

**VARIATION ORDERS IN UNIVERSITI TEKNOLOGI MALAYSIA  
(UTM) CONSTRUCTION PROJECTS**

**NOR HAYATI BINTI IBRAHIM**

Laporan projek ini dikemukakan sebagai memenuhi  
sebahagian daripada syarat penganugerahan  
Ijazah Sarjana Sains  
(Pengurusan Pembinaan)

Fakulti Kejuruteraan Awam  
Universiti Teknologi Malaysia

NOVEMBER, 2006

## **ABSTRACT**

The project holder have to believe that no construction method or for that matter the project, is free of variation and it's afterward activity of claims. A document review was done for 18 numbers of construction contract documentation projects in Universiti Teknologi Malaysia (UTM) during the period of the Seventh Malaysian Plan from 1996 to 2000 with the total value of all projects in the excess RM100 million. The client, consultant and contractor become the main respondent target. In general, UTM's construction projects of building works, renovation works and infrastructure works during Seventh Malaysian Plan are not impervious to variation orders. Every project of building works an average of RM 2.08 million is expend on variation orders and about RM 0.31 million is spent for every variation orders occurred in renovation and infrastructure works. All these have impacted the cost and the completion time of projects. This study has concluded the most numerous cause of variation orders in UTM construction projects which is inadequate consideration of design. Meanwhile, the top five of the effects of these variation orders are listed as followed; increase in project cost; delay in payment; procurement delay; logistic delay; completion schedule delay. The findings of this study also points out that the involvement of profession in the design phase and continuous coordination and direct communication are the two most considered factors to minimizing the happening of variation orders.

## ABSTRAK

Industri pembinaan seolah-olah sudah tidak mampu mengelak dari terlibat dengan sebarang perubahan kerja terutamanya ketika berlangsungnya projek yang kemudiannya disusuli pula oleh pelbagai tuntutan. Ulangkaji dokumentasi pembinaan telah dilaksanakan terhadap 18 buah dokumen kontrak pembinaan Universiti Teknologi Malaysia (UTM) di dalam tempoh Rancangan Malaysia Ketujuh iaitu dari tahun 1996 hingga 2000 yang melebihi nilai RM 100 juta. Sasaran responden utama adalah terdiri dari klien, kontraktor dan perunding. Umumnya, keseluruhan projek pembinaan UTM ketika tempoh Rancangan Malaysia Ketujuh samada kerja-kerja yang melibatkan kerja-kerja bangunan, kerja ubahsuai dan kerja infrastruktur semuanya ada perubahan kerja. Mengikut anggaran, sebanyak RM2.05 juta akan dibelanjakan bagi perubahan kerja yang terlibat di setiap kerja bangunan, manakala lebih kurang RM0.31 juta pula dibelanjakan setiap kali perubahan kerja pada kerja-kerja ubahsuai dan infrastruktur. Semua ini sudah tentu menjejaskan kos dan tempoh siap kerja bagi setiap projek yang terlibat. Kajian yang dilakukan telah menunjukkan punca utama yang mendorong berlakunya perubahan kerja adalah kerana pertimbangan yang kurang jitu ketika fasa rekabentuk. Sementara itu, lima (5) kesan besar yang timbul setelah berlakunya perubahan kerja disenaraikan sebagaimana berikut; meningkatnya kos projek; melambatkan proses bayaran; melambatkan pelaksanaan; mlambatkan logistik; dan melambatkan/menjejaskan jadual pelaksanaan. Dua (2) langkah telah dikenalpasti di dalam kajian ini yang mana berkemungkinan mampu untuk mengurangkan berlaku perubahan kerja di dalam sesebuah projek iaitu; penglibatan semua profesion ketika fasa rekabentuk dan penyelenggaraan yang berterusan dan komunikasi langsung antara pihak yang terlibat.

## LIST OF CONTENT

<b>Title</b>	<b>i</b>
<b>Declaration</b>	<b>ii</b>
<b>Dedication</b>	<b>iii</b>
<b>Acknowledgement</b>	<b>iv</b>
<b>Abstract</b>	<b>v</b>
<b>Abstrak</b>	<b>vi</b>
<b>List of Figures</b>	<b>x</b>
<b>List of Tables</b>	<b>xi</b>
<b>CHAPTER I: INTRODUCTION</b>	
1.1 Introduction	1
1.2 Background of the problem	3
1.3 Objective of study	5
1.4 Scope of study	6
1.5 Significance of study	6
1.6 Research methodology	7
<b>CHAPTER II: VARIATION ORDER – CAUSES AND EFFECTS</b>	
2.1 Introduction	9
2.2 Definition of variation order	10
2.3 Causes of Variation Orders	15
2.4 Effects of Variation Orders	19
2.5 Variation Claims Procedures under the PWD Standard Form 203	23
Summary	
<b>CHAPTER III: RESEARCH DESIGN</b>	
3.1 Introduction	28
3.2 Research Design	28
3.3 Research Procedure	30
3.4 Data Gathering Process and Instrumentation	35

3.4.1	Document Study Design	37
3.4.2	Questionnaire Survey Design	40
3.4.3	Structured Interview Research Design	43
3.4.4	Summary	46

