, process, and schedule of the group discussion. In the beginning, the moderator introduced the purpose of the study, gave a brief introduction to the whole

process (e.g., procedure, techniques, and schedule), specified the rules of group discussion (e.g., equal chances of participation to speak, free responses to any suggestions and judgements, no right/wrong answers for each question, respectful listening to others' opinions and keeping the result of the discussion in confidential), and finally requested each participant to introduce him- or herself (Krueger, 2002; Liang et al., 2018).

To ensure systematic data collection and facilitate the comparison of results, all groups were invited to discuss according to the same semi-structured questions and under a similar procedure (Knodel, 1993). Participants were asked to discuss: (1) current VM /traditional team decision-making process; (2) team behaviors during the VM /traditional team decision process; and (3) VM /traditional team decision outcomes in particular countries. During the whole process, the moderator recorded the qualitative data via immediate notetaking, videos, and flip charts. Moreover, to stimulate creative thinking, each team member was asked to write down opinions and generated ideas on the flip chart for sharing among all groups. At the end of the focus group, the moderator made a conclusion and asked the participants whether they had further comments and suggestions for the current study. The focus group discussion ended if there were not any further comments proposed.

Results

To avoid bias, the data analysis was based on the whole group instead of individual. Contextual analysis, the most common method for qualitative analysis, was applied in this study to analyze qualitative data collected from the scripts mentioned by the participants. Grounded theory, as the fundamental of contextual analysis, helped researchers to establish and validate the theoretical framework of a specific topic (Charmaz and Belgrave, 2012). By applying it, the keywords and phrases were identified and further categorized into groups and named as meaningful factors (Yu and Leung, 2015). Finally, critical success factors were integrated into different dimensions in terms of the technical process, team behaviors, and outcomes.

194 **Table 2 Factors of Technical Process in VM and/or Traditional Team Decision-making**

Factors / Manifestation	Transcript Good practices	R1	R2	R3	Current problems	R1	R2	R3
Preparation								
Timing	R1: To reap the fullest benefits, the VM process was encouraged to be started at the very *beginning stage of a project, such as the technical feasibility study stage* (HK).	✓			R2: VM intervention was not proposed for the *project initial stage* (MY).		✓	
	R2: We conducted more than one VM workshop for a project in *different project stages such as procurement, design, construction, operation, and so on* (IR).		✓		R3: Team decision-making activities were conducted at the times *when materials or equipment were already procured* (PH).			✓
	R2: We had VM interventions *for different project stages* (MY).		✓					
					R3: The number of public holidays affected *the date selection of team decision-making activities* (LK).			✓
Duration	R2: The average VM workshop lasted *at least 2 days* (IR).		✓		R1: Due to insufficient time, the VM workshops in HK were limited to *1 day or even half days* (HK).	✓		
	R2: We spent *more than 2 days* in VM workshops (MY).		✓		R3: The decision-making workshops lasted *1 day* (BN).			✓
Cost	R2: We did not need to pay *additional fees* to the internal facilitator (MY).		✓		R3: We *lacked funding for VM implementation and facilitation* (BN).			✓
Logical procedure								
Procedure	R1: The *workshop procedure* in Hong Kong was based on *a systematic job plan* (HK).	✓			R3: In Brunei, *VM workshops were not conducted in a systematic manner* (BN).			✓
	R2: We followed the *VM procedure identified in the standards* (MY).		✓		R3: The decision-making workshops with VM concept *just consisted of the creative and presentation phases*, which means that we did not conduct VM properly (PH).			✓
					R3: There were *no independent logical VM workshops conducted* (LK).			✓
Function analysis								
Function analysis techniques	R1: *Function analysis techniques such as function diagramming and functional performance specification* were used (NE).	✓						
	R1: We identified the actual needs of the stakeholders in order to generate ideas by *function analysis techniques* (HK).	✓			R2: In Malaysia, *I could not see where the function analysis techniques were properly used*. It meant that the heart of VM was not fully understood (MY).		✓	
	R2: The government required VM practitioners to use *function analysis techniques such as verb and noun and the FAST diagram* in some projects (IR).		✓		R3: *The function analysis phase was ignored* (PH).			✓
Integration								

Factors / Manifestation	Transcript Good practices	R1	R2	R3	Current problems	R1	R2	R3
Management methodology	R1: In some projects, VM was *integrated with partnering and risk management* (HK).	✓			R3: The *management techniques were not integrated or adjusted to fit local values, beliefs, and behavioral patterns* (LK).			✓
	R2: VM was *integrated with risk management in some real projects* (MY).		✓					
Advanced techniques	R1: *High technologies (e.g., computer programs, software, etc.)* had been developed at a mature state to integrate with VM flawlessly (HK).	✓						
	R1: *Online software* was used to overcome time and location constraints for VM application in international projects (NE).	✓						
	R2: VM was integrated with *advanced techniques, such as IBS and BIM* (MY).		✓		R3: No known *advanced technology was* being applied to support team decision-making (BU).			✓
Follow-up								
Follow-up actions					R1: *Unclear implementation* of *VM outcomes* was an issue in Hong Kong (HK).	✓		
					R2: It was *hard to conduct follow-up actions* after VM (MY).		✓	
					R3: The *monitoring and controlling of the project were ineffective* in the developing world (LK).			✓
Feedback	R2: After VM, we *reviewed the achievements and performance and identified the lessons learned for further improvement* (MY).		✓		R2: The *evaluation process in the follow-up stage could not be carried out* because it would cause conflicts in the procurement procedure and lead to bias with constructors (MY).		✓	
Total number of excerpts		**7**	**10**	**0**		**2**	**4**	**11**

Note: R1 = advanced VM developed regions; R2 = advanced VM developing regions;
R3 = unadvanced VM developing regions;
BN = Brunei; HK – Hong Kong; IR= Iran; LK = Sri Lanka MY= Malaysia; NE = the Netherland; and PH= the Philippines

Technical Process

The participants were invited to discuss the technical aspect of team decision-making in specific countries. According to the results of the contextual analysis (see Table 2), five factors were identified for the technical process of VM /traditional team decision-making, namely, preparation, logical procedure, function analysis, integration, and follow-up. The numbers of total excerpts related to good practices in R1, R2, and R3 were 7, 10, and 0 respectively, while the frequencies of the current problems for each region were oppositely increased as 2, 4, and 11 respectively.

