

ISSN 1029-0982

Vol. 12 No. 3, 2006

# THE VALUE MANAGER

The official publication of The Hong Kong Institute of Value Management



THE HONG KONG INSTITUTE OF VALUE MANAGEMENT

## THE VALUE MANAGER

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## AIMS AND OBJECTIVES OF THE HKIVM

- To create an awareness in the community of the benefits to be derived from the application of Value Management in Hong Kong.
- To encourage the use of the Value Management process by sponsors.
- To establish and maintain standards of Value Management practice in Hong Kong.
- To contribute to the dissemination of the knowledge and skills of Value Management.
- To establish an identity for the Institute within Hong Kong and overseas.
- To encourage research and development of Value Management with particular emphasis on developing new applications of the process.
- To encourage and assist in the education of individuals and organisations in Value Management.
- To establish and maintain a Code of Conduct for Value Management practitioners in Hong Kong.
- To attract membership of the Institute to support these objectives.

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## EDITORIAL

Welcome to the 3<sup>rd</sup> issue of The Value Manager of 2006. Chan and Leung provide a good summary of the Inaugural Asia Pacific Value Convention, jointly organised by the Hong Kong Institute of Value Management and the Australian Institute of Value Management. Yang introduces an improved Monte Carlo method which incorporates correlations between cost elements in the process of estimation, and helps VM facilitators assess risks better and thus contributes to enhance the competitiveness of organizations. Shen et al. present a joint research project that seeks to develop a rigorous performance measurement framework capable of measuring the performance of VM studies in construction, and a preliminary framework for measuring the processes and outcomes of VM studies developed by the research team so far. Dallas describes an integrated approach of Value and Risk Management to arrive at desired and successful project outcomes, whereby Value Management enables the definition, measurement and optimisation of Value, whilst Risk Management enables the investor to take calculated risks to maximise his investment, and the project delivery team to manage the risks and avoid the destruction of value. Enjoy!

*Geoffrey Shen*

Editor, The Value Manager

# INAUGURAL ASIA PACIFIC VALUE CONVENTION

The 8th HKIVM International Conference & the 11th Biennial Conference of IVMA  
The World of Innovation “Managing value, Risk & Relationships”

**Yee-Shan Chan and Mei-yung Leung**

City University of Hong Kong

An International Value Conference, jointly organized by the Hong Kong Institute of Value Management (HKIVM), Institute of Value Management Australia (IVMA), Hong Kong Architectural Services Department (HKASD) and City University of Hong Kong (CityU) was successfully held with more than 120 participants on 2nd and 3rd November in Hong Kong Convention & Exhibition Centre. After the opening speeches by Mr. Anthony Wilson, the chairman of the HKIVM, Mr. David Baguley the ex-president of IVMA and Mr. C.H. Yue, the director of ASD, over 30 excellent and innovative papers were presented by the speakers came from various international countries including USA, Canada, Australia, UK, China, Hong Kong, Denmark, Japan, Germany, etc.

The conference aims at providing a common platform for the construction professionals to share their experiences and impart their valuable knowledge to different countries and sectors, (i.e. UK Public Service Sector, HKASD, Civil & Engineering sector, etc.), that can benefit from VM. This conference covers the growing need within many organizations in a variety of industries, and is to use a comprehensive set of management skill (i.e. value management, risk management, project management, etc.), techniques and tools (i.e. FAST diagram) in a more integrated manner to get cost efficient and best practice outcomes across a wide range of issues (i.e. Facade selection, Green building project, Expressway tunnel construction, Whole performance improvement, dwelling house construction, etc).

On day-1, a special interactive value session named “Interactive Illustrative Workshop” was arranged to establish a platform for a face-to-face discussion between the international construction professionals and the VM experts. The topics raised were “Reduce CO2 Emission at Home”. During the limited time frame, participants have experienced the Information Phase, Analysis Phase and the Creative Phase of the VM process. Finally, more than 100 ideas and functions were generated with respect to the social, technology development and government policy aspects. The participants of each group then shared their result of discussion with others. This interactive session was held successfully, though the stimulated topic cannot be covered in the specific period. The conference committee is planning to circulate them for further discussion in future.

In order to acknowledge and memorize the outstanding services and commitment of the founding president of HKIVM, Mr. Tony Toy, the regular Tony Toy Memorial Award 2006 was presented to students who have done projects or dissertations related to value management with good quality in the second day of the conference. This year, an additional award, namely the Distinguish Achievement Award, was presented to Mr. Anthony Wilson, the president of HKIVM, for his diligent promotion of VM to the practical industry in Hong Kong throughout the years.

Besides the Conference, a Value Management seminar was also held in Shenzhen Shangri-La hotel as an extension of the Hong Kong Conference. This seminar went a step forward to provide a stage for the construction professionals to share their invaluable experience and knowledge in value management. The speakers presented in this seminar include Dr. Jack Bacon from USA, Mr. John Kelly from UK, Mr. James D. Bolton from USA, Mr. Wang Chun Sheng from China and Mr. Axel Peter Ried from Germany. Through their excellent speeches, the participants’ understanding towards value management has been deepened a lot.

All in all, this conference was held successfully and we hope to see more new faces of VM expertise, innovative VM ideas and excellent VM papers in our upcoming 2008 International Value Management Conference at HKCEC.



*Conference Speakers*



*Opening Speech by ASD*



*Conference Delegates*



*Presentation of Distinguish Achievement Award to Mr. Anthony Tony*



*Opening Speech by HKIVM*



*Conference Organisers*



*Opening Speech by IVMA*



*Conference Dinner*



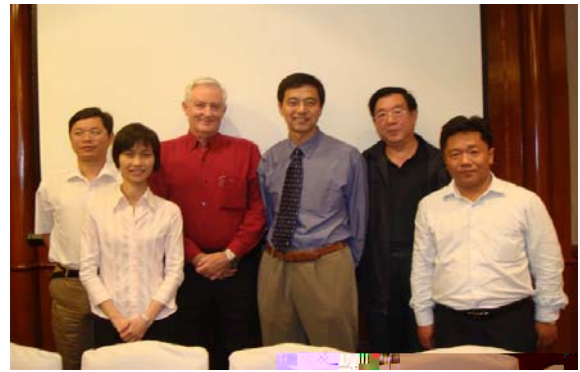
*Interactive Session*



*Shenzhen Conference Delegates*



*Presentation by Participant*



*Shenzhen Conference Organisers*



*Presentation by Participant*

# MANAGING COST ESTIMATION RISKS DURING PLANNING STAGE

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## ABSTRACT

Monte Carlo methods have been used extensively to evaluate the risks associated with cost estimation, which serves as a foundation for effective value management (VM). The present study improves existing Monte Carlo methods to further incorporate correlations between cost elements in the process of estimation. The methodology being considered is the Gaussian copula in the field of multivariate random variate generation. The proposed method is applied to practical datasets to indicate that the impact of correlations is significant and may cause serious problems if neglected. The result is also used to validate that the proposed method can capture the correlations with relatively minor deviations. The improved accuracy helps VM facilitators assess risks better and thus contributes to enhance the competitiveness of the organization.

