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An analysis of value management in practice: the case of Northern Ireland's construction industry

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Abstract

Purpose – The purpose of this paper is to report the findings of research into the principles and procedures associated with value management (VM) and assess its use and effectiveness within the construction industry in Northern Ireland. It provides a brief review of the principles, various procedures and methods associated with VM, investigates the positive and negative factors relating to its use whilst analysing the extent of its usage and determining its effectiveness.

Design/methodology/approach – Using a mixed method approach, the authors present the results of a survey of construction professionals operating in Northern Ireland and provide an examination of three case studies exploring the use of VM within the Northern Ireland construction industry.

Findings – In an industry where the client's needs and demands are of paramount importance, VM has emerged as a tool which can help satisfy these needs. This study shows that VM is frequently used within the Northern Ireland construction industry and on the whole is quite effective. However, the research exposed a general consensus that the VM process is frequently not implemented at the most appropriate stage of a project, which suggests that if it was, it could perhaps be more effective than it is at present. There is an apparent lack of formal methods used to carry out the VM process. Instead, rather loose and informal methods are used.

Originality/value – In the absence of a similar study that analyses the factors that influence the VM process highlighting and documenting the views and opinions expressed by the professionals within today's industry and reviewing the effectiveness of its usage, this paper documents a snapshot of practice of VM within the Northern Ireland construction industry.

Keywords Northern Ireland, Value management, Effectiveness, Practice, Construction industry

Paper type Research paper

1. Introduction

Value management (VM) has been increasingly applied to construction projects in the UK building and construction industry since the 1980s and has developed and changed direction in its focus over the years (Kelly *et al.*, 2004). VM is considered to be the umbrella term used to describe a management process where the focus is on creating and capitalising on the opportunity to improve value (Building Research Establishment (BRE), 2000). It is frequently used interchangeably with terms such as "value engineering" (VM during the design and development stages of a project) and

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"value analysis" (when seeking improvements to an existing product or activity); and in this paper refers to the whole process.

The ultimate aim of VM is to deliver best value or ensure value for money from a project. It is not a cost cutting exercise, which when used in the context of value engineering, it has a reputation for same. Indeed, VM has faced scepticism or at the very least an air of reluctance from project teams applying it for the first time. However, as practical results start coming and team members find that their powers and position within the project team are not adversely affected (and that in fact often they are improved) they begin to take part more enthusiastically in the performance and extension of VM activities (Venkataraman and Pinto, 2008).

VM originated as value analysis in the manufacturing industry of the USA in the 1940s. The ideas and principles of the process are based on the work of Miles (1972), a purchase engineer with the General Electric Company. His philosophy was based on the aim of providing the necessary functions at the lowest cost (Kelly and Male, 1993; Dallas, 2006). It was developed as an organised approach to providing the necessary function at the lowest cost. The original methodology which analysed the component parts of a product in terms of its function, considered ways of providing the functions at a lower cost; then confirmed the economic and technical viability before changing production procedures (Male *et al.*, 1998) is still recognisable, but its application has been widened and the methodology adapted and translated to meet the needs of different sectors of industry.

Within the UK, value engineering was first applied to construction in the 1960s with a renaissance from the mid 1990s onwards (Ashworth and Hogg, 2000) as a result of the focus on the need for innovation and excellence within the UK construction industry as advocated first by Latham (1994) and then Egan (1998). VM is now regarded as a popular tool used within the construction process and VM clients span across all industry sectors (Ellis *et al.*, 2005).

VM is sometimes regarded as being synonymous with cost reduction, however, this should not be the case. Norton and McElligott (1995) state that although VM normally does result in the reduction of the cost, the aim is not to reduce cost but to improve value. Therefore, the process essentially involves the elimination of unnecessary costs embeded in designs without reducing the level of functional quality.

The Achieving Excellence Procurement Guide (Office of Government Commerce (OGC), 2007a) states that:

> It [VM] enables stakeholders to define and achieve their needs through facilitated workshops that encourage participation, team working and end-user buy in. The focus of VM is on function and value for money, not reducing cost.

VM is orientated towards providing the best possible product (building) for the client, by providing a process that guarantees that the various personnel involved throughout the entire building life cycle are aware of the needs and functions the particular building must satisfy. This then ensures that these functions and needs can be fulfilled at the most favourable cost, hence providing optimum value for money.

During 1980s, the use of VM as a technique to improve value and control costs became popular in the UK construction industry (Kelly and Male, 1993). Unlike in the USA, the very existence of cost planning as a technique to control costs negate the need for ready

adoption of VM in the UK construction industry. As a result, the practice of VM tends to vary within different parts of the UK and still is not as popular as in the USA.