## **CHAPTER IV: RESEARCH ANALYSIS AND FINDINGS**

4.1	Introduction	47
4.2	Respondent and primary source of information	48
4.3	Limitation of study	50
4.4	Data Analysis	50
4.4.1	1 <sup>st</sup> Method: Frequency Analysis	50
4.4.2	2 <sup>nd</sup> Method: Relative Index Analysis	51
4.4.3	3 <sup>rd</sup> Method: Document Study Analysis	52
4.5	Research analysis of the construction contract document study	53
4.6	Research Findings of the Construction Contract Document Study	53
4.7	Research Analysis of the Respondent for Questionnaire and Interview	56
4.8	Research Findings of the Respondent for Questionnaire Survey and Interview	57
4.9	Research Analysis of Contribution Factors of Variation Orders for Questionnaire Survey and Interview	59
4.10	Research Findings of Contribution Factors of Variation Orders for Questionnaire Survey and Interview	59
4.11	Research Analysis of Effects of Variation Orders for Questionnaire Survey and Interview	64
4.12	Research Findings of Effects of Variation Orders for Questionnaire Survey and Interview	65
4.13	Research Analysis of Proposed Strategies to Minimize the Adverse Effects of Variation Orders for Questionnaire Survey and Interview	68
4.14	Research Findings of Proposed Strategies to Minimize the Adverse Effects of Variation Orders for Questionnaire Survey and Interview	69
4.15	Summary	71

## **CHAPTER V: CONCLUSION**

5.1	Introduction	72
5.2	1 <sup>st</sup> Objective; To identify contribution factors of variation orders	72
5.3	2 <sup>nd</sup> Objective; To study the effects of variation orders in construction Projects	74
5.4	3 <sup>rd</sup> Objective; To propose strategies to minimize the adverse effects of variation orders	77
	<b>Bibliography</b>	79
	<b>Appendix</b>	87

## LIST OF FIGURES

Figure 1.1: Research methodology	8
Figure 2.1: Some of the events where the supervising officer shall issue instruction	13
Figure 2.2: Some of the events where the supervising officer is deemed to have given instructions	14
Figure 2.3: Some of the events where the supervising officer may issue instructions	14
Figure 2.4: Process from inception to site operations	16
Figure 2.5: Origin of variation	18
Figure 2.6: Variation order process	24
Figure 3.1: Research design	29
Figure 3.2: General research procedure	31
Figure 3.3: Research methodology phase 1	32
Figure 3.4: Research methodology phase 2	33
Figure 3.5: Research methodology phase 3	34
Figure 3.6: Research design procedure	35
Figure 4.1: Respondents categories	48
Figure 4.2: Types of contract document	54
Figure 4.3: Variation order value according to types of contract	54
Figure 4.4: Variation order value according to types of contract for every project	55
Figure 4.5: Respondent organization for questionnaire survey	57
Figure 4.6: Respondent profession for questionnaire survey	58
Figure 4.7: Reasons for providing a variation clause in a building contract	60
Figure 4.8: Reasons for claims by contractors	62
Figure 4.9: Greatest problem in contract management	63
Figure 4.10: Effects of variation orders	66
Figure 4.11: Strategies to minimize adverse effects of variation orders	70
Figure 5.1: Summaries of proposed strategy	78

## LIST OF TABLES

Table 1.1: The summaries of government allocation and expenditure for such development within Seventh Malaysian Plan, 1996-2000	7
Table 3.1: Instruments in data gathering process	36
Table 3.2: Principles of qualitative research	37
Table 3.3: Validity in qualitative research	38
Table 3.4: Procedure of document study	40
Table 3.5: Steps to design and manage questionnaire	41
Table 3.6: Questionnaire research design	41
Table 3.7: Questionnaire survey section	42
Table 3.8: Types of interview	44
Table 3.9: Do and Don't during interview	45
Table 3.10: Structured interview design	46
Table 4.1: UTM construction projects during Seventh Malaysian Plan	49
Table 4.2: Document study general information tabulation	53
Table 4.3: Variation order value according to types of contract	54
Table 4.4: Causes of variation order used in questionnaire	56
Table 4.5: Reasons for providing a variation clause in a building contract	59
Table 4.6: Contribution factors of variation orders	61
Table 4.7: Reasons for claims by contractor	62
Table 4.8: Effects of variation orders	64
Table 4.9: Findings of effects of variation orders	65
Table 4.10: Best five overall score in effects of variation orders	66
Table 5.1: Contribution factors of variation orders	73
Table 5.2: Effects of variation orders	75
Table 5.3: Overall score in effects of variation orders	76



## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 Introduction**

The construction industry has been consistently criticized for poor performance in attaining its client's requirements. Time and cost overruns were predominately common and were well documented. The incidence and magnitude of variations was identified as a major cause and a focus of much of the criticism. Variation issued during the construction period are time consuming and costly. Thus accepted as an inevitable part of construction, variations are a major cause of disruption, delay and disputes and generate significant cost impact (Ibbs et al, 2001).