Preparation

Participants of R1 stated that VM could be applied at the very beginning of the project management process (e.g., the technical feasibility stage) for gaining maximum benefits. However, the VM /traditional team decision-making activities were always conducted too late in the developing regions (i.e., R2 and R3). Malaysian participants mentioned that although a VM study could be conducted at various decision points throughout the project management processes (e.g., procurement, design and construction and operation), there was still no VM activity applied as early as in the project initiation stage in practice (R2; Public Works Department of Malaysia, 2013). Even worse, in R3, traditional team decision-making activities were normally conducted after the procurement of materials and equipment, which made it too late for gaining good project benefits. In fact, there were plenty of public holidays in Sri Lanka (R3), and thus the construction professionals postponed the tasks of the project (i.e., team decision-making activities) in order to enjoy vacations.

In the B&R regions, the duration of VM/traditional team decision-making activities varied from half to 2 days or more (all regions). VM practitioners in Hong Kong were facing huge workloads and had limited time for the implementation of VM due to a highly competitive construction market. Therefore, experienced VM facilitators in Hong Kong tried to increase VM efficiency by simplifying the process and shortening workshop duration to 1 day or even half days for most of the projects (R1; Leung, 2009). In countries like Malaysia and Iran where VM was newly adopted, project practitioners were willing to spend more time for VM activities, and normally followed the systematic job plan with a duration of more than 2 days (R2; Zainul-Abidin and Jaapar, 2010). However, in R3, some critical phases (e.g., analysis and evaluation) of decision-making were skipped, combined, or condensed with their results in a short duration (e.g., a 1-day workshop in Brunei) (Leung et al., 2014b).

The participants of R3 complained that insufficient financial support for the application and facilitation of VM was a common threat in the developing regions along the B&R. To reduce the cost of VM facilitation, VM practitioners in R2 had come up with some solutions. For instance, the Malaysian government had cultivated internal facilitators to coordinate VM workshops for public projects rather than hiring external facilitators from consultant companies with additional costs (R2).

Logical procedure

VM practitioners of both R1 and R2 usually held VM activities logically based on the standardized process documented in official guidelines. In R3, very few independent VM workshops were implemented, while project practitioners "*did not conduct VM workshops in a systematic manner*", because the VM concept was not properly adopted in the project management process. For example, "*the team decision-making workshops with the VM concept generally just involved the creative and presentation phases*" (R3), and the key steps of VM such as function analysis, evaluation, development, etc., were ignored.

Function analysis

Out of various decision-making techniques, those used for analyzing functions were fundamental in the VM activities (Spaulding et al., 2005). In the developed regions, techniques such as verb-noun phrases, the FAST diagram, functional performance specification and so on were widely used in the function analysis phase to identify the actual needs of the stakeholders (R1). Nevertheless, the concept of VM was often misunderstood in the developing regions. Participants from R2 mentioned that even though "*the government required VM practitioners to use function analysis techniques such as verb-noun phrases and the FAST diagram in some projects*", those techniques were still rarely or improperly used in real VM activities. In R3, the application of function analysis techniques was uncommon.

Integration

In the project management process of construction projects along the B&R regions, VM can be integrated with other managerial-related methodologies, such as risk management (R1 and R2), partnering (R1), and so on (Bowen et al., 2010; Clifford, 2006; Green, 2001). However, a Sri Lankan participant pointed out that managerial techniques were not efficient in practical traditional team decision-making activities because they "*were not integrated or adjusted to fit local values, beliefs, and behavioral patterns*" (R3). According to the discussion among participants of R1 and R2, advanced techniques such as computer programs and software can be flawlessly integrated into the VM process in their regions. For instance, Dutch VM specialists conducted remote virtual VM workshops with Indonesian practitioners via online software, while the VM practitioners in Malaysia tried to integrate VM with advanced techniques such as Information Building System (IBS) and Building Information Modelling (BIM). Due to the relatively low level of IT development, "*no known advanced technology was being applied to support the team decision-making process*" in R3.

Follow-up

Proper follow-up activity plays an important role in implementing the proposed ideas (Liu and Leung, 2002; SAVE International, 2020), but it meets various difficulties in all regions along the B&R. In the VM activities of construction projects along the B&R regions, "*unclear implementation of VM outcomes*" was common (R1) because "*it was hard to conduct follow-up actions*" (R2) to monitor the implementation of VM recommendations. As the traditional team decision-making activities of R3 lacked effective project monitoring and control systems, the implementation of final decisions was not easy to trace. It is expected that the decision efficiency and performance of future VM studies can be improved by assessing the performance of final outcomes via feedback (Leung and Liu, 2003). Malaysian VM practitioners were willing to collect feedback to "*review achievements and performance and identify the lessons learned for further improvement*" (R2) in the evaluation process of the follow-up stage. However, the feedback process often was not executed "*because it would cause conflicts in the procurement procedure and lead to bias with contractors*" (R2).

Team Behaviors

Team behaviors should be emphasized during the decision-making process, especially for complex projects involving multiple stakeholders along the B&R regions. Based on the results, in construction projects along the B&R regions, identified critical team behaviors in VM /traditional team decision-making consisted of specificity, conflict, commitment, transparency, and participation (see Table 3). Good practices (with 11 excerpts in R1, 4 excerpts in R2, and 1 excerpt in R3) and current problems (with 1 excerpt in R1, 3 excerpts in R2, and 11 excerpts in R3) related to goal-setting behaviors for each group of regions were summarized in Table 3.

275 **Table 3 Factors of Team Behaviors in VM and/or Traditional Team Decision-making**