VM has become a proactive, problem solving or solution seeking process, which can be used to enhance the functional value(s) of a project by managing its development from design concept to operational use (and eventual decommissioning) through structured, team-oriented and open-dialogue exercises, which recommend alternatives (or confirm existing solutions), and appraise subsequent decisions, by reference to the value requirements of the client (Hayles *et al.*, 2010). It is a structured, team-oriented approach to problem solving that can be applied to the concept, design construction and maintenance phases of buildings. VM addresses the key issue of function in relation to cost to achieve maximum value for the client (Hayles and Simister, 2000), providing the client with the means to help ensure that their investment in construction produces a valuable asset, one which is cost-effective to construct, use and maintain. Thus, the emphasis is on functionality or functional performance and ensuring the client gets what they need and want from their investment.

VM specifies ways to think about the problem and its constraints, using the concept of value and by identifying what things actually do; their function (Fong, 1999). Value is the relationship between cost and performance: a measure of what is achieved for a given level of effort.

Value is often assessed by the relationship:

$$Value = \frac{Functional\ Performance}{Cost\ of\ Resources}$$

In this context, "cost" embraces all relevant costs and functional performance embraces all stakeholder requirements (Kelly *et al.*, 2004).

VM is a creative problem solving process which takes a broader approach to problem solving than many other techniques and includes a number of qualitatively different components (Barton and Knott, 1994). The VM framework provides an auditable process for "judgements" in decision making and a forum for all parties to contribute information and views. Stakeholder consultation and political debate can all fit into this framework. This approach, which allows a project team and stakeholders to take a step-by-step approach to decision making, is called a VM job plan and comprises the following stages (Ashworth and Hogg, 2000; Kelly *et al.*, 2004):

- Assembling information (including information on values to be used in decision-making).
- Prioritising information (normally as a set of functional requirements/objectives).
- Creative thinking (to generate options and packages of options).
- Prioritising options (making decisions which balance use of resources and functionality in meeting objectives).

These may be summarised as four stages in the core job plan:

(1) issues analysis;
(2) function analysis;
(3) creativity; and
(4) evaluation.

The detail of the "job plan" varies according to the timing within the project and the scope of the value study. At the outset, the job plan is focused on identifying and establishing a balance between competing stakeholder objectives and then throughout a project, the job plan focuses on options appraisal and refinement of design and activity to deliver best value for the community and other stakeholders. Toward the end of a project, VM studies tend to be focused on learning to apply the benefits of a project. VM has been codified in the British and European Standards, BS EN 12973 (2000).

The VM processes can be as successfully applied to long-term strategic partnership working arrangements as it can to small teams set up to deliver one-off projects within an organisation. At the strategic level corporate values and political vision will strongly influence policy development. It is for the project team and the appropriate stakeholders to develop agreement on a set of specific objectives that address need within the context of strategic policy and regulatory frameworks. At operational level, it is for the team and the appropriate stakeholders to agree specific project activities which address the agreed objectives (Hayles *et al.*, 2010).

VM should offer the means for the project stakeholders to contribute to a better built environment and ultimately the opportunity to accelerate development. VM should never be seen as a quick fix or cost cutting exercise for projects in trouble.

Within this context, the aim of this study was to investigate the use of the VM process within the construction industry in Northern Ireland. Issues identified for investigation included; awareness of VM, level of involvement of design and construction teams, extent of usage of VM, effectiveness of VM in achieving its objectives and driver and barrier factors affecting adoption of VM.

The findings of this research will enable the construction industry to refocus on barriers for implementation of VM and to develop strategies for successful implementation.

2. The VM process

Norton and McElligott (1995) describe VM as a tool which can be used to enable a design team to maximise the value of a particular project in relation to the clients needs. It is a planned, multidisciplinary effort, which is concentrated at analysing the functions of projects in order to achieve the best value at the least cost. The term "VM" is used to describe the overall process.

The VM process ensures that all project participants have a clear understanding of the project brief and work towards the client's requirements (*The Surveyors Construction Handbook*, 2000). The process consists of three distinct phases: the pre-study phase, the study or workshop phase (consisting of information phase to recommendation phase) and the post-study phase. The phases within the study or workshop phase are collectively referred to as the "job plan" (Kelly and Male, 1993; Dallas, 2006). The key phases of the job plan can be summarised as follows:

- Pre-study phase: preparation for the adoption of VM, stakeholder identification and consultation.
- Information phase: assimilation and analysis of information required in order to define the study, including, client and end-user requirements.
- Creativity stage: development of creative alternative solutions, brainstorming, ideas generation.

