INTEGRATING VALUE, RISK AND ENVIRONMENTAL MANAGEMENT AT THE STRATEGIC DEFINITION STAGE

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Over the years, researchers and practitioners have argued that the integration of value Management (VM) and Risk Management (RM) in construction projects would help avoid duplication of work and deliver better value for money thereby leading to better project outcomes. Others have integrated the VM and Environmental Management (EM) to achieve the same goals. In the UK, research has shown that the lack of awareness of the environmental issues and the timing of implementing the various Project Management Systems (PMS) during the course of a construction project are the main constraints to better integration of these systems. This paper will argue that the integration of VM, RM and EM would provide better efficiencies and suggest how it could be achieved. Using desk study, the paper investigates the issues and problems surrounding the integration of PMS. It also identifies the aspects of VM, RM, and EM that could be integrated in projects using published literature. The findings at this stage form an initial frame of reference as a basis upon which a model will be developed for the complete integration of VM, RM and EM in construction projects at the early stage.

Keywords: value management, risk management, environmental management, systems integration.

INTRODUCTION

Typically, the activities that any organisation needs to manage can belong to different management systems such as risk, value and environmental management systems. The organisation can achieve the maximum efficiency at the minimum cost by managing these different systems collectively rather than separately (Bernardo, 2014). Applying this practice involves assessing the different activities in the different systems, exploring the synergy between them and finally integrating them together in a new management system, i.e. integrated management system (Orlru, 2014). Hence, the integrated system will be largely affected by the integration strategy, the integration methodology, the level of the integration, and the benefits and barriers of the integration (Bernardo, 2014).

The integration of value Management (VM) and Risk Management (RM) in construction projects has been argued to help avoid duplication of work and deliver better value for money, leading to better deliverables in projects and higher level of satisfaction. Others have argued for the integration of VM and Environmental Management (EM) to more or less achieve the same goals. To date there is no comprehensive integration model to merge and combine these three project

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management systems (PMSs). As a part of an ongoing research project this paper contends that the integration of VM, RM and EM would provide better efficiency, particularly when set up at the strategic definition stage (i.e. RIBA Stages) (RIBA Plan of Wok, 2013). It also suggests how this integration can be achieved. The paper sets out to investigate the issues and problems surrounding the integration of PMSs through desk study. It also identifies integration models and explores the aspects of VM, RM, and EM that could be integrated in projects. The findings at this stage form an initial frame of reference as a basis upon which a model will be proposed – at later stages of this research once the expert opinions were gauged using corresponding methods – to help realisation of full integration of VM, RM and EM in construction projects.

INTEGRATION OF MANAGEMENT SYSTEMS

The different management systems, e.g. VM, RM, and EM can be integrated mainly using three approaches namely i) developing a new model, ii) using an existing model, or iii) merging two or more existing models (Dalling and Holt 2012). In case of adopting an existing model, one can use one of the following available models:

Wilkinson and Dale (2001) proposed a total quality model to integrate quality, environment, health and safety processes into one management system. The model earned the title total quality model as it implements a full integration between the different activities in the different management systems such that the independent systems are digested and amalgamated into a new system rather than simple merger of documentations of different systems. Furthermore, this model is based on considering effect of both integrated organisational structure and people's culture on the interplay between the resources, processes and procedures throughout different phases of the integration, as described in table 1.

Pun and Hui (2002) suggested a similar model to integrate Quality, Environment, Health and Safety (QEHS) processes into one management system. This model is built upon the synergy between the different processes involved in the integrated system, which are assumed to be interrelated. For instance, in case of QEHS, several links were found between the size of company and awareness of safety and quality management on one hand and structure of the organisation, focus of employee, leadership, safety culture and cost consideration of integration on the other hand. This model adopts the Total Quality Management (TQM) in the integration phase but adds one phase for planning the different processes and identifying the synergies and one phase after integration to train people on quality and safety culture and get them involved and finally to standardise the adopted methods.

Karapetrovic (2003) proposed the systems model to combine the benefits of the process model, which guides interconnected processes to achieve best quality, and Shewhart's Plan–Do–Study–Act (PDSA) cycle or Plan–Do–Check–Act (PDCA), deals with a single process. Therefore, the idea behind the systems model is to improve every phase of the integration by focusing on improving the efficiency of not only the collective multiple processes as a whole but also the single processes by their very individual nature. The continuous improvement of these processes can be achieved throughout the different major phases of the integrated system as indicated in table 1.

