THE EFFECT OF ECONOMIC SITUATION ON CLIENT'S CHOICE OF PROCUREMENT APPROACH AND THE FUTURE OF CONSTRUCTION MANAGEMENT APPROACH

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Abstract:

Construction Management (CM) procurement approach has been used in the UK construction industry for more than two decades, particularly in complex, multidisciplinary projects. However, the recent uncertainty of the economic conditions had considerable impact on the clients' and funders' choices of procurement approaches. In many recent projects, due to the uncertainty of the economic situation, the CM procurement approach has not been utilised because it is perceived as a high risk procurement approach to clients, particularly in term of costs. Clients have preferred Lump-sum approach to procure their projects because construction costs can be fixed once the project is awarded therefore the inflationary or non-availability costs are no longer of concern to the client. On the other hand, the Specialist Trade Contractors (STCs) can play an important role in design, supply, manufacture and construction however in Lump-sum the involvement of the STCs during the design stages of the project is limited. This can lead to lack of design and construction integration, restriction of build-ability and innovation.

CM procurement approach is considered more flexible than Lump-sum procurement approach as it facilitates the engagement of the STCs and construction managers in design, supply, manufacture, and construction. However, CM approach is believed to be of high risk to the client, especially in terms of cost certainty.

The paper examined the role of the STCs in the UK construction industry and explored the terms of contracts and contractual relationships in order to evaluate the flexibility of Lump-sum and CM in facilitating timely involvement of the STCs. Then it investigated the cost and risk issues in both procurement approaches in order to predict the future of CM approach. This research concluded that it is necessary for CM approach to adapt to the changing markets as well as develop to suite the necessary organisational changes.

Key words: Lump-sum, Construction Management, Procurement, Specialist Trade Contractors, Risk, Cost

INTRODUCTION

Uncertainty of economic conditions and the unpredictable effects on the eventual cost of the project can affect client's choices of procurement approaches (Henchie, 2009). Recently, some complex projects initially planned to use management contracts have been switched to be built under Lump-sum approach. Examples include (Fixed Price Deal, 2007, Shard and Fast, 2010, Park House, 2010 and Multiplex win Bishopsgate, 2007). Clients have selected Lump-sum approach because they trust it to guarantee a firm price for their projects before committing to them (Luu et al., 2007, Hayman, 2012). Under the pressure from ~~of~~ funders and banks, clients wish to transfer all risks to contractors (Rogers, 2007). The Lump-sum contract, thereby limiting financial risks and conveying risks to the contractor is favoured (Morledge, 2007). However, the Lump-sum approach is not flexible enough to involve the early and full participation of STCs who have extensive knowledge of particular design and construction (Mosey, 2009).

Nowadays, STCs may increasingly become involved in not only installation, but also design of the work (AIS, 2011). CM approach recognizes the importance of early involvement of STCs (Mason, 2007, Gray & Hughes, 2001) as their contribution is vital to project success (Cheng, Law, Bjornsson, Jones & Sriram, 2009, Trigunarsyah, 2007, Arditi, & Chotibhongs, 2005, Nobbs, 1993 and Gray, & Flannagan, 1989). However, the CM approach is considered to bring many risks to the client especially in terms of costs. The cost of each package is only known after tender and packages are implemented on site while the scheme is not yet fully designed (Tendering and Estimating, 2008). Besides, the client might encounter more risks because they have to manage work related to project packages (RICS, 2012).

The paper examined the role of the STCs in the UK construction industry and explored the terms of contracts and contractual relationships in order to evaluate the flexibility of Lump-sum and CM in facilitating timely involvement of the STCs. Then it investigated the cost and risk issues in both procurement approaches in order to predict the future of CM approach.

RESEARCH METHODS

The methods used here fall into two types. The first involved analysing the relevant published literature in order to assess the role of the STCs in the UK construction industry as well as the effect of their timely involvement on the success or otherwise of a project. The terms of Lump-sum and CM contracts were studied and a model showing the contractual relationship implications on the flexibility of Lump-sum and CM in facilitating the involvement of the STCs was provided. The cost and risk issues in both procurement approaches were investigated and summarised.

