

# THE USE OF SUPPLY CHAIN MANAGEMENT TO REDUCE DELAYS: MALAYSIAN PUBLIC SECTOR CONSTRUCTION PROJECTS

Salman Riazi Mehdi Riazi

School of Urban Development, Queensland University of Technology, Brisbane, Australia  
salman.mehdiriazi@student.qut.edu.au

Martin Skitmore

School of Urban Development, Queensland University of Technology, Brisbane, Australia  
rm.skitmore@qut.edu.au

Yan Ki Fiona Cheung

School of Urban Development, Queensland University of Technology, Brisbane, Australia  
y.cheung@qut.edu.au

*Construction delays are a critical problem for Malaysian public sector projects. These delays have been blamed mainly on inefficient traditional construction practices that continue to dominate the current industry. This paper reports the progress to date of a Ph.D. research project aimed at developing a framework to utilize Supply Chain Management (SCM) tools to improve the time performance of Malaysian Government projects. The potential of SCM has been identified for public sector governance and its use in Malaysia is now being considered within the strategy of the Malaysian Construction Industry Master Plan (2006-2015). Encouraged by success in the UK, there is a cautious optimism concerning the successful application of SCM in Malaysia. This paper considers delay as a problem in Malaysian public sector projects, establishes the need to embrace SCM and then elucidates the need and strategies for the development of a delay reduction framework. A literature review, survey mechanism and structured interview schedule will be undertaken to achieve the research objectives. The final research outcome will be a framework that addresses root delay contributors (“pathogens”) and applies SCM tools for their mitigation.*

**KEYWORDS:** ‘Supply Chain Management’, ‘construction projects’, ‘construction delay’, ‘public sector’, ‘Malaysia’

## INTRODUCTION

The inability to complete projects on time is a problem in the global construction industry and more particularly in developing countries (e.g. Ahmed et al., 2002). This problem is manifested in the underachieving Malaysian construction industry (CIDB, 2009), with recent public project delay rates of 80% (Joshi, 2009). Abdullah et al. (2010) have also reported a 90% delay rate for projects handled by Majlis Amanah Rakyat (MARA), a government agency that plays an important role in implementing the Malaysian Government’s construction policies.

This situation has, for a long time, been blamed on ineffective management (Munns & Bjeirmi, 1996) and the dominance of traditional construction practices. Love and Sohail (2002) claim that these practices create unnecessary waste, errors and misapprehension

amongst the project supply chain. Current construction practice in Malaysia has also resulted in duplication of work, lengthy approval and work time, lack of transparency and surging costs (CIMP, 2007). Calls for improvement have been made through the Malaysian Construction Industry Master Plan 2006-2015 (CIMP, 2007) with similar efforts being previously made in other nations such as Australia, Sweden, Finland, Hong Kong, Norway, Singapore and the United Kingdom (Love et al., 2004). This suggests the need for a transformation in the way projects are managed.

Many researchers and practitioners have recognised the potential of Supply Chain Management (SCM) as a way forward for the construction industry (Egan, 1998; Strategic Forum, 2002; Love et al., 2004). Existing research also supports the fact that SCM benefits client organisations (London & Kenley, 1999) and has later appeared as an important concept for the public sector (London & Chen, 2006). Therefore, SCM appears to have the potential for helping the Malaysian public sector achieve better project time performance. Thus, the research described in this paper aims to develop a framework utilizing SCM tools and present a clear guide for the adoption of SCM techniques to reduce Malaysian Government project delay. As part of producing a holistic and workable delay mitigation framework, the delay causes will be tackled from their “latent” condition - described by Busby and Hughes (2004) as “pathogens”. With suitable modification, it is anticipated that the framework will be useful for public sector projects in other parts of the world.

### **Malaysian Construction Industry Outlook**

Following independence in 1957, the Malaysian’s construction industry developed initially through the inaugural economic plan (1956-1960). Since then, Malaysia’s construction industry has played a significant role in improving the community’s lifestyle, generated wealth for the country and contributed to the economic development of the nation. In addition to realising the Government’s socio-economic policies, the sector also creates a multiplier effect on other industries such as manufacturing, services and professional services. Considering its importance to the nation, however, the growth of the sector has been slow, recording an average growth of only 0.7% from year 2000 to 2007, and, with the share of GDP shrinking from 3.3% to 2.5% over the same period, the lowest percent in the region (CIMP, 2007). With the aim of achieving a world-class industry by 2015, major improvement is needed within the Malaysian construction industry.