Factors / Manifestations	Transcript Good practices	R1	R2	R3	Current problems	R1	R2	R3
Specificity								
Value specificity	R1: We *specified demands of the client* (HK).	✓						
	R1: The *client's expectations* were *clarified* (NE).	✓						
	R1: We *listened to all participants' views and opinions* (HK).	✓						
	R2: VM was used *to identify the authorities' demand* (MY).		✓					
Goal specificity	R1: We *avoided having pre-determined solutions* (HK).	✓						
	R2: *Goals of the project were specified and aligned* among participants (MY).		✓		R3: The *final goals did not match the client's requirements* (PH).			✓
Conflict								
Conflict manifestation	R1: *Different opinions among VM participants during the team discussion* would cause conflict (HK).	✓			R3: *No conflict was noticed* among participants (BN).			✓
Resolve conflict	R1: We always tried to *provide solutions for conflicts* among different parties in the VM workshops (HK).	✓						
Commitment								
Goal commitment	R1: Decisions made by VM could be *used to convince the legislative council for funding approval* (HK).	✓			R3: Decisions were *often rejected by the owners or designers* (PH).			✓
	R2: For some projects, *a clause was included in the contract requiring the project team to adopt VM results* (IR).		✓		R2: The *final VM results were often not executed* in the final project (IR).		✓	
					R3: *Intense motivation for goal implementation* was necessary to Sri Lankan construction processionals since their productivity was very low (LK).			✓
Transparency								
Information transparency	R1: *The transparency of the project information was high* during the VM process, and related *information could easily be acquired* by practitioners (NE).	✓			R2: Some of the *project information was not easy to access*, which had a huge impact on the project success (IR).		✓	
	R2: We were trying to establish new VM interventions to improve the project briefing so that it could *increase transparency* (MY).		✓		R3: It was *hard to get cost information* from different stakeholders (PH).			✓
					R3: *Poor documentation* was one of the common obstacles to achieving value for money in Sri Lanka (LK).			✓
Public accountability	R1: *Public consultation* was conducted for public projects (HK).	✓			R1: There was too much *duplicate and useless information from the public* (HK).	✓		

Factors / Manifestations	Transcript Good practices	R1	R2	R3	Current problems	R1	R2	R3
	R1: Social media was used to *ensure information transparency* (HK).	✓			R3: We *did carry out the public consultation* for some projects, but it was *limited to understanding the public's concerns* for specific issues (BN).			✓
Corruption					R2: There were *some corruption issues, such as disputes of interest allocation and advanced payments of contract* in the project management process (MY).		✓	
					R3: We faced *corruption issues* such as *bribes, unethical practices, and unsolicited contracts* (LK).			✓
Participation								
Participants' participation	R1: The Dutch participants were more individualistic than Asian participants, but they *fully cooperated with others in VM* (NE).	✓			R3: When the project manager became the dominant participant, *consultants thought that they were limited in what they could say* (BN).			✓
					R3: *Less effort was put to motivate stakeholder participation* (LK).			✓
					R3: The team often failed to evaluate and develop ideas as a team because of poor *team coordination* (PH).			✓
Total number of excerpts		**11**	**4**	**1**		**1**	**3**	**11**

Note: R1–R3, BN, HK, IR, MY, NE, PH, and LK: refer to the notes in Table 2.

Specificity

Value specificity in this study is defined as the level of explicit of participants' needs and wants (Leung and Liu, 2003). The client and the authority representatives were the most powerful people among all stakeholders, so their requirements had to be specified during the VM process (R1 and R2; Kelly, 2007). Nevertheless, the expectations and views of other stakeholders also played important roles in R1. For instance, a Hong Kong participant said "*At the beginning of the VM workshop, we listened to all participants' views and opinions*". It is expected that participants' specific values could be effectively transferred to specific shared goals by conducting VM effectively (Leung et al., 2004; Leung and Liu, 2003). Therefore, *pre-determined decisions* before the VM activities were avoided (R1), and all goals were clarified and aligned among team members through the logical VM process (R2). Traditional team decision-making activities in R3 often failed to set common and specific goals among participants. For example, one of the challenges for project practitioners in the Philippines during the team decision-making process was that the final project goals just focused on cost reduction and failed to consider the clients' requirements in terms of design, aesthetics, and so on.

Conflict

In R1, conflicts (e.g., disagreements, arguments, and contradictions) among the participants during the VM process were welcome because practitioners could hear opinions from different perspectives (De Dreu and Weigart, 2003; Leung et al., 2002). After conflict manifested, VM practitioners in Hong Kong "*always tried to provide solutions for conflicts among different parties in the VM workshop*". However, Malaysian and Iranian participants did not mention any information about conflict manifestation and resolution (R2), while the Bruneian participants said that no conflict was noticed among the practitioners in team decision-making process (R3). Perhaps VM practitioners in R2 were not aware of conflict management via VM, and/or the traditional team decision-making often failed to encourage project practitioners in R3 to freely share thoughts in contradiction with other team members.

Commitment

Mutual understanding and consensus among team members are both critical for gaining goal commitments from the participants (Leung et al., 2014b; Leung et al., 2004). In Hong Kong, the results of VM could "*be used to convince the legislative council for funding approval*" (R1). They represented that commitment from the senior organizations (e.g., the government and client) could be significantly improved via VM in developed regions. Practitioners in developing regions (i.e., R2 and R3) usually showed a lack of intrinsic determination to implement final decisions. In R2, VM results were often not executed in the actual project. To ensure goal commitment, "*a clause was included in the contract requiring the project team to adopt the VM results*" in Iran. Meanwhile, insufficient commitment was identified as one of the drawbacks in the traditional team decision-making process in R3. Participants from the Philippines and Sri Lanka complained that "*Decisions were often rejected by the project owners or designers*", which resulted in the low productivity of project practitioners. Therefore, to implement project goals, intense motivation was necessary in order to increase the commitment of construction professionals in R3.

Transparency

According to the focus group results, transparency can be separated into three aspects: information transparency, public accountability, and corruption. Information transparency in this study was defined as a timely and reliable project information flow that is available to all stakeholders (Bruzelius et al., 2002; Williams, 2015). Participants in R1 from the Netherlands stated that "*The transparency of the project information was high during the VM process, and related information could be easily acquired by VM practitioners*". In contrast, in the developing regions, some project information was not easy to access and was seldom shared by stakeholders, especially information relating to the project cost (R2 and R3). Participants from R2 said that limited transparency of project information would "*make a huge impact on the project success*". In R3, poor documentation hindered information transparency during team decision-making process and reduced the value for money of the project. Aside from this, the level of openness to the public was a critical part of transparency

because it predicted accountability (Palanski et al., 2011; William, 2015). In Hong Kong, social media was used to disseminate project information to the public for ensuring transparency of the VM study. Moreover, for some public construction projects in R1, public consultation was also conducted in the VM study. However, based on the experiences of participants from Hong Kong, it resulted in a lot of duplicate and useless information, which could reduce VM efficiency (R1). The level of information openness to the public was limited in the developing regions along the B&R. For example, public consultation was insufficient for ensuring transparency in Brunei because it was conducted in few projects and was "*limited to understanding the public's concerns about specific issues*" (R3). Due to huge investment in construction projects, *corruption* is also a critical issue for transparency in the construction industries along the B&R regions, especially in developing countries (R2 and R3; Locatelli et al., 2017). There were various problems related to corruption in the construction projects of R2 and R3, such as disputes of interest allocation and advanced payments of contracts in Malaysia (R2), and bribes, unethical practices, and unsolicited contracts in Sri Lanka (R3). In Malaysia, the government discovered that VM could be used to increase transparency during the decision-making process. For instance, the Malaysian government was trying to establish new VM interventions for improving project briefing in order to ensure transparency. Sadly, the traditional management strategy in R3 was ineffective in dealing with transparency.