- Judgement stage: evaluation of ideas generated, analysis and ranking of solutions.
- Development stage: further development of the short listed idea/creative solutions to detailed workable solutions.
- Recommendation: final recommendation to the client.
- Post-study stage: implementation of the recommendations, determines the level of success or failure.

3. VM methods

There are a number of different methods through which the VM process can be implemented. According to Phillips (2002), the choice of method to use may be dependant upon the type of project and the objectives of the client.

The 40-hour workshop is considered to be the most comprehensive implementation of the VM process and takes five full working days to complete. This traditional approach to the VM process is highly time consuming and expensive, but can provide best results (Kelly and Male, 1993). A shortened version of this process, which some refer to as a "design charette" may be adopted. This generally takes between one and three days to complete (Kelly *et al.*, 2004) and is the preferred approach as it is shorter and costs less in terms of up front time and resourcing.

Other VM methods are more specific in nature. The value engineering audit as explained by Kelly and Male (1993) is a service which analyses the expenditure proposals of associated branches of large companies or government departments. Concurrent VM is on the otherhand, a continuous and parallel process of implementing VM throughout the design development phases. This would require a specialist value manager employed for its implementation. The contractor's change proposal is essentially a post tender method. The contractor is able to use their expertise to propose alternatives resulting in time and or cost savings with possibility of sharing the benefits so derived (Kelly and Male, 1993).

3.1 Factors for success

The timing of the implementation of the process is also crucial. The application of VM as a formal technique will usually depend on the value of a particular project and the level of risk involved. For example, for a high value high-risk project, a VM procedure is almost always required and warranted. On the other hand, for a low value low risk project, a VM exercise is not necessarily required. There appears to be a widespread view that VM should be carried out at the earliest possible stage of the project lifecycle in order to maximise the benefits (*The Surveyors Construction Handbook*, 2000; Elias, 1998). This view is substantiated by the fact that the more detailed the design is, the cost reduction and value enhancement potential diminishes.

There are a number of factors that influence the success of the VM process. The composition and characteristics of the VM team is an important one. Shen and Liu (2003) points out that the most crucial requirement for the VM team formation is its multidisciplinary composition. It is important that the team members should come from the relevant disciplines in order to ensure that all the issues that are under study are covered. This view is also supported by Kelly and Male (1993).

Another significant factor is the individual attitudes and personalities of those within the VM team. Shen and Liu (2003) recommend that team members be open-minded, creative, innovative and have good communication skills. With regards to clients

influence, it is argued that the clients support and activity within the process is vital in ensuring its success (Norton and McElligott, 1995; Shen and Liu, 2003) and also in overcoming any opposition or resistance to its implementation.

The VM facilitator and his or her team management skills play a fundamental role in the VM process and significantly contributes to how successful it is (Shen and Liu, 2003). The VM facilitator can be a well trained professional sourced internally from the design team or completely external to the design process (Fong, 1999).

3.2 The benefits of using VM

The benefits derived out of VM can be categorised as client-related, cost-related and project-related. VM process acts as a catalyst for the development of the design brief (Yu *et al.*, 2005). Both the client and the design team effectively learn about the client requirements and the functional requirements of the design. The cost-related benefits are considered as bi-product of the enhancement of value of the design. Norton and McElligott (1995) believe that VM can reduce the overall cost of a project by 10 per cent, whilst only costing 1 per cent of the overall cost to carry out, hence producing a savings ratio of 10:1. Project-related benefits arise from the fact that the VM process ensures a common understanding between all those involved resulting in the management of the project being considerably smoother.

3.3 Disadvantages of using VM

Some project stakeholders may perceive VM as a critique of their own design by others resulting in negative attitudes and resistance to implementation of VM recommendations (Norton and McElligott, 1995; Kelly and Male, 1993; Ellis *et al.*, 2005). Fong (1999) argues that that whilst the VM has grown in popularity, there is still a lack of understanding of the principles of the process amongst some clients and construction professionals. This lack of knowledge can provide resistance to its use, and in the case where it is implemented, the process will not be as successful. Another problem that is common with VM implementations relates to timing of VM implementation. Ellis *et al.* (2005), contend that using VM at later stages often manifests as a cost cutting exercise rather than preserving or improving value. This perception that VM is frequently viewed and applied by some organisations strategically as a cost cutting exercise is shared by Hayles *et al.* (2010).

4. Research methodology

A mixed mode research methodology was adopted for this study. It involved the use of a postal questionnaire survey to gather broad views of use of VM from participants operating within the Northern Ireland construction industry and augmenting and verifying the initial findings through a series of case studies. Random sampling was adopted for this research. The population from which the sample was to be taken from was identified and a list of companies from Northern Ireland was drawn up. This list included clients, architects, engineers, quantity surveyors and contractors. The population concerned included 172 architects, 111 quantity-surveying practices and 184 contractors. A sample of 100 was selected from this with a view of obtaining a required response sample of 40. About 100 questionnaires were then distributed to professionals working in these companies. It was expected that as a random sample of different construction professional were used it would eliminate any possible bias.