The second was directly consulting experts in the field using an adapted Delphi approach to obtain a broad picture of the current issues regarding construction procurement systems. In order to acquire diverse viewpoints from different angles and ensure the impartiality of the research outcome (Patton, 2008 and Saunders et al. 2007), the panel of experts was selected carefully from a wide range of people and organisations with varied roles and areas of expertise (clients, designers, managers, contractors, quantity surveyors, trade contractors and researchers in the field) and handled large and complex projects such as the Shard of Glass and Bishopsgate. By this method the research was extended and endorsed by soliciting experts' opinions (Patton, 2008 and Saunders et al. 2007) and achieving consensus on goals and objectives rather than providing specific answers and predicting future events (Pive, G. 2008 and Chu and Hwang, 2008) therefore it worked well in this unpredictable area (Manoliadis, et al, 2006). Consulting the expert panel and acquiring their contribution was carried out in two stages. The model established in the first part of the research was sent to the panel by email and their views and feedback were incorporated into a revised model (Fellow & Liu, 2008 and Drever, 2003). The second stage was interviewing the experts face-to-face individually using the model as the basis for a semi-structured discussion.

Lump-sum versus Construction Management

Table 1 provides a comparison between the duties of the parties involved in a project under Lump-sum approach in comparison to those under Construction Management.

<Insert table 1>

Design responsibilities implications

Traditional contracts place the responsibility of design firmly with the designers and there is no design responsibility on the contractor and STCs (JCT, 2008 and JCT CE Guide, 2006) therefore the risk of any design errors or omissions lies fully with the client (Devon County Council, 2007). In this procurement system the STCs are a de facto member of the design team but this is not properly reflected in contractual relationships (Hughes et al. 1997, p. 41). Problems happen when design defects appear as the contractor is not responsible for design (Chappel, 2012, p13). This leads to a lack of real incentive for the contractor to monitor the design or manage the design process of STCs (Hughes et al., 1997, p. 40). In addition, under the traditional approach design and construction are performed sequentially and independently from another (AIS, 2011 and Rowlinson, 1999 and Becker & Murphy, 2008) thus limiting the opportunity for STCs and supply chain to participate by adding value to the design and providing practical solutions (Blockley & Godfrey, 2000; Holti et al., 2000; Rowlinson, 1999).

In the CM approach the client enters into direct contract with STCs (JCT, 2008) who can be appropriately engaged to allow them to work in conjunction with the designers, thereby taking advantage of their contribution (CM Forum, 1991). They are on equal terms with the other professionals, engendering a spirit of trust and cooperation (JCT, 2002 and Masterman, 2002). In this approach, a fully integrated design and construction can be achieved as the specialist trades work together with designer to deal with the issues of build-ability, construction methods and techniques (CM Forum, 1991). The construction manager can be selected at any stage during the design phase to assist on design issues such as build-ability (JCT, 2011and Hughes et al. 1997, p. 14).

Costs and variations issues

Traditional contracts require that the client through his professional consultants should provide at tender stage a set of drawings and bills of quantities which specify the works in terms of quality and quantity (JCT, 2008) assuming that design by consultant is completed and the project cost is calculated before the procurement of the contractor (Rashid et al., 2006; Strang, 2002 and Murdoch & Hughes, 1992, p. 32). However this is seldom the case (Tommelein & Ballard 1998) resulting in the contractor having to tender for work that is not completely or inadequately designed (DVPM, 2009). Once the project cost is committed and fixed and the contract is signed, design cannot be changed without cost penalties and delays to construction programme (AIS, 2011 and Masterman, 2002).