Participation

In this paper, participation was one of the critical factors in encouraging participants to contribute to decision-making (Heller et al., 1998). Based on their rich VM experience, VM practitioners in R1 realized that "*It was impossible to achieve project success if participants did not participate in the team discussion and speak out their concerns*". By applying VM techniques, stakeholders "*knew how to cooperate with other team members*", even for those who came from a society with a more individualistic culture (i.e., the Netherlands). However, there was insufficient motivation in participation due to ineffective team coordination in the traditional team decision-making activities of R3. The Bruneian participants complained that some project practitioners felt restricted and less involved in team discussions, especially when architects or project managers dominated the whole decision-making process.

VM Outcomes

To evaluate final performance, the expected VM /traditional team decision-making outcomes among the three groups of regions along the B&R must be discussed and compared. The total numbers of excerpts related to good practices in the three groups of regions were 6 for R1, 5 for R2, and 3 for R3, and those related to current problems were 0 for R1, 2 for R2 and 9 for R3. Based on the qualitative results, there were three outcome factors identified, including stakeholder outcome, project performance, and social support (see Table 4).

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354 **Table 4 Factors of VM and/or Traditional Team Decision-making Outcomes**

Factors / Manifestations	Transcript Good practices	R1	R2	R3	Current problems	R1	R2	R3
Stakeholder outcome								
Stakeholder satisfaction	R1: We tried to find *a win-win situation for all stakeholders via VM* (HK).	✓			R3: The *final decisions could not satisfy stakeholders* because of reworks caused by unsatisfactory decisions (PH).			✓
	R2: VM could *improve client-user satisfaction* (MY).		✓					
Stakeholder learning	R3: Construction professionals *learned VM practices* from co-managing projects with Malaysia (BU).			✓	R2: Some construction professionals *lacked knowledge of VM* (MY).		✓	
					R3: *Few Filipino construction professionals understood VM* (PH).			✓
					R3: There was *a scarcity of trained personnel* who know the advanced project management tools (SL).			✓
					R3: The cheap labor and rich resources in developing countries attracted many overseas investigators. So, local construction personnel *needed to learn project management knowledge and techniques* for enhancing competitiveness in the local job market (LK).			✓
Project performance								
Project cost	R1: *The project's value for money was improved* (NE).	✓			R3: *The budget sometimes did not match the project design* after an improper VM process (PH).			✓
	R1: VM was undertaken for *improving project's value for money* in public works contracts (HK).	✓						
	R2: VM could *optimize project cost* (MY).		✓					
	R3: *We considered VM a tool of cost control* (BN).			✓	R3: *Cost overrun* was very common (LK).			✓
	R3: In contrast with developed regions, *VM in the Philippines was just for cost-cutting* (PH).			✓				
Improving project value	R1: *Manpower and project time constraints* were all considered in VM (HK).	✓						
	R1: We focused more on the *best value* instead of on the lowest cost (NE).	✓			R3: *Time delays* often happened in Sri Lanka (LK).			✓
	R2: VM could be used to *explore new design options with more creativity* (IR).		✓		R3: The late conduction of team decision-making resulted in *design and quality downgrade and posed problems for the*			✓

Factors / Manifestations	Transcript Good practices	R1	R2	R3	Current problems	R1	R2	R3
					timeline (PH).			
	R2: The VM application could *optimize project design and achieve delivery improvement* (MY).		✓					
Social outcome								
Supporting other countries	R1: VM experts in the Netherlands *supported* Indonesian construction professionals for VM implementation (NE).	✓						
	R2: For some projects, we *hired foreign VM facilitators* (MY).		✓		R2: Iran was facing sanctions from the US, so *SAVE stopped providing VM support* to us (IR).		✓	
Social relationship					R3: There were *poor social relationships* among project practitioners (PH).			✓
Total number of excerpts		**6**	**5**	**3**		**0**	**2**	**9**

Note: R1–R3, BN, HK, IR, MY, NE, PH, and LK: refer to the notes in Table 2.

Stakeholder outcome

From the focus group discussions, *stakeholder satisfaction* was revealed as an important indicator of VM/traditional team decision-making outcomes. A Malaysian participant confirmed that the satisfaction of clients and end-users significantly improved after VM was applied, because they were the stakeholders who were the most affected by the final outcomes (R2; Yu and Leung, 2018). Participants from Hong Kong further said that value study teams always tried to find a win-win situation for all stakeholders (R1). Nevertheless, the traditional decision-making process of R3 often failed to satisfy stakeholders because it always resulted in repetitive work due to unsatisfactory final decisions.

In regions along the B&R, one of the main obstacles of VM application in construction projects of R2 and R3 was that project practitioners had insufficient knowledge of both VM and advanced project management, especially regarding function analysis and team coordination (e.g., solving conflicts, coordinating communication and participation; Hwang et al., 2014). In recent years, the construction market of developing countries has attracted many overseas investors due to the low cost for construction labor and rich resources. Indigenous construction professionals needed to improve their competitiveness in the local job market by learning advanced project management knowledge and techniques (R3). Some project practitioners in R3 tried to enhance their VM competency by joining VM activities facilitated by VM specialists from R1 and R2 (R3). For instance, in countries with less VM knowledge such as Brunei, the practitioners learned VM practices from co-managing overseas projects and then applied them to local projects (R3).

Project performance

In some countries of R3, the VM concept was integrated into the traditional team decision-making process as cost reduction (R3), because cost overrun was very common. Maximizing the project's value for money was regarded as one of the

critical outcomes for VM application in R1 and R2 instead of simply cost-cutting. On the other hand, poor team decision-making in R3 could result in design and quality downgrade with time overruns. VM was used in construction projects of R1 and R2 to help the project practitioners achieve the best project value, including design optimization, manpower improvement, timesaving, and so on.