Nevertheless, it should be mentioned that the success of the integration process does not depend only on the choice of the model but also on certain key factors. These

factors rely on achieving: clear focus, common understanding of the integration structure and processes, complete implementation of the integration model, and complete implementation of the PDCA procedure (Dalling and Holt 2012). Furthermore, Ranesh *et al*. (2012a) identify four main Critical Success Factors (CSF) for effective integration:

1. Availability and adoption of appropriate integration standard.
2. Appropriate linkage between the tasks and phases of the systems.
3. Degree of integration.
4. Selection of appropriate integration techniques, e.g. brainstorming, etc.

Table 1: Available models of integration systems

Model	Main stages
Process model (Pun and Hui 2002)	• Planning objectives and tasks determination • Integration implementation and evaluation • Installation • Measuring results and standardizing procedure
Systems model (Karapetrovic and Jonker 2003)	• Goals determination • Planning and designing processes • Acquiring resources • Deploying resources • Implementing processes • Evaluating results
Total quality model (Wikinson and Dale 2001)	• Goals determination • Resources integration • Processes integration • Planning, controlling and implementing processes • Evaluating results and redefining goals • Continuous improvement cycles

The integration between the different management systems can be performed at different phases throughout the project. For instance, the integration can be implemented in the project's job plan through workshops and brainstorming (Abd-Karim *et al*. 2011). Ranesh *et al*. (2012a) conclude that the integrated workshops are the most accepted means of integration from the client's point of view. These workshops can help achieve integration while minimizing the cost and time compared to workshops when held individually. In addition, the integrated workshops help utilize the multidisciplinary team. In these workshops, it is vital to incorporate external experienced consultants (Ammenberg and Sundin 2005). These consultants, along with the multidisciplinary, team can help to stimulate the discussion, pinpoint the appropriate links between the tasks in the different systems, find appropriate or alternative solutions, and adopt apt existing standards or modify them as needed.

Based on the aforementioned discussion, the integration of different management systems seems to be beneficial. Nevertheless, this integration can also have certain disadvantages. The advantages, disadvantages and barriers for any integration process will be discussed thoroughly in the following sections.

BENEFITS OF INTEGRATION

There are several benefits to integration between the different management systems. These benefits include saving time and resources, maximizing efficiency, facilitating the flow of information and improving the decision making process (Hiley and Paliokostas 2001, Ranesh *et al*. 2012a). The complete formal integration also promises better outcome and maximizes the savings of time and efforts through avoidance of

repeating the common tasks (Ranesh *et al*. 2012b). Moreover, the integration benefits greatly from addressing certain tasks and issues encountered in one system in light of the experiences gained through similar tasks and phases in other systems (Mootanah *et al*., 1998). For instance, Haghnegahdar and Asgharizadeh (2008) suggest that the integration of RM and VM can help in early recognition of risk, decrease project time, and increase value. Dalling and Holt (2012) reiterate this by stating that integration is beneficial and mention that finding correlations and shared impact between the different tasks involved in the project is one of the greatest benefits for the integration. Hiley and Paliokostas (2001) argue that the benefits of integration exceed the traditional view of best value for money (VfM) to include better communication between the team members and stakeholders. In addition, clearer objectives can be defined and followed. Rajković *et al*. (2008) stress that integration provides better control of the resources compared to when individual management systems are deployed separately. Kirk (1995) highlights that the integration is beneficial from different angles including i) the benefits of the views of outside experts, ii) eye-opening to difficult-to-quantify elements, and iii) analysis of savings based on the different alternatives. Finally, Ranesh *et al*. (2012b) assert that the benefits of integration include simplifying the management records and facilitating communication and discussion between the team members and stakeholders.

