EFFICACY OF VALUE MANAGEMENT SYSTEM IN BUILDING PROJECTS: A UK PERSPECTIVE

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The main purpose of using Design and Build (D&B) procurement method is to ensure client's satisfaction is maximised, which is in full concordance with the main purpose of using Value Management System (VMS). VMS is considered as a useful tool for enhancing functions, improving quality, and reducing cost and time in construction projects. This synergy has laid the foundation for this research to investigate the measures that are used in practice to adopt VMS for medium-sized D&B building projects in the UK. Eight building and construction professionals from different backgrounds having significant experience in using D&B procurement system were recruited through purposive sampling method and participated in the data collection using semi-structured interviews. In-depth qualitative analysis has identified key benefits in adopting VMS in D&B projects. However, some of these benefits were squandered due to the lack of systematic VMS practice in place. The research concluded that raising clients' awareness of VMS and its benefits, using the VMS techniques, and appointing a value facilitator are of paramount importance yet still widely overlooked by practitioners in the construction industry. This paper makes key recommendations for/on how these shortcomings could be addressed.

Keywords: design and build, procurement, value management system

INTRODUCTION

Building projects output in the UK generates more than £110 billion per annum and contributes 7% of GDP distributed into three main sub-sectors: Commercial and social (approximately 45%); residential (approximately 40%); and infrastructure (approximately 15%). Approximately 60% of construction output is new build, whilst 40% is refurbishment and maintenance (Government Construction Strategy, 2011). In 1970, the Value Management System (VMS) was first employed in construction industry to help practitioners focus on not only saving money but also balancing quality with cost.

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This system is typically embraced by practitioners in big building projects. However, clients of small to medium sized projects are more preoccupied with what they perceive as additional cost and managerial effort of employing VMS compared to the small budget of the project (Gidado, 2000). A report by the Chartered Institute of Building in 2010 revealed that traditional procurement is the most efficient and appropriate method for building projects of less than £5m, while D&B procurement is often selected for medium-sized building projects of up to £50m (CIOB, 2010).

In construction project management, VMS has goals, methods, processes, and techniques. The main goal of the system is to increase value and functionality with optimum cost (Nasir *et al.,* 2016). The other goals include improving communication, improving project management structure and system, enhancing design choice considerations, saving time, and making quicker decisions during the development process (Yeo and Lee 2018).

Takim *et al.,* (2013) analysed six case studies in D&B projects in Malaysia that identified VM and value engineering (VE) as among the key processes that bring improvements in construction. Other processes include partnering, constructability, benchmarking, total quality management (TQM), sustainability management and safety management. They proposed a conceptual framework integrating VM, VE and Partnering as a unified process improvement solution. Park *et al.,* (2017) suggested to embed VE into the Building Information Modelling (BIM) and presented meticulous examples into how that can be done to improve the idea generation process, save time, cost and resources during the VE workshop. The aim of the study is to investigate the critical success factors that make the application of value management in D&B medium size building projects effective.

LITERATURE REVIEW

Yeo and Lee (2018) argued that before fully adopting VM in building projects, there are different obstacles that must be borne in mind, namely: The heavier implementation liability of the VM concept, the diverse - and sometimes adversarial - nature of the design team, the lack of an established approach to functional analysis, and the lack of specific cost modelling approach. They suggested that the VM team and design team should work closely together to achieve the best project outcomes. Notwithstanding, coordination appears to be a clear weakness within the D&B system especially during the design stage of the project where the contractors' early involvement is expected to have a major influence on the effective achievement of the project objectives (Mohamed and Coffey 2010). Another weakness within the D&B projects is the lack of clear guidelines identifying not only the implementation steps of the VM but also the extent of projects to which it should be applied. It is only assumed that VM should mainly be used in complex and big projects that have high potential of restoring the investment made.

