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THE VALUE MANAGER

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THE HONG KONG INSTITUTE OF VALUE MANAGEMENT

THE VALUE MANAGER

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COUNCIL MEMBERS OF THE HONG KONG INSTITUTE OF VALUE MANAGEMENT (HKIVM)

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 third issue of The Value Manager 2007. Different from the previous issue, the focus of the papers presented this time will be on “procurement”, an area in construction that there is considerable scope for the use of VM. Three outstanding papers, two from Hong Kong and one from the UK, are highly recommended to you in the current issue. The first paper “Value management in the Architectural Services Department (ArchSD) in Hong Kong” is written by our Past President, Tony Wilson, who is the former Chief Architect of the ArchSD. This paper introduces some successful VM studies in the ArchSD and comes to a conclusion that the application of VM could result in greatly improved project outcomes and added value for all those involved for a very small cost outlay. In the paper titled “A VM approach to the appointment of consultants and contractors on a value for money basis”, Prof. John Kelly and Kirsty Hunter from the U.K. introduce a value based method capable of description within the tender documents which meets all the requirements of probity. A panel of stakeholders will construct the paired comparison and blank scoring matrix at the time of preparing the brief. Last but not least, “A functional based multi-criteria decision framework for contractor selection” written by Jacky et al. describes a functional based multi-criteria decision framework which demonstrates the principle and technique of applying VM to contractor selection and thus, helps users develop criteria and procedures for their own projects. I hope you will enjoy reading these papers

Jacky Chung

Editor, The Value Manager

MESSAGE FROM THE PRESIDENT

Geoffrey Q.P. Shen
President of HKIVM

I am very pleased to inform you that built on the success of our previous eight international conferences, our 9th International VM Conference "Achieving Sustainable Values through Collaboration" will be held in InterContinental Grand Stanford Hotel on 30-31 October 2008. This is an event jointly organized with the Department of Building and Real Estate of the Hong Kong Polytechnic University.

Linked to this conference, is an international symposium for speakers and participants from primarily the Greater China region including Hong Kong, China Mainland, Macau, and Taiwan to exchange views and appreciate the practices and advancement in different parts of the region.

The organizing committee of the Conference and Symposium are working very hard in arranging the call for papers, logistics, sponsorship, and promotion etc.. Please give as much support as you possibly can to ensure the success of these two very important events organized by the Institute.

Thank you very much for your support!

Best regards,

Geoffrey Shen

President, HKIVM

VALUE MANAGEMENT IN THE ARCHITECTURAL SERVICES DEPARTMENT IN HONG KONG

A.R. Wilson
Former Chief Architect, Architectural Services Department, HKSAR

THE GOVERNMENT OF THE HKSAR

The Government of the HKSAR is headed by a Chief Executive who is reported to by a ministerial system. Below the ministers are various bureaux and departments. Under the Environment Transport and Works Bureau are a series of works departments including Civil Engineering, Drainage, Water Supplies and the Architectural Services Department (ArchSD).

THE ARCHITECTURAL SERVICES DEPARTMENT (ARCHSD)

The major roles of ArchSD are:-

- As the professional advisor to the Government for all public buildings except Public Housing.
- To manage and monitor the in-house or outsourced design, and the procurement of new facilities.
- To maintain the up keep of government facilities.

In addition, ArchSD seeks value for money, promotes best practice in the Construction Industry and is a leader in sustainable building design matters. ArchSD's web page is http://www.archsd.gov.hk.

In 2005 ArchSD completed 67 projects with a total value of around $6.4 billion HK dollars. Currently we have 264 capital major projects and 237 minor projects under planning and construction, with a total value of about $76 billion HK dollars.

ArchSD has around 1770 staff consisting of professionals, technical officers, administrative and staff site supervisory staff. The professionals include multi-disciplinary project managers, architects, landscape architects, engineers, building services engineers and quantity surveyors. Many are individuals with various other specialist training, e.g. V.M. Life Cycle Costing etc.

ArchSD serves Government clients and Policy Secretaries. ArchSD has a wide range of expertise including assisting clients in Public and Private Partnership Projects (PPP's). Other key areas are tourism enhancement projects, recreation facilities, parks and open spaces, international exhibitions, education facilities, heritage and conservation projects, etc. One typical client example is the Secretary for Security who is responsible for prisons, border crossings, customs and immigration facilities, the Hong Kong police, fire and ambulance services etc. Each of these departments has their own groups of users.

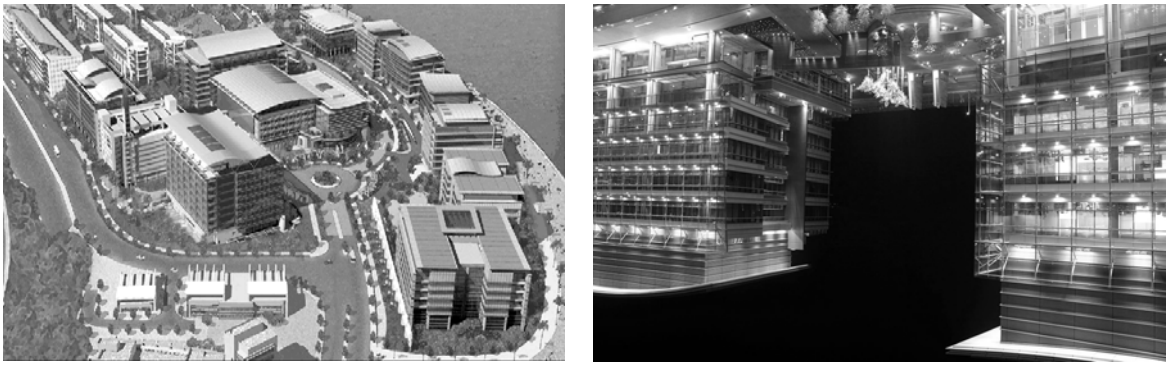

Figure 1: The Hong Kong Science Park

Figure 2: Stanley Waterfront Improvement

Figure 3: Tsim Sha Tsui Beautification

Figure 4: Kowloon Park

VALUE MANAGEMENT IN HONG KONG

Although not the first to use Value Management (VM) in Hong Kong, ArchSD was the leader to push VM into Government and the public use of the construction industry. Recognizing the potential of VM, ArchSD Assistant Director Mr. Tony Toy, introduced VM to the heads of all Government Departments in 1994. He founded the Hong Kong Institute of Value Management (HKIVM) in 1995 and became its first President. He also arranged to have several ArchSD staff properly trained and qualified in VM to recognize how to achieve better results and obtain better value for money in the future.

Commencing in 1998, ArchSD assisted the Environment Transport and Works Bureau (ETWB), establish the current Technical Circular 35/2002 on the use of VM within the Works Departments. For details please refer to ETWB web page http://www.etwb.gov.hk. The HKIVM monitors and maintains lists of qualified VM facilitators for the ETWB works departments to use. The HKIVM web page is http://www.hkivm.org.

VM is now professionally practised in the public and private sectors of the construction Industry in Hong Kong.