BARRIERS TO INTEGRATION

Despite numerous advantages of integration, there are inevitable disadvantages and barriers that can greatly affect the integration efficacy. For instance, Hiley and Paliokostas (2001) argue that the lack of information about the exact guidelines and standards, which practitioner should follow, can be one of the biggest obstacles in integration process. In addition, integration can be hurdled by differences in two or more systems which are to be integrated, what requires different team members with different views in order to tackle the problems in more efficient ways (Hiley and Paliokostas 2001). However, having a multidisciplinary team in the same workshop might not always be beneficial. This is because integrating two systems that are somehow different and involve different phases, makes it difficult to discuss the two in the same workshop, which can result in losing the purpose or focus mainly due to lack of enough time, appropriate knowledge and/or relevant information. Therefore, there is a need for a facilitator to organise the participation at different stages of the project. This leads to another critical issue that is people involved in the integration process might not be needed all the time (Ranesh *et al*. 2012b).

Campos *et al*. (2014) suggest that a well-defined and permanent organisation structure is required to implement and follow-up the integration process. Ammenberg and Sundin (2005) affirm that integration can be affected or hindered by the available standards, driving interest, available resources, competence and information. Similarly, Dalling and Holt (2012) summarise six barriers for successful integration: 1) Lack of commitment, 2) Conflict of interests, 3) Lack of stakeholders drivers for integration, 4) Lack of standardized methods and protocol for integration, 5) Lack of information and knowledge, 6) Resistance to change.

On the other hand, Zeng *et al*. (2006) show that the main internal barriers for any successful integration include human resources, knowledge, structure and culture of the organization. In addition, the main external barriers are lack of technical standards and models, lack of legislation bodies, lack of stakeholder's interest and the institutional environment. Rajković *et al*. (2008) reiterate these barriers and add that

the complexity of the different management systems and the effort needed for integration can also hinder the integration process.

INTEGRATION BETWEEN VM AND RM SYSTEMS

The aim of the integration between value management and risk management systems is to maximize the value for money by the efficient allocation of risk. RM and VM are somehow similar in different aspects including that both i) are structured decision making tool, ii) contribute to the VfM, iii) have same processes with different focus, iv) involve the same stakeholders, v) require information sharing, and vi) use the same techniques such as brainstorming and function diagrams. The complete formal integration also pledges better outcome and maximizes saving in time, cost and effort through the avoidance of repeating the common tasks, which is common occurrence where VM and RM are considered separately (Ranesh *et al* 2012b). Moreover, the integration benefits greatly from addressing all risk issues in light of VM (Mootanah *et al*. 1998). To investigate the extent of integration between VM and RM, Ranesh *et al*. (2012b) use semi-structured interviews conducted with ten industry practitioners involved in Public Private Partnerships (PPPs) projects in Australia. The study concluded that the integration between VM and RM were never performed formally. Similarly, Hiley and Paliokostas (2001) came up with similar findings which imply that the integration between VM and RM is practiced in the built environment project in informal ways. One reason behind this formally abandoned integration can be attributed to the confusion related to the lack of knowledge of how exactly to integrate VM and RM and at which stage of the project should this be addressed (Ranesh *et al*. 2012b, Hiley and Paliokostas 2001). Therefore, to avoid any confusion, Othman (2005) proposes that the IRVM should be simple and easy to follow, otherwise the integration will be hindered and the focus will be lost. In addition Ranesh *et al*. (2012b) suggest that the participant of Integrating Risk Management and Value Management (IRVM) should be knowledgeable of not only VM or RM but also the two of them together. This is also proposed by Othman (2005) who indicates that the diversity of the team is crucial for making good decisions.

There are several approaches for integrating VM and RM. Abd-Karim *et al*. (2011) study the applicability of integration in the project's job plan through workshops and brainstorming in four infrastructure projects in the UK. The study highlighted that the efficiency of integration through the job plan and brainstorming is much better than applying only one of them. Moreover, the study identified that the efficacy of integration relies upon the time and budget constraints in addition to the project's complexity and client's requirements. Another critical element is that all the participants in the IRVM workshops should be familiar with the methods, techniques and tools used in the integration (Ranesh *et al*. 2012b). Ranesh *et al*. (2012a) identify several CSF for the implantation of IRVM including the discipline, scope, location, and time of the study as well as the involvements of the key stakeholders and the client's willingness and requirements. On the other hand, Ranesh *et al*. (2012b) identify the following six CSF for the IRVM integration: 1) Study type; 2) Study methods; 3) Study tools and techniques; 4) Selection of integration standards; 5) Effective linkage between RM tasks and VM phases; 6) Degree of integration.