Atabay and Galipogullari (2013) argued that the implementation of VM has a convoluted cost, therefore it is best implemented in projects big enough to meet the associated cost and obtain profit above the desired threshold. It is worth noting that Atabay and Galipogullari (2013) did not specify exactly how big the project should be in order for the implementation of VM to be economically, strategically and practically viable. This can be argued that it might be a cause of unnecessary ambiguity deterring clients and practitioners alike from considering VM systems. In most projects, the implementation of VM is simple and straightforward. It simply involves the selection of the optimum option bearing the highest value, quality and

functionality but with the lowest cost, risk, time and environmental footprint. However, the selection process tends to become tedious especially for complex projects requiring the use of numbers and matrixes to choose the best solution among several alternatives in a multi-dimensional consideration. In this case, a simple VM implementation is inadequate, and it is often necessary to use sophisticated models or techniques. There is numerous modelling software that can help find the best solution, but the burden of framing the selection criteria and success factors lies always on the operator of such models. There is a certain degree of ambiguity in distinguishing between the factors leading to success and the indicators of performance measurements, so it is necessary to define those terms in detail.

Performance measurement in the context of VM studies is about quantifying the efficiency and effectiveness of VM workshops (Lin and Shen 2007). Performance indicators are parameters used to quantify the efficiency and/or effectiveness of a past action (Neely *et al.,* 2002). Thus, the Key Performance Indicators (KPIs) are classified as core elements of any performance measurement framework. On the other hand, Critical Success Factors (CSFs) were defined by Sanvido *et al. (*1992) as factors predicting the success of projects in the context of construction field. The identification of CSFs, which describes how an objective of VM studies can be measured and achieved, is important in performance measurement (Lin and Shen 2007). A careful performance measurement of the VM workshop is likely to improve the success of the project (Surlan *et al.,* 2016).

A variety of factors can determine the success of VM. A clear understanding of these factors will be instrumental in overcoming constraints caused by the higher demands of clients (Shen and Liu 2003). Each CSF should have a few KPIs that can be measured and quantified (Lin *et al.,* 2011). Surlan *et al.,* (2016) explained that CSFs were introduced as a means of measuring client value system. In addition, CSFs were used to steer the project brief in a direction that will maximise the desired expectations of the client. Kulatunga *et al. (*2005) considered CSF in specific construction project settings and argued that assigning values to particular CSF and quantifying client priorities through the pre-brief VM workshop can substantially impact the brief. However, CSFs can also be used for the assessment of whole life performance, as suggested by Park (2009).

There is a myriad of studies that investigated the performance indicators of VM and their identifications and classifications. For instance, Male *et al. (*1998) highlighted 10 CSFs for VM. These factors were reviewed by Shen and Liu (2003) who introduced 15 CSFs affecting the success of VM, which were categorised under four different clusters namely VM team requirements, clients' influence, facilitator competence, and relevant department's impact. Later on, Lin and Shen (2007) identified 23 different CSFs factors under four different groups depending on the stage of implementation within the project. The researchers evaluated the importance of these CSFs by surveying experienced VM practitioners, but they did not identify performance indicators that link to these CSFs at an operational level.

Chen *et al.,* (2010) have produced a model to measure the performance of VE workshops highlighting the importance of the composition, capability and participation of the VE workshop team. They have named the CSFs as primary Performance Assessment Criteria (PACs) under four Performance Assessment Aspects (PAAs). The researchers used factor analysis to extract the assessment criteria, which were then further grouped and weighted using the Analytic Hierarchy

Process (AHP). The assessment criteria were calculated using the Simple Additive Weighting Method (SAWM). The conducted quantitative study showed that the eight most important PACs are: Constructability of recommendations; integration and coordination ability of team leader; team leader's ability to control job plan and schedule; completeness and clarity of recommendations; team leader's conformance to the six-phase job plan; communication, coordination and consensus level during VE workshop (VEW); Professional level of VE workshop team members; and Team leader satisfaction with workshop goal. Lin *et al.,* (2011) defined 18 indicators out of potential 47 of highly ranked CSFs. They grouped these indicators under three categories: Predicting, process performance, and outcome performance. The outcomes of all these studies are summarised in Table 1.