Under the CM approach on the other hand, work starts on site while the scheme is still being developed (Tendering and Estimating, 2008) thus burdening contractors with problems of uncertainty (Wong et al., 2004). The client does not know the overall price at commencement of the works (Potts, 2008) as price certainty can be achieved only when all the construction work packages have been let (Morledge et al., 2006). This perceived cost uncertainty might make the CM approach less attractive to clients (Potts, 2008) as it exposes them to higher risks (Rawlinson & Langdon, 2006).

Clients' roles and responsibilities under Construction Management

Under CM approach, the client employs all of the firms directly and provides the co-ordination and management of increasingly technical people (Hughes, et al. 1997, p. 31 and Murdoch & Hughes, 1992, p. 48) consequently the client assumes all of the contracting risks under each individual trade contract (Hughes, et al. 2006). The client should have mechanism for entering into direct contracts with specialists and for making monthly payments to many individual contractors (RICS, 2012). Therefore, the client assumes a potentially onerous burden, due to the large number of individual trade contracts entered into, each of which must be managed and coordinated as well as administered separately in terms of contract signing, payment, holdback and warranty.

Table 2 below provides a comparison between Lump-sum approach and CM in term of project outcomes.

<Insert table 2>

CONCLUSIONS

This research confirmed that modern construction projects can achieve better outcomes if STCs take greater responsibility for their work and are given greater opportunities to participate in the design, supply, manufacture, and construction. On the other hand, clients might wish to inhibit the early and full involvement of STCs so that they will not influence the design in a way that is not beneficial to the project. Many clients prefer to develop the design to a certain level before involving the STCs.

Under Lump-sum, designers obtain the free advice from the STCs on the promise that they will be nominated to the main contractor or by applying a two-stage Lump-sum. This might result in many disputes and risks for the client later such as the conflicts between the main contractor and the client on the selection of appropriate sub-contractors in the construction phase. Therefore, this approach does not give the client sufficient flexibility to deal with issues such as build-ability, innovation, adequacy of design information, and using off-site manufactured components. Lump-sum approach is set up based on the assumption that the client does know exactly what they want from the outset. In reality, it is difficult to determine what will happen during the process of the project, and therefore the client will always require some changes. Cost control becomes more complicated due to the increased technological complexities and under the volatile economic situation. It is concluded that the perception that Lump-sum approach brings cost certainty to the client is only correct for small or medium projects where the scope of services is defined precisely, and there is little risk of significant variations in the scope of the work. Therefore, there is a need for more robust and flexible mechanism to deal with issues of design and cost control.

Under CM approach it is believed that the client is able to know the costs through a sound cost plan, which is established meticulously by competent quantity surveyors beforehand. During construction phase the cost is controlled by the construction manager who would review design proposals, monitor tender costs adjusting the content of future works packages and ensuring adherence to approved estimate of the cost of work. Furthermore, it is found that CM might give the client cost savings by the division of packages and the early involvement of construction managers and trade contractors. Under CM approach, design changes are possible as construction proceeds. The client can modify and adjust costs and specifications of trade packages according to changing project requirements. If individual trade prices are not within the budgeted amount for the trade, the design can be adjusted and the price negotiated to maintain budget control. Alternatively, the client may agree to adjust the budget during the process of obtaining trade prices. Thus, CM is more suitable for complex project and volatile economic climate than the other procurement approaches as it provides flexibility to the client, which helps deal with cost uncertainty effectively.

The future of CM approach

It is believed that CM approach is gradually coming back although not being able to get to its pinnacle like the in the 1980s. CM will be steadily getting back in favour however it should be developed in order to accord to the tendency of integrated design and construction. The construction industry is predicted to continue focusing on approaches, which help achieve the integration of design and construction processes and in particular, organisational approaches such as technology cluster approach (Al-Bizri & Gray, 2010). These approaches will form a framework, which involves a multi-faceted group including the client, the designer and the STCs who are collaborating together. Therefore, the procurement approaches which promote and facilitate the full integration of the supply chain will have a sound standing position in construction industry. However, it is necessary for CM approach to adapt to the changing markets as well as develop to suite the necessary organisational changes.