Many studies have introduced clear methodologies and models for integration. For instance, Kirk (1995) presented a methodology for the complete integration between VM and RM in every stage of the project. In addition, Othman (2005) introduced Value and Risk Management Protocol (VRMP) asserting that the integration should

be performed in three main stages: i) the pre-study phase that is used to collect data and information, ii) the study phase where the objectives and alternatives are defined and evaluated, and iii) the post-study phase during which the best alternative is implemented and monitored. Mootanah *et al*. (1998) highlight that these stages are in line with the different value management phases, and therefore can be carried out simultaneously while performing VM tasks. Haghnegahdar and Asgharizadeh (2008) argue that applying integration at the early stages, e.g. briefing stage, is best practice, which leads to minimized cost and early recognition of risks and their effects on value. Chang and Liou (2005) argue that the degree of integration should not be considered arbitrarily but rather as inversely proportionately to the budget and urgency of the project. Therefore, for small budget projects, the authors propose to integrate RM into only the evaluation phase of the VM. This is an executive approach to save more time and money that is especially applicable to small projects.

Based on the aforementioned discussion, it can be concluded that the integration process is complex and requires paying careful attention to all the details of the project including its location and budget constraints.

INTEGRATION BETWEEN VM AND EM SYSTEMS

The whole life value of any project involves the identification of stakeholders, functionality, performance, cost, risk and environmental sustainability (Mootanah 2005). Zeng *et al*. (2006) examine the difficulties and barriers in integrating the environmental and occupational management systems. The study showed that the main internal barriers for any successful integration of EM include human resources, knowledge, structure and culture of the organization. Furthermore, the main external barriers are lack of technical standards and models, lack of legislation bodies, lack of stakeholder's interest and the nurturing institutional environment (Zeng *et al*. 2006). Al-Saleh and Taleb (2010) investigate the integration of VM and sustainability especially in the Gulf States. The study concluded that in most of the cases the integration is very weak. The study also identified the following reasons behind this absence or procrastination of integration in built environment projects:

- lack of infrastructure and government bodies to support the integration
- lack of skilled workforce to implement and follow-up the integration process
- lack of awareness of local regulations concerning the necessity of sustainability as a vital integral part of the project.

Al-Yami and Price (2005) also point out that the biggest obstacles on the way of full integration can be related firstly to the misinformed practitioners that sustainability is already taken care of by Value Engineering (VE) or RM and secondly to the lack of information concerning the guidelines of how to apply the integration in different projects. Al-Saleh and Taleb (2010) also point out that the lack of codes and protocols as well as time constraints can put hurdles on the way of integration. Moreover, the focus on cost reduction rather than sustainability improvement can hinder the integration significantly. Al-Yami (2006) draws attention to the fact that cost of not considering sustainability, including environmental sustainability, in fact increases due to the increased consumption of energy and raw material. Furthermore, Al-Yami (2006) suggests that the only effective way to implement sustainability is by changing the general view to focus on long-term value instead of short-term cost. Campos *et al*. (2014) assert that a well-defined and permanent organisation structure is required to implement and follow-up the integration process. Al-Yami and Price (2005) advocate

a link between VE and sustainability which can be linked in early stages of projects using an integration scheme that utilizes six stages:

i) professional consideration of VM using experience of VE
ii) identification and optimization of the available resources
iii) dedication of a team for VE
iv) finding creative solutions to achieve the project's goals in light of the available resources
v) performing the VE study
vi) implementing the recommendations of the VE study

Furthermore, Ammenberg and Sundin (2005) claim that integrating the EM system and design for the environment (DfE) could be achieved by adding a life-cycle perspective to the EM system.

INTEGRATING VM, RM AND EM SYSTEMS: A PROPOSAL FOR A NEW FRAME OF REFERENCE

Berawi *et al*. (2013) show that the main factors affecting the success of any building project are the time schedule of the project, completion effectiveness, efficiency of investment, security and safety, and physical and psychological comfort of the occupants. In addition, their study suggests that the main barriers to the success of a project are lack of commitment and support from management, unethical behaviour from the professionals, lack of supervision, lack of expertise in the project, and delayed implementation schedule. These factors can affect the VfM and can impose additional risks if not handled properly. This highlights the need to integrate VM, RM and EM to maximize value, minimize risk and achieve long-term sustainability. This need for integration is also stimulated from the fact that the whole life value of any project involves the identification of cost, risk and environmental sustainability (Mootanah 2005). Therefore, the integration between the value, risk and environmental management systems is expected to improve the whole life value. So far, this integration is not fully achieved. In addition, thus far no complete model has been proposed to formally establish clear guidelines for the Integrating Risk Management, Value Management and Environmental Management (IRVEM) process. This paper aims at filling this gap and laying the foundations for proposing a model for integrating VM, RM and EM systems.