Table 1: CSFs for Effective VMS Application

N	Critical Success Factor	Male *et al.* (1998b)	Shen and Liu (2003)	Wilson (2007)	Chen *et al.* (2007)	Lin *et al.* (2011)	Counts
1	Availability of multidisciplinary team	*	*	*	*	*	5
2	VM facilitator skills and qualifications	*	*	*	*	*	5
3	Structured VM process	*		*	*	*	4
4	Understanding of relevant information before the VM workshops	*	*	*		*	4
5	An implementation plan for the VM workshop outcomes	*	*			*	3
6	Clear objective of VM workshops		*		*	*	3
7	Interaction between VM workshops participants		*		*	*	3
8	Senior management support and commitment for applying VM	*	*	*			3
9	Use of VM function analysis techniques	*	*				2
10	Participants knowledge and experience in VM	*	*				2
11	Project scope/assumptions clarified				*	*	2
12	Timing of VM workshops (studies)		*		*		2
13	The job plan of five phases must be implemented			*	*		2
14	Decision-makers participation in VM workshops	*				*	2
15	Client's objectives clarified					*	1
16	Client's participation					*	1
17	Client's satisfaction					*	1
18	Client's support					*	1
19	Constructability of recommendations				*		1
20	Controlling the VM workshops (studies)		*				1

21	Identifying and clarifying the client's requirements				*	1
22	Improving the project quality				*	1
23	Knowledge and experience of VM team in their own disciplines	*				1
24	Number of recommendations			*		1
25	Participants personalities	*				1
26	Primary function identified				*	1
27	Quality of the VM workshop output report				*	1
28	Recommendation supports of designer			*		1
29	Relevant departments' support				*	1
30	Representing level of designer			*		1
31	Sufficient time for VM workshops	*				1
32	The commitment of VM team members		*			1

The aforementioned studies considered all types of projects in determining the CSFs regardless of size and procurement type used. However, this study will focus primarily on D&B medium-sized building projects in the UK to determine the CSFs that directly affect the performance and effectiveness of VE and VM.

METHOD

This research selected exploratory research design to achieve its objective that is to investigate the items that make VM effective in medium-sized D&B building projects in the UK building and construction industry. A qualitative methodology using semi-structured face-to-face interviews has been conducted to investigate the items that should be considered in implementing VM in D&B medium-sized building projects. It is intended to identify the items that make VM an effective system from the perspective of senior practitioners who have extensive expertise in D&B building projects. Therefore, one of the main objectives of this interview is to gain information from experienced practitioners about the effective implementation of VM during the life cycle of the project based on their current and past experience in managing D&B medium-sized building projects. The interviews also included the determination of: Whether the project size is key to implementation of VM; the effect of appointing VM facilitator; the use of VM techniques during the VM workshops.

Table 2: Participants Profiles

Organization type/Participant role	Y	Organization type/Participant role	Y
1. Private Consultancy/ Senior Designer	24	5. Principal Contractor/ Senior Project Manager	25
2. Private Consultancy/ Senior Designer	29	6. Principal Contractor/ Senior Project Manager	16
3. Private Consultancy/ Clients Consultant	25	7. Principal Contractor/ Commercial Manager	14
4. Principal Contractor/ Senior Project Manager	25	8. Private Consultancy/ Clients Consultant	22

A total of eight face-to-face interviews were carried out. The interviewees comprised three representatives from different sectors of the building industry including client's consultants, principal contractors, and designers. The participants role, nature of their organization and work experience are summarised in Table 2. The selection of participants was performed by expert sampling (purposive sampling) in order to get data based on their past experience to describe the situation. Thus, the main selection

criterion of the participants was their current and previous experience in managing D&B building projects mainly in the UK. Due to time and budget constraints, all interviewees were chosen from the South East of England. Transcripts were collected and the contents were analysed on the basis of contextual themes. The qualitative analytical tool, NVivo 12, was used to analysis the interviews.