Social support

Project practitioners in R3 found that social relationships among participants were poor after the traditional decision-making process, and these poor relationships resulted in less social support among stakeholders. Through positive team interaction and cooperation, VM can build up good social relationships among participants (i.e., VM experts and project practitioners) for helping each other in future works. For instance, Dutch VM experts provided professional support to Indonesian practitioners in VM facilitation under a project supported by the Asian Development Bank (R1). Social networks among VM experts from the Netherlands and Indonesian project practitioners were thus created for future cooperation. However, a lack of support from the developed regions could impede VM development and application in the developing regions. The Iranian participants in R2 stated that they were facing sanctions by the US government, while all VM support from SAVE had been stopped, which caused huge damage to the application of VM in Iran.

Propositional Model

To explore critically the differences in VM and/or traditional team decision-making between different regions along the B&R, good practices and difficulties in the application of VM and/or traditional team decision-making in advanced VM developed regions (R1), advanced VM developing regions (R2) and unadvanced VM developing regions (R3) are combined and summarized in Table 5.

Table 5 Comparison of VM and/or Traditional Team Decision-making

Factor	Good practice (+)	Current problem (-)	Number of excerpts R1	R2	R3
Technical Process			***7+/2 −***	***10+/4 −***	***0+/11 −***
Preparation			**1+/1 −**	**5+/1 −**	**0+/4 −**
	+ Conduct VM in the early stages	− Late application of VM/DM	1+	1 −	1 −
	+ Conduct VM at different stages	− Agenda affected by holidays		2+	1 −
	+ Sufficient time for VM	− Insufficient time for VM	1 −	2+	1 −
	+ Cultivate internal facilitators without additional cost	− No financial support for VM		1+	1 −
Logical Procedure			**1+/0 −**	**1+/0 −**	**0+/3 −**
	+ Adopt systematic and standard job-plan	− Unsystematic process	1+	1+	3 −
Function analysis			**2+/0 −**	**1+/1 −**	**0+/1 −**
	+ Use function analysis techniques	− Ignore or unproperly use of function analysis techniques	1+	1+/1 −	1 −
	+ Identify actual needs and wants of stakeholders via function analysis		1+		
Integration			**3+/0 −**	**2+/0 −**	**0+/2 −**

	+ Integrate VM with other management methodologies	− No integration of management techniques with local framework	1+	1+	1 −
	+ Integrate VM with IT techniques	− No advanced technology support	2+	1+	1 −
Follow-up			**0+/1 −**	**1+/2 −**	**0+/1 −**
		− Ineffective follow-up actions	1 −	1 −	1 −
	+ Review VM achievements and identify lessons learned	− Hard to conduct evaluation of VM outcomes		1+/1 −	
Team Behaviors			***11+/1 −***	***4+/3 −***	***0+/11 −***
Specificity			**4+/0 −**	**2+/0 −**	**0+/1 −**
	+ Specify the demands of the client/authority		2+	1+	
	+ Exchange views of all participants		1+		
	+ No predetermined goals		1+		
	+ Specify and align project goals	− Fail to align goals with client's requirements		1+	1 −
Conflict			**2+/0 −**	**0+/0 −**	**0+/1 −**
	+ Manifest conflicts	− No conflict raised	1+		1 −
	+ Provide solutions to resolve conflict		1+		
Commitment			**1+/0 −**	**1+/1 −**	**0+/2 −**
	+ Help to gain commitment from the government	− Reject decisions made	1+		1 −
	+ Require project team to accept VM decisions	− Lack implementation of final decisions		1+/1 −	
		− Lack intense motivation for goal implementation			1 −
Transparency			**3+/1 −**	**1+/2 −**	**0+/4 −**
	+ High information transparency	− Hard to access information	1+	1 −	1 −
	+ Establish new VM intervention for increasing transparency	− Poor documentation		1+	1 −
	+ Conduct public consultation	− Insufficient public consultation	1+		1 −
	+ Use social media	− Too much duplicate information	1+/1 −		
		− Serious corruption		1 −	1 −
Participation			**1+/0 −**	**0+/0 −**	**0+/3 −**
	+ Fully cooperate with each other	− Dominant participants	1+		1 −
		− Low motivation to participate			1 −
		− Poor team coordination			1 −
Outcomes			***6+/0 −***	***5+/2 −***	***3+/9 −***
Stakeholder outcome			**1+/0 −**	**1+/1 −**	**1+/4 −**
	+ Satisfy stakeholders	− Fail to satisfy stakeholders' needs	1+	1+	1 −
	+ Learn from co-managing projects	− Insufficient knowledge		1 −	1+/3 −
Project performance			**4+/0 −**	**3+/0 −**	**2+/4 −**
	+ Reduce cost	− Cost overrun			2+/2 −
	+ Improve value for money		2+	1+	
	+ Improve other performance	− Decrease performance	2+	2+	2 −
Social support			**1+/0 −**	**1+/1 −**	**0+/1 −**
	+ Support overseas VM projects	− Poor social relationships among stakeholders	1+		1 −
	+Are supported by other countries	− Poor international relationships		1+/1 −	

Note: R1 = Advanced VM developed regions; R2 = advanced VM developing regions; and R3 = unadvanced VM developing regions.

Since VM is essentially a team decision-making process with a logical procedure, critical factors of VM in R1 and R2 and

team decision-making in R3 can be integrated theoretically. In this study, 13 critical success factors were revealed for the application of VM /traditional team decision-making in construction projects along the B&R regions, including 5 for the technical process (i.e., preparation, logical procedure, function analysis, integration, and follow-up), 5 for team behaviors (i.e., specificity, conflict, commitment, transparency, and participation), and 3 for outcomes (i.e., stakeholder outcome, project performance, and social support). An integrated model of VM/traditional team decision-making-outcomes in B&R regions was developed based on the identified factors with numbers of good practices and current problems (see Figure 1).