Delay is generally acknowledged as the most common, costly, complex and risky problem encountered in Malaysian construction projects. Many of the problems were originated from the lack of knowledge and skills needed (Azhan, 2004). Most of the construction projects are often plagued with delays and cost overruns, revealing this shows that most of the construction of Government School Projects initiated by Ministry of Educations especially for the School Computer Laboratory Projects, were totally delays and Housing Quarters for Teachers only 412 units completed out of 1900 units targeted in the Seventh Malaysian's Plan from 1996-2000 (Berita, March

2002). Yet no empirical method or tool, quantitative or otherwise, is available for managing or controlling them.

By that, the conventional approach is to include a percentage of the project cost as contingency in the pre-contract budget for their occurrences. The allocated contingency based on this method is largely judgmental and arbitrarily allocated. However, construction projects are unique; as they may have distinctive set of objectives, require the application of new technology or technical approaches to achieve the required result, or even duplicate a given set of results in an entirely different environment. This uniqueness makes the conventional method based wholly on the project manager/supervisors' experience and intuition in danger of overly simplistic and unrealistic. The objectives of the contingency allocation are to ensure that the budget set aside for the project is realistic and sufficient enough to contain the risk of unforeseen cost increases. Therefore any realistic contingency must serve as a basis for decision making concerning financial viability of the variations, and a baseline for their control. The problem could become worse when there is a series of variations, when the programmed is affected and when the time spent by the contractor's head office staff becomes totally disproportionate to the value of the contract.

There are many reasons why variations occur. They may be due to extra work caused by subsurface conditions, errors in contract documents, additional quantities of works or materials, reduction of work, or lack of proper communication between the parties. There is room for improvement in present practices for keeping track of variations. Therefore, proposing some strategies to minimize the variation orders can be valuable.

## 1.2 Background of the problem

Variations are inevitable in any construction project (Ibbs et al, 2001). Needs of the owner may change in the course of design or construction, market conditions may impose changes to the parameters of the project, and technological developments may alter the design and the choice of the engineer. The engineer's review of the design may bring about changes to improve or optimize the design and hence the operations of the project. Furthermore, errors and omissions in engineering or construction may force a change. All these factors and many others necessitate changes that are costly and generally un-welcomed by all parties.

Variations in drawings and contract documents usually lead to a change in contract price or contract schedule. Variations also increase the possibility of contractual disputes (O'Brien, 1998). Typically, variations present problems to all the parties involved in the construction process. Variations can be originated from numerous factors pertinent to the construction projects. Development in the education sector and the new modes of teaching and learning advanced the need for renovation or extension of existing academic institutions. The change of space in academic institutions is required to cater for the new technology used. The construction of an institutional building poses risks common to any other large projects (Faizal, 2005)

The construction process can be influenced by highly changing variables and unpredictable factors that could result from different sources. These sources include the performance of construction parties, availability of resources, environmental conditions, involvement of other parties and contractual relations. As a consequence of these sources, the construction of projects may face variations that could cause delay in the project completion time (Clough and Sears, 1994).

Kumaraswamy et al (1998) studied claims for extension of time due to excusable delays in Hong Kong's civil engineering projects. Their findings suggested

that 15-20 percent time over run was caused mainly by inclement weather. A total of 50 percent of the projects surveyed were delayed because of variations. The institutional projects would also experience similar delays due to variations and inclement weather as Malaysia is in the tropical zone.

Kaming et al (1997) studied the factors influencing construction time and cost over runs for high-rise projects in Indonesia where 31 project managers working in high-rise buildings were surveyed. Kaming et al (1997) pointed out that the major factors influencing cost over run were material cost increase due to inflation, inaccurate material estimating and the degree of project complexity. In the case of time over run, the most important factors that caused delays were design changes, poor labour productivity, inadequate planning, and resource shortage.

The magnitude of average schedule slippage due to variations was reported as 18 percent (CII, 1990; Zeitoun and Oberlender, 1993). The deviation (variation) cost amounted to an average of 14 percent of the total cost of the project. Although there have been cases where variation cost accounted for as high as 100 percent of the budgeted funds, the industry norm was about 10 percent. The impact of variations varies from one project to another. However, it is generally accepted that variations can affect construction projects with unpalatable consequences in time and cost (Hester et al, 1991; Ibbs et al, 2001).

Variations are of two types, namely beneficial variations and detrimental variations. Beneficial variations are those that actually help to improve quality, reduce cost, schedule, or degree of difficulty in the project. Detrimental variations are those that reduce owner value or have a negative impact on a project. The project team should be able to take advantage of beneficial variations when the opportunity arises. The need to make changes on a construction project is a matter of practical reality. Even the most thoughtfully planned project may necessitate changes due to various factors. The variations can be minimized when the problem is studied collectively as

early as possible, since the problems can be identified and beneficial variations can be made (CII, 1994).