Effect of increased complexities of technology

The increased complexities of technology have opposite effect towards the popularity of CM approach. On the one hand, technologically complex and innovative building project produces large amount of information and specification requirements. This demands the integration of many skills from different parties such as designers, quantity surveyors, contractors, STCs etc. The CM approach is a procurement framework that allows this integration to happen. On the other hand, the unpredictable economic climate and under the pressure from funders, together with increases in building complexities, the client might be

unwilling to handle trade contractors directly and turn to other procurement approaches such as Lump-sum. Many clients are unhappy about entering into a contract which does not have a contract sum or finite commitment like in CM approach. Besides, it is generally accepted that CM approach is only the preferred method for those clients who have the capability and confidence to follow the management path of CM procurement because this system requires more hands-on involvement of the client, thus being only suitable for experienced and knowledgeable clients.

Issues of management

In this risk-averse period, many hands-on clients still prefer the CM route. These organisations prefer CM approach because they are confident that they have the skill for managing the design, construction and supply chain. Such clients believe that the main thrust of project implementation is the management approach to design and construction processes regardless of the contractual arrangement or form of contract. In fact, the CM, if used correctly and efficiently with effective managerial methods is one of the most efficient methods of successfully managing large and complex building projects.

Recommendations

Regardless of the form of contract, project organizational framework should be designed in such a way to deal with the full integration of the supply chains for component-based construction. It needs to facilitate interface management thus simplifying the management of the interfaces both within the supply chain and between supply chains and preserve the value chain by linking all the contributors to a specific system in a vertically integrated supply chain.

Currently, there are many organizational approaches in the market, which are generated to deal with the full integration of the supply chains. The technology cluster is an example of a management framework that provides a framework where groups of experts from different disciplines holding all the necessary specialist knowledge work together continuously (Al-Bizri & Gray, 2010). There is a need for more research on procurement approaches, which are able to give better organizational integration. One of the researches that need to be conducted is how to develop the procurement approaches such as the CM approach in order for it to be less risky, more flexible and improve the capability of integrating supply chains for component-based construction. The newly developed procurement system can be based upon a practical organisational approach, which involves all STCs, designer, contractor and other parties at the right time. Besides, there is a need for the comparison between actual costs and risks in Lump-sum and CM approaches. This research will have highly practical value.

References

AIS. (2011), *Design Responsibility of Specialist Contractors.* Factfile Report, West Midlands.

Al-Bizri, S. & Gray, C. (2010), Management framework for technology clusters implementation. *Construction Management and Economics*, **28** (7), 771 - 782.

Arditi, D, & Chotibhongs, R. (2005), Issues in subcontracting practice. *Journal of Construction Engineering and Management,* **131***(8)*, 866-876.

Becker, J. & Murphy, T. (2008) *Alternative Construction Delivery Methods.* Toronto: Ontario Bar Association.

Blockley, D. & Godfrey, P. (2000), *Doing it differently: systems for rethinking construction (1st ed.).* London: Thomas Telford Publishing.

Cheng, J.C.P, Law, K.H, Bjornsson, H. Jones, A. & Sriram, R. (2010), A service oriented framework for construction supply chain integration. *Automation in Construction,* **19**, 245–260.

Construction Management Forum. (1991), Centre for Strategic Studies in Construction, University of Reading, Whitenights, the United Kingdom.

Chu, H.C. Hwang, G.J. (2008), A Delphi-based approach to developing expert systems with the cooperation of multiple experts, *Expert Systems with Applications: An International Journal*, **34**(4), 2826-2840

Drever, E. (2003), *Using Structured Interviews in Small-scale Research.* Glassgow: SCRE.

DVPM. (2009), *Construction Management as a viable procurement option in comparison to traditional 'single-point' contracting.* Retrieved from http://www.dvpm.co.za/images/construction_management.pdf.

Fellow, R. & Liu, A. (2008), *Research Methods for Construction.* Chichester: John Wiley & Sons.