TIMING OF VM STUDIES

Value can be added throughout the project procurement process with a series of VM studies at the right times. A new VM study is especially important when there has been a major change in circumstances or scope. One VM study at the right time is usually more productive than several weeks of meetings and follow ups. The most appropriate time to hold a VM is at the very beginning when the idea is first raised because it can ensure that the plan can develop in the right direction, changes are minimal, major risks identified and resources are not wasted.

PROJECT CLARIFICATION

At the start of a project, ArchSD project managers consider the following points: Is the scope clearly defined? Are there questions on the Client Brief and Schedule of Accommodation? Does the project have multi-users? Is there enough information and are the risks positioned with enough certainty to prepare a Technical Feasibility Study to seek initial approval and funding.

CRITICAL SUCCESS FACTORS

There are five critical success factors that must be carefully managed:

- The Client/owner must give full support to the study.
- The organization of VM process must be understood and properly managed with clear objectives set.
- A properly qualified VM facilitator must be appointed.
- The correct key stakeholders must attend and contribute positively.
- The five phase VM job plan must be followed.

There are other lesser factors that can contribute to better success which should be discussed with the qualified VM facilitator.

Figure 5: Penny's Bay Fire Station

SYSTEMS THINKING

It is important to recognize that looking for value should consider the whole system. In the construction industry, a project should be considered achieving a wider purpose. For example, a new clinic building is part of group clinics, which contribute to the general health care system, therefore this contribution as a functional asset in the whole system must be understood to determine the scope of the clinic. Changes in one part of a system can impact on other parts considerably.

Sometimes the individual parts of the system if all working to their maximum may not achieve the required objective for the product. For example, the target to create maximum safety in a car may result in a heavier vehicle which will probably require the use of more fuel. The compromise or balance to achieve safeness and fuel consumption for the best total end result is most important. Careful consideration of the VM objectives and a full understanding of the required functions are very necessary.

USE AND ESTEEM FUNCTIONS

It is very important to position use functions against any required esteem functions. Use functions are normally fairly easily identified. Esteem functions relate to appearance, image, etc. and often are less defined but have considerable cost and other implications. If identified early in the process, esteem functions can be properly discussed and positioned in the design.

VM STUDY EXAMPLES

ArchSD has completed 30 major studies, the first commencing in 1994. VM facilitators used have been from all around the world with very impressive results.

Figure 6: The Wetland Park

Costs have definitely been saved in ArchSD projects but these are not always easily measurable especially in VM studies carried out at project inception. It is preferred to concentrate on clarifications, adding value, minimizing risks and resolving problems in early studies. Later as the design develops, the larger cost items can be identified and explored in more detail.

Study 1

Wetland Park, conceptual stage, strategic VM. Project estimate $430 million H.K.

The objective for this workshop was very broad, to agree the project objectives and key functional requirements.

The outcomes were:

- Agreement on key issues, quality and needs for main functional areas.
- A plan in how to mitigate impact and maintain the wetland, the buffer area and the water treatment.
- A plan on how to compliment and expand existing education on the subject.
- The result was :
- Smoother implementation of the project which is now completed and has the exhibition under installation for opening next year.
- The strategic study was essential as it had all the key stakeholders involved to focus on a common approach from the beginning.

Study 2

Sheung Shui, Slaughterhouse Scheme design stage, $1208 million H.K.

The objective of this study was:

- To rate the design proposal which had used the design and build contract procurement method, against the required functions and propose improvements.

The outcome was:

- The design proposals were ratified.

The proposed improvements were:

- Reducing area for liarage (animal collection)
- Reducing some internal building heights.
- Reducing some under building areas.
- Reducing size of water tanks
- Consideration of shared facilities
- The client user/operator relationship and understanding of operations greatly improved.

The result was smoother project implementation and equipment co-ordination with savings of were over $50 million HK.

Figure 7: Sheung Shui Slaughterhouse

Study 3

Mongkok Stadium, Rough Cost Indication $250 million HK. Feasibility study stage.

One of the best measurable VM examples in ArchSD was a study on an old existing soccer stadium which the client wished to considerably upgrade. An outline feasibility report was prepared based on the given information. The rough cost estimate was $250 million Hong Kong. ArchSD thought that this was high for the extra improvements requested.

- The objectives of the two day VM study were:
- To ensure the scope of the project was fully understood and accepted.
- To determine if flexibility for future works can be built in
- To ensure value for money.
- The outcomes at the end of the two day study were:
- an improved schedule of accommodation with clearer functional requirements.
- improvements in site utilization and pitch orientation.

The result the following week however, was more surprising. The client stopped the project! The client considered that for the same money they could have built a new facility on a better site, have more spectator seating and correct soccer pitch orientation. Why waste funding on something that would not meet the objective of "ensure value for money?" The project architect was upset. The senior management were happy because this happened now rather than six months later when all the design work and resources would have been wasted. The story had a happy ending. One month later, the client came back with a revised project brief and the project was reactivated. The final cost was just over $50 million HK, improvements were made in a shorter time, creating almost as many spectator seats as before but saving the Government and taxpayers almost $200 million HK. This 'measurable' result from the timely use of Value Management clearly indicates how successful it can be.

CONCLUSIONS

ArchSD has found most difficulty in implementing early VM studies as clients often use the excuse, "Not ready for it yet". When we have convinced them to have the study, they replied afterwards, "We wish we had done that sooner"!

VM can improve projects by ensuring: Value for money for the whole project, appropriate quality, responsiveness to client's priorities, client involvement and insight in the design process and project, improved communications and understanding.

ArchSD has used VM especially when there is a need to improve communications, resolve conflicts, set targets and objectives, establish priorities, create more options and validate design proposals, etc.

In ArchSD VM studies, we have been able to add value through, cost savings, time savings, options evaluation, expediting decisions, minimizing wastage, forecasting risks, optimizing resources, promoting innovation and breaking deadlocks.

Common VM solutions concentrate on key areas to add value, using staged or phased development, and seeks areas of shared or multi benefits, e.g. solar panels used integrated as roof covering etc.

ArchSD has found that the professional application of VM at the right time, results in greatly improved project outcomes and added value for all those involved for a very small cost outlay.

A VM APPROACH TO THE APPOINTMENT OF CONSULTANTS AND CONTRACTORS ON A VALUE FOR MONEY BASIS

John Kelly and Kirsty Hunter
Glasgow Caledonian University, UK

INTRODUCTION

The research reported in this paper makes reference to the acquisition or procurement regulations of Australia, Hong Kong, United States, and United Kingdom. Within the past decade there has been a move by public sector organisations towards the procurement of public works on a design build basis. The design build is either procured as a capital purchase or, as a public-private partnership. In the latter the private sector partner tenders a unitary charge and remains responsible for the building for a number of years. Additionally, public sector organisations have, concurrently, increasingly moved towards best value procurement in which the successful tender is judged on a number of factors in addition to price.