## INTRODUCTION

Value management (VM) has been applied to increase the performance of construction projects in Taiwan. Examples include the Taipei Mass Rapid Transit System and Taiwan High-speed Railroad. In the process of value analysis, an important goal is to identify and eliminate unnecessary costs. Accurate cost estimation therefore serves as the foundation for successful value management.

Since cost estimation has to be performed before the project commencement, it is exposed to a great deal of uncertainty. To incorporate such uncertainty, Monte Carlo simulation has been applied to assess possible outcomes of cost performance in value analysis.

The present study advances the current practice of using Monte Carlo simulation to perform cost estimation. The breakthrough is to incorporate a recently developed random variable generation method, Gaussian copula, to consider correlations inherent between cost elements. Such correlations shall be considered to increase the accuracy of cost estimation and thus ensuring a smooth journey of value management.

## MONTE CARLO SIMULATION IN COST ESTIMATION

To estimate costs, Monte Carlo simulation is to develop a mathematical model constructed based on pre-specified probability distributions, which describes the possible outcomes of major cost elements (e.g.,

substructure, exterior walls, and electrical finishing) involved in a project, and to run to see what the overall project cost will be for each simulation replication. After a certain number of replications, the collected samples are used to derive the output distribution of the overall project cost.

An enhancement of ordinary Monte Carlo simulation methods has been directed to consider statistical correlations (dependencies) between cost elements. The correlation represents the co-movement of two cost elements; when one is more expensive, the other tends to cost more as well (or cost less for a negative correlation). Arguments and evidences for the existence of correlations and their profound impact on simulation results have been addressed in (Raftery 1994).

There are two sets of input data required to perform a simulation-based cost analysis considering correlations. The first set describes marginal distributions of individual cost elements and the second is a correlation matrix consisting of the correlation coefficients between pairs of cost elements. Both sets of data can be estimated in two ways: (1) by summary statistics on historical data, or (2) by subjective judgments.

The first step to start Monte Carlo simulation is to estimate distributions of cost elements (hereby called marginal distribution). When historical data is used to describe the marginal distributions, it involves an attempt to fit theoretical distributions to the data and verify goodness-of-fit statistically. The fitting process can be done very efficiently by

commercial software packages. A typical result is a list of several “good” distributions and their associated parameters, based on which the estimator can select the most proper one. Previous studies suggested that the lognormal distribution fits historical cost data better than other well-known distributions, such as normal or beta (Touran and Wiser 1992).

Despite its theoretical maturity, using historical data to forecast possible outcomes has some pitfalls. First, actual values may lie outside the range of historical records due to new technology, equipment, and material. Second, historical data may not adequately represent the true underlying population because of sampling error. Last, the prices of resources may not always be repeatable, thus the historical approach may be fallacious.

In the absence of reliable historical data, the second best alternative is for a cost estimator to rely on his/her experiences to subjectively specify the marginal distributions. In the context of probabilistic estimation, it is usual to assume the underlying distribution is a beta distribution whose parameters are specified by three point estimates: the minimum, maximum, and most likely values. Some recent controversy has been whether the beta distribution should be replaced with the triangular distribution since the former does not have clear-cutting bounds (Johnson 1997) and requires four parameters, which do not have a one-to-one correspondence with the three estimates (Van Dorp and Kotz 2002).

Both approaches mentioned above (historical and subjective) may involve the following practical concerns. First, they may actually be mixed in practice. A cost estimator may not have historical data of all the cost elements if some works are usually outsourced or subcontracted. Thus he/she can obtain summary statistics only on those data on hand and has to rely upon subjective estimation for the remaining cost elements. Another possibility occurs when the estimator has reasons to believe some of the cost elements in a new project have their own bounds (minimum and maximum) and thereby cannot be represented by historical data. For these particular elements, the subjective approach is more appropriate. Second, it has been frequently encountered that the price options

of some cost elements are collections of discrete outcomes rather than continuous functions.

The practical concerns above give rise to the need for a more general simulation model, which should be able to treat all different types of distributions in one framework (some are discrete while some are continuous; some are lognormal while some are beta). This is the goal of this paper.

## PROPOSED METHOD

The proposed method takes two sets of input: marginal distributions of the cost elements (measured in unit cost, for example £/m<sup>2</sup>) and a correlation matrix between these elements. The correlation matrix stores ordinary product-moment (Pearson) correlation coefficients, which range between +1 and -1. A correlation coefficient of +1 signifies a perfect positive relationship (if one cost element is more expensive, so is the other), while -1 shows a perfect negative relationship. The smallest correlation is 0.

The underlying concept of the proposed method is the Gaussian copula, which relates a set of Gaussian distributions. Detailed steps are to generate a vector of correlated normal variates, transform them into uniform variates by the aid of the cumulative normal probability function, and then map the variates into their individual marginal distributions by the inverse transform method. The generated random variates are used to model the cost elements with the desired correlation structure. In what follows, we enumerate the steps:

1. Apply the Cholesky decomposition to the correlation matrix so that  $M=CC^T$  where  $C$  represents the Cholesky triangular.
2. Generate an IID (independent and identically distributed) unit scaled uniform random vector,  $Y=(Y_1, Y_2, \dots, Y_n)$  where  $n$  is the number of cost elements.
3. Translate  $Y$  into a standard-normal random vector  $P=(P_1, P_2, \dots, P_n)$ .
4. Transform  $P$  into a correlated standard-normal random vector  $Z=(Z_1, Z_2, \dots, Z_n)$ .
5. Compute  $U_i = \Phi(Z_i)$  for  $i = 1, 2, \dots, n$ , where  $\Phi(\cdot)$  denotes the standard normal cumulative distribution function (CDF).