Fixed Price Deal. (2007), Retrieved from Skyscrapernews, website: http://www.skyscrapernews.com/news.php?ref=1211

Gray, C. & Hughes, W. (2001), *Building Design Management.* Oxford: Butterworth-Heinemann.

Gray, C. & Flannagan, R. (1989), *The changing role of specialist and trade contractors.* Surrey: The Chartered Institute of Building.

Hayman, A. (2012), *Mace to push for 40% growth in turnover by 2015.* Retrieved from http://www.building.co.uk/news/mace-to-push-for-40-growth-in-turnover-by-2015/5039926.article

Holt, G.D. Love, P.E.D. & Heng, L. (2000), The learning organisation: toward a paradigm for mutually beneficial strategic construction alliances. *International Journal of Project Management*, **18**, 415-421.

Holti, R. Nicolini, D. & Smalley, M. (2000), *The handbook of suppy chain management.* Westminster, London: CIRIA.

Hughes, W. Hillebrandt, P. Greenwood, D. & Kwawu, W. (2006), *Procurement in Construction Industry: Impact and cost of alternative market and supply processes.* Oxon: Taylor & Francis.
Hughes, W. Gray, C. & Murdoch, J. (1997), *Specialist Trade Contracting: A Review.* London: CIRIA.
JCT. (2002), *Guide to Construction Management Documentation.* London: RIBA.
JCT. (2008), *Deciding on the appropriate JCT contract.* London: Sweet & Maxwell Limited.
JCT. (2008), *JCT 05 Pre-Construction Services Agreement (General Contractor) (PCSA).* London: Sweet & Maxwell.
JCT. (2011), *Deciding on the appropriate JCT contract.* London: Sweet & Maxwell.
JCT CE Guide. (2006), *JCT- Constructing Excellence Contract Guide.* London: Sweet & Maxwell.
Luu, D.T. Chen, S.E. & Ng S.T. (2007), Decision criteria and their subjectivity in construction procurement selection. *Journal of Construction Economics and Building,* **2** (1), 70-80.
Manoliadis, O. Tsolas, I. and Nakou, A. (2006), Sustainable construction and drivers of change in Greece: a Delphi study, *Construction Management and Economics*, **24**(2), 113-120
Mason, J. (2007), The views and experiences of specialist contractors on partnering in the UK. *Journal of Construction Management and Economics*, ***25*** (5). pp. 519-527.
Masterman, J.W.E. (2002), *Introduction to Building Procurement Systems.* London, New York: Spon Press.
Morledge, R. Smith, A. & Kashiwagi, D.T. (2006), *Building Procurement.* Oxford: Blackwell.
Mosey, D. (2009). *Early Contractor Involvement in Building Procurement* (1st ed.). Chichester: Wiley-Blackwell.
Multiplex win Bishopsgate Tower Contract (2007), Retrieved from Skyscrapernews, website: http://www.skyscrapernews.com/news. php?ref= 1078
Murdoch, J. & Hughes, W. (1992), *Building Contract Law.* London: Longman.
Nobbs, H. (1993), *Future Roles of Construction Specialists*, the Business Round Table, London.
Park House. (2010), Retrieved from http://www.macegroup.com/projects/ park-house
Patton, M.Q. (2008), *Qualitative Research & Evaluation Methods.* London: SAGE.
Pive, G. (2008), Responsible property investment criteria developed using the Delphi Method, *Building Research and Information*, **36**, 20-36
Potts, K. (2008), *Construction Cost Management - Learning from Case Studies*. Oxon: Taylor & Francis.
Rashid, R.A. Taib, I.M. Ahmad, W.B. Nasid, M.A. Ali, W.N. &Zainordin, Z.M. (2006), *Effect of procurement systems on the performance of construction projects*. Retrieved from http://eprints.utm.my/790/1/Procurement_ performanceRosli.pdf.
Rawlinson, S. & Langdon, D. (2006), Procurement : Construction Management. *Building, **35**,* 62-67.
RICS draft guidance note - Comparative construction and engineering contracts. (2012), Retrieved from Royal Institution of Chartered Surveyors website:https://consultations.rics.org/consult.ti/comparative. construction/viewCompoundDoc?docid=2424148&partid=2425236&sessionid=&voteid=
Rogers, D. (2007), *Mace fights back as Shard looks to fixed-price deal.* Retrieved from http://www.cnplus.co.uk/news/mace-fights-back-as-shard-looks-to-fixed-price-deal/213932.article.
Rowlinson, S. (1999), A definition of procurement systems. In S. Rowlinson & P. McDermott (Eds.), *Procurement systems: a guide to best practice in construction.* London: E & FN Spon.
Saunders, M. Lewis, P. & Thornhill, A. (2007), *Research Methods for Business Students.* (4th ed.). Harlow: Pearson.
Shard and Fast: EU's tallest building continues to rise. (2010), *Premier Construction*. p. 38.
Smith, J. Love, P. E. D. & Jackson, N. (1999), *Changing construction procurement for the millennium*. Retrieved from buildnet.csir.co.nz.
Strang, W. (2002), *The risk in Construction Managment "at-risk".* Retrieved from http://cmaanet.org/files/risk_in_cm_at_risk.pdf.
Tommelein, I.D. & Ballard, G. (1998), Coordinating Specialists, *Journal of Construction Engineering and Management*, ASCE, in review.
Trigunarsyah, B. (2007), Project designers' role in improving constructability of Indonesian construction projects. *Construction Management and Economics,* **25**(2), 207-215.
Wong, F.W.H. Lam, P.T.I. & Chan, A.P.C. (2004), Procurement approaches to achieve better constructability. In R. Ellis, & M. Bell (Eds.), *Proceedings of the international construction research conference of Royal Institution of Chartered Surveyors.* Leeds: Leeds Metropolitan University.