These changes bring new and unique challenges to the probity of public sector procurement. The first challenge is to define the design build procurement process so that judgment can be made on factors other than price. The second challenge is to define the design build procurement process such that the methodology employed in the selection of the contractor and consultants is transparent and capable of audit. This paper introduces such a methodology based upon a value management approach.

BEST VALUE

The following four procurement guidance documents have been analysed in this research and the definition of best value stated:

- Australia – Commonwealth Procurement Guidelines (Jan 2005) – "Value for money is the core principle underpinning the Australian government procurement. In a procurement process this principle requires a comparative analysis of all relevant costs and benefits of each proposal throughout a whole procurement cycle (Whole of Life Costing)".
- Hong Kong Treasury Branch guide to public procurement – "To achieve the best value for money, we take into account in our tender evaluation not only the competitiveness in price, but also compliance with users' requirements, reliability of performance, qualitative superiority, whole-life costs and after-sale support, where applicable."
- USA - Federal Acquisition Regulation (FAR Mar 2005) – "Best value means the expected outcome of an acquisition that in the Government's estimation provides the greatest overall benefit in response to the requirements".
- UK - The Scottish Procurement Directorate's Policy Manual – "The prime objective of the Scottish Executive's procurement policy is to achieve value for money - the optimum combination of whole life cost and quality to meet the customer's requirements".

The above guidance documents are consistent in the definition of best value/value for money and are similar in highlighting those factors to be considered in their judgment. These factors include:

- Past performance / performance history of the supplier
- Special features of the supplier or service required for effective programme performance
- Trade-in considerations
- Probable life of the items selected as compared to that of a comparable item
- Warranty considerations
- Maintenance availability
- Environmental and energy efficiency considerations

- Delivery terms
- Understanding of scope by supplier
- Supply chain management
- Performance measurement
- Health and safety
- Fraud prevention
- Understanding of culture
- The relative risk of each proposal
- Flexibility to adapt and possible change over the life cycle of the property or service
- Financial considerations including benefits and costs over the whole procurement cycle
- Quality of the finished building
- Particular ability, skills and strengths.

The Scottish Executive Client pack: construction works procurement guidance Section 2 - value for money, summarises the factors to be considered as standard of service provided; including factors such first design, aesthetic, appropriateness, sensitivity to surroundings, ease of maintenance, adaptation to future requirements, impact on the wider environment.

The research questions which arise from this brief summary are as follows:

- Are there a discrete number of factors which can be identified which can be commonly used in an auditable manner to judge value for money tenders?
- Can a value based method be evolved which is transparent, capable of being described in the tender documents and used in the judgement of tenders?
- Is value management fundamental to the method?

A METHOD FOR CLASSIFYING SELECTION CRITERIA

The above factors are cited in various international government publications as those on which value for money will be determined. In order to answer the research questions it is necessary to build a framework or methodology to manage value for money. A logical approach to managing value for money is Value Management (VM). Clearly the procurement method is a valid topic for discussion at a project briefing value management study and the criteria for judging a value for money tender could be determined at that time. However, the question is whether there are a discrete number of factors for judging value for money tenders.

Value is commonly cited as being a relationship between cost and function (O'Brien:1976 p16, Crum: 1971 p14, EUR 14394:1993, ICE: 1996 p3, Hayden and Parsloe: 1996 p5, RJ Park: 1999 p96). Adam (1993 p176) defines value as the lowest cost to reliably perform a function where the definition of function is that which the product process or system delivers to make it work and sell, the definition of basic function is the specific reason why the device was designed and made. Norton and McElligott (1995 p13) define value as a relationship between cost, time and function. They state that in a value management study the objective is to improve value through the balancing of cost, time and function which can be achieved in three ways:

- to provide for all the required project functions but at a reduced cost
- to provide additional desirable project functions without adding to the cost
- to provide additional desirable project functions while at same time reducing costs

Other authors introduce the relationship between value, quality and cost for example, Burt (1975) states that maximum value is obtained from a required level of quality at least cost, the highest level of quality for a given cost or from an optimum compromise between the two. Best & De Valence (1999 p14) state that value is a relationship between time, cost and quality, and illustrate the time, cost, quality triangle, a technique commonly used in project management and illustrated on numerous commercial websites. Although accredited to Dr Martin Barnes academic debate is thin and citations are dominated by Atkinson (1999).

The relationship between quality and function is best illustrated by reference to Juran and Gryna (1988) who defined quality as the totality of features and characteristics (functions) of a

product or service that bear on its ability to satisfy stated needs or implied needs. The definition of value as being a relationship between time, cost and quality is helpful in the search for characteristic factors of value for money.

Bicheno (2000: p170) describes the Kano model developed by the Japanese quality guru Dr Noriaki Kano who states that maximum quality is attained when targeted characteristics are achieved and the customer is delighted. There are three variables within the model. These are 'basic factors', 'performance factors' and 'delighters', which have a relationship to the presence of quality characteristics and customer satisfaction. These variables are included in the Kano model, illustrated in figure 1.

In the Kano model a basic characteristic is expected to be present, the customer will be dissatisfied if it is absent and only neutral if the characteristic is completely fulfilled. The performance characteristic relates to the essential function. The customer will be more satisfied if higher levels of performance are achieved. The delighter is a performance characteristic, not specified by the customer but desired by the customer once its benefits have been revealed. There is however a time dimension to the model such that the three variables will tend to sink over time, i.e. what once delighted is now expected and higher levels of performance are always sought. For example, power steering on small cars as a standard feature once delighted customers but now power steering is expected as a basic characteristic and its absence would lead to dissatisfaction.

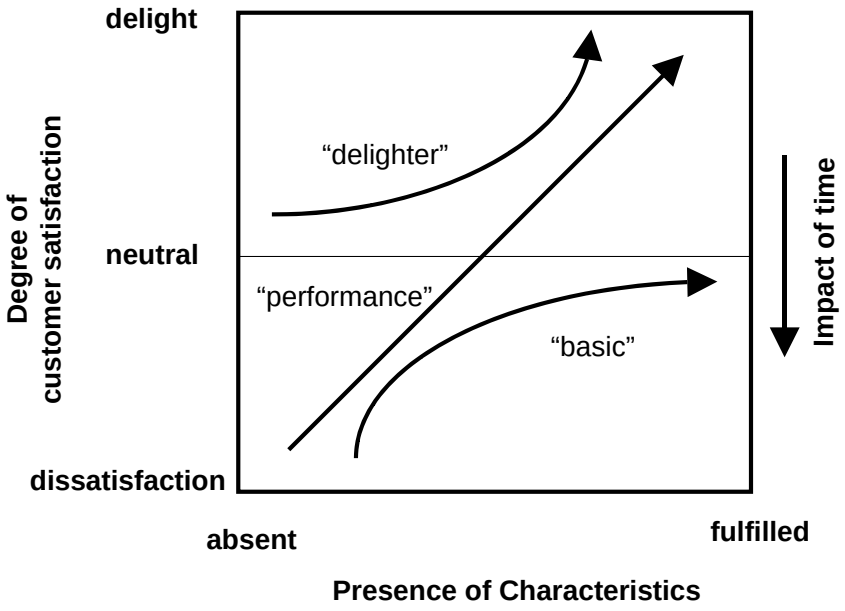

Figure 1 The Kano model (adapted from Bicheno: 2000)

The relationship between time, cost and quality and definition of quality in terms of basic and performance criteria is useful in the analysis of factors to be considered in the judgement of value for money tenders.