### **Construction Delay**

It is generally accepted that time is one of the main efficiency measures of projects (NEDO, 1998), thus projects that experience delays are severely criticised. However, delivering projects on time is often very difficult due to the dynamic, complex, multidisciplinary and uncertain nature of the industry (Wright, 1997). Delays can have a major effect on construction organizations, resulting in increased costs, lost opportunity costs, reputation damage, arbitration, litigation and, in the worst cases, the total abandonment of projects. Construction delays also directly relate to the performance of a project and customer satisfaction level. Research in Finland by Kärnä et al. (2004) found that the customer satisfaction level declines when a project negatively deviates from the planned schedule. Therefore, customers appear to be dissatisfied when construction performance is less than what is regarded as standard (Kärnä et al., 2004).

The severity, and seeming intractability, of delays has triggered much research to identify their leading factors. There are studies from Saudi Arabia (Al-kharashi & Skitmore, 2009), Hong Kong (Chan & Kumaraswamy, 1997), Jordan (Al-Moumani, 2000), Ghana (Frimpong et al., 2003), Malaysia (Sambasivan & Soon, 2007). Previous studies have also described the

“blame-game” that is played out every time a project exceeds its planned time (Al-Kharashi & Skitmore, 2009), picturing an adversarial scenario. In reality, the construction processes are inter-related (Love et al., 1998), which is a major issue in current management philosophies (i.e. SCM). SCM adopts a system perspective that suggests that the whole system is responsible for the project performance. Therefore, a different method for categorising delay causes is needed to detect the execution and system problems rather than individual errors.

Busby and Hughes (2004) have introduced the term “pathogens”, whose greatest conceptual value is that they remain dormant in the system until an actual failure occurs. This means that participants may be carrying out defective practices that have not yet resulted in a failure and so are continuously exposed to the same risk of error. Therefore, the identification of delay pathogens could avoid the risk of implementing similar mistakes over and over again. In construction, pathogen identification is also considered to be the first step towards attaining process stability (Love et al., 2008). For that reason, the identification of latent factors of delay allows mitigation to be carried out from the root cause and appears to be a positive move towards the development of a holistic delay reduction framework.

### **Delay in Malaysian Public Sector Construction**

Delays in completion are a very significant problem for the Malaysian construction industry, with the latest statistics indicating that these occur on 80% of all public sector projects (Joshi, 2009). This is not a new problem and has created a negative image for the industry, with the delays being the subject of previous research by Abdul Rahman et al. (2006) and Pratt (2000). According to CIDB (2009), limited trust, adversarial relationship and problems in communication and coordination are major causes of the time overruns in Malaysian construction projects. The convoluted and inefficient nature of traditional Malaysian practices (Rowlinson, 1999) is thought to be responsible for the fragmented and unpleasant attitudes of construction industry participants (CIDB, 2009). Research by Abd Shukor et al. (2011) also revealed that traditional and Design and Build procurement arrangements are preferred by most Industrialized Building System (IBS) contractors in Malaysia.

Few other initiatives have been made despite the introduction of numerous forms of private initiative modalities. For example, the Private Finance Initiative (PFI) was officially implemented by the Malaysian government in 2006 via the Ninth Malaysia Plan (2006-2010) under the National Privatization Plan (Netto, 2006) and still remains at the initial stage. Since then, several private-public collaboration initiatives have been undertaken. However, these have often been combined with traditional practices, leading to limited outcomes from the schemes on which they have been used. In fact, the PFI initiatives also deviate from the international PFI framework in terms of risk transfer to the private sector (Jayaseelan & Tan, 2006).

In addition, partnership practices in the Malaysian public sector mainly involve the contractor and client organisations, with little or no consideration given to involvement of other supply chains (e.g. supplier, sub-contractor) in its processes, deviating further from the main idea of collaborative approaches. Shortcomings also appear in terms of risk allocations, benefit sharing and encouragement of innovative ideas.

It could therefore be suggested that the current partnership approach in Malaysian public sector practice is merely an improved version of Design and Build practice, which has not yet managed to integrate the whole supply chain throughout the construction process. The failure to do this has missed the point of forming collaborative relationships thus fails to eliminate

the adversarial nature and opportunistic behaviour that occurs in traditional practice. As a result, project performance has yet to achieve a convincing state, and time overruns remain a severe problem for the industry. This suggests a further shift is needed in the way projects are currently managed.