Table 1: Comparing the duties of the parties involved in a project under Lump-sum and Construction Management (CM) procurement approaches

Roles and responsibilities set out below are based on: Construction Management Forum (1991), the JCT Intermediate Building Contracts 2005 (2006) and JCT80 the Design Team (1985)

Stages	CLIENT				Comparative Comments
	In Lump-sum procurement approach		In CM procurement approach		
	Duties	notes	Duties	notes	
Feasibility	Appoint the designer team who are responsible for the design.	There is no involvement of construction manager and STCs. It is easy for client to manage because responsibility is upon one entity (designer)	Appoint the designer team and Construction Manager who are responsible for design.	This can lead to the role confusion between designer team and Construction Manager. Client must be prepared to resolve potential friction and conflicts.	. If comparing with Lump-sum, CM requires clients more experiences and knowledge in management, this brings more risks to clients
			Establish lines of communication with the Designer and the construction Manager. Discuss with the Designer and Construction Manager the advantages in seeking design contribution from the Specialist Contractors to assist the Designer with pre-tender design.	More responsibilities for clients	
Scheme Design	There is no design agreement with Specialist Contractors		Approve and sign the design agreements with Specialist Contractors	This means that client must take resource to manage Specialist Contractors.	The Client is totally committed to all aspect of the project described and drawn in a Scheme Design Report, coordinated by the Construction Manager, which should provide definitive Cost Plan and Programme. These once more require more knowledge, experience from clients
	In Lump-sum, clients do not need to manage packages because packages are not available in this stage.		Accept each package and proceed the package to be implemented on site.	Accept each package and proceed the package to be implemented on site while the scheme is not yet to be fully design architecturally and structurally. These can cause risks for projects because it can be impossible to change later on.	
Design completion & Construction	Clients approve the design and tender document.		Agree the number of Works Contractors for each package.	Multiple sub-contractors may have potential to increase administration costs and clients assume all of the contracting risks under each individual trade contract.	Due to potentiality to increase administration costs from Multiple sub-contractors, CM assumes more risks than Lump-sum
	Client only can allow on-site construction when the entire design is completed.		Clients can allow work to start shortly after acceptance of the Scheme Design Report.	This means that costs and time are subject to change in subsequent stages	If comparing with Lump-sum, CM has tendency to increased costs.
Completion	Pay final account		Pay final account		This stage, client needs to pay final account. However, in CM the client has to face much more risk of paying because they have to manage many trade contractors