6. Compute  $X_i = F_i^{-1}(U_i)$  for  $i = 1, 2, \dots, n$ , where  $F_i^{-1}(U_i)$  denotes the inverse of the  $i$ th marginal CDF.
7. Return  $X_i$  as the estimate for cost element  $i$ .
8. Compute the total project unit cost by summing up all the cost elements.
9. Repeat Steps 2 through 8 for each simulation replication,  $j = 1, 2, \dots, m$ .
10. Return summary statistics on all simulation replications.

The computational guideline for the steps is elucidated in (Yang 2005). To seek for broader application, the steps have been implemented into a MATLAB application. The program has been used to analyze the following case.

### CASE STUDY

The proposed method is applied to the British data set described in (Wall 1997) to demonstrate its practical use. The data set is drawn from 216 office buildings built between 1980 and 1994 and consists of 8 major cost elements. The data set has been standardized based on the times and locations the buildings were built.

All the cost elements and their marginal distributions are shown in Table 1. The value of each cost element is expressed as £/m<sup>2</sup>. Here a cost element represents a relatively large work package, which may consist of several tasks. For example, “superstructure” involves formwork, steelwork, and concrete pouring. This level of granularity is suitable for higher level estimation. Moreover, the measure of £/m<sup>2</sup> can be changed to reflect the usual unit for progress measurement, if the proposed method is applied to other construction projects. For instance, a reasonable measure of cost elements for a highway project may be £/m while that for a residential community project may be £/house.

In the example, we consider three families of distributions, i.e., lognormal, beta, and discrete. The lognormal distributions are used because they fit the data better. The use of the other two is based on a pragmatic situation when a cost estimator prefers not using historical data but rather using a discrete

distribution to describe possible outcomes of “fitting and furnishings”, and beta distributions (three points) to estimate the distributions of “services” and “external works”.

Table 2 shows the rank correlation coefficients between the cost elements of the full data set. Before applying the proposed method, the rank correlation coefficients are reviewed and adjusted to verify (1) if they can reflect the actual behavior of the correlations and (2) if they, derived from past data, are suitable for the current project. This process is based on practical judgments and can complement pure mathematic analysis. In this example, the rank correlation coefficients between “external works” and other cost elements are adjusted to be zero.

A simulation experiment is designed to implement the proposed method and to evaluate the impact of correlations between cost elements. In the experiment, every simulation replication leads to a sample of the project cost by simply summing up cost elements drawn from individual distribution. The output statistics can then be used to assess the behavior of the true project cost. Before a full-scale simulation, validation runs are conducted to ensure the code is correct and the random variables have the specified distributions.

After 1000 simulation replications, Table 3 lists the descriptive statistics for the unit cost of the project. To assess the impact of correlations, we compare two scenarios: including and excluding correlations. The second observation is that the scenario of “including correlations” has a much longer tail to the right than that of “excluding correlation”. This indicates the former has a larger variability (uncertainty) than the latter. Consequently, the 95% confidence interval of the former is much wider than that of the latter

Figure 1 plots the CDF's of both scenarios: including (bold curve) and excluding (dashed curve) correlations. A practical use of the chart is to estimate the unit cost of the project with a certain probability. Taking correlations into consideration, the unit cost with a 0.90 probability is 958.50 £/m<sup>2</sup>, which would be profoundly underestimated as 903.52 £/m<sup>2</sup> if the correlations are neglected. The difference of 54.98 £/m<sup>2</sup> is greater than the cost of

“substructure” (with a mean of 47.2 £/m<sup>2</sup> in Table 1). In other words, by neglecting the correlations, the error can be as serious as doing the substructure for free. This highlights

the importance of considering correlations between cost elements and hence stresses the merits of the proposed method.

**Table 1: Marginal Distributions of Cost Elements**

Cost Elements	Descriptive Estimate (in £/m <sup>2</sup> )
Substructure	Lognormal (47.2,30.9)
Superstructure	Lognormal (263.6,82.4)
Internal finishes	Lognormal (63.2,24.4)
Fittings and furnishings	Discrete (7,0.2; 8,0.5; 9,0.2; 10,0.1)
Services	Beta (150,180,220)
External works	Beta (70,85,120)
Preliminaries	Lognormal (76.4,47.3)
Contingencies	Lognormal (21.2,13.2)

**Table 2: Correlation Matrix**

	1.Sub.	2. Super.	3. Inter.	4. Fit.	5.Ser.	6.Extern.	7.Prelim.	8.Conti.
1. Substructure	1.00							
2. Superstructure	0.33	1.00						
3. Internal finishes	0.26	0.52	1.00					
4. Fittings and Furnishings	0.10	0.26	0.28	1.00				
5. Services	0.28	0.57	0.64	0.33	1.00			
6. External works	0.00 <sup>b</sup>	0.00 <sup>b</sup>	0.00 <sup>b</sup>	0.00 <sup>b</sup>	0.00 <sup>b</sup>	1.00		
7. Preliminaries	0.35	0.37	0.44	0.18	0.39	0.00 <sup>b</sup>	1.00	
8. Contingencies	0.23	0.28	0.34	0.21	0.29	0.00 <sup>b</sup>	0.36	1.00

<sup>a</sup> Correlations above 0.10 significant at 95% confidence

<sup>b</sup> Subjective correlations

## CONCLUSION

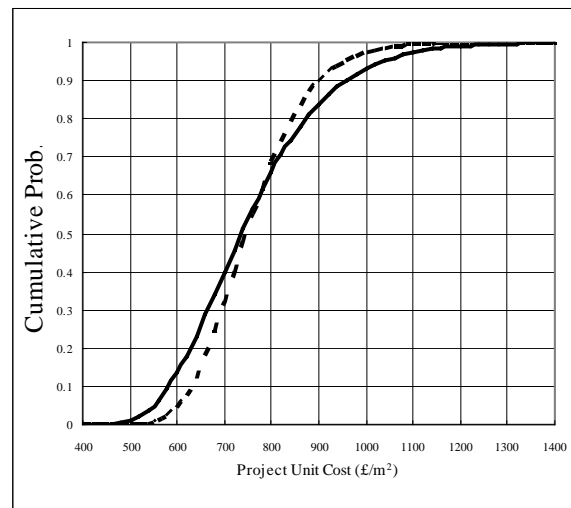
With the main goal of increasing the accuracy of cost estimation during value analysis, this paper presents a Monte Carlo simulation model to consider the correlations between cost elements. The modeling capabilities of the proposed method are empirically validated by an application to a modified British data set consisted of 216 office buildings. With the modeling capabilities, the proposed method helps cost estimators assess the true impact of correlations between cost elements on the

project unit cost. The impact has been shown significant and shall never be neglected

Note, however, that the proposed method is an approximation; users are suggested to perform a validation analysis to ensure the deviations between the sampled and specified correlation matrices are within an acceptable range. It is also important to note that the proposed method relies heavily on the input of correlation data, which require not only mathematical computations but also professional judgments.