The composition of the questionnaire is given in Table I.

The findings of the survey are augmented with an in-depth analysis using three case studies. This sequential mixed mode approach provides an opportunity to verify the views expressed in the questionnaire survey and to further explore emerging criteria.

5. Findings and discussion

About 45 responses were received giving a response rate of 45 per cent. The case studies were obtained from companies in Northern Ireland who are familiar with the VM process. An analysis of the respondents is presented in Table II.

The majority of responses were received from Quantity Surveyors employed by consultancy practices and contracting organisations. This was expected, as in general quantity surveyors as a profession would usually have greatest involvement in VM.

5.1 Awareness of VM

Table III demonstrates that 49 per cent (22 out of 45) of respondents were perceived to have a high-level of awareness of VM as a process by indicating awareness in the categories of excellent or very good level of knowledge. Further, 20 per cent have

Section	Composition
Section A. Introduction	Respondent and company profile
Section B. Evaluation of the views of various parties	Gathers an understanding of the views of the various parties in relation to various thoughts and ideas about VM. Likert scale is used as it provides a unified means of assessing the views of the respondents with opportunity to quantify and evaluate. The scale varied from one to five with one representing strong disagreement and five representing strong agreement to the statements provided
Section C. The extent of usage of VM in the construction industry	Identify the methods of VM with which the respondents are familiar with. The section then proceeds to identify if the respondent has ever been involved in a VM exercise, and if so, what methods were used and how many times were they used
Section D. The effectiveness of VM in the construction industry	Effectiveness of VM: the percentage of savings obtained
Section E. Attractive factors for adopting VM	Respondents' views about various comments concerning VM, which are perceived advantages identified from the review of the literature. Likert scale used
Section F. Negative factors when implementing VM	Perceived disadvantages, Likert scale used
Section G. Additional comment	Any additional comment

Table I.
The composition of the survey questionnaire

Area of industry	No. of responses	Percentage of responses (%)	Cumulative percentage (%)
Client	8	18	18
Architect	6	13	31
Engineer	6	13	44
QS practice	13	29	73
Contractor	12	27	100

Table II.
Respondents to questionnaire survey

indicated that they have a good level of awareness. This shows that there is considerable degree of awareness of VM in the industry.

5.2 Level of involvement

Table IV shows that there was 46 per cent (21 out of 45) of respondents who had significant level of involvement in VM suggesting there is very good level of usage of VM within the industry. As the process is very much client driven, it is worth noting from the data that the majority of clients are aware and are or have been very much involved with the process.

5.3 Evaluation of the views of the various parties

Attitudinal statements were included in the questionnaire and using Likert scales, the respondent were required to rate how they felt about each view. Their opinion was measured with 1 indicating strongly disagree; 2, disagree; 3, neither agree/disagree; 4, agree and 5, strongly agree (Table V).

It is interesting to note the small standard deviation of the views expressed by the different parties surveyed. It can be deduced that all parties expressed similar views. There is a strong agreement that VM is best carried out at the earliest possible stage. In fact, 96 per cent (43) of the respondents either agreed or strongly agreed with this statement which supports both Elias (1998) and Norton and McElligott (1995) sentiments. It is also interesting to see that there is a strong support for the implementation of VM on all projects. There is a disagreement to some extent with the opinion that VM is merely a form of cost reduction. This could be arising out of the fact that most have a good understanding of VM. However, it must be pointed out that 22 per cent (10) of respondents agreed with this, suggesting that there is a divided opinion on this matter. The respondents do not agree that VM should be carried out externally. They envisage the role of VM facilitator to be internal and to be carried out within the design team. Although one might expect that it will then assist in greater

Level of awareness	Client	Architect	Engineer	QS practice	Contractor	Total
Excellent	2	0	0	1	0	3
Very good	5	5	1	5	6	19
Good	0	1	1	4	3	9
Fair	0	2	2	3	3	10
Poor	1	1	2	0	0	4
Total	8	6	6	13	12	45

Table III.
Level of VM awareness of respondents

Level of involvement	Client	Architect	Engineer	QS practice	Contractor	Total
Heavily	3	0	0	0	2	5
Considerably	3	2	1	6	4	16
Moderately	1	1	1	4	2	9
Partially	0	1	2	2	3	8
Not at all	1	2	2	1	1	7
Total	8	6	6	13	12	45