Variations are familiar in all types of construction projects. Variations in construction projects can cause substantial adjustment to the contract duration, total direct and indirect cost, or both. The variations and variation orders can be deleterious in any project, if not considered collectively by all participants. Most of University Teknologi Malaysia (UTM) construction projects were delayed with certain amount of variation order increasing from the original value of the contract sum. The focus of this study would be on the total value of all projects in the excess RM100 million with 18 numbers of projects received during the period of the Seventh Malaysian's Plan from 1996-2000. Due to general background of the problems in the construction industry and the specific problems within the UTM construction scope, there is a cause for a study to be made on causes and effects of variation orders in UTM construction projects.

### **1.3 Objective of study**

The aim of this study is to identify and analyze the potential effects of variation orders in Malaysian construction projects. To achieve the above aim, the following objectives have been identified.

1. To identify contribution factors of variation orders.
2. To study the effects of variation orders in construction projects.
3. To propose strategies to minimize the adverse impact of variation orders.

#### **1.4 Scope of study**

The scope of the study is focused on government projects. The imperative of the study would be reflected on the total value of all projects in the excess RM100 million with the projects reviewed during the time of the Seventh Malaysian Plan from 1996-2000, where most of the UTM construction projects were implemented during this period.

#### **1.5 Significance of study**

As variation orders can have numerous negative effects to projects cost and schedule, this study is carried out to identify the major causes that contribute to variation orders and to study the effects of variation orders during the implementation of construction projects, which will be supportive for construction professionals in assessing and taking proactive measures for reducing the adverse impact of that. Noted that the Government had allocated for the five (5) years development about RM103.56 billion, and RM 20.19 billion from that amount were for education and training sector development. From RM145 million that had been allotted to UTM construction projects, about RM108 million had been laid out from RM105 million (original contract). This amendment occurred because of variation order. Reflecting to variation order, almost RM3 million could be saved if variation order can be controlled and this was one of the adverse effects that rise from variation order. The summaries of these situations are shown in Table 1.1.

Table 1.1: The Summaries of Government Allocation and Expenditure for Such Development within Seventh Malaysian Plan, 1996-2000.

<b>Subject</b>	<b>Allocation (RM)</b>	<b>Expenditure (RM)</b>
By Sector : Education And Training	20.19 Billion	19.72 Billion
UTM	145 Million	108 Million

(Source: Harta Bina, UTM; RMK7, 1996-2000)

## 1.7 Research methodology

The method used in conducting this study started with literature review. This followed with the document study, that are study, review and analyze of contract documents and final accounts that is related to variation orders. The document contract are treated as forbidden document and restricted therefore digital photo study are required to be employed where the document are not to be brought out from the particular area. The digital photo study of the contract document will be prepared similarly to the document study. Vital aspects of variation orders in the contract document will be identified and tabulated accordingly to their considerable.

The focus of the research mainly concentrated at the client organization as the primary respondent where the contract document originated. Structured interviews are to be conducted with the professionals in the client organization who are involved in the construction process and contract administration. This will reveal the facts for the second objective that is the effects of variation orders in construction projects. In order to strengthen the data for the secondary respondent, telephone interview with the contractor and the consultant parties will be conducted. After the telephone interview, if the secondary respondents are cooperative and supportive, postal questionnaire will be sent to them for a better detailed exploration. Further structured interviews are deliberate for the secondary respondent where possible.

Finally, matching methods were in use as in preceding step by performing structured interview and questionnaire in the client organization and telephone survey with the consultants and contractor to recognize strategies to minimize the adverse effects of variation orders. Advance analysis and synthesis of the documents will be prepared to identify the strategies that can be done. The proposed strategies to minimize the adverse impact of variation orders expose as a result.

The summaries of research methodology are shown in figure below.