**Table 3: Simulation Results (Including versus Excluding Correlations)**

Statistics	Excluding correlations (in £/m <sup>2</sup> )	Including correlations (in £/m <sup>2</sup> )
Mean	759.21	756.88
Standard Deviation	108.92	149.55
Minimum	514.50	470.50
Q1 (25% percentile)	680.99	647.07
Q2 (Median)	759.21	756.88
Q3 (75% percentile)	823.71	843.35
Maximum	1147.20	1939.30
95% C.I. lower bound	590.30	522.00
95% C.I. upper bound	1024.00	1091.00
Estimate with 0.9 Probability	903.52	958.50

**Figure 1: CDF's of Two Scenarios: Including (bold) and Excluding (dashed) Correlations****REFERENCES**

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# MEASURING THE PROCESSES AND OUTCOMES OF VALUE MANAGEMENT STUDIES IN CONSTRUCTION

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## ABSTRACT

Value management (VM) is a useful tool in coping with many challenges faced by the construction industry today. In addition to cost savings, a VM study can often result in a number of intangible benefits such as improved understanding of customer requirements and communication among project stakeholders. However, the lack of a robust and rigorous performance measurement framework makes it difficult to measure the success of VM studies. Not knowing the return from investment, many potential users in the construction industry are reluctant to apply VM studies in their projects, which hinders the wide application of the VM methodology. This paper describes a research project which seeks to develop a rigorous performance measurement framework that is capable of measuring the performance of VM studies in construction continuously and easily. Critiques of existing performance measurement frameworks are given. The establishment of a theoretical foundation is discussed, followed by the selection of potential indicators. Finally, a preliminary framework for measuring the processes and outcomes of VM studies is introduced.

## INTRODUCTION

Value management (VM) has been introduced into the construction industry as a useful tool to cope with the many challenges: budget constraints, safety issues, environmental impact, and after all, value for money. If implemented successfully, this group problem-solving methodology can reduce costs while maintaining or improving performance and quality requirements in a project. The highway and transportation departments in the U.S., for example, saved US taxpayers \$1 billion in 2000 by applying the VM methodology to construction projects (SAVE International, 2005). A VM study can also clarify client requirements and improve communication among project stakeholders (Shen and Liu, 2003).

The lack of proper measurement of performance is, however, a major factor which hinders the development of VM. The reasons are: 1) Clients in the construction industry are reluctant to apply VM studies without knowing the performance and returns from the investment; and 2) Little improvement on VM methodology can be made without rigorous measurement on the processes of VM studies which indicate the efficiency of the tool. There are numerous research findings and

publications on VM studies, but most of them are concerned with its practice. Very little has been written about the performance measurement of VM studies, especially the measurement of process performance.

This paper describes a research project which seeks to develop, validate, and refine a framework to measure the performance of VM studies properly, promptly and continuously. Following a critique of the strengths and weaknesses of existing performance measurement frameworks, the establishment of a theoretical foundation is discussed, and the selection of potential indicators is explained. Finally, a preliminary framework for measuring the processes and outcomes of VM studies is introduced.

## CRITIQUES ON EXISTING MODELS

Many models and frameworks were developed to measure the performance of organizations and projects. The widely referred models are shown in Table 1. Since the Balanced Scorecard, EFQM model, and KPI framework were widely used in the construction industry (Bassioni et al, 2004), a detailed discussion on their strengths and weaknesses is given below.

**Table 1: Well-known performance measurement frameworks**

Model Names	Abbreviations	Developers
Strategic measurement analysis and reporting technique	SMART	Cross and Lynch
Performance measurement questionnaire	PMQ	Dixon et al
Balanced scorecard	BSC	Kaplan and Norton
European Foundation for Quality Management Excellence Model	EFQM Model	European Foundation for Quality Management
Malcolm Baldrige National Quality Award	MBNQA	National Institute of Standards and Technology
Construction industry key performance indicator	KPI framework	Construction Best Practice Programme

Balanced Scorecard (BSC) has been an excellent contribution to performance measurement, but it is neither complete nor comprehensive. The four perspectives in the BSC have been considered insufficient by many researchers (Neely et al, 2002; Kagioglou et al, 2001). They appear to be especially limited when measuring VM studies. BSC provides a valuable perspective to measure the performance in multi-criteria situation which should be adapted to measure performance of VM studies. However, it requires months, if not years, to see the outcomes of implementing BSC, so that it is not suitable for VM studies which last for only a few days. BSC is developed for use in a strategic level rather than operational level, and will be tailor made to meet the need of a specific organization. It is inefficient to develop a specific BSC system for a specific VM study.

The EFQM and Baldrige models have gained much popularity in the field of performance measurement. EFQM model provides a perspective to integrate result areas (lagging indicators) and organization areas (leading indicators) in one model which can be adopted when measuring the performance of a VM study. However, research works have to be undertaken to identify the proper criteria which meet the unique requirement of VM studies. The criteria of EFQM model are fixed because of the similarity of organization performance. This feature limits its flexibility when measuring VM studies which are different from one another. Bassioni et al (2004) listed the limitations of performance

measurement frameworks and excellence models after a general critique of deficiencies:

- Limited/non-comprehensive performance criteria/ perspectives;
- No relations among criteria, or if relations exist, they are simple and do not simulate actual complexities;
- No measure development or design process;
- Lack of implementation guidelines and long-term maintenance of the framework to adapt to the changing environment; and
- Little consideration for existing performance systems and their interaction with the model/ framework.

The Project Excellence Model (Westerveld, 2003) which was developed from EFQM model uses five different project types to describe the project, giving guidance to the application of the model. This method could be adapted to classify VM studies by types when measuring performance.