Table IV.
Level of VM involvement of respondents

Statement	Client	Architect	QS practice	Engineer	Contractor	Mean	SD
VM should be implemented on all construction projects	4.5	4	4.2	3.8	3.9	4.1	0.3
VM is invariably better when implemented at earliest possible stage	4.6	4.2	4.5	4.2	4.4	4.4	0.2
VM is better when carried out by an external team	2.9	2	2.6	2	2.5	2.5	0.4
VM is merely a form of cost reduction	2	2.5	2.5	2.5	2.5	2.4	0.2
VM helps team working and dissolves adversarial relationships	3.3	2.8	3.5	3.5	3.3	3.3	0.3
Design team should be liable for changes made due to VM	2.9	2.5	2.2	2.7	3.2	2.7	0.4

Table V.
Mean Likert values for evaluation of attitudes towards VM

collaboration and team working, the respondents do not purport that view (with 3.3 mean value). This also contradicts the popular view (Norton and McElligott, 1995) that VM helps removing adversarial relationships. With respect to design liability even the clients do not express a clear view as to where responsibility lies. However, as expected the contractors' think that it should lie with the design team.

5.4 Extent of usage of VM

This section intended to firstly identify how familiar the respondent was with the various methods of VM and then to determine whether they had actually been involved in a VM within the past five years. The Figure 1 shows the extent of awareness of different methods of VM.

The contractors change proposal with 34 (76 per cent) seems the well known method of VM implementation. Only 20 (44 per cent) respondents were aware of the 40-hour workshop and only three (7 per cent) were aware of the Charette. This somewhat contradicts what Leung *et al.* (2003), suggest as they say that these are the most traditional and commonly used methods within VM. This does, however, support McGeorge and Palmer (1997), as they suggest that these methods are not practiced very commonly within the UK.

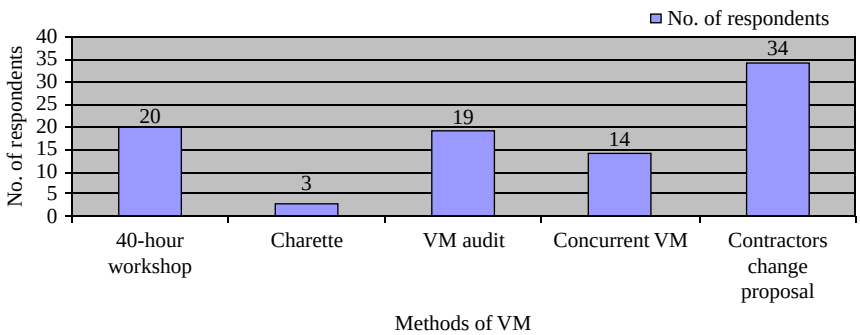

Figure 1.
Respondents awareness of VM methods

Question 6 was divided into three parts, the first asking if the respondent had ever been involved in a VM process and if they answered yes, the second part determined how many of these occurred within the past five years. The third and final part then proceeded to find out what method was used to carry out each VM exercise.

The responses indicated that 76 per cent (34) of survey respondents have been involved with VM. Table VI shows the total number of VM exercises the respondents have been involved in.

The respondents have been involved in a total of 336 VM exercises over the past five years, which is substantial. The average number of projects per respondent is ten, however, this can be misleading as the standard deviation is 10.52 and mode is 2. This would indicate that there is a considerable variance in the number of VM exercises each respondent has been involved in. This suggests that there are companies who utilise the process more frequently than others.

Figure 2 shows the breakdown of these exercises into the various methods.

It is clear that contractors change proposal has been the most popular choice of method over the last five years confirming the previous response on awareness of methods. There is also limited use of the 40-hour workshop whilst Charette again remains the least popular. This also indicates that VM is predominantly used as a method to improve value (or reduce cost) during post contract stages. However, this is where there is the least potential to achieve value and the cost of change is greatest. It indicates that there is greater potential for improving application of VM in projects by moving the emphasis from post contract stages to design stages of the project.

5.5 The effectiveness of VM

This section aimed at gauging the respondents' views on the effectiveness of the VM process and how it performed in the projects they implemented it on. First, it sets out

Total number of projects respondents have been involved	336
Average number of projects per respondent	10
Standard deviation	10.52
Median	5
Mode	2