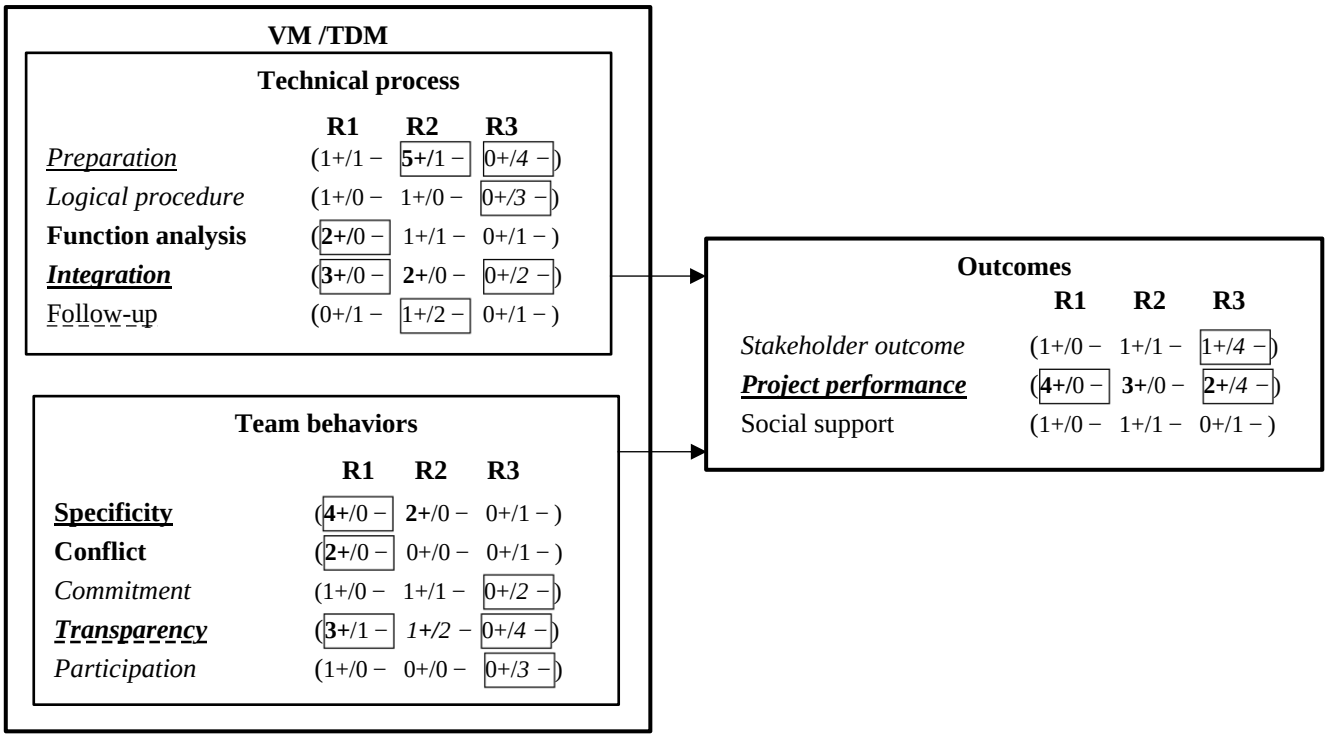

Figure 1 Propositional Model of VM /Traditional Team Decision-making–Outcomes in Three Regions along the B&R

Note: R1 = advanced VM developed regions; R2 = advanced VM developing regions;
R3 = unadvanced VM developing regions;
VM = value management; TDM = traditional team decision-making;
Nos. in bold = the positive nos. of excerpts of the three regions not less than 2;
Nos. in italics = the negative nos. of excerpts of the three regions not less than 2;
Nos. in bold with box = the highest nos. of positive excerpts amongst the 3 regions;
Nos. in italics with box = the highest nos. of negative excerpts amongst the 3 regions;
Factors in bold = factors significantly and positively mentioned by R1 participants;
Factors with underline = factors significantly and positively mentioned by R2 participants;
Factors with dot line = factors significantly and negatively mentioned by R2 participants; and
Factors in italics = factors significantly and negatively mentioned by R3 participants.

The model indicated that VM application with adequate preparation, function analysis, integration, specificity, conflict management, and transparency could improve the project performance, while traditional decision making in R3 without proper preparation, logical procedure, integration, commitment, transparency, and participation induced negative stakeholder outcomes and the poor project performance. Thus, the application of VM did help in improving the final project outcomes for construction projects along the B&R regions.

Discussion

Advanced VM Developed Regions

According to the results, R1 had more positive comments (i.e., 7 for technical process, 11 for team behaviors, and 6 for outcomes) and fewer negative comments (i.e., 2 for technical process, 1 for team behaviors, and 0 for outcomes) than R2 and R3 (see Table 5). VM in those developed regions was an effective problem-solving methodology with a systematic technical process and a mechanism for gaining positive team behaviors. As the core of VM, function analysis (2+) techniques were emphasized and widely used. Apart from traditional VM techniques, other managerial methodologies (i.e., risk management and partnering) and advanced techniques (e.g., computer programs; online software, etc.) were also integrated (3+) into VM for achieving better project outcomes. On the other side, VM provided a platform for construction professionals in developed regions to cultivate positive team behaviors, especially for specifying (4+) participants' values and project goals, well-managing *conflicts* (2+), and ensuring transparency (3+), which can finally improve the project performance (4+) (Leung et al., 2014b). Nevertheless, there were still deficiencies that existed in the VM application in developed regions, such as time constraints (1 negative comment) for VM study, insufficient follow-up actions (1–) and duplicate information from the public in public consultation (1–).

Advanced VM Developing Regions

In total, the numbers of positive excerpts revealed in R2 for technical process, team behaviors, and outcomes were 10, 4, and 5 with 4, 3, and 2 negative comments respectively (see Table 5). Although countries in advanced VM developing regions (R2) like Malaysia and Iran were new VM adopters and had implemented VM for a relatively short period, the basic concept of VM had been well-embraced in those countries. It was interesting to find out that in some technical respects, VM practitioners in R2 did better than those in R1. For example, in the preparation stage (5+), they allocated sufficient time for VM activities (2 days or more) in order to conduct a completed VM process for solving all possible issues. On the other hand, VM practitioners in those countries had a strong desire to apply VM in different stages (e.g., procurement, conceptual and detailed design, and construction) throughout the project management process with the integration (2+) of both traditional and new advanced techniques.

Although VM could significantly improve the overall project value in R2, there was still room (e.g., late application of VM, improper use of function analysis techniques, and insufficient follow-up activities) for further improvement in terms of the technical process. Due to the complex procedure and a lack of experienced VM facilitators, the application of function analysis techniques (1–) was still facing difficulties in R2 (Zainul-Abidin and Jaappar, 2010). Meanwhile, the results showed that VM practitioners in R2 emphasized technical aspects rather than team behaviors. VM application was still at an initial stage in R2, and VM practitioners had little concept of the importance of positive team behaviors (except

specificity (2+)) to the overall VM outcomes. Focus group participants from R2 did not mention conflict. Perhaps they were not yet aware of the application of VM for proper conflict management. Compared with developed regions, transparency issues (i.e., difficulty accessing project information and corruption) were more serious in the developing regions (2–) because of immature law systems and ineffective public supervision mechanisms (Bologna and Del Nord, 2000). Some developing countries along the B&R regions (e.g., Iran) had poor relationships (1–) with advanced VM developed countries (e.g., US) due to political issues, and this impeded VM development in their local construction industries. Therefore, it is important for VM practitioners in developing regions along the B&R (i.e., R2 and R3) to gain positive social support from VM specialists in R1.