The KPI framework was also considered to be problematic by some researchers. Kagioglou et al (2001) pointed out that a) the measures offer little indication from a business point of view, b) it lacks a holistic viewpoint on the relationship between different measures, c) none of the measures is designed to measure the performance of suppliers, and d) none of the measures deals with 'innovation and learning perspective'. As a benchmarking method, Neely et al (2002) argued that this kind of activities is for short-term

improvement initiatives. The KPI framework gives no explanation on the cause and effect between best practices and project processes. Because of these problems and the uniqueness of VM studies, benchmarking method is not suitable to measure the performance of VM studies. It could be implemented to collect and compare the values of indicators used in the measurement. Potential for improvement and actual cost savings can be quantified supporting further self-analysis and improvement programs (CII, 2005).

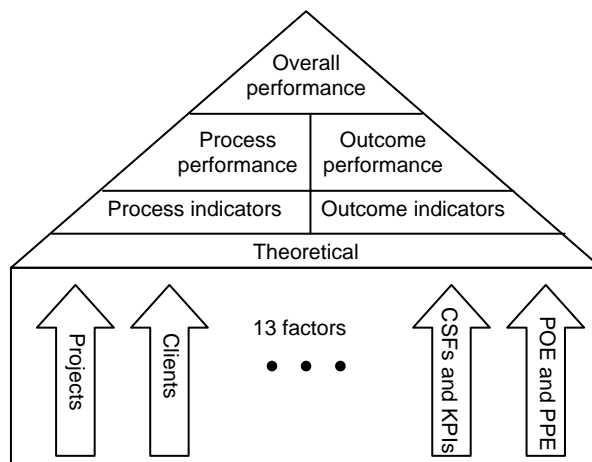
**A THEORETICAL FOUNDATION**

There are many factors that may affect the performance of VM studies. Thirteen major factors were identified in the theoretical foundation of the performance measurement framework. They are:

- Projects
- Clients
- Facilitator

- Participants
- Team and team dynamics
- Techniques used in VM studies
- Time and venue of VM studies
- Process of VM studies
- Types of VM studies
- Critical Success Factors (CSFs)
- Key Performance Indicators (KPIs)
- Post Occupancy Evaluation (POE)
- Post Project Evaluation (PPE)

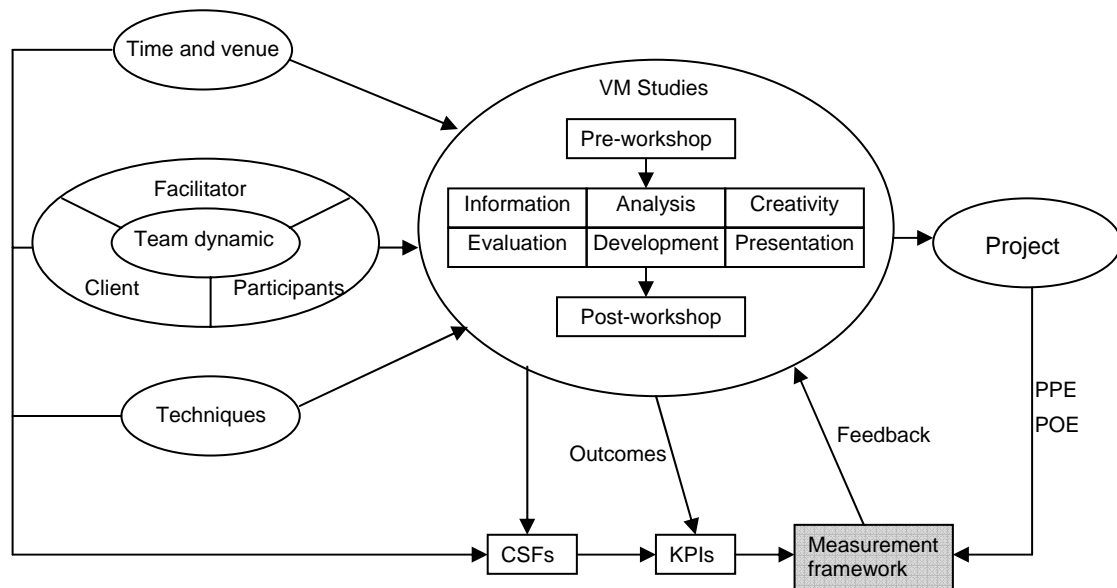
Figure 1 shows the theoretical structure for the proposed performance measurement of VM studies. This framework is expected to measure both processes and outcomes performance which are derived from the integration of process indicators and outcome indicators. These factors will serve as the foundation of indicators, making them reasonable and invulnerable.



**Figure 1: Theoretical structure for performance measurement**

Figure 2 portrays a theoretical framework for performance measurement of VM studies and shows how the factors relate to one another. Facilitator, client and participants constitute the human resources of VM studies. Participants from relevant disciplines and client representatives form the team which is

facilitated by the facilitator in the process of VM studies. A positive team dynamic is expected to add value to the project. These human resources, as well as the duration, venue, and the techniques used in VM studies are seen as the input which may affect the performance of VM studies.



**Figure 2: Theoretical framework for performance measurement of VM studies**

A VM study is a systematic approach which consists of pre-workshop, six-phase workshop and post-workshop. Each phase requires the input of previous phases and yields output for the subsequent phases. The performance of each phase could be measured and integrated to form the process performance of VM studies. The whole process of a VM study is integrated into the project management process to add value to the project.

Measuring the performance of a VM study will start from the objectives of the study. Each objective should be linked to one or more critical success factors (CSFs) which are identified according to the inputs and processes of VM studies. Each CSF should have a few KPIs that can be measured and quantified. These KPIs are used to measure the process performance of the VM study, being ‘leading’ indicators which could predict the performance of the study. The outcomes of the VM study will include issues such as quality of decision, time to reach decisions, and satisfaction with the outcomes. These outcomes will also be linked with relevant KPIs which are judged as ‘lagging’ indicators.

The ‘leading’ indicators and ‘lagging’ indicators, as well as their relevant weightings, make up the core of the measurement framework. The feedback of the measurement could be used to improve the performance of the VM study and guide the following VM activities. Results from POE or

PPE could be used as an addition to measure the performance of VM studies, though they may be influenced by many internal or external factors of the project. On the other hand, these results could be used to demonstrate the usefulness of VM studies.