Table VI.
Survey respondents experience with VM

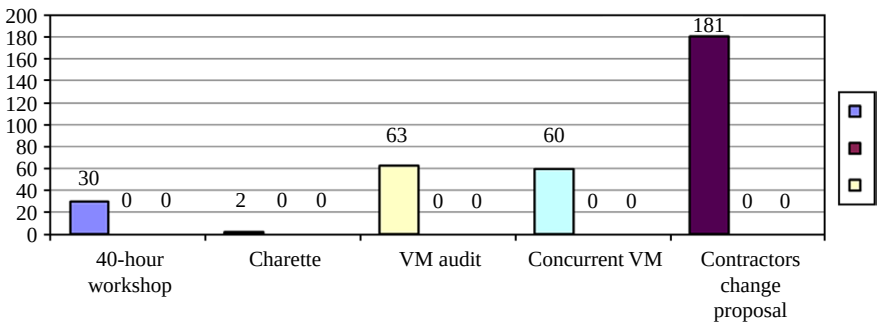

Figure 2.
VM methods used by respondents in last five years

to find out if the respondents agreed with the statement that VM generally obtains a saving of 10 per cent, the popular theory put forward by Norton and McElligott (1995).

There is very much a divided opinion with regards to this statement. Less than half of the respondents agree (47 per cent) with the theory whilst 53 per cent disagree. This is further shown by Figure 3. It shows that the number of projects the respondents were involved in yielded a saving >10 per cent is 81 (24 per cent).

As indicated in the graph above 182 projects (54 per cent) fall into the category of 5-10 per cent savings and 74 projects (22 per cent) fall into the 10-20 per cent savings category, giving a total of 76 per cent of projects obtaining a saving over 5 per cent and <20 per cent. It is, therefore, difficult to establish that there is 10 per cent saving from application of VM to projects.

5.6 Attractive factors for adopting VM

This section explores the views of the respondents about the perceived advantages of using VM. Statements were produced from the literature and using a Likert scale, the respondents indicated their views about each perceived advantage. Again their opinion was measured with 1 indicating strongly disagree; 2, disagree; 3, neither agree/disagree; 4, agree and 5, strongly agree. The section also provided an opportunity for the respondents to outline any perceived additional advantages.

Overall, the respondents generally seemed to agree with most of the advantages stated (Table VII). They strongly agreed that the client's gain more value for money as a result of VM which supports the statement from The Surveyors Construction Handbook (2000) that the process has grown in popularity and usage because it simply works. In fact, not one respondent disagreed with this view, whilst only 7 per cent neither agreed nor disagreed, leaving the remaining 93 per cent agreeing or strongly agreeing.

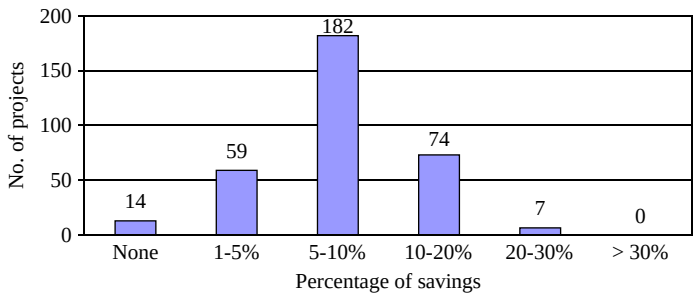

Figure 3.
Percentage of savings obtained by VM exercises

Statement	Average	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
The client gains more value of money	4.29	0	0	7	58	36
The process results in successful team working	3.64	0	4	40	42	13
Significant cost reductions are obtained without compromising value	4.02	0	4	20	44	31
The process results in a quality product being delivered	3.89	0	7	27	38	29
Cost control of the project is improved	3.67	2	2	36	47	13

Table VII.
Percentage and mean Likert values for survey respondents' perceptions of the advantages of VM

There was a limited agreement to the view that the process resulted in improved team working. Whilst only 4 per cent (2) of respondents disagreed with this, many respondents neither agreed nor disagreed suggesting that the process may have no effect upon the performance of the team members. This would then somewhat differ with the view of the OGC (2007b), as they contend that an improved team ethos is created with use of VM. However, the difference of opinion can be explained by the fact that most of the respondents to the research have experience in contractor change proposals rather than pure VM.

The respondents also agreed that the process results in a quality product being delivered and that significant cost reductions can also be achieved, without compromising quality.

There was a slight agreement on the statement that cost control of the project is improved when the process is implemented. Whilst only 4 per cent (2) of the respondents disagreed with this statement, 36 per cent (16) of respondents neither agreed nor disagreed, which suggests that perhaps the process may not have a significant impact on cost control. This again could be due to the fact that majority of respondents experience in VM lies in contractor change proposals which has minimal effect of cost control. Another explanation may be that some of the respondents may not have an in-depth knowledge of the cost control of a project.

A number of respondents also commented on other advantages of VM. One respondent noted that the process improves client buy-in to the design and construction of a project and gives the client greater input, whereas without VM client participation would be more limited. Another believed that VM challenges design, buildability and quality at an early stage and in doing so improves each of these aspects. This respondent also commented that the process ultimately saves time in the construction phase as the design is fool proofed and any changes that may be required would be minimal.