In the past, some significant delay cases have been experienced in public sector projects. For example, the MATRADE project experienced nine years of delay and a 70% cost overrun, said to be due to inferior construction and the abandonment of the project by the first contractor, resulting in the appointment of another contractor. Similarly, Pandan hospital took approximately six years to build rather than the planned two years due to many extensions of time. Other projects include the Middle Ring Road (2) that underwent post-occupational ratification due to the appearance of cracks in 31 of its flyover piers. Meanwhile, the second Penang Bridge, which is currently under construction, has been delayed for more than 12 months due to additional technical aspects that were not considered in the early stages, thus affecting the project execution date. A recent case is the Shah Alam hospital that scheduled completion for August 2010 but required an extension to June 2011, again due to contractor incompetence. Most of these cases were due to the incompetence of the whole project team, specifically the contractor. Incorrect selection and lack of integration among those involved in the supply chain has led to problems, such as mistakes in project planning, buildability issues, wrong project team selection, miscommunication of information, etc.. This non-productive condition has caused the Malaysian construction industry to be inefficient and of low quality and productivity, leading to a comprehensively negative image and economic volatility (CIDB, 2004).

### **Need for Change**

The construction industry worldwide has been heavily criticized for decades for its adversarial relationships, fragmented nature, poor customer/end-user focus, limited investment in improvement and innovation, poor time and cost performance, and low quality, productivity and satisfaction levels (Chan et al., 2003; Egan, 1998; Latham, 1994). There is now an urgent need for revolutionizing construction practice, technology, mentality, work practice and processes and to maintain continuous improvement through effective benchmarking and performance measurements. Such a change would ensure an advantage over conventional practice (Ibrahim et al., 2010), as the survival of the industry depends on its improved capability and aptitude (Abdul Rahman et al., 2005). Calls for greater project success have been made in recent times (Kärnä & Jonnonen, 2005). However, the Malaysian Government's investment in the industry has declined considerably (Abdul Rahman et al., 2005), forcing work to be undertaken with limited resources and with concomitant sacrificing of productivity and satisfaction levels (Ibrahim et al., 2010). Thus, in order to adapt in the new era, considerable improvement needs to take place to improve the country's construction performance.

Realizing the need for change, Malaysia's initiative came through the Malaysian Construction Industry Master Plan (CIMP) 2006-2015. This has resulted in a greater demand for improvement issues such as quality, human resources, innovation, communication, technology and environmental sustainability, with utmost priority being placed on integrating the industry's value chain (CIMP, 2007). Other programs include the "zero delay" target via the 10<sup>th</sup> Malaysia Plan which covers the 2011 to 2015 period (Abu Mansor, 2010). These initiatives clearly indicate the urgency faced by the Malaysian construction industry in terms of improving its overall industry performance, especially concerning the value chain

attributes. Construction delay has been affecting the industry for many years and thus the elimination of delays has been prioritized in the most recent Malaysia Plan.

Examining the improvement needed for Malaysian construction practice, the industry could possibly benefit from the best practices from other industries such as manufacturing and production. The UK's Egan (1998) also stresses the need for industry to modernize itself to become more competitive and efficient. The increasing complexity and dynamic nature of today's construction industry (Gidado, 1996) suggests that conventional practice should be 'a story of the past' (Naoum, 2003). A move towards a longer-term relationship that nurtures better integration, knowledge sharing, investment in relations and greater flexibility is vital (Rahman & Kumaraswamy, 2002). Improvement in the management of supply chains is therefore necessary for increased construction productivity (Vrijheof & Koskela, 2000). In the case of Malaysia, effective construction supply chain integration practice needs to be related to the current trend in order to enhance its competitiveness and innovativeness (Abd Shukor, 2011).

### **SCM in Construction**

Project success has long been sought after by construction practitioners (Mitchell & Trebes, 2005) and growing competition means that construction organisations need to find better ways to improve project success (Kärnä & Jonnonen, 2005). This has resulted in an increased call for more collaborative approaches. Recently, initiatives have supported SCM as a new mechanism for effective construction management (Egan, 1998; Love et al., 2004; Strategic Forum, 2002). In his report Egan (1998) urged the construction industry to engage higher integration, improve performance, nurture harmonious inter-organizational relationships and offer better value in projects.