An analysis of the factors listed above based upon Kano results in their classification into 4 types:

- Basic characteristics. Either the tenderer meets the required level of performance or not. This applies to such factors as health and safety and fraud prevention. Basic factors, which relate to the company as opposed to the proposed design, should be determined through the pre-qualification questionnaire such that those tendering will all meet the

requirements. Alternatively, an acceptable level should be specified such that a tenderer with an unacceptable performance will not be considered. For example, any company having a company director with a fraud conviction should not apply.

- Measurable performance characteristics. These characteristics are those such as energy consumption, hard facilities management costs, soft facilities management costs, capital cost and time. These are valid characteristics of a tender appraisal process. In a design build lump sum tender the tenderer should be required to submit an estimate of all these costs to be used in judging the tender whether or not there is a contractual compliance requirement i.e. a proving of energy and FM costs over say the first five years of operation.
- Non – measurable performance characteristics. These characteristics are those such as aesthetics, contribution to community, popularity with stakeholders, etc. These are valid characteristics of a tender appraisal process.
- Risk. Risk is commonly defined as being a hazard, the chance of a bad consequence or loss, or the exposure to miss chance. Risk management maximises the certainty of the functional value of a project. Risk is a solution focused factor of value and is a valid criterion when viewed from the perspective of the client. However, although it could be a discrete discretionary factor in the choice of a design it is better incorporated into the scoring system as risk is an overlay on basic and performance characteristics. The client should only consider those risks incorporated into the design which affect operability; construction risks will be incorporated into the tender by the tenderer.

The 4 types give a useful classification system when determining those factors for judging value for money tenders.

A METHOD FOR IDENTIFYING SELECTION CRITERIA

During a value management workshop at the project briefing stage, at which all client stakeholders are present, the subject of procurement should be discussed and a method of procurement selected. The criteria for judging best value/value for money tenders will depend on whether the tender is to be based upon a full design by the client (or client's consultants) or whether the tender will contain elements of design by the tenderer. The primary difference in the criteria will be the relevant performance characteristics and risk. In the situation where a tender is submitted based upon the client's design the only performance characteristics relevant are capital cost and time. The risk to the client should be the same for each tenderer. The basic characteristics should be defined as a prescribed requirement and the information on this gleaned through a pre-qualification questionnaire. In this way all tenderers will meet the basic criteria.

For those tenders which contain elements of design by the tenderer a new technique is required to elicit the measurable and non-measurable performance variables. The following technique has been evolved and tested within two training workshops. It is considered that the technique is ready to go live. The stages of the new technique are described with reference to a design build project for a new primary school. The method assumes that that Value Management briefing workshop is held with the head and deputy head designate for the new school together with the local councillor and representatives from; the local authority education department, the local authority facilities management department and the local community council.

Stage 1 – Brainstorming and classifying relevant criteria

As a part of the workshop the team should brainstorm those factors considered relevant in judging tenders. The factors should then be categorised in terms of the 4 types described above. An example of the brainstorming and categorisation exercise is given in figure 2.

CRITERIA	CLASSIFICATION	CRITERIA	CLASSIFICATION
CAPITAL COST	**MEAS PERF**	**HEALTH & SAFETY**	**BASIC**
PAST PERFORMANCE	**BASIC**	**TIME**	**MEAS PERF**
ENVIRONMENTAL IMPACT (GREEN)	**MEAS PERF**	**AESTHETICS**	**NON-MEAS PERF**
		CULTURE	**NON-MEAS PERF**
COMMUNITY USE	**NON-MEAS PERF**	**ESTEEM**	**NON-MEAS PERF**
FRAUD PREVENTION	**BASIC**	**COMFORT (STAFF & PUPILS)**	**NON-MEAS PERF**
FLEXIBILITY (UPGRADEABLE)	**NON-MEAS PERF**	**LIGHT AND AIRY**	**NON-MEAS PERF**
SOFT FM COST	**MEAS PERF**	**COMMERCIALLY SOUND**	**BASIC**
HARD FM COST	**MEAS PERF**	**PAST PERFORMANCE**	**BASIC**
EARNING POTENTIAL (RENTED FACILITIES)	**MEAS PERF**	**SCOPE CREEP/CLAIMS**	**BASIC**
		ATTITUDE TO PARTNERING	

Figure 2 – Stage 1 brainstorming and classifying relevant criteria

In Figure 2 the basic criteria relates more to the company and not to the designed solution. These issues should be discovered as a part of the pre-qualification questionnaire and the companies selected to tender for the project will therefore be acceptable on these counts. The measurable and non-measurable performance criteria relate to the building and should be judged on a weighted scale. The risks associated with the company should be dealt with through the basic criteria. Risks associated with the design should be assessed as a part of the evaluation.

Kelly et al (2004: p212) describe the basic criteria for a value system as capital cost, operations cost, time, community, environmental impact, exchange (earning potential) flexibility, esteem, and comfort. From the above brainstorming session it can be seen that all of the measurable and non-measurable performance criteria fit within the basic criteria, for example soft and hard FM costs are operational costs and aesthetics and culture could be considered parts of esteem.

Stage 2 – Determining the weights to factors

To determine the weights given to the various factors a paired comparison matrix exercise is undertaken. An example for the primary school is given in figure 3.

A. Through Life Cost - OPEX

A							B. Time
A	C						C. Esteem / Aesthetic
A	D	C					D. Environment
A	E	C	D				E. Exchange
A	B	F	F	F			F. Politics / Community
G	G	G	G	G	G		G. Flexibility
A	H	H	H	H	H	H	H. Comfort

A	B	C	D	E	F	G	H	
6	1	3	2	1	3	6	6	Total

Figure 3 – Paired comparison to obtain factor weights

From the matrix it should be noted that capital cost is excluded since all other factors will be judged in the context of capital cost. The matrix is designed to be included with descriptive text in the tender documents together with a statement of the proportions used for capital cost and other factors. In this example the judgement is made on the basis of 70% capital cost and 30% other factors.

Stage 3 – Judging the tenders

Once the tenders are received a panel, ideally including representatives from the value management workshop will convene to judge the tenders in accordance with the pre-determined weightings. The scoring is on the basis of multiplying the score against each factor by its weighting as shown in figure 4. The indicative scoring is inclusive of risk therefore an exciting and innovative design with acceptable risk will score 2. A good solution which is risk free will also score 2. For example tenderer A in figure 4 viewed from the context of operating cost has an innovative solution with little risk, however, the team were not impressed by the aesthetic which they scored as acceptable.