Stages	DESIGNERS				Comparative Comments
	Lump-sum procurement approach		CM procurement approach		
	Duties	notes	Duties	notes	
Concept	Prepare the Brief, organise the production of sketch design and specification	In these stages, there is limited design contribution from any Specialists Trade Contractors. This is a disadvantage of Lump-sum.	Coordinate with Construction Manager in order to prepare the Brief, organise the production of sketch design and specification.	In these stages, construction manager helps clients and designer prepare sketch proposals, consisting of outline brief, outline cost plan and programme.	The difference between the two procurement approaches is the presence of construction manager in CM from the Concept stage. With the early involvement of construction manager, the preparation of sketch design, preliminary costs and feasibility studies would be better.
Feasibility	Prepare preliminary costs		Prepare preliminary costs and agree with construction manager or the cost consultant (if appointed).		
	Carry out construction feasibility studies.		With recourse of Construction Manager, carry out construction feasibility studies.		
Scheme Design	Carry out Scheme Design		Discuss build-ability, cost-in-use and innovation with Construction Manager, Specialist Contractors and Suppliers**.** Agree with Construction manager and Suppliers about the use of construction technologies including particularly the extent of off-site prefabrication, preferred material and components.	Advice of management contractor at design stage leads to an early input of build-ability, allowing better build-ability, innovation and use of materials	Increased technological complexity demands a greater involvement in design process by specialist contractors. The difference between Lump-sum and CM in this stage is the early involvement of STCs in CM, which helps resolve issues of build-ability, application of new technology, material and off-site prefabrication.
Design completion and Construction	Designer finalises the design, prepare tender for client before on-site construction.	This means that Lump-sum offers the separated process, limiting the involvement of specialist contractor in this stage.	Cooperate with Construction manager, Specialist contractor finish design of each package in order for work contractor to implement on site.	Involvement of management contractor also leads to better packaging works.	In this stage, in CM there is the simultaneous involvement of construction manager (from Concept stage), specialist contractor and construction contractor. This leads better work on site.
	There is limited contribution of designers in this stage of construction	This means that designers finished their work before commencing on-site construction	Jointly ensure that the work carried out by the Works Contractors meets their contractual obligation for quality, time and costs.		

Stages	MANAGERS			Comparative Comments
	In Lump-sum procurement approach Duties	In CM procurement approach		
		Duties	notes	
Concept	In these stage, Lead Designer, Lead consultant and Project Manager have design management role. They coordinate preparation of a project quality plan and work stage programme(s) for the design process.	Coordinate with Client and Designers in order to prepare the Brief, organise the production of sketch design and specification.	The involvement of CM provides Client and Designer with better management.	With the presence of construction manager in these stages, it is certain that quality in design relating to feasibility, build-ability and innovation would be improved if comparing to Lump-sum.
Feasibility		Work with clients, prepare preliminary costs		
		Work together with client, consultant, and specialist contractors carry out construction feasibility studies.		
Scheme Design		Discuss build-ability, technical design with Designer, Specialist Contractors and Suppliers. Agree with Designer the use of construction technologies including particularly the extent of off-site prefabrication, material and components	Advice of management contractor at design stage leads to an early input of build-ability, allowing better build-ability, innovation and materials	
Design completion and Construction	Project Manager, Lead design helps consultant finalise the Design.	Cooperate with Designer and Specialist Contractors, finish design of each package in order for work contractor to implement construction on site.	Involvement of management contractor also leads to better packaging works.	
	In this stage, Main Contractor will play management and operational role. The contractor's primarily obligation is to carry out and complete the works in accordance with contract documents. The contractor has only to produce what is set out in the contract documents & there is therefore no responsibility for any design of the work.	Ensure the coordination of production and assembly tasks with the Designer and Works Contractors. Monitor the Designer and Works Contractors in the performance of their duties and the discharge of responsibilities as set out in their respective Schedule of Duties. Ensure that the Contractors protect the works in accordance with contract documents.	In these stage, construction manager and specialist contractors will play essential role in management (component design, manufacturing and site assembly)	The difference here is still the crucial and necessary involvement of construction manager who are responsible for every activities along stages.