SCM is a concept that originated and flourished within the automotive manufacturing industry and has recently gained the attention of the construction industry. It emerged in the late 1990's (Jones & O'Brien, 2003) and has been the focus of construction industry ever since. SCM has been defined by Christopher (1992, p. 18) as, "The management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole". Unlike traditional practice, SCM promotes competition between supply chains, not merely single entities (Gier et al., 2006), which motivates all parties to be competitive and productive (Jones & Saad, 2003).

SCM lacks theoretical support to explain its existence and boundaries; however a few theories are able to explain its nature, structure and survival. These include Transaction Cost Theory, which contends that asset specificity creates inter-dependence between partners to avoid the cost of creating new collaborations (Noteboom, 2000). Another theory in use is Resource-Based Theory (RBT) which believes that having control over and access to resources provides an extra edge to an organization's competitiveness (Rungtusanatham et al., 2003). On the other hand, Knowledge-Based Theory (KBT) compensates the RBT by recognising the value of sharing knowledge-based resources. Other applicable theories include the Contingency Theory, which suggests that the external environment could facilitate the establishment of an organisation's tactical strategies (Ranganathan & Lertpittayapoom, 2002) and Social Exchange Theory, which is based on the assumption that people tend to return favours (Gouldner, 1960). Finally, Industrial Organisation Economic Theory illustrates behavioural aspects of how market structures affect organisations and inter-organisational performance (O'Brien et al., 2002).

SCM is based on the notions that inter-firm and intra-firm relationships are important for organisations to be more agile in the global market. It claims that individual organisations cannot be self-contained and need to collaborate in a 'win-win' manner in order to supplement each other in terms of resources and experience, while at the same time nurturing long-term business relationships, increasing trust, configuration and control, and continuously improving the performance of the whole supply chain. SCM is said to be better than traditional practice in various aspects, such as reduced inventories, sustained improvement, cost efficiency, speedier operation, improved information flow, higher coordination and shared risks and rewards (see Cooper & Ellram, 1993).

It is necessary for the entire scope of the supply chain to be understood for successful implementation of SCM (Vriehoef & Koskela, 1999). Past SCM initiatives in construction, however, have had limited coverage, with studies restricted to split issues such as the contractor/supplier interface (Vriehoef & Koskela, 2000), rework (Love et al., 1999), environmental performance (Ofori, 2000), design management (Khalfan et al., 2001), service quality (Hoxley, 2001) and purchasing behaviour (Dubios & Gadde, 2000). Research in construction SCM has yet to take a holistic approach (e.g. Barker et al., 2000). Furthermore, despite many researchers concluding clients mostly benefit from SCM (London & Kenly, 1999), most research initiatives focus on the contractor's supply chain, not particularly on SCM (Vriehoef & Koskela, 1999).

In Malaysia, SCM is a new concept with little or no application in industry. The relational approach as a whole is still in its infancy within the industry (Rashid, 2002), as are 'lean' practices (Abdullah et al., 2009). This review invites the conclusion that SCM has a great potential within the local construction industry, especially for public sector projects which experience the most delays. Due to the limited coverage of previous SCM studies, the research needed to be conducted in a holistic manner covering a subset of issues that lead to delays in Malaysian public sector projects. In light of the success of its application within the UK's Ministry of Defence (Pearson, 1999), there is some optimism that SCM could similarly benefit the Malaysian construction industry.

### **The Research Route**

The first step in the research is to obtain existing relevant information on the causes of construction delays, pathogens of delay and the construction of SCM tools relevant for improving time performance. This involves a literature review and preliminary structured interviews conducted with Malaysian construction industry experts and aimed at identifying Malaysia's current issues, and take into account the locality factors that may apply. These have now been completed and are proving to be essential for the preparation of comprehensive questionnaire and survey forms for data collection in the later stage of the research.

The next stage of the research will adopt both qualitative and quantitative methods for data collection in order to achieve a broad array of data available for analysis. The survey forms will be prepared, tested and sent to industry practitioners in order to identify the main causes of delay in Malaysian public sector projects, which will then be grouped into distinctive pathogens. To increase the validity of the survey outcomes, the research will ensure that questionnaires are purposively scattered throughout the industry's supply chain, with the proposed sample size of 300 responses and at least a 35% response rate. After analysing the data from the first survey session and establishing a list of pathogens of the main causes of delay, this research will carry out another survey session with the aim of matching each delay

pathogen with suitable SCM tools for the purpose of framework development. To ensure reliability of information, the same strategy will be applied as for the first survey session.