5 exciting/innovative / risk free
4 exciting/innovative / little risk
3 excellent design solution / some risk
2 good solution / acceptable risk
1 acceptable / risky
0 unacceptable / high risk

	Through Life Cost - OPEX	Time	Esteem / aesthetic	Environment	Exchange	Politics /community	Flexibility	Comfort	Total
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	
	6	**1**	**3**	**2**	**1**	**3**	**6**	**6**	
Tenderer A	4 / 24	2 / 2	1 / 3	4 / 8	4 / 4	3 / 9	1 / 6	3 / 18	74
Tenderer B	5 / 30	5 / 5	5 / 15	4 / 8	4 / 4	4 / 12	5 / 30	5 / 30	134
Tenderer C	2 / 12	1 / 1	2 / 6	1 / 2	1 / 1	2 / 6	1 / 6	3 / 18	52
Tenderer D	4 / 24	2 / 2	2 / 6	5 / 10	2 / 2	3 / 9	4 / 24	4 / 24	101
Full score	5 / 30	5 / 5	5 / 15	5 / 10	5 / 5	5 / 15	5 / 30	5 / 30	140

Figure 4 – Matrix showing weighting and scoring

The total score for each tenderer is used in a notional discounting exercise described by CIRIA (1998) to determine the best value for money. The discounting is illustrated as follows:

The notional discount is calculated by the total for each tenderer as a proportion of the full score (in this case 140) multiplied by the percentage importance given to other factors (in this case 30%). The notional discounts are therefore for each tenderer:

Tenderer A 74 ÷ 140 x 30% = 15.86% notional discount

Tenderer B 134 ÷ 140 x 30% = 28.71% notional discount

Tenderer C 52 ÷ 140 x 30% = 11.14% notional discount

Tenderer D 101 ÷ 140 x 30% = 21.64% notional discount

The tenders received are adjusted to take account of the notional discount to give their relative position in value for money terms:

Tenderer A £2,130,000 less 15.86% notional discount = £1,792,182

Tenderer B £2,365,000 less 28.71% notional discount = £1,686,009

Tenderer C £1,950,000 less 11.14% notional discount = £1,732,770

Tenderer D £2,225,000 less 21.64% notional discount = £1,743,510

Therefore, based upon the notional tenders, Tenderer B, the highest tenderer should be awarded the contract as the full solution offered gives the best value for money as proved through the value for money process.

CONCLUSION

The research described set out with three questions:

- Are there a discrete number of factors which can be identified which can be commonly used in an auditable manner to judge value for money tenders?
- Can a value based method be evolved which is transparent, capable of being described in the tender documents and used in the judgement of tenders?
- Is value management fundamental to the method?

The research undertaken has proved that there are four factors which may be used in the judgement of value for money tenders for design build namely, basic factors, measurable performance factors, non-measurable performance factors and risks. The basic factors are those which relate primarily to the company as opposed to the proposed design and should be determined through the pre-qualification questionnaire such that those tendering will all meet the requirements. The measurable and non-measurable performance factors will need to be determined for each tender but are likely to be highly correlated with capital cost, operations cost, time, community, environmental impact, exchange (earning potential) flexibility, esteem, and comfort. The risks involved with the technical solution offered by the tenderers are taken into account in the weighting and scoring matrix exercise as shown in figure 4.

The research demonstrates a value based method capable of description within the tender documents which meets all the requirements of probity. A panel of stakeholders will construct the paired comparison and blank scoring matrix at the time of preparing the brief. A value management workshop is not fundamental to the method but preparing the necessary pre-tender documents through a value management workshop and using a panel of members from the workshop to judge tenders reinforces the probity and increases the certainty that judgements are fair. The overriding conclusion is that the process accords with the requirements of the procurement and acquisition regulations reviewed.

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A FUNCTIONAL BASED MULTI-CRITERIA DECISION FRAMEWORK FOR CONTRACTOR SELECTION

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CONTRACTOR SELECTION IN HONG KONG

Importance of contractor selection

The contractor selection process is described as an investigation of contractors' potential to deliver a service of acceptable standard, on time, and within budget (Topcu, 2004). In short, it is just like a matching exercise between buyers and sellers, i.e. construction clients and construction contractors. Construction clients, like customers everywhere, want to achieve the best possible value for their money in construction projects. However, buildings are unlike consumer goods that can be evaluated in terms of quality, price and suitability before purchase and thus, their quality is heavily relied on the capability and performance of contractors. Fong and Choi (2000) believed that selecting a suitable contractor is one of the most critical factors to achieve successful project outcomes. There are many types of contractor selection procedures including open tendering, selective/ restricted tendering, prequalification, or negotiation (Palaneeswaran and Kumaraswamy, 2001 and Topcu, 2004) and the common selecting procedures are presented in the following figure.

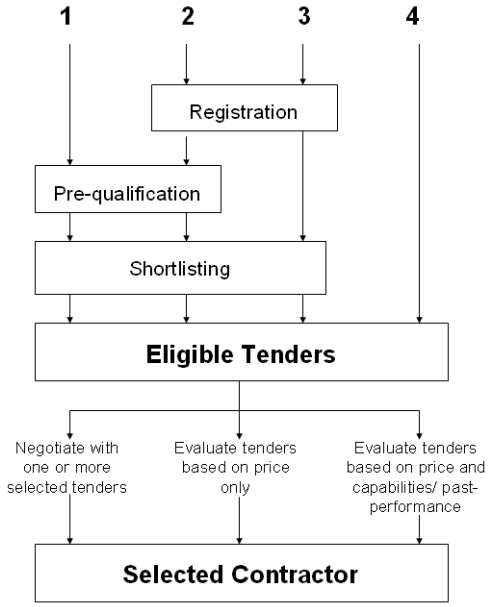

Figure 1: Alternative routes to contractor selection (Kumaraswamy, 1996)

Common practice in Hong Kong

Hong Kong's construction industry is mainly comprised of a strong private sector clienteles, as well as significant Government departments under the Environment, Transport and Works Bureau and quasi-Government organisations such as Mass Transit Railway Corporation (MTRC) and Hong Kong Housing Authority (HKHA) etc. (Kumaraswamy, 1996). To manage contractor selection process, many experienced clients have already established their own systems to examine the qualifications and performance of contractors. Two typical examples are given below:

- The Environment, Transport and Works Bureau maintains lists of approved contractors which are complied according to their relevant expertise, financial status, technical and managerial capabilities as well as their performance of completing past projects (Environment, Transport and Works Bureau, 1997)

- Hong Kong Housing Authority has established a comprehensive Performance Assessment Scoring System (PASS) to review the registered contractors' performance levels of their contracting works in the ongoing projects since 1990 (HKHA, 1994).

Nevertheless, it is observed that contractor selection processes could be informal and unsystematic in the private sector. Kumaraswamy (1996) explained that private clients might only draw up a short-list of prospective tenderers based on their own experience because they do not need to conform to rigid rules. Moreover, the data involved in the selection could be subjective and imprecise (Fong and Choi, 2000).