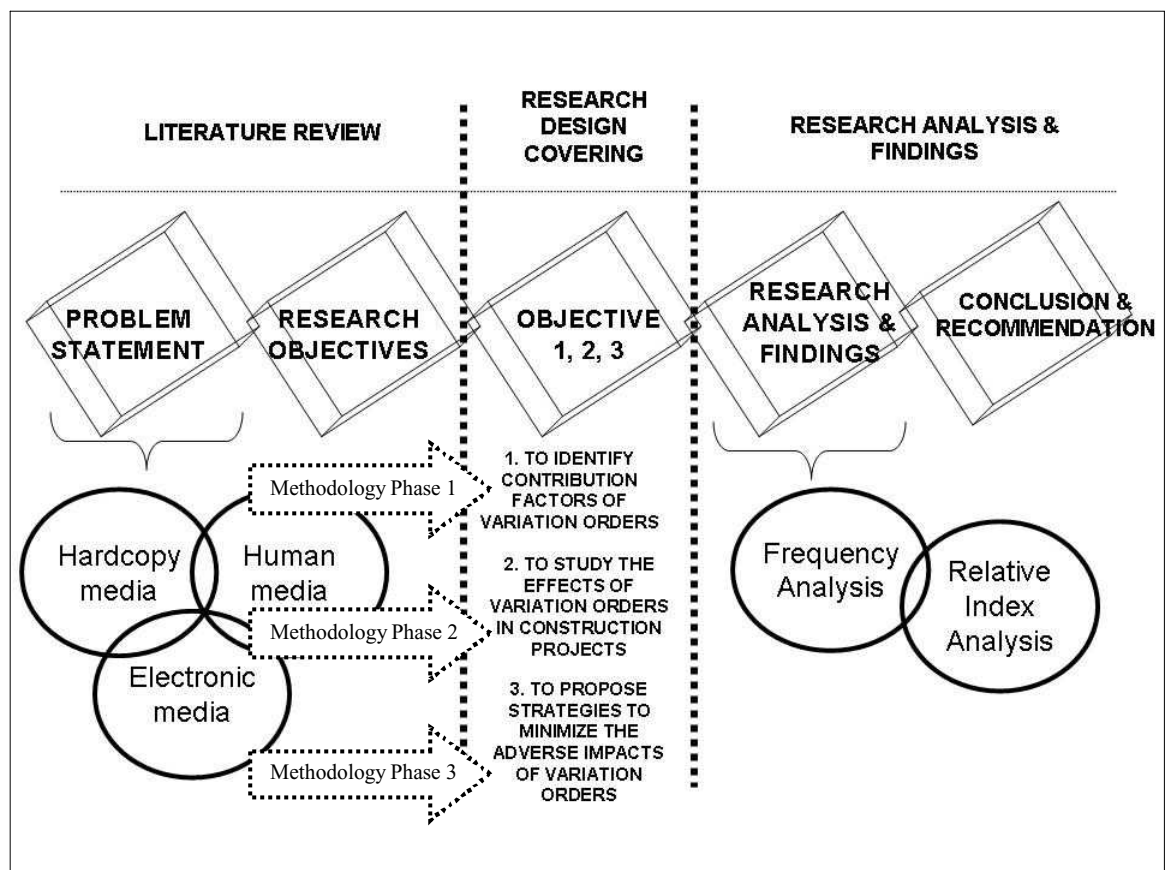


Figure 1.1: Research Methodology



## 6.0 REFERENCES / BIBLIOGRAPHY

Abd. Majid M.Z. and McCaffer R. (1998). Factors of Non-excusable Delays That Influence Contractors' Performance: *Journal of Management In Engineering*. Vol. 14, issue 3: page 42-49.

Adhikari. D.K. and Manavazhi M.R. (2001). Material and Equipment Procurement Delays in Highway Projects in Nepal: *International Journal of Project Management*. Vol. 20: page 627-632.

Aibinu A.A. and Jagboro G.O. (2002). The Effects of Construction Delays on Project delivery in Nigerian Construction Industry: *International Journal of Project Management*. Vol. 20: page 593-599.

Akintola A.(1994) "Design and Build: A Survey of Construction Contractors' Views" *J. Const. Mgmt and Eco*. Volume 12, 155-165

Al-Khalil M.I. and Al-Ghafly M.A (1999). Delay in Public Utility Projects in Saudi Arabia: *International Journal of Project Management*. Vol. 17, No. 2: page 101-106.

Al-Momani,A., (2000), " Construction Delay: a quantitative analysis", *International Journal of Project Management*, 2000, 18:51-59.

Aminuddin Ali. (2006). Exploitation of Contract Document for Construction Project Planning and Controlling. FKA. UTM Skudai.

Ashley D. B., Laurie C. S. dan Jaselskis E. J. (1987) "Determinants of Construction Project Success" ASCE, *J. of Mgmt in Engrg*. Vol. 15 No. 2, 69-79

Assaf S.A, Bubshait A.A., Atiyah S., and Al-Shahri M. (2001). The management of construction company overhead costs: *International Journal of Project Managemnet*. Vol. 19, page 295-303.

Assaf, S.A., Al-Khalil, M., and A-Hazmi, M., (1995), "Causes of delay in large building construction projects", *Journal of Management in Engineering*, ASCE, March/April, 1995, pp 45-50.

Azhan Seth. (2004). The Effects of Delays in Construction Industry. FKA. UTM Skudai.

Baden Hellard R (1995) "Project Partnering: Principle and Practice" Thomas Telford Publication, London

Baden-Hellard R (1988) "Managing Construction Conflict" Longman Group UK Ltd UK

Bambang Trigunaryah (2004). Constructability Practices among Construction Contractors in Indonesia: *Journal of Construction Engineering*; September/October 2004, page 657-669

Bennett J dan Grice T (1992) "Procurement System for Building" in Brandon, PS (ED). "Quantity Surveying Technique New Directions". Blackwell Science Ltd, London

Chan A. P. C., Chan. D. W. M., Chiang Y. H., Tang B. S., Chan E. H. W., dan Ho K. S. K (2004) "Exploring Critical Success Factors for Partnering in Construction Projects" ASCE, *J. of Constr. Engrg. and Mgmt.*, Vol. 130 No. 1, 188-198

Chan A.P.C, Scott D., dan Chan A.P.L (2004) "Factors Affecting the Success of A Construction Project" ASCE, *J. of Const. Engrg. and Mgmt.*, Vol. 130 No. 1, 153-155

Chan A.P.C, Scott D., dan Lam E.W.M (2002) "Framework of Success Criteria for Design/Build Projects" ASCE, *J. of Mgmt in Engrg.* Vol. 18 No 3., 120-128

Chan A.P.C., Ho D.C.H dan Tam C.M (2001) " Design and Build Project Success Factors: Multivariate Analysis" *J. Constr. Engrg. and Mgmt.*, ASCE, Vol. 127 No. 2, 93-100

Chan A.P.C., Ho D.C.K. dan Tam C. M. (2001) "Effects of Interorganizational Teamwork on Project Outcome" ASCE, *J. of Mgmt in Engrg.*, Vol 17 No. 1, 34-40

Chartered institute of building (CIOB). 1987. Managing construction worldwide; productivity and human factors in construction. International council for building research studies and documentation. London.