5.7 Negative factors when implementing VM

The Section F of the questionnaire is set out and structured similar to Section E explained in the Section 5.6. VM. Table VIII shows the summary of the responses to statements related to negative attributes of VM.

There is an agreement amongst the respondents that the process is time consuming and that it is also not implemented early enough, only 4 per cent (2) of respondents felt that it was not time consuming whilst not one respondent felt it was implemented early enough. This would appear to greatly support Ellis *et al.* (2005), as they suggest that there is general feeling that VM is applied at too late a stage. There is general consensus that VM is more focused on cost and not value.

Statement	Average	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
The process is time consuming	4.02	0	4	20	44	31
The process is not implemented early enough	4.02	0	0	27	44	29
It is more an assessment of the design teams work	2.98	4	33	29	27	7
It is more focused on cost, not value	3.78	0	13	18	47	22
There is not enough personnel with the correct knowledge to carry out the process	3.60	0	16	33	27	24
It is costly to carry out	3.09	0	24	47	24	4

Table VIII. Percentages and mean Likert values for survey respondents' perceptions of the disadvantages of VM

There is very much a divided opinion with the statement that the process is an assessment of the design team's work, whilst there also is a mixed reaction with regards to the cost of carrying out VM.

There is some evidence to support the view of skill shortage in VM (Fong, 1999). Only 16 per cent (7) of respondents disagreed with this suggesting that there may be a need for better guidance and overall skill development on the VM process.

5.8 Additional comment

This section of the survey questionnaire provided an opportunity for the respondents to submit any additional comments with respect to VM. A number of respondents made some interesting remarks. One noted that if implemented at the right time VM can be of substantial benefit to the client provided that all team members contribute fully to the process with the aim of providing value for money. Two respondents commented on how effective the process can be provided that it is not driven by the client's desire for cost reduction. Finally, one respondent noted that it is a useful tool that the tendering process can run from time to time. What they meant by this was that if the contractor is brought on board at design stage the process usually reaps its greatest rewards. However, the respondent is of the view that when the contractor is appointed after the design has been substantially completed, there is greater possibility for adversarial relationships to be brought about.

6. Case studies

Table IX summarises the main features of the three case studies investigated. These case studies were obtained from the construction industry of Northern Ireland:

Case study A. This is an adult psychiatric unit procured through performance-related partnership method where the contractor is required to submit cost efficiencies as part of their tender. Estimated contract sum was £12.6 million.

	Case study A	Case study B	Case study C
Aims and objectives	To reduce the budget figure without affecting the performance of the building in terms of the clients' needs	To identify value improvements and cost savings to reduce the outturn cost to the client	To reduce the budget figure without compromising the finished product through analysing the functions of the building
Procedure adopted	A series of weekly one-day workshops	Two one-day workshops with a four week break in between	Two one-day workshops with a six week break in between
Personnel involved	The entire design team, the contractor and the client	The entire design team and the client	The entire design team and the client
Time taken	12 weeks	Six weeks	Eight weeks
Results achieved	Overall saving of £835,328.77, bringing the budget figure below what was required. Represents a 6 per cent saving	Overall saving of £1.50 million. Many of the changes implemented provided a greater value to the client. Represents a 5 per cent saving	Overall saving of £2.50 million. Many value improvements were obtained for the client. A superior design was achieved. Represents a 21 per cent saving

Table IX.
Summary of VM case studies

Case study B. This is a female health care unit with an overall cost of £33 million. VM was applied throughout the design process reducing cost and achieving greater functionality.

Case study C. A new build factory with an overall cost of £11.5 million. VM was applied in order to enhance value concentrating on the functions of the building and creating alternative element design proposals.

The design team in all above case studies involved: architect, structural engineer and mechanical and electrical engineers, client's quantity surveyor.

6.1 Aims and objectives of the exercise

It was interesting to note that the VM exercises implemented on both the Case studies A and C were driven by the fact that each project had run over budget. This corroborates the findings in the questionnaire survey that many of the respondents felt that VM was too focused on cost reduction. However, it should be noted that all three case study interviews revealed that there was no room allowed for compromising on quality and performance of the building. Enhancing the functionality of the design was at the core of all these exercises. Therefore, despite the driver for initiation of VM being cost reduction the theory and principles of VM would be upheld.