Problems and limitations of contractor selection

The selection process should identify a contractor to whom the client can confidently entrust the responsibility of executing the project satisfactorily. Unfortunately this is not always possible because the majority of current selection methods generally over-emphasise acceptance of the lowest bid price (Fong and Choi, 2000). As a result, selection of contractors is generally based on the principle of acceptance of the lowest bid price (Nguyen, 1985; Russell and Skibniewski, 1988; Kumaraswamy, 1996, Fong and Choi, 2000, Topcu, 2004). For example, the public Sector clients in Hong Kong are most often constrained to select the lowest bidder (Kumaraswamy, 1996). However, the intensity of price competition between contractors has been blamed for many industry ills (Kumaraswamy et al., 2000) and a significant amount of research has proved that this is one of the major causes of project delivery problems (Holt et al., 1994; Hatush and Skitmore, 1998; Kumaraswamy, 1996; Fong and Choi, 2000, and Topcu, 2004). Latham (1994) recommended that the selection of contractors should be made on a value for money basis, with proper weighting of criteria for skill, experience and previous performance, rather than automatically accepting the lowest bid price in all cases. Fong and Choi (2000) agreed with this and pointed out that there should be a trade-off between time, cost and quality and none of them should not be under or overweighed.

Tools and techniques applied to contractor selection

Literature review showed that a large number of tools and techniques had been successfully applied to contractor selection. A summary of previous research works in contractor selection is given in Table 1.

Table 1: A summary of tools applied to constructor selection

	Tools	Introduced by
1	Capability evaluation	Rugg., 1993
2	Multi-attribute analysis	Holt et al., 1995
3	PERT approach	Hatush and Skitmore, 1997
4	Needs-based approach	Chinyio et al., 1998
5	Partnering approach	Kumaraswamy and Matthews, 2000
6	Fuzzy neural network approach	Lam et al., 2001
7	Evidential reasoning approach	Sonmez et al., 2001
8	Performance modeling approach	Alarco´n and Mourgues, 2002
9	Multi-criteria approach	Mahdi et al., 2002
10	Analytic network process approach	Cheng and Li, 2004

This paper aims to demonstrate the principle and method of introducing Value Management (VM) to contractor selection which has not been explored according to the Table 1 with a view to improving the process. A value framework which integrated (i) function analysis of VM methodology with (ii) Functional Performance Specification (FPS) is recommended, through which the identification, clarification, representation, and assessment of client requirements (selection criteria) for contractor selection can be facilitated. Function analysis, which is an essential tool in VM, is based on the intuitive logic of testing function relationships and graphically displaying them in a diagram form. It enables functions to be displayed in a logical sequence and their dependency tested rigorously (SAVE, 1998). FPS is an additional technique applied to VM methodology. It requires each function to determine all the criteria by which it will be measured, the expected level of satisfaction and then, for each criteria level, the corresponding flexibility allowed (EUR 16096 EN, 1995 and Masson, 2001).

THE VALUE FRAMEWORK FOR CONTRACTOR SELECTION

Introduction to the framework

The proposed value framework introduces a new contractor selection method that provides a more comprehensive evaluation of a contractor's all-round performance. The framework involves a two-stage selection process and details are summarised in Figure 2.

The first stage, prequalification, aims to identify those potential contractors who are eligible for further consideration so as to minimise the amount of abortive tendering work. As suggested by Kumaraswamy (2001), prequalification can ensure that the selected contractors are sufficiently responsive, responsible and competent to undertake the contract and deliver optimal results, meeting client requirements with minimal failures. The second stage, final selection, is undertaken in form of a 1-day VM workshop. It aims to establish a client value system to capture, organise and present the client requirements (selection criteria) in form of a set of functional objectives. Finally, recommendations will be submitted to tender review committee for consideration. The committee would clarify the queries raised by the VM study team and to make negotiation with the contractors during tender interview meetings. In addition, there is an option of requesting the contractors to submit the revised tenders based on the comments and suggestions from tender interviews before making the final decision.

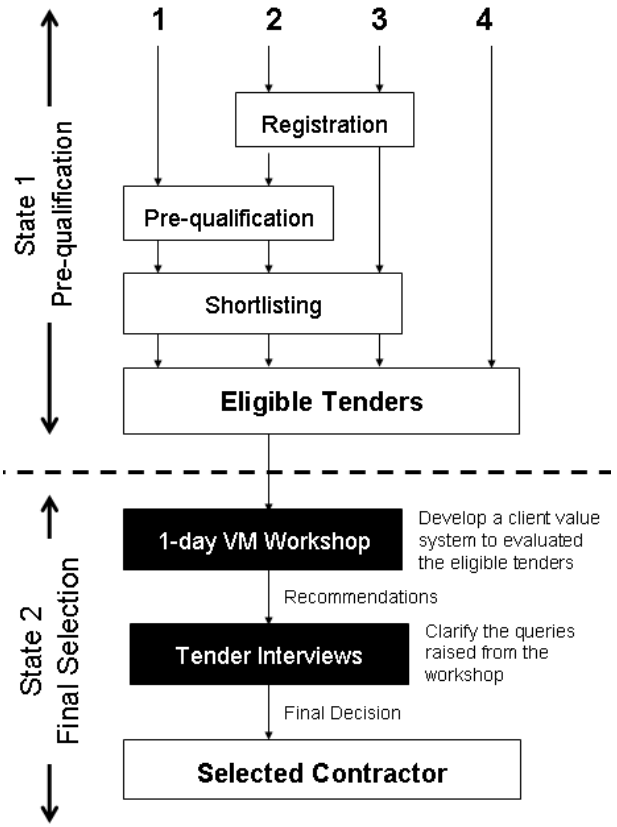

Figure 2: 2-stage contractor selection by the value framework

Job plan of the framework

In stage 2, the framework has four phases, namely preparation phase, information phase, analysis phase and evaluation phase. Referring to Figure 2, the first two tasks are common in VM studies and relatively straightforward. The remaining two tasks need some further explanation.