Cheng E. W. L., Li H. dan Love P. E. D (2000) "Establishment of Critical Success Factors for Construction Partnering" ASCE, *J. of Mgmt in Engrg.*, Vol 16 No.2, 84-92

*CIDB Construction Industry Review 2001/2002*

CII (1986), Impact of Various Construction Contract Types and Clauses on Project Performance, Construction Industry Institute, University of Texas at Austin, Austin, TX, .

CII (1990), The Impact of Changes on Construction Cost and Schedule, Construction Industry Institute, University of Texas at Austin, Austin, TX, .

CII (1990), *The Impact of Changes on Construction Cost and Schedule*, Construction Industry Institute, University of Texas at Austin, Austin, TX, .

CII (1994), *Project Change Management*, Construction Industry Institute, University of Texas at Austin, Austin, TX, .

CII (1995), *Qualitative Effects of Project Changes*, Construction Industry Institute, University of Texas at Austin, Austin, TX, .

CIRIA (1983) "A Client's Guide to Traditional Contract of Building" CIRIA, Special Pub 29 London

Clamp H dan Cox S (1989) "Which Contract: Choosing Appropriate building Contract" RIBA Pub. London

Clough, R.H., Sears, G.A. (1994), *Construction Contracting*, 6th ed., John Wiley & Sons Inc., New York, NY, .

Cook E. L dan Hancher D. E (1989) "Partnering: Contracting for the Future" ASCE, *J. of Mgmt in Engrg*, Vol 6 No. 4, 431-445

Cooke, B. (1979). *Cost and financial control for construction firms*. The Macmillan press ltd. London

Dallaire, D. (1974). *Thermal Power Plants: Key Problems, Trends. Civil Engineering*. ASCE. Pp 35- 39.

Dennis F Turner. (1984). *standard contracts for building*. Longman Inc. New York

Dennis L. Mulvey (1998). *Project Delivery Trends: A Contractors Assessment: Journal of Management In Engineering*. page 51-53.

Eldin N. N.(1988) "Constructibility Improvement of Projects Design" ASCE, *J. of Const. Engrg. and Mgmt.*, Vol. 114 No. 4

Ferguson N. S., Langford D. A. dan Chan W.M (1995) "Emperical Study of Tendering Practice of Dutch Municipailties for the Procurement of Civil-Engineering Contracts" Elsevier Science Ltd., *Int. J. of Project Mgmt.*, Vol. 13 No. 3, 157-161

Flora G., Ernzen J.J., dan Schexnayder C. (1998) " Field-Level Management's Perspective of Design/Build" ASCE, *J. of Prac. Perd. On Struc. Design and Const.*, Vol 3 No. 4, 180-185

Forster, G. 1986. *Building organization and procedures*. Longman Inc. New York

Frank J (1992) "Building Procurement Systems". 2nd edition *Ascot Chatered Ins. Of Building (CIOB)*

Frederick E. G dan nancy E. J (2000) "'Construction Project Management". New Jersey. Prentice Hall,Inc

Frimpong, Y., Oluwoye, J., and Crawford, L., (2003), "Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study", *International Journal of Project Management*, 2003, 21:321-326.

Hester, W., Kuprenas, J.A., Chang, T.C. (1991), *Construction Changes and Change Orders: Their Magnitude and Impact*, University of California, Berkeley, CA, .

Hibberd, Peter R. (1986). *Variations in construction contracts*. William Collins sons & co ltd. London.

Ibbs, C.W. (1997a), "Change's impact on construction productivity", *Journal of Construction Engineering and Management*, Vol. 123 No.1, pp.89-97.

Ibbs, C.W. (1997b), "Quantitative impacts of project change: size issues", *Journal of Construction Engineering and Management*, Vol. 123 No.3, pp.308-11.

Ibbs, C.W., Lee, S.A., Li, M.I. (1998), "Fast tracking's impact on project change", *Project Management Journal*, Vol. 29 No.4, pp.35-41.

Ibbs, C.W., Wong, C.K., Kwak, Y.H. (2001), "Project change management system", *Journal of Management in Engineering*, Vol. 17 No.3, pp.159-65.

Ivor H. Seeley. 1993. *civil engineering contract administration and control*. The Macmillan press ltd. London

Jack Rizzo (1998). *Design and build alternative: A contracting method: Journal of Management In Engineering*. page 44-47.