FINDINGS

The analysis of the interviews revealed several key CSFs that make the VM implementation effective in the D&B construction projects in the UK. In total, 11 critical success factors (CSFs) have been defined by practitioners, as shown in Figure 1. It is evident that there is almost complete unanimity among interviewees that satisfying clients by achieving their needs is the most important item that enhances the effectiveness of the VM system. Also, the interviewees indicated that the client is the main driver and supporter for updating and implementing the VM system. As clients play paramount role in achieving effective VM, the participants stated that clients need to be empowered and constantly engaged to participate in the VM processes. They need to be educated about the VM importance and benefits. Participant (1) stated that

> the [client] is doing now 160 units, which is pretty massive, that is close to £50 million, so it is a large project, but we still do not do [VM] because it is not the client mindset …

This means that even in a rather big D&B projects, the VM system is still not implemented just because of the lack of interest or understanding from the client towards the VM system and its benefits.

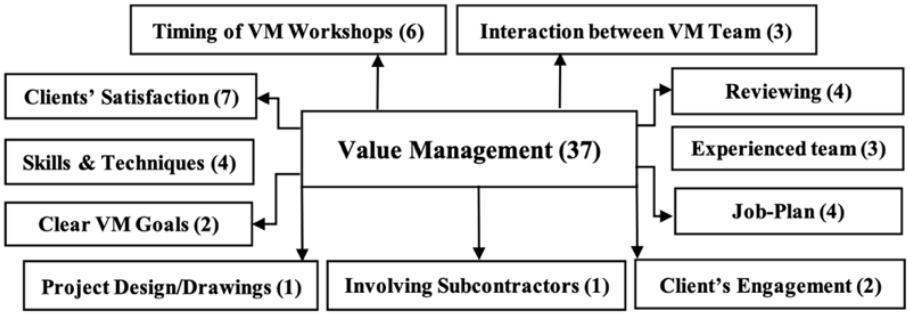

Figure 1: Thematic Diagram of CSFs for VM in the UK medium-sized building industry

Timing and Attendances of VM Workshops

The second most critical CSF to consider is the importance of timing of VM workshops during the project life cycle. The participants highlighted that changes in any construction project have greater effects before the construction phase starts, which indicates the importance for VM to be considered in the preconstruction phase. This phase would also be ideal for integrating VM with any other management systems such as risk management (RM) and environmental management (EM). Therefore, in this phase a full team including VM, RM and EM experts, among others, should jointly attend the workshop due to the overlap of the different management systems; whereas VM and RM both aim at reducing risk, VM and EM both aim at reducing environmental footprint. In addition, stakeholders including contractors and subcontractors should be present. Participant (6) mentioned that in the D&B projects the risks are typically transferred to principal contractors who then distribute them among subcontractors, thus there is a necessity for subcontractors to appear in all VM workshops. In this particular point, there was a disparity in the definition of

stakeholders who should be present in VM workshops. The consensus of three sectors representatives is that the interaction between participants in VM workshops is important in making VM effective due to the exchange of their experiences and knowledge. Therefore, it is important to run VM workshops involving all parties.

Three project managers from large principal construction companies in the UK emphasised the importance of using VM techniques. When they were asked about the types of such techniques, the responses showed that brainstorming is the only technique used with complete absence of any modelling/mathematical software tools that may help optimise the selection process for the best option with the highest value. Participant (7) presented a detailed explanation on how VM workshops are typically performed in the UK. The participant perceived the VM workshop as a tool to merely test the best option mainly in terms of cost among several available alternatives, whereas in reality it should be more about enhancing functionality, performance, value (not cost) and delivery time with lowest possible risk and environmental footprint.

The different participants expressed positive and confident response when using the brainstorming at the innovation phase, i.e., the third of the seven stages of the Job-Plan. However, among the participants there appeared to be a lack of confidence in using VM models in selecting the optimal solution among several alternative scenarios. The absence of this skill indicates that in any complex setting, where the knowing-how of VM models is essential, "poor" practice of VM is inevitable. Furthermore, none of the client representatives mentioned the importance of using VM techniques or setting up job-plans, which clearly indicates that clients and their consultants "do not care much about VM" as one interviewee put it. This is fully consistent with what has been mentioned in the literature about the importance of engaging and educating the clients about the benefits of VM. In addition, Participant (3) stated that there are no specific VM workshops or available VM facilitators in construction projects. This emphasises the lack of any true VM implementation in the UK construction industry, which means that the VM benefits are largely wasted.