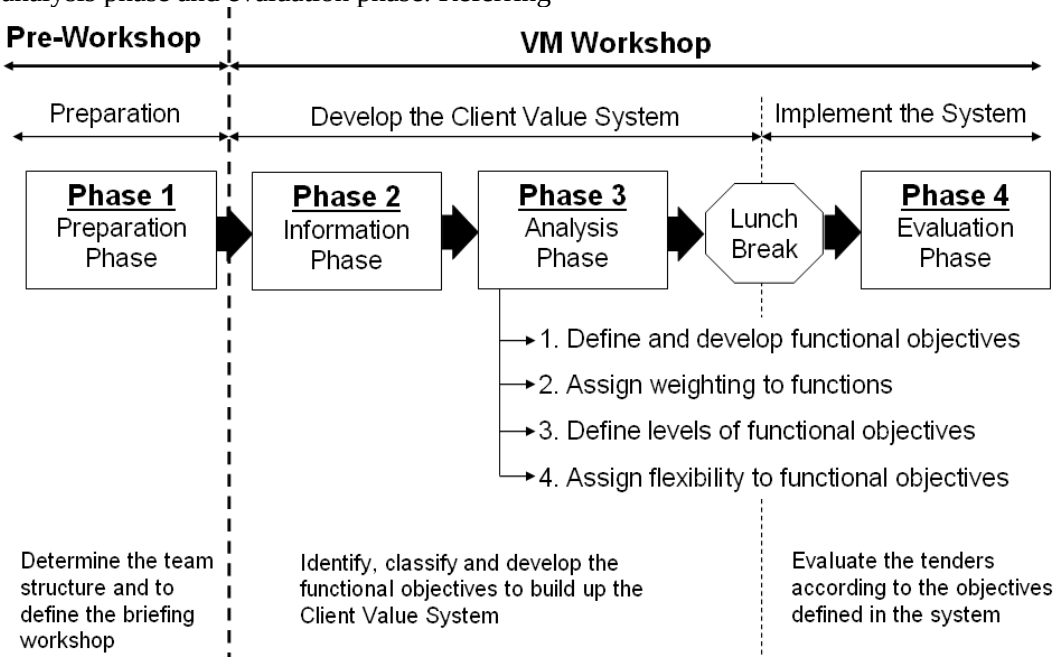

Figure 3: Job plan of the value framework

(1) Preparation phase

The main objective of the preparation phase is to define the scope and objectives of the workshop. Facilitators assist clients to define the scope and objectives of the workshop. They select and invite the key stakeholder to join the workshop. A typical team should include project managers, client representatives, architects, surveyors, engineers and facilitators. Finally, they draw up a list of necessary information and ensure that sufficient information is available for the workshop.

(2) Information phase

The main objective of the information phase is to get all members of the team to fully understand the background, constraints and limitations of the project. Key tasks include an introductory presentation given by the facilitator; a presentation of project requirements given by the client representative and a short discussion of project concerns and constraints by other stakeholders.

(3) Analysis phase

The main objective of the analysis phase is to develop the client value system of selecting contractor and there are four steps in total. In reference to the commonly selection criteria in Hong Kong (Fong and Choi, 2000), an example of the functional objective hierarchy is presented in Figure 4.

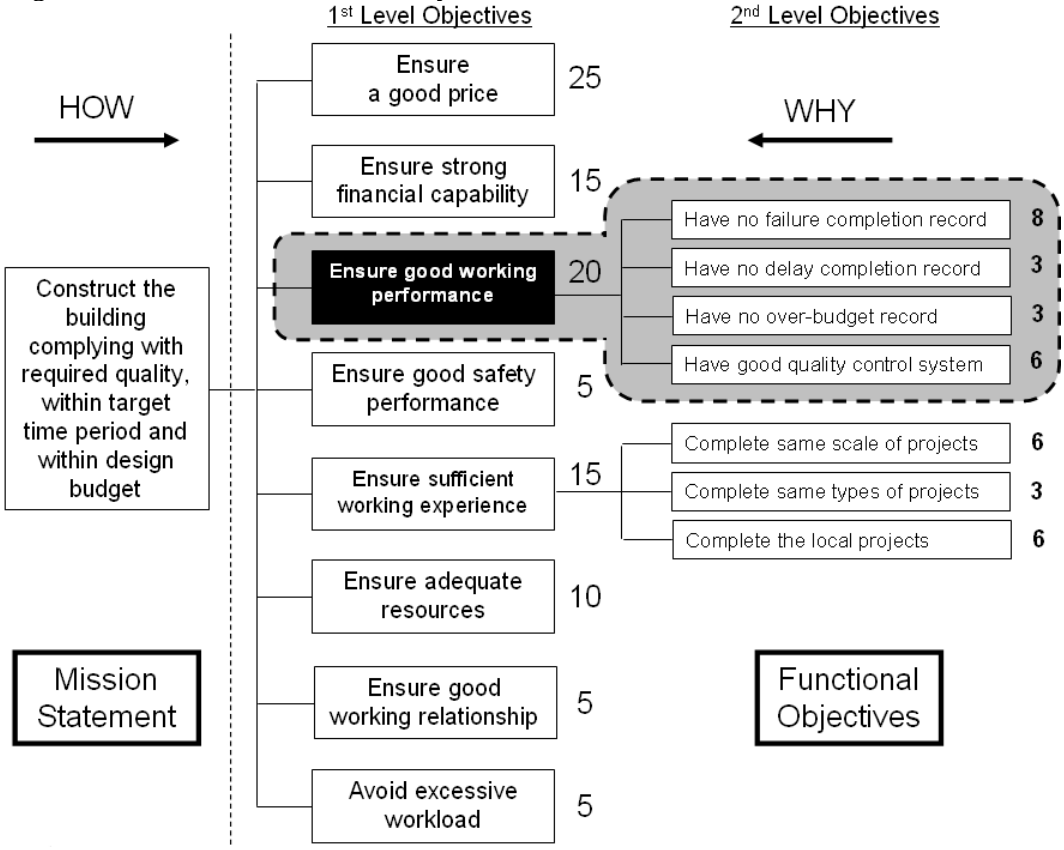

Figure 4: An example of the hierarchy of the functional objectives

Step 1: Define and develop functional objectives

A mission statement which concisely indicates the fundamental reasons for a client to hire a contractor is established on the first stage. To realize the statement, a list of functional objectives will be developed and linked together by using the "why-how" logic.

Step 2: Assign weighting to functions

Assigning weighting is to determine the relative importance among functions. One approach is to distribute 100 points among level-1 functions, further spread the points assigned to a level-1 function among its corresponding level-2 functions, and so on. This allows comparison of functions at the same level. Showing the importance of functional objectives not only helps clients to understanding their

requirements and needs more thoroughly, but also provides useful information to the design team members who will participate in contractor selection process. An example of the relative importance of functional objectives is illustrated in Figure 3.

Step 3: Define levels of functional objectives

This is to define the levels of quality to be reached by contractors in order to satisfy the minimum standards of functional objectives. For example, implementing ISO9001: 2000 or equivalent control system for at least 3 years is considered as an acceptable level for the criterion of 'having a good quality control system'.

Step 4: Assign flexibility to functional objectives

This is to assign flexibility to each criterion to indicate its negotiability. A four-scale assessment system (F0 to F3) is adopted and some examples are demonstrated in Table 2.

Table 2: Specification for the objective of "ensure good working performance"

	Functional Objectives	Levels	Flexibility
Ensure working performance	Have no failure completion record (8)	The contractor should have no failure completion record within 10 years (8)	F0
	Have no delayed completion record (3)	The contractor should have no late completion record (more than 3 months) within 2 years (3)	F2
	Have no over-budget record (3)	The contractor should have no over-budget record within 3 years (3)	F2
	Have a good quality control system (6)	The contractor should implement ISO9001:2000 or equivalent control system at least 3 years (5)	F1
		The contractor should received quality awards (1)	F3

Note
F0 The criterion is an absolute must, not negotiable, all effort must be made to meet this level, whatever the cost
F1 The criterion is a must if at all possible, no discussion unless there is a very good reason
F2 The criterion is negotiable, hope this level is reached, ready to discuss
F3 The criterion is very flexible, this level is proposed but is open to any suggestion

(4) Evaluation Phase

The main objective of the evaluation phase is to undertake the assessment of contractor proposals and tenders referring to the client requirements identified and discussed in previous phases. By using the criteria scoring matrix technique, these requirements can be used as criteria to assess whether the contractors can meet the client values. An example of the assessment exercise is demonstrated in Table 3.