Johns G. T. (1994) "Managing the Behaviour of People Working in Teams" Elsevier Science Ltd., *Int. J. of Project Mgmt.*, Vol. 13 No. 1, 33-38

Jung Y. and Woo S (2004). *Flexible Work Breakdown Structure for Integrated Cost and Schedule Control: Journal of Construction Engineering*; September/October, page 616-625

Kamaruddin md. Ali, (1993). *tender dan kontrak pembinaan; penyediaan dan pengendalian*. Dewan bahasa pustaka, kuala Lumpur.

Kaming, P.F., Olomolaiye, P.O., Holt, G.D., Harris, F.C. (1997), "Factors influencing construction time and cost overruns on high rise projects in Indonesia", *Construction Management and Economics*, Vol. 15 No.1, pp.83-94.

Khang D.B., and Myint Y.M (1999). Time, cost and quality trade off in project management: a case study: *International Journal of Project Management*. Vol. 17, page 249-256.

Koushki, P.A., Al-Rashid, K., and Kartam, N., (2005), "Delays and cost increase in the construction of private residential projects in Kuwait", *Construction Management and Economics*, March 2005, 23-285-294.

Koushki, P.A., and Kartam, N., (2004), "Impact of construction materials on project time and cost in Kuwait", *Engineering, Construction and Management*, 2004, 11 (2): pp126-132.

Kraiem, Z.M. (1987). Concurrent Delays in Construction Projects. *Journal of Construction Engineering and Management*. ASCE, Vol.113, No. 4, page 591-601

Kumaraswamy M.M and Chan D.W.M (1998). An Evaluation of Construction Time Performance in the Building Industry: *Building and Environment*. Vol. 31, No. 6: page 569-578.

Kumaraswamy M.M and Chan D.W.M (2002). Compressing construction durations: lessons learned from Hong Kong building projects; *International Journal of Project Management*. Vol. 20, page 23-35.

Kumaraswamy M.M and Yogeswaran K. (2003). Substantiation and assessment of claims for extension of time.; *International Journal of Project Management*. Vol. 21, page 27-38.

Kumaraswamy, M.M, and Chan, D.W.M., (1998), "Contributors to construction delays", *Construction Management and Economics*, 1998, 16:17-29.

Kumaraswamy, M.M., Miller, D.R.A., Yogeswaran, K. (1998), "Claims for extensions of time in civil engineering projects", *Construction Management and Economics*, Vol. 16 No.3, pp.283-94.

Laufer A. dan Cohenca D. (1990) "Factors Affecting Construction-Planning Outcomes" ASCE, *J. of Constr. Engrg. and Mgmt.*, Vol. 116 No. 1, 135-155

Lim E. C. dan Alum J (1995) "Construction Productivity: Issues Encountered by Contractors in Singapore" Elsevier Science Ltd., *Int. J. of Project Mgmt.*, Vol. 13 No. 1, 51-57

Ling F. Y. Y., Chan S. L. Chong. E dan Ee L. P. (2004) "Predicting Performance of Design-Build and Design-Bid-Build Projects" ASCE, *J. of Constr. Engrg. and Mgmt.*, Vol. 130 No. 1, 75-83

Long N.D., Ogunlana S., Quang T. and Lam K.C. (2004). Large construction projects in developing countries: a case study from Vietnam: *International Journal of Project Managemnet*. Vol. 22, page 553-561.

Loosemore M (1998) "The Three Ironies of Crisis Management in Construction Projects" Elsevier Science Ltd., *Int. J. of Project Mgmt.*, Vol. 16 No. 3, 139-144

Mahmoud-Jouini S.B., Midler C., and Garel G (2004): Time-to-market vs. time-to-delivery Managing speed in Engineering, Procurement and Construction projects.: *International Journal of Project Management*. Vol. 22, page 359-367.

Manavazhi M.R. and Adhikari D.K. (2002). Material and equipment procurement delays in highways projects in Nepal: *International Journal of Project Managemnet*. Vol. 20, page 627-632.

Mastermann J W E (1992) " An Introduction to Building Procurement Systems" E & FN Spin, London

Mezher T.M., and Tawil W., (1998); "Causes of delays in the construction industry in Libanon", *Engineering Construction and Architectural Management Journal*, 1998, 5 (3): 251-60.

Mohsini R A dan Davidson C H (1999) " Building Procurement: Key to Improved Performance." *Building Research and Info* 29/3 106-113

Molenaar K. R., Songer A. D., dan Barash M. (1999) "Public Sector Design/Build Evolution and Performance" ASCE, *J. of Mgmt in Engrg.* Vol. 15 No. 2, 54-62

Moore R F C (1984) "Response to Change: The Development of Non Traditional Forms of Contract" *Ascot Chatered Ins. Of Building (CIOB)*

Munns A. K. (1995) "Potential Influence of Trust on the Successful Completion of a Project" Elsevier Science Ltd., *Int. J. of Project Mgmt.*, Vol. 13 No. 1, 19-23

Naphthine R. dan Smart R (1995) "Design and Build-Lessons from the UK Channel Tunnel Terminal" *Proc. Instn. Civ Engrns.*, Sept, 123-130

Ndekugri I. dan Turner A. (1994) " Building Procurement by Design and Build Approach" ASCE, *J. of Const. Engrg. and Mgmt.*, Vol. 120 No. 2, 243-255

NEDO (1991) "Partnering : Contract Without Conflict". National Economical Development Office (NEDO), London

Nigel M.R., Anthony P.L., George Tan K.H., Chan R. (1996). *Construction Law in Singapore and Malaysia*. 2nd ed. Butterworths Tolley.