Unadvanced VM Developing Regions

The results showed that, among the 3 groups of regions, the most of negative comments (i.e., 11 for technical process, 11 for team behaviors, and 9 for outcomes) with only a few positive excerpts (i.e., 0 for technical process, 1 for team behaviors, and 3 for outcomes) were revealed in R3 (see Table 5). As mentioned, the traditional methodology in R3 could not support the team decision-making process in terms of both technical process and team behaviors efficiently and eventually resulted in poor project outcomes. All participants from R3 complained that the traditional team decision-making activities did not follow systematic and logical processes (3–), and that the analytical aspect of decision-making was usually ignored (1–). Even though VM was introduced to some countries in R3, it was not yet clearly understood and contextualized with advanced techniques into local situations (2–). Meanwhile, negative team behaviors, especially poor commitment (2–), lack of transparency (4–), and insufficient participation (3–) hindered the project outcomes. In R3, transparency issues always happened during the team decision-making process due to inaccessible project information, insufficient public involvement, and serious corruption. On the other hand, participants with high power often dominated the whole team discussion and restricted lower-status participants from speaking freely, which resulted in limited participation by others (Elele and Fields, 2010; Sagie and Aycan, 2003). In R3, project teams often were not determined to implement the final decisions made through illogical traditional team decision-making activities, and the decisions were eventually rejected by project teams (Leung and Chan, 2007). Due to poor team decision-making, failure to satisfy (4–) all stakeholders and project performance (4–) downgrade were common in R3 and then resulted in a huge potential demand for VM (Li and Ma, 2016).

Recommendations

Through focus group discussions, the critical success factors of VM application in the construction projects along the B&R regions were identified in three aspects: technical process, team behaviors, and outcomes. Meanwhile, good practices and current problems in VM /traditional team decision-making in construction projects in the three groups of regions were also

revealed. Based on the results, practical recommendations are proposed to improve the VM application and outcomes in construction projects along the B&R regions.

In the **preparation** stage, a sufficient amount of time for VM workshops should be allotted because it is essential for in-depth team discussion, especially when resolving complex issues (Kelly et al., 2015). The tight schedule (i.e., half-day or one day) for VM activities was regarded as one of the difficulties in Hong Kong (R1). It is strongly recommended that the clients and VM facilitators in R1 *allot 40 hours for a formal VM workshop as recommended by the Society of American Engineers (SAVE) in the pre-VM stage*. Even though public consultation was conducted to increase the **transparency** of VM activities in R1, the duplicate and redundant information provided by the public reduced the efficiency of information analysis. It is better to *hire qualified VM facilitators in public consultation* for designing a proper process as well as dealing with mass information.

Function analysis techniques were hard to implement effectively in R2 because practitioners lacked sufficient knowledge to handle such a complicated process (Zainul-Abidin and Jaappar, 2010). *Joint VM training should be held by influential VM institutions of R1 (e.g., HKIVM and DACE) and local VM organizations in R2 (e.g., IVMM and SIVE) together*. Thus, VM practitioners in R2 can learn comprehensive function analysis knowledge and advanced tools from VM specialists in R1. After the VM activities in R2, the post-evaluation of VM performance was deficient in the **follow-up** stage. Clients and VM facilitators are suggested to *conduct post-VM meetings with project team members* for evaluating the VM performance and collecting feedback for future improvement. Difficulties in terms of **commitment** were not uncommon for project practitioners in R2, which led to poor implementation of final VM decisions in the final project. It is recommended that VM practitioners *use public scrutiny through publishing the final VM results in multiple media*, which can provide extrinsic pressure to the project practitioners for implementing VM decisions. Hard-to-access project information impeded the **transparency** of VM in R2. It is hoped that *a digital platform for project information could be developed for VM practitioners in R2 to upload and review project information without restriction*.

In R3, financial support for VM activities was insufficient. To encourage VM application, *the governments of R3 are advised to provide adequate funding to VM activities at the **preparation** stage*. The **unsystematic and illogical team decision-making procedure** was uncovered as a drawback in R3, while information **analysis** and **follow-up** were usually ignored in traditional team decision-making. It is thus recommended that construction professionals of R3 *adopt existing and mature overseas VM guidelines*, such as the SAVE International Standard of the US (SAVE International, 2020), the Australian standard AS 4183-2007 (Standard Australia, 2007), the European standard BS EN 21973-2020 (British Standard Institution, 2020), the Hong Kong technical circular No. 35/2002 (Environment, Transport and Works Bureau, 2002), and so on for guiding logical VM activities with all critical phases. Moreover, advanced managerial techniques were not

integrated or adjusted to fit local values, beliefs, and behavioral patterns in R3. To integrate VM with the local project management framework, *a domestic VM guideline* should be developed on the basis of the existing mature international VM standards in R3. Due to undeveloped IT techniques in R3, *free online tools, such as Google and Microsoft online spreadsheets, chatting software, virtual collaborative whiteboard platforms (i.e., MIRO.com), and so on should be integrated into VM processes to support practitioners in effectively implementing VM techniques*. In the traditional team decision-making of R3, poor team coordination induced insufficient **specificity**, improper **conflict** management, weak **commitment**, low **transparency**, and poor **participation**, and finally resulted in low performance. *Overseas qualified VM experts from R1 who have sufficient team coordination skills should be hired* to well coordinate the value study teams in R3 and ensure positive behaviors from team members.

Moreover, except those for specific regions, some recommendations are also proposed for two or three regions together. In the **preparation** stage, traditional team decision-making in R3 and VM activities in R2 were often planned to be conducted at late stages during the project management process of a project. *The government*, as the most powerful organization within the country, *is expected to mandate VM application in the project flexibility study stage in order to require the client to conduct VM early*. Lack of **follow-up** activity for monitoring the implementation of VM results was a critical issue in all three groups of regions (i.e., R1, R2, and R3) along the B&R. *A clause for monitoring VM results should be included in the consultant contracts* for requiring VM practitioners to supervise the implementation of the final decisions. Moreover, traditional team decision-making in R3 failed to effectively **manage conflicts**, while project practitioners in R2 and R3 usually lacked awareness of using VM for conflict management. To improve the effectiveness of conflict management during the value study, *VM practitioners in R2 and R3 are expected to learn conflict management skills from VM experts in R1* to enhance their abilities in manifesting and resolving conflicts (Leung et al., 2014b).