**SELECTION OF POTENTIAL INDICATORS**

Proper indicators are the fundamental elements in developing a measurement framework. It is hard to determine whether an indicator is useful, and we should also consider the feasibility of data collection. According to the research work of Male et al (1998) and Shen and Liu (2003), as well as the key factors mentioned above, a list of potential indicators is made for further investigation. The process related indicators are judged as ‘leading’ indicators. These ‘leading’ indicators will be used to measure the process performance of VM studies. The outcome related indicators are judged as ‘lagging’ indicators. These indicators will be used to measure the outcome performance of VM studies. Though some of the indicators were judged as useless in the research of Male et al (1998), we believe that a reinvestigation is meaningful. Since the judgment made by them is only based on 4 cases. They do not suffice to make a solid conclusion. There may be some other indicators which are useful but not listed in the table. Due to the different

objectives of different VM studies, the choice of indicators may be changed. Further investigation will be done to choose adequate indicators for a specific VM study.

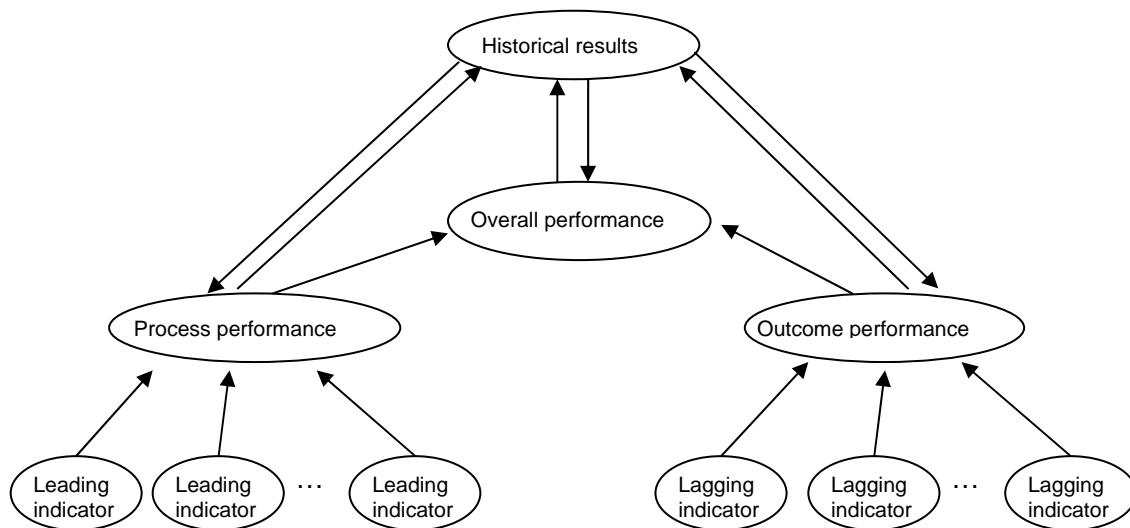
**DEVELOPMENT OF A CONCEPTUAL FRAMEWORK**

How to integrate the indicators to form a proper model for measurement is of key importance. Based on the critiques of existing frameworks, a proper model has to include following features: 1) to be multi-criteria to provide a comprehensive evaluation, 2) to be dynamic to provide real time measurement results and 3) to be flexible to fit different types of VM studies. A preliminary conceptual framework is developed to meet these features. As shown in Figure 3, leading indicators are used to measure the process performance of VM studies while lagging indicators are used to measure the outcome performance. It is possible to measure and improve promptly when acquiring and

comparing leading indicators to historical results. Choosing proper indicators when measuring a specific VM study makes this framework flexible. A comprehensive measurement of a VM study can be achieved by integrating the measurement results of previous VM and both process performance and outcome performance. Meanwhile, the measurement results of overall performance will be add to the database as historical results which can benefit later VM studies so that this framework can grow continuously.

**CONCLUSIONS**

The performance measurement of VM studies is required to ensure the confidence of clients and to identify areas to improve. However, the existing performance measurement frameworks cannot be applied directly in VM studies due to their limitations, though they provide some valuable concepts on how to conduct performance measurement.



**Figure 3: A conceptual framework for performance measurement in VM studies**

The thirteen factors are at the bottom of the performance pyramid, forming a solid theoretical formation of the performance measurement of VM studies in construction. They cover major aspects of VM studies which should be considered in the measurement. The theoretical framework shows that CSFs are extracted from the inputs and processes of VM studies. KPIs, which are

in line with the CSFs, are seen as ‘leading’ indicators, which can predict the performance of VM studies, while other KPIs which represent the outcomes of VM studies are seen as ‘lagging’ indicators. Both ‘leading’ and ‘lagging’ indicators, and their relevant weightings, are critical elements of the performance measurement framework.



From this theoretical foundation, a list of potential performance indicators and a preliminary performance measurement framework are developed. Although the list is limited and the framework is very brief, they illustrate how to measure the performance of VM studies promptly, properly and continuously.

Further investigation will be conducted to choose valid indicators from potential list and to determine their weightings. Focus group meetings and real-life case studies will be conducted to refine the proposed framework. A computer-aided toolkit will be developed that will be integrated with the existing VM process so that performance measurement can be carried out easily and continuously during these studies, capitalising on data already captured by these tools, and enabling continuous and timely improvement.

#### ACKNOWLEDGEMENT

The work described in this paper was supported by the Research Grants Council of the Hong Kong Special Administrative Region, China (PolyU 5114/03E and PolyU 5161/04E).

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# TWIN DRIVERS FOR SUCCESS - VALUE AND RISK

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## ABSTRACT

Michael Dallas is the partner at Davis Langdon LLP (the UK member of Davis Langdon Seah International) responsible for Value and Risk Management to assist in delivering the firm's Mission "to add value and reduce risk for our clients". He is a founder member and past chairman of the UK's Institute of Value Management (IVM). Michael chaired the working group who developed BS EN 12973:2000, the European Standard in Value Management and the guidelines to its use and implementation. He was instrumental in developing the IVM's Training and Certification System. Michael has, for many years, applied innovative Value and Risk Management to a wide variety of construction related projects at all stages in their life cycle. He is the author of numerous papers and a regular speaker at professional events. His new book, "Value and Risk Management – a guide to best practice", carries the endorsement of many of the main construction related Professional Institutions in UK and will be published by Blackwell's in the autumn of 2005.

## INTRODUCTION

It is common practice to treat Value and Risk Management as separate processes. Whilst the processes may differ in detail, I believe that Project Teams should be encouraged to apply both Risk and Value Management simultaneously throughout their projects.

Value and Risk Management enable organisations to succeed in the delivery of ambitious projects by defining their desired outcomes and then exercising processes that maximise value and minimise uncertainty. This applies as well to strategy and business change projects as it does to those in the built environment

A successful outcome requires that the Value to their business is maximised through the delivery of a facility that gives them the benefits they need at a price they can afford at the time when they need it and to a quality that fulfils their expectations. It requires that the outcome is clearly defined and communicated to those who deliver it (the Project Team). It also requires effective delivery processes that minimise the impact of the unexpected and uncertainties.