O'Brien, J.J. (1998), *Construction Change Orders*, McGraw Hill, New York.

Odeh, A. M., and Bataineh, H. T., (2002), "Causes of construction delay: traditional contracts", *International Journal of Project Management*, 2002, 20: 67-73.

Ogunlana, S.O., Promkuntong, K., and Jearkijrm, V., (1996); "Construction delays in a fast-growing economy: comparing Thailand with other economies", *International Journal of Project Management*, 1996, 14(1): 37-45.

Okpala, D.C., and Aniekwu, A.N.(1998). Causes ogf High Cost of Construction in Nigeria. *Journal of Construction Engineering; ASCE*, Vol 114, No. 2, page 223-244

Palaneeswaran E. dan Kumaraswamy M. M (2000)"Contractor Selection for Design/Build Projects" ASCE, *J. of Constr. Engrg. and Mgmt.*, Vol. 126 No. 5, 331-339

Parfitt M.K. dan Sanvindo V.E (1993) "Checklist of Critical Success Factors for Building Projects". ASCE, *J. of Mgmt in Engrg*, Vol 9 No. 3, 243-249.

Pinto J. K. dan Slevin D. P. (1988) "Critical Success Factors Accross the Project Life Cycle" *Proj Mgmt J*. Vol. 19 No. 3. 67-75

Pocock J. B., Liu L. Y dan Kim M. K (1997) "Impact of Management Approach on Project Interaction and Performance" ASCE, *J. of Const. Engrg. and Mgmt.*, Vol. 123 No. 4, 411-418

Riaf, N., Arditi, D., and Mohammadi, J. (1991). A Conceptual Model For Claim Management in Construction: An AI Approach. *Journal of Computers*.

RIBA (1980) "RIBA Plan of Work for Design Team Operation" in Powell J (ed) "Handbook of Architect Practice and Management" RIBA Pub London 347-373

Sanvindo V., Grobler F. Parfitt K., Guvenis M. dan Coyle M (1992)"Critical Success Factors for Construction Projects". ASCE, *J. of Const. Engrg. and Mgmt.*, Vol. 118 No. 1, 94-111

Sawczuk B (1996) "Risk Avoidance for the Building Team" E & FN Spin, London

Songer A.D., dan Molenaar K. R. (1997). "Project Characteristics for Successful Public-Sector Design-Build" *J. Constr. Engrg. and Mgmt.*, ASCE, Vol. 123 No. 1, 34-40

Songer A.D., dan Molenaar K. R. (1998). "Model For Public Sector Design-Build Project Selection" ASCE, *J. of Constr. Engrg. and Mgmt.*, Vol. 124 No. 6, 467-479

Stephen O. Ogunlana and Krit Promkuntong (1996). Construction delays in a fast growing economy: comparing Thailand and other economies. *International Journal of Project Management*. Vol. 14, No.1: page 37-45.

Syed M. Ahmed, Salman Azhar, Pragnya Kappagantula, and Dharam Gollapudi (2003). Delays in Construction: A brief study of the Florida Construction Industry: *ASC Proceedings of the 39th Annual Conference*. April 10-12; page 257-266

The CIDB Directory 2003-3004 (The Nation Builders, Contractotors, Construction Materials, Plant and Equipment)"CIDB

Thomas S N, Thanh D L and Swee E C (2003) " A Case-Based Procurement Advisory System for Construction" *Journal of Advance Engineering Software*. pg 429-438

Tiong R. L. K. (1996) "CSFs in Competitive Tendering and Negotiation Model for BOT Projects". ASCE, *J. of Constr. Engrg. and Mgmt.*, Vol. 122 No. 3, 205-211

Tse R.Y.C., and Love P.E.D. (2001). An Economic Analysis Of The Effect Of Delays on Project Costs: *Journal of Construction Research*. Vol. 4, No. 2, page 155-1

Turner A (1990) "Building Procurement" Mac Millan Edu. Ltd. London

Weston D. C. dan Gibson G. E. (1993) "Partnering-Project Performance in U.S. Army Corps of Engineers" ASCE, *J. of Mgmt in Engrg*, Vol 9 No. 4, 410-425.

Wong P (2002) "*Malaysian Construction Industry-Review and Outlook*" Journal of Malaysian Master Builder.3rd Quarter Edition. pg 69-76

Yates J.K. (1995) "Use of Design/Build in E/C Industry" ASCE, *J. of Mgmt in Engrg*, Vol 11 No. 6, 33-38

Yates, J.K. (1993). Construction Decision Support System for Delay Analysis. *Journal of Construction Engineering and Management*. ASCE, Vol. 119. No. 2, page 226-243

Zeitoun, A., Oberlender, G. (1993), Early Warning Signs of Project Changes, Oklahoma State University, Stillwater, OK, .