There is a clear consensus among all participants on the importance of experienced team. However, the responses from all participants indicate that there is no dedicated person for VM or VE on their projects. Participant (4) assigned managing the cost (not value) to the quantity surveyor. On the other hand, Participants (1, 6, and 8) assigned the responsibilities for VM or VE to the project manager. However, Participant (7) stated that the project manager is only concerned with delivering projects on time while the cost manager is only interested in reducing expenses and that is why conflicts always arise between the two. This is a clear management problem.

Participant (5) stated that managing the value is "a team work really, and it is not necessarily specific. It is actually done as a whole team, which includes obviously the architect, engineer and MNP designer and D&B managers and the commercial manager …". The different responses related to who is in charge of managing the value within any D&B project highlights clearly that the construction industry does not value VM or VE systems from practical point of view because these systems are perceived as wasting time and costing money unnecessarily. For instance, Participant (1) stated: "The thing with the medium-sized building project [is that VM] takes time and costs money, nobody wants to spend that ...". It is clear that the different interviewees equated VM to cost management (CM). However, VM is different from

CM as VM is focused on functionality and balancing between cost, quality, risk, and environmental benefits. It is worth highlighting Participant's (2) response: "When you meet the client, they want everything green and when you start to work on cost and identify things that cost more generally, they drop them away and then pulled back to the cheapest options." Furthermore, Participant (3) stated: "I think the value management is commonly seen as purely a cost management exercise by generally construction teams and all project managers."

This proves the lack of understanding of VM within the practitioners in the building industry in the UK who have cost-oriented mentality instead of value-oriented mentality. For instance, Participant (5) stated: "[when proposing] renewable energies [to clients] and we recommend that it is going to save them … around 100,000 pounds a year less than other bids [using conventional energy] but the other bids are cheaper and the client decided to go for the cheap bid even though they could be paying more …". This emphasises the decisive role of the client to adopt and implement VM. Therefore, clients need to be educated about the benefits of the VM. Furthermore, a simple and clear tool/framework/process need to be created to enable them to use VM accordingly. Clarity was emphasised by Participant (6), a senior construction manager at one of the biggest international contractor company, who stated: "So, the only way to make effective value management is to ensure that you have clear information from client (clarity of intent). In any D&B contract the client gives us a Design Intent …".

CONCLUSION

Expert practitioners (principal contractors, client's consultants, and design consultants) that have significant experience in VM studies helped in identifying 11 key CSFs that influence the effective and efficient application of VM practice for medium-sized D&B building projects in the UK. Amongst these, the most important CSFs that can enhance the effectiveness of the VM system are: Achieving clients' needs and regular client's engagement; timing of and attendance in VM workshops; setting-up job-plan and use of relevant skills and techniques; regular reviewing; and availability of experienced team. The research concluded that without the client's approval and awareness of VMS, the D&B project will not harness the full benefits of VMS.

Thus, it is critical to raise client's awareness of/about the advantages of VMS in enhancing value and quality while reducing risk, time and environmental fingerprint. This could be enhanced by integrating the VMS with the management systems used for managing risk and environment. This research, therefore, recommends the integration of VM, Risk Management (RM), Environmental Management (EM) into a single framework, which must be user friendly both practitioners and clients as a key solution. Furthermore, the research concluded that the ideal timing for the implementation of VMS is in the preconstruction phase, which is also ideal for integrating the VMS with RM and EM in one workshop attended by all stakeholders across different fields. Finally, the research concluded that appointing a value facilitator is of paramount importance yet still widely overlooked by practitioners in the construction industry. The participants mentioned the availability of a multi-disciplinary team on each construction project that regularly meets to review the progress of the project. This already available team can be a great driver to adopt and implement any new integrated system led by a dedicated facilitator.

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