Stages	Specialist Trade Contractors (STCs)				Comparative Comments
	In Lump-sum procurement approach		In CM procurement approach		
	Duties	notes	Duties	notes	
Concept	Contractor does not contribute in this stage		Contribute to Concept		
Feasibility	Contractor does not contribute in this stage.		Contribute to Detailed Feasibility		
Scheme Design	Contractor does not contribute in this stage.		Contribute to Scheme Design		
Design completion and Construction	Contractor's obligation is to carry out and complete the works as described in the Contract Documents	This means contractor is not responsible for Design and does not contribute to Design. The process of project is separated by this effect of this clause.	Monitor and control costs as design is developed, in conjunction with the Designer and Construction Manager, especially contribute to build-ability and innovation and materials		The most evident difference between Lump-sum and CM is the involvement of Work Contractor in design and package preparing, this leads to better design and
			In conjunction with the construction manager, manage on-site assembly operations to integrate efficiently with the work of other Works Contractors		

Table 2: Comparing Lump-sum and Construction Management (CM) procurement approaches in terms of project outcomes

Outcomes	Traditional Lump-sum procurement approach	CM procurement approach
Quality	This system does not provide opportunities for contractor to contribute his construction technology and management expertise because design and construction process are divided into two separated stages.	Design and construction skills integrated at an early stage. Specialist trade contractor and construction manager's expertise, knowledge and experience make design more buildable, innovative and adept in selecting materials and components of the right type and quality.
	Separate contractual relationships in Lump-sum create adversarial attitudes between client and consultant, and client and contractor, reinforce the lack of integration between design and construction. This can cause conflict, thereby harmfully affecting the quality of the project.	The construction manager acts on the client's behalf. There is integration between parties, leading to decrease of adversarial attitudes between parties. This helps increase quality.
	The disintegration in design and construction also leads to little incentive for innovation. This causes reduction of quality of the project.	Innovation is always developed in CM because receiving the involvement of specialist contractors and construction manager. Therefore the project received the latest application in materials or technologies.
	Provide limited level of variations and flexibility. Changes in drawings and specifications can be source of trouble. This affects adversely quality of project.	Clients can modify or develop design requirements during construction. Management contractor can adjust programme. CM offers more flexibility, thereby improving quality of project.
	Provide more time for client and consultants to review, fully develop, scrutinize and review the design and specification thus allowing better documentation preparation.	In situation of fast tracking, because the design of various components is often not very far ahead of its construction in the field, this can lead to incomplete or insufficiently detailed and erroneous drawings and specifications.
Cost	This system provides more price certainty to the client at the very early stage of the project.	Uncertainty about the cost of the complete works at the start of construction and costs tend to increase during construction.
	Provide the client firmer and more competitive price because the design plus the complete working drawings have been fully developed and detailed out prior to tendering	Management contract is appointed because of management expertise rather than because his fees is competitive. However, competition can be retained for the works packages.
	Adversarial contract environment can potentially cause higher costs from claims	The integration between parties declines effect of adversarial contract environment, thus reducing costs claim.
Time	Due to its linear or sequential approach, the traditional procurement system has been identified as the slowest project delivery approach.	Overlap of design and construction leads to early start on construction and quicker completion.
Summary	In Lump-sum procurement system, total period is prolonged and lack of integration between designs and construction. However, it provides the client with certainty on construction costs, because a contract figure is usually known at the outset.	In CM procurement system, the client suffers variable costs that can be out of initial budget. However, this system provides the better quality of design and construction due to integration and can reduce the time of project owing to the overlap of design and construction.