The data obtained from both surveys will then be translated into a framework which will illustrate how each unique SCM tools could be utilized in order to improve each pathogen of delay. Finally, the framework will be validated through two sessions of structured interviews with the experts and decision makers of the Malaysian construction industry to ensure that it is workable and suitable for Malaysian public sector application.

## CONCLUSIONS

The Malaysian construction industry has been plagued by project delays for decades. This has led to the conduction of much research to address the problem; however, the industry is showing few signs of improvement. In the case of Malaysian public sector projects, time performance is at critical level, suggesting there are major issues with the industry's current practices.

The “*leitmotiv*” of published works is the call on industry to improve its sense of integration, communication, collaboration and coordination through embracing SCM. For example, the effectiveness of SCM in improving construction efficiency and productivity has now made it the preferred choice of partnering in the UK construction industry. Several client and contractor organisations have also benefited, suggesting that it could have significant potential within the Malaysian public sector.

Having realized the limited research coverage of SCM domains, the research will examine SCM tools needed to reduce the delay in Malaysian public sector projects in a holistic manner, covering all the sub-set issues grouped into ‘pathogens’. Identifying the delay pathogens first enables a framework to be developed to address delay problems from their fundamental causes, thus avoiding future problems with unidentified causes.

The outcomes of the research aim to fill the gap in empirical studies in relation to SCM and will be of particular use to the Malaysian public sector and the construction industry as a whole. The proposed framework is also expected to be a useful guide for similar initiatives in other countries.

## REFERENCES

Abd Shukor, A.S., Mohammad, M.F., Mahbub, R. & Ismail, F. (2011). Supply Chain Integration in Industrialized Building System in the Malaysian Construction Industry. *The Built & Human Environment Review*, **4**(1), 108-121.

Abdul Rahman, H., Berawi, M. A., Berwai, A. R., Mohamed, O., Othman, M. & Yahya, I. A. (2006). Delay mitigation in the Malaysian construction industry. *Journal of Construction Engineering and Management*, **132**(2), 125-33.

Abdul Rahman, H., Mohd Rahim, F. A., Hamid, M. & Zakaria, N. (2005). Beyond basic: the potential role and involvement the QS in public projects – an observation. *Sustaining the Profession – Towards Diversification*. Kuala Lumpur, Malaysia: QS National Convention.

Abdullah, M. R., Abdul Rahman, I. & Abdul Aziz, A. S. (2010). Causes of Delay in MARA Management Procurement Construction Projects. *Journal of Surveying, Construction & Property*, **1**(1).

Abdullah, S., Abdul Razak, A., Abu Bakar, A. H. & Mohammad, I.S. (2009). Towards Producing Best Practice in the Malaysian Construction Industry: The Barriers in Implementing the Lean Construction Approach. *Paper presented at International Conference on Construction Industry*, Padang, Indonesia.

Abu Mansor, S. (2010). The Construction Sector at the Onset of the 10<sup>th</sup> Malaysia Plan. *Presented at the 7<sup>th</sup> Malaysia construction sector review and outlook seminar*, Putra World Trade Centre, Kuala Lumpur.

Ahmed, S., Azher, S., Castillo, M., & Kappagantula, P. (2002). Construction delays in Florida; an empirical study. *Final report submitted to: Mr. Michael Ashworth, planning consultant, state of Florida, Department of Community Affairs*.

Al-Kharashi, A. & Skitmore, M. (2009). Causes of delays in Saudi Arabian public sector construction projects. *Construction Management and Economics*, **27**(1), 3-23.

Al-Momani, A. (2000). Construction delay: a quantitative analysis. *International Journal of Project Management*, **20**, 51–9.

Barker, R., Hong-Minh, S. & Naim, M.M. (2000). The terrain scanning methodology: assessing and improving construction supply chains. *European Journal of Purchasing and Supply Management*, **6**(3-4), 179-93.

Busby, J. S. & Hughes, E. J. (2004). Projects, pathogens, and incubation periods. *International Journal of Project Management*, **22**, 425–434.

Chan, A., Chan, D., & Ho, K. (2003). An Empirical Study of the Benefits of Construction Partnering in Hong Kong. *Construction Management and Economics*, **21**(5), 523-33.

Chan, D. W. M. & Kumaraswamy, M.M. (1997). A comparative study of causes of time overruns in Hong Kong construction projects. *International Journal of Project Management*, **15**(1), 55–63.