Value Management provides an effective process to maximise Value in line with the Owners' and End users' requirements and fulfils the first of these requirements.

Risk Management fulfils the second requirement as part of effective Project Management, by providing a process for managing Risk.

Both processes should be applied on every significant Development and Construction project.

## DELIVERING SUCCESS

The effective, formalised, processes of Value and Risk Management enhance the chances of project success for minimal outlay.

## VALUE MANAGEMENT

At the outset of a project, Value Management provides an exceptionally powerful way of exploring Clients needs in depth, addressing inconsistencies and expressing these in a language that all parties, whether technically informed or new to the construction industry, can understand.

This results in the following benefits:

- It defines what the Owners and End Users mean by value and provides the basis for making decisions, throughout the project, on the basis of value. It provides a means for optimising the balance between differing stakeholders' needs.
- It provides the basis for clear briefs which reflect the client's priorities and expectations, expressed in a language that all can understand. This improves communications between all stakeholders so that each can understand and respect other's constraints and requirements.

- It ensures that the project is the most cost-effective way of delivering the business benefits and provides a basis for refining the business case. It addresses both the monetary and non-monetary benefits.
- It supports good design through improved communications, mutual learning and enhanced team working, leading to better technical solutions with enhanced performance and quality where it matters. The methods encourage challenging the status quo and developing innovative design solutions
- It provides a way of measuring value, taking into account non-monetary benefits, and demonstrating that Value for Money has been achieved.

## RISK MANAGEMENT

In his report, *Trusting the Team*, proposing improvements to the construction industry, Sir Michael Latham stated "No construction project is risk free. Risk can be managed, minimised, shared, transferred or accepted. It cannot be ignored".

Indeed, it is necessary to take risk if one is to maximise the benefits (or value) in an organisation. The first and major benefit of Risk Management, therefore, is that it enables senior management to embark upon projects in the full knowledge that they will be able to control risk and, thereby, maximise their rewards.

Engaging in fire fighting, whilst it may be exciting is not efficient. It concentrates management's attention on day-to-day matters whilst diverting attention from the wider issues. Risk Management, helps the team to concentrate on the big issues and manage these in an orderly way.

A formal Risk management process delivers the following benefits for the project team:

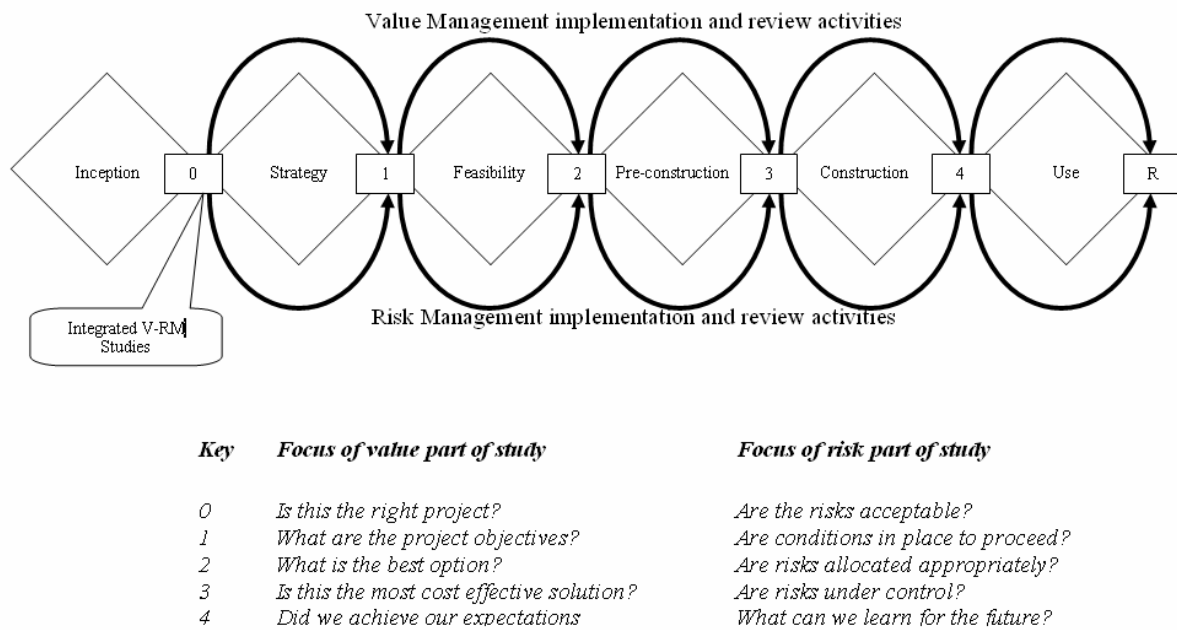
- It requires that the management infrastructure is in place to deliver successful outcomes. This includes setting clear, realistic and achievable project objectives from the outset.
- It establishes the risk profile of the project, enabling appropriate allocation of risk, so that the party best placed to manage it has the responsibility for doing so. Risk allocation is a key component of contract documentation.
- It allows the team to manage risk effectively, concentrate resources on the things that really matter, resulting in risk reduction as the project proceeds. It also enables them to capitalise on opportunities revealed through use of the process.

## WHY INTEGRATE?

To optimise value on a project I believe that it is essential that the team actively manage both value and risk. There is little point in going to great lengths to maximise the value if significant risks materialise which impair its delivery, thereby destroying value. A project in which all risk is avoided is unlikely to maximise value.

It is necessary to take risks to maximise value. Formal processes, rigorously applied, provide a structured route for the team to control risk effectively.

Figure 1 illustrates how the integrated process comprises a series of joined up studies interspersed by separate streams of Value and Risk activities.



**Figure 1: Integration of Value and Risk Management through the project cycle**

**VALUE AND RISK ARE COMPLEMENTARY**

Both Risk and Value Management are needed to maximise the chances of project success. The reason for this lies in the different but complementary objectives of each discipline outlined above

Value is maximised using Value Management. Uncertainty and consequent Value erosion is minimised using Risk Management.