The proposed model is inspired by the models, which are proposed, by Kirk (1995) and Othman (2005) for IRVM. Kirk is one of the first to propose a full implementation model for quantitative assessment and analysis of the associated risks with the different elements in each process, i.e. labour, material, duration and cost. Therefore, a probability curve can be obtained for every associated risk, which can be used to weigh the possible alternatives to choose from. Othman (2005) used the same methodology but suggested that not only risks but also value should be quantified. Hence, based on Othman's model, one needs to develop a hierarchy matrix, i.e. importance weights, for every objective. In addition, one needs to develop a decision matrix through which risks are taken into account based on their severity and likelihood whereas the alternatives are assessed based on their importance weights in the hierarchy matrix.

Adopting the same philosophy to integrate EM in RM and VM, the first step in our proposed IRVEM model is to define the hierarchy of demand i.e. the most critical elements in the integration that have the greatest impact followed by the less influencing elements. For instance, in case of considering the integration of value, risk

and environment, the first element in the hierarchy of demand is risk minimization, followed by value maximization and saving resources. The critical task here is to find the common ground to achieve most of the hierarchy of demand matrix with less resources and faster response time. In this respect, the following frame is proposed for a new integration model:

1. Pre-integration phase
1.1. Identify the goals
1.2. Identify the hierarchy of demand matrix
1.3. Identify the tasks related to every item in the matrix
1.4. Identify the resources available to every task
1.5. Identify the different risks associated with the different tasks
1.6. Identify the elements in the different tasks related to environment
1.7. Rank the matrix items and the associated tasks, resources, environment elements and risks according to the demand. The final rank would be considered as the importance rank multiplied by the number of associated tasks divided by the available resources

2. Integration phase
2.1. Link the different resources in order to maximize the value for money
2.2. Recalculate the hierarchy of demand matrix based on the linked and shared tasks
2.3. Integrate the tasks according to their rank, e.g. high-risk tasks together and high-value tasks together.
2.4. Deploy resources on the integrated tasks based on their rank
2.5. Implement processes

3. Post-integration phase
3.1. Evaluate outcome
3.2. Redefine goals
3.3. Re-identify the tasks, risks, resources and hierarchy of demand matrix
3.4. Compare the current ranks with the initial counterparts
3.5. Reprocess

The advantage of this model is the clarity of the phases and the tasks involved at each phase. In addition, it presents clear criteria for making the decisions about which tasks should be merged together or considered simultaneously. Interviewing expert practitioners in the field of RM, VM and EM will help shed some light on functionalising the model, its applicability and adopting any recommendations and adapting the preliminary model through professional feedback loop validation process.

CONCLUSIONS

In the UK, research has shown that the lack of awareness of the environmental issues and the timing of implementing the various Project Management Systems (PMS) during the course of a construction project are the main constraints to better integration of these systems. This paper argued that the integration of VM, RM and EM would provide better efficiencies and suggest how it could be achieved. Using desk study, the paper investigated the issues and problems surrounding the integration of PMS. It also identified the aspects of VM, RM, and EM that could be integrated in projects using published literature. The findings formed a basis upon which a framework for a new model was developed and proposed for the complete integration of VM, RM and EM in construction projects. This initial framework will be deployed at the next stage of this ongoing research project as a basis for developing a novel model to integrate VM, RM and EM. Real data will be collected and collated from different live projects and via questionnaire surveys, expert interviews and industrial expert steering/focus groups to help facilitate the approach and to mobilise the model. Through the text and content analysis, different factors, elements, barriers and facilitators of such integration will be interrogated, and effective strategies, methods

and actions will be developed to help form the model, its verification and improve its applicability, validity and reliability through a reiterative feedback loop.

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