6.2 Procedure adopted

It is surprising to see that no formal techniques of VM were applied in any of the case studies investigated. In each case, a somewhat modified form of concurrent VM was implemented. However, it differs from this method in that it is not applied throughout the duration of the project. Instead, it is only carried out for as long as necessary. The preferred choice seems to be to a series of one-day workshops, with the continuation of the process in between each of the workshops. In each of the case studies, the workshops were used as a tool to generate ideas and alternatives. The development of ideas then took place outside of workshop hours and the presentation and judgement stages then took place within the following workshop. This explains the limited use of the 40-hour VM workshop within the findings of the questionnaire survey. A series of one-day workshops may be more beneficial and suitable for the professionals within today's highly commercialised industry, rather than having to set aside an entire week to concentrate on one particular project.

6.3 Personnel involved

In each of the case studies examined, those who participated in the process were all involved with the project. No external teams or leaders were brought in at any stage. This suggests that there may be some resistance to the use of an external team or leader as the questionnaire survey suggested. There is clear opposition for the use of an external team. It is worth noting that in each case, the quantity surveying (QS) acted as the VM leader.

6.4 Time taken

The overall time taken for the VM process to be fully executed in each of the case studies could be considered relatively long compared to a 40-hour workshop. There also appears to be a high variation in the time taken to carry out the process.

The quickest to carry out was the Case study B at six weeks long, the longest being the Case study A at 12 weeks, with the Case study C taking eight weeks to complete. The fact that each exercise took a reasonably long time to carry out supports the views of the respondents in the questionnaire survey that the VM process is quite time consuming.

6.5 Results achieved/effectiveness of the exercise

The VM procedures carried out in each of the case studies were successful in that they fulfilled the aims and objectives set out at the beginning of the exercise.

The application of VM to the Case study A proved very successful as the estimated figure was considerably reduced to the target figure originally set. Savings were obtained through simply dedicating time to analyse the various elements of the building and eliminate any unnecessary cost. More importantly, the case study interviews revealed that the quality and standard of the building was not altered in any way and the client has expressed greater satisfaction of the final product.

The VM exercise carried out for the Case study B also proved successful as the clients ultimately gained more value for money as they were directly involved in improving the design through the VM process. The overall objective of the exercise was to identify value improvements and cost savings for the client.

For the final case study, the Case study C, the objectives were also fulfilled, proving successful VM exercise. It prompted the design team to think in terms of value for the client and in doing so a much more superior design was created. Overall, a cost saving of £2.50 million was obtained, despite the budget overrun being only £1 million. The client, therefore, gained a superior product at a much more economical cost, and was ultimately left very satisfied. In two of the case studies, the VM process was paid for by the client whilst the other (Case study A) was carried out by the contractor. At the time of conclusion of the research, the case study buildings were not completed and as such final account costs were not available to verify that the gains achieved in VM were sustained.

7. Conclusion and recommendations

This study provides a snapshot of the state of VM use in the construction industry of Northern Ireland. VM has gained greater usage and popularity within the Northern Ireland construction industry over the years since its introduction to the UK in the early 1980s. The survey carried out reveals that 49 per cent of respondents perceive themselves to have a good awareness of the VM process. There is a healthy use of the VM process within today's construction industry with greater levels of success. About 46 per cent of the respondents indicated that they have significant involvement in VM. This is further backed up by the successes indicated in the case studies. Best value is sought at the most beneficial cost. This study has, however, found that although there is good use of the VM process, there is a lack of formality in terms of the execution of the process, which could perhaps affect its efficiency. The use of one day workshops with intervals between was found to be the preferred choice of procedure, allowing most of the work to be carried outside of workshop hours.

The study also indicates the VM process often proves successful with 5-10 per cent net savings with 54 per cent of projects surveyed achieving it whilst another 22 per cent of projects achieving even higher savings of 10-20 per cent of project costs. These findings are further confirmed through the three case studies carried out.

However, further analysis of the VM process indicates that there is scope for further improvement. The study has found the contractors change proposal to be the most favoured VM approach with 76 per cent indicating their involvement in the use of this technique. This limits the effectiveness of VM constraining it from reaping full benefit of early stage adoption. The adoption of VM at an early stage would no doubt bring the perceived benefits of improved greater value design for construction clients of Northern Ireland, thereby reaping the maximum benefits VM has to offer.

Achieving greater value for money was the main perceived advantage of VM whilst the additional time required for the implementation of the VM process and late adoption of VM were the perceived disbenefits of the VM process. These were also confirmed through the case studies where interviewees stressed the importance, they placed on achieving value through reduction of cost and preserving or enhancing functionality.

There seems to be a skill gap in VM resulting in non-formal usage of VM as well as very limited usage of formal methods of VM. This requires action by academic institutions and professional bodies to provide the greater awareness and training to the construction industry professionals on the use of VM and the need for adoption of VM at early stages of design.

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Further reading

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