Limitations and Future Studies

Although the sample size of this study satisfied the minimum requirement of the focus group, the results uncovered with a relatively small sample size may not fully represent the real situation of all countries along the B&R regions. To reduce the impact of this issue, respondents in the study were selected throughout regions along the B&R, including Europe (the Netherlands), West Asia (Iran), southeast Asia (Malaysia, the Philippines, and Brunei), East Asia (Hong Kong), and South Asia (Sri Lanka). On the other hand, both reliable data collection and analysis processes were used to ensure the validity of the study results—for example, (1) using the purposive sampling method to select participants (e.g., all of the participants were construction professionals in the B&R regions who had a basic understanding of VM and ideally had VM and/or traditional team decision-making experience); (2) introducing the purpose of discussion at the beginning of each section to help participants have a good understanding of the discussed topic; (3) adopting multiple sources of evidence to avoid bias

in the results (e.g., utilizing note-taking, worksheets, and video records); (4) ensuring the discussion results were viewable for all participants during the whole process in order to eliminate data distortion and to stimulate more opinions; (5) analyzing and comparing data among groups with different background based on appropriate units; and (6) double-checking the opinions of the participants by watching videos of the group discussion during the data-analysis process (Leung and Chan, 2012; Leung et al., 2014a; Liang et al., 2018; Yu and Leung, 2005). Therefore, the results of this study can be regarded as reliable.

In this study, the critical success factors for VM application in construction projects along the B&R regions (in terms of technical process, team behaviors, and outcomes) was identified, and a propositional model was developed. However, the differences among personal cultural values (power distance, collectivism, uncertainty avoidance, etc.) may also be critical in guiding individual behaviors in team decision-making, which is difficult to reveal via focus group discussion. It is hoped that individual semi-structured interviews can be applied to construction professionals in different regions for exploring how their personal cultural values affect VM/team decision-making process. On the other hand, the propositional model of the study was developed based on VM in R1 and R2 and traditional team decision-making in R3. In the future, focus groups of traditional team decision-making in R1 and R2 and of VM in R3 should be conducted for comparison purposes.

The current study used the focus group method to collect qualitative data to explore the critical success factors in terms of technical process, team behaviors, and outcomes for applying VM in construction projects along the B&R regions. In the future, a questionnaire for a quantitative survey can be designed on the basis of this study and released through various means (e.g., online survey link, email, and face-to-face) to collect quantitative data from VM/construction professionals in different regions along the B&R. The inter-relationships between the identified critical VM process and outcome factors in construction projects along the B&R regions will then be analyzed in detail. Based on the triangulation method, the results of quantitative studies would be used for validating the propositional model of this study. The results in this study were based on the general situations of VM in R1 and R2 and traditional team decision-making in R3. In the future, through semi-structured interviews with project practitioners, case studies should be implemented to validate the proportional model in real construction projects along the B&R regions (Hancock and Algozzine, 2017).

Conclusion

To identify critical success factors for applying VM in construction projects along the B&R regions, this study conducted six focus group discussions covering seven countries and regions along the proposed B&R routes. Furthermore, the six groups were classified into 3 groups of regions along the B&R, including advanced VM developed regions (i.e., Hong Kong and the Netherlands), advanced VM developing regions (i.e., Malaysia and Iran) and unadvanced VM developing

regions (i.e., Brunei and the Philippines and Sri Lanka) for comparing their current VM and/or traditional team decision-making. According to the qualitative analysis results, the critical success factors in terms of technical process, team behaviors, and outcomes were identified. The technical decision-making process included 5 factors: preparation, logical procedure, function analysis, integration, and follow-up. Team behaviors consisted of 5 critical factors: specificity, conflict, commitment, transparency, and participation. To better evaluate the VM/traditional team decision-making performance, stakeholder outcome, project performance, and social support were explored as critical outcome factors.

Based on these findings, VM application in R1 had a systematic procedure with an effective function analysis mechanism, positive team behaviors, and a high level of final outcomes. However, some shortcomings still existed including insufficient time, poor follow-up actions, duplicate and useless information during public consultation, and so on. On the other hand, VM was adopted in R2 in a relatively short period but was well embraced in their construction industry. In the real situation, the overall VM application in R2 was still behind in R1 because of various hindrances (e.g., late VM timing, improper function analysis, insufficient transparency, lacking VM knowledge, and poor international relationship). However, VM practitioners in R2 used VM better than those in R1 in some technical respects, such as allocating sufficient time for VM activities, conducting more than one VM workshop in different stages of a project, and so on. Moreover, the results also revealed that in the construction industry of R3, financial support for the VM activities was insufficient, while traditional team decision-making had an unsystematic technical process without a proper information analysis mechanism and other managerial and IT techniques integration. On the other hand, poor team behaviors including unspecified clients' requirements and project goals, low commitment, lack of transparency, insufficient participation, etc., were not uncommon throughout traditional team decision-making in R3. Finally, traditional team decision-making often resulted in a low level of final outcomes such as cost overrun, performance downgrade, poor social relationships among participants, etc.

Several practical recommendations were proposed to ensure effective VM application and promotion in different regions along the B&R. For construction projects in R1, it is recommended to prepare 40-hour VM workshops and employ qualified VM experts to facilitate public consultation activities. Recommendations proposed for VM in the construction projects of R2 include conducting joint training by VM institutions of R1 and R2 together, holding post-meetings for evaluating VM performance and collecting feedback, using multiple media for releasing VM results to the public, and developing a digital platform for storing and assessing all project information without constraint. To apply VM well in the construction projects of R3, providing adequate financial support to VM activities, adopting mature international standards, establishing local VM guidelines based on mature international guidelines, using free and well-developed online tools during value studies, and inviting VM facilitators from R1 to coordinate the value study teams are suggested. On the other hand, setting a governmental mandatory requirement for conducting VM in the project flexibility stage and learning conflict management knowledge from VM experts in R1 are recommendations proposed for VM application in the construction

projects in both R1 and R2. Moreover, in all the three regions, a clause for monitoring VM results should be included in the consultant contracts.

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