**SIMILARITIES IN THE PROCESSES**

Whilst the processes may differ in detail, they have the following similarities:

- The Preparation Stage, to understand the project and the issues relating to it
- The requirement for consultation with and involvement of the main stakeholders.
- The use of facilitated workshops involving a balance of stakeholders, disciplines and characters
- The development of proposals to improve the project and management actions to implement them

- The need for an explicit implementation plan
- The written record, or report on the outcome, providing a clear audit trail.
- The need for regular reviews to monitor implementation and report progress.

**THE INTEGRATED PROCESS**

Combining the two processes within a single study is therefore logical and practical.

Essentially the integrated process comprises a number of formal studies that coincide with key milestones, or decision gateways, throughout the life of the project.

Between the formal studies, the progress of implementation and management actions should be reviewed by a responsible person on a regular basis and reported in the regular project reports. These reviews and progress reports are likely to be conducted and reported separately. This is because different people within the project team may be responsible for conducting them.

**PROJECT STAGES AND STUDY TYPES**


A project’s duration is from inception to the delivery of benefits.

Traditionally, in the construction industry, a project is seen as the construction activity alone, beginning with an instruction from an owner and ending when the completed building is handed over for use. From the owner’s perspective, constructing the building is a small component of a much broader project to bring about a benefit to a business. Until the construction is complete, occupied

and working, it brings the owner no benefit whatsoever. It is simply an expense. Realisation that the client gains no benefit from a building until after it is in use is an important step in putting oneself in the client’s shoes and delivering best value with minimum uncertainty (risk).

Although they may have a similar structure, each of the studies will have a different objective, linked to the stage in the project. The integrated Value and Risk Management programme for a major project can be expressed by the generic model illustrated in Figure 2

Project Stage	Value Study Type	Issues addressed	Outputs	Risk Study Type
<i>Inception</i>	<b>VM0</b> Need Verification	Strategic Fit Need for project	Recommendations to Sponsor	<b>RM0</b> Strategic Risk Study
<i>Strategy</i>	<b>VM1</b> Project Definition	Linking design consideration to project objectives	Value & Risk Profiles Project Brief Risk Allocation Management plan	<b>RM1</b> Initial Project Risk Study
<i>&amp; feasibility</i>	<b>VM2</b> Brief Development	Selecting options Procurement strategy Project organisation	Brief Risk Register and Management Plan	<b>RM2</b> Project Risk Reviews
<i>Pre-construction</i>	<b>VM3</b> Value Engineering	Optimising cost, time and quality	Inform design development and tender documentation Risk Register and Management Plan	<b>RM3</b> Detailed Project Risk Reviews
<i>Build</i>	<b>VM4</b> Design Cost Review	Review Cost effectiveness Optimise components	Refine detailed design and construction Construction Risk Management Plan	<b>RM4</b> Construction Risk Management
<i>Use</i>	<b>VM5</b> Project Review	Project review	Lessons learned for future projects Identifying future project needs	<b>RM5</b> Operational Risk Reviews

 Arrows thus indicate potential re-iterations which may be necessary if circumstances require strategic changes to the project

**Figure 2: Milestones for Integrated Value and Risk Management Reviews**

**MIGRATION OF STUDY OBJECTIVES**

To reflect project progress, the objectives of Value and Risk studies change as the project moves from stage to stage. In the early stages the emphasis is on ensuring that the project fits with the strategic needs of the business. Later studies are designed to inform the Briefs to ensure that project teams develop solutions that deliver client and user expectations. When the design is being developed the team concentrates on ensuring effective project

delivery by maximising value for money and controlling project risk. When a building is handed over for use it is good practice to undertake a review to understand the effectiveness of the Value and Risk processes during delivery and learn lessons from them for future projects. Once the facility is in use, the users may wish to review the productivity of the operations from time to time. Such reviews can provide the catalysts for future projects.

## ITERATION

The evolution of most Development and Construction Projects is, by their nature, an iterative process. It requires constant juggling between the demands of the business, all the influential stakeholders, including the end user, the owner, the delivery team, the authorities and external pressure groups. It is therefore common practice to revisit previous stages due to changes in requirements.

## SUMMARY

This paper describes how, used in isolation, Value and Risk Management may not result in the desired project outcomes. Combined into

an integrated approach, however, Value Management enables the definition, measurement and optimisation of Value, whilst Risk Management enables the investor to take calculated risks to maximise his investment, and the project delivery team to manage the risks and avoid the destruction of value. Together they are likely to result in a successful outcome.

## REFERENCES

This article is extracted from Michael Dallas's new book "Value and Risk Management – a guide to best practice, to be published by Blackwell's in the Autumn of 2005.



## HKIVM NEWS



- 2-3 November 2006, An International Value Conference entitled "Inaugural Asia Pacific Value Convention" was successfully held in Hong Kong Convention & Exhibition Centre, with more than 120 participants attended. This conference was jointly organized by the Hong Kong Institute of Value Management (HKIVM), Institute of Value Management Australia (IVMA), Hong Kong Architectural Services Department (HKASD) and City University of Hong Kong (CityU). Please visit [http://www.hkivm.com.hk/conference/8th\\_conference/index.htm](http://www.hkivm.com.hk/conference/8th_conference/index.htm) or contact the Conference Secretary at [conference@hkivm.com.hk](mailto:conference@hkivm.com.hk) for further information.

## FORTHCOMING EVENTS



- 13 December 2006, The HKIVM 11th Annual General Meeting and Christmas Lunch will be organised in the Hong Kong Club. The President and Treasurer will present their annual reports during the meeting. Please contact Leona Tsang at [tsangkml@archsd.gov.hk](mailto:tsangkml@archsd.gov.hk) for reservation.

# APPLICATION FOR MEMBERSHIP OF HKIVM

If you are interested in knowing or joining the Hong Kong Institute of Value Management (HKIVM), please download the membership application form from HKIVM website <http://www.hkivm.com.hk>. Alternatively, please fill in the reply slip below and return it to the membership secretary of HKIVM.

Membership requirements are as follows:

**Member (MHKIVM)** This classification is available to individuals who can demonstrate an acceptable level of knowledge and experience in the field of Value Management. For admission, details on the Application Form are to be completed and copy of CV outlining professional employment, experiences and value management background enclosed. **Value Management Background** incorporating details of VM training and courses in VM process, application and techniques, number of studies, types of studies, role in process, days and dates should be stated clearly in the CV.

**Associate Member** The Associate Member classification is available to any individual who can demonstrate interest in the objectives of HKIVM, but may not have had sufficient Value Management experience to qualify as a Member.

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<b>Request of the HKIVM Membership Application Form</b>	
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