Table 3: Assessment of the objective of "ensure good working performance"

Levels	Weighting	Flexibility	Contractor A			Contractor B			Contractor C		
			Performance	Weighted Score	Meet the Flexibility	Performance	Weighted Score	Meet the Flexibility	Performance	Weighted Score	Meet the Flexibility
The contractor should have no failure completion record within 10 years	8	F0	1	8	P	0	0	F	1	8	P
The contractor should have no late completion record (more than 3 months) within 2 years	3	F2	0	0	P	2	6	P	1	3	P
The contractor should have no over-budget record within 3 years	3	F2	1	3	P	2	6	P	2	6	P
The contractor should implement ISO9001: 2000 or equivalent control system at least 3 years	5	F1	1	5	P	2	10	P	1	5	P
The contractor should received quality awards	1	F3	0	0	P	2	2	P	0	0	P
Overall			16		P	24		F	22		P

Note: 0: Unsatisfied, 1: Satisfied, 2: Highly Satisfied (more than requested level)

BENEFITS OF THE FRAMEWORK

This framework is part of the on-going research project and validation of the framework will be undertaken by a group of local construction professionals as well as VM facilitators shortly. Based on some preliminary discussions with the professionals, some potential benefits of the framework are summarised as follows:

User friendly framework

This framework is simple and does not involve complicated mathematical formulations. It is easy to use by the construction professionals. Moreover, the framework provides a step-by-step method of contractor analysis so as to increase the efficiency of contractor selection process. This enables clients the flexibility to add or reduce the functional objective so as to meet different projects easily.

Improve the understanding of selection criteria

All construction projects are unique due to the variety in building design, site condition and environment. Moreover, clients are also unique due to the differences in mission and organisation culture. Consequently, they would have different selection requirements and expectation on contractors. For these reasons, the selection criteria should be specified to project characteristics and client backgrounds. To achieve this, this framework introduces client value system to crystallises the client requirements (selection criteria) by using the logic of Why-How. The functional representation of requirements provides a precise description of the required functionalities and non-functional requirements of the client expectation about the contractor performance with a minimum of constraints. This facilitates the examination and comparison of tenders and thus, helps clients to identify the best option.

Improve the comprehensiveness of contractor evaluation

Disastrous consequences from awarding contracts to the lowest bidders, without due consideration of their competencies, have led to growing awareness of the needs to incorporate non-price parameters into contractor selection methodologies (Kumaraswamy et al., 2000). This framework goes beyond the traditional

minimum cost model and provides a balanced approach to assess the potential of contractor's all-round performance for contractor evaluation. The framework facilitates clients to evaluate contractors systematically with respect to their economic and technological aspects, quality standards, past performances and other tangible and intangible characteristics.

Improve the transparency of selection process

Most public sector and some private sector clients still find it difficult to accept anything other than the lowest bid from tenderers (Kumaraswamy, 1996). One of the reasons is that it is very difficult to justify and explain the rationale of the selection for selecting a contractor other than the lowest bidder. As discussed before, this framework provides a quantitative approach to investigate client requirements in contractor selection systematically. In addition, the 2-stage contractor selection by the value framework allows independent teams to develop client value system and make recommendations before the tender interview. This objective approach help the public clients to prove to the general public that projects are awarded based on the best possible combination of a variety of criteria and thus to hold a greater accountability for their decisions. Besides, the framework adopts teamwork approach to improve communication and increase involvement among clients, designers, surveying and engineering consultancies. This reduces potential conflicts by bringing the expertise of all major stakeholders into the selection process.

LIMITATIONS OF THE FRAMEWORK

The successful implementation of the framework depends largely on the support from clients as additional time and resources are required. Hence, it is highly recommend that the framework should be applied to large-scale projects in order to maximise the benefits gained. In addition, the composition of study teams and the skill of facilitators are also critical in this process.

CONCLUSIONS

This paper describes a functional based multi-criteria decision framework for construction contractor selection in Hong Kong. The framework demonstrates the principle and technique of applying Value Management to contractor selection and thus, helps users develop criteria and procedures for their own projects. It has successfully demonstrated the innovative use of function analysis and FPS in supporting contractor selection. It also improves the understanding of client expectation about contractor performance well as the comprehensiveness and transparency of contractor selection process. The framework has the potential to make major improvement in the process by employing the selection criteria more effectively and efficiently in terms of identification, clarification and representation of. It also helps reduce and resolve conflicts among major stakeholders by bringing them into the process, and by facilitating the assessment of tenders and contractor performance as well. Whilst there are potential benefits in using the proposed framework in the briefing process, further research work is needed to verify the benefits of putting this proposed approach in practice and to make further improvements. Encouraged by the enthusiasm of practitioners in the industry, we are planning to implement and further test the proposed framework in a number of real life projects in the near future.

ACKNOWLEDGEMENTS

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HKIVM NEWS AND EVENTS

- 10 Oct 2007, A public seminar named "**Add value to Ocean Park**" was held r in conjunction with the Department of Building and Real Estate in The Hong Kong Polytechnic University. The speaker, Daniel Altier, the General Construction Manager for Dragages (HK) JV, presented the details of this project and talk through how the problems encountered were overcome. He will explain how Partnering and Value Engineering benefited all parties involved.

- 2 Oct 2007, A public seminar on "**Best Value, Value Management and the Sustainability Agenda**". Professor John R Kelly, who is the Chair of Construction Innovation in the School of the Built and Natural Environment in Glasgow Caledonian University, reported the progress of Best Value within the public sector in the UK, the place of value management and tools and techniques, including a new approach to whole life costing, designed to meet the sustainability agenda in this seminar. The talk was followed by a discussion of the application of value management methodologies in the context of sustainability in Hong Kong.

- 16-19 Nov 2007, **a series of VM workshops and seminars** have been organised in junction with the Department of Building and Construction in City University of Hong Kong to bring the experiences of the VM to local to construction professionals and details are as follows:

Workshop 1 - Key VM phase: Function Analysis, by Dr. Roy Barton
Workshop 2 - Key VM phase: Creativity Analysis, by Ms. Laurie Dennis
Workshop 3 - Key VM phase: Evaluation techniques, by Mr. Ken Scott
Seminar 1 - Successful VM applications in Australia, by Dr. Roy Barton
Seminar 2 - Innovative VM tech. in Complex Projects, by Dr. Steve Kirk
Seminar 3 - Information analysis for Complex Projects, by Dr. Steve Kirk
Seminar 4 - VM Trends in the United State, by Ms. Laurie Dennis
Seminar 5 - Novel VM applications in Europe, by Mr. Ken Scott

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