Christopher, M. (1992). *Logistics and Supply Chain Management - Strategies for Reducing Costs and Improving Service*. (2<sup>nd</sup> ed.). London: Financial Times Professional Ltd.

Construction Industry Development Board Malaysia (CIBD). (2004). *Master Plan for Occupational Safety and Health in Construction Industry 2005-2010*. Kuala Lumpur, Malaysia: CIBD.

Construction Industry Development Board Malaysia (CIDB). (2009). Integration of the construction industry through partnering – the Malaysian initiative. *Part 2: Theme paper of the 15<sup>th</sup> Asia Construct Conference*, Kuala Lumpur, Malaysia.

Construction Industry Master Plan Malaysia 2006-2015. (2007). *Construction Industry Development Board Malaysia (CIBD)*. Kuala Lumpur, Malaysia: CIDB.

- Cooper, M. C. & Ellram, L. M. (1993). Characteristics of Supply Chain Management and the Implications for Purchasing and Logistics Strategy. *The International Journal for Logistics Management*, **4**(2), 13-24.
- Dubois, A. & Gadde, L-E. (2000). Supply Strategy and Network Effects – Purchasing Behaviour in the Construction Industry. *European Journal of Purchasing & Supply Management*, **6**(3-4), 207-15.
- Egan, J. (1998). *Rethinking Construction*, London: Department of the Environment, Transport and the Regions & HMSO.
- Frimpong, Y., Oluwoye, J. & 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*, **21**, 321–326.
- Geir, G., Marianne, J. & Goran, P. (2006). Supply chain management – back to the future? *International Journal of Physical Distribution and Logistics Management*, **36**(8), 643-659.
- Gidado, K. I. (1996). Project Complexity: The Focal Point of Construction Planning. *Construction Management and Economics*, **14**(3), 213-25.
- Gouldner, A. W. (1960). The Norm of Reciprocity: A Preliminary Statement. *American Sociological Review*, **25**(2), 161-178.
- Hoxley, M. (2001). Purchasing UK public sector property and construction professional services: competition v. quality. *European Journal of Purchasing and Supply Management*, **7**(2), 133-139.
- Ibrahim, A. R., Roy, M. H., Ahmed, Z. & Imtiaz, G. (2010). An investigation of the status of the Malaysian construction industry. *Benchmarking: An International Journal*. **17**(2), 294-308.
- Jayaseelan, R., & Tan, M. (2006). PFI-cure for all ills. *The Edge Malaysia*, 72-74.
- Jones M. & O'Brien V. (2003). *Best Practice Partnering in Social Housing Development*. London: Thomas Telford Publishing.
- Jones M. & Saad M. (2003). *Managing Innovation in Construction*. London: Thomas Telford Publishing.
- Joshi, M. (2009, June 1). *80 per cent of Malaysian government projects delayed, minister says*. Webpage accessed 01-10-2009 at: <http://www.topnews.in/80-cent-malaysian-government-projects-delayed-minister-says-2173299>.
- Kärnä, S. & Jonnonen, H. (2005). Project feedback as a tool for learning. *Paper presented at International Group for Lean Construction-13*, Sydney, Australia.
- Kärnä, S., Junnonen, J.M. & Kankainen, J. (2004). Customer Satisfaction in Construction. *Paper presented at International Group for Lean Construction-12*, Copenhagen, Denmark.

- Khalfan, M. M. A., Anumba, C. J., Siemieniuch, C. E. & Sinclair, M. A. (2001). Readiness assessment of the construction supply chain for concurrent engineering. *European Journal of Purchasing and Supply Management*, **7**(2), 141-53.
- Latham, M. (1994). *Constructing the Team*. London: HMSO.
- London, K. & Chen, J. (2006). Construction supply chain economic policy implementation for sectoral change: moving beyond the rhetoric. *OBRA 2006: Proceedings of the Annual Research Conference of the Royal Institution of Chartered Surveyors*, University of Newcastle, Australia.
- London, K. & Kenley, R. (1999). Client's role in construction supply chains - a theoretical discussion. *Proceedings CIB Triennial World Symposium W92*, Cape Town, South Africa.
- Love P. E. D. & Sohal A. S. (2002). Influence of organisational learning practices on rework costs in projects. *Proceedings of the Eighth International Conference on ISO 9000 & TQM (Change Management)*. RMIT Storey Hall, Melbourne: Centre for Management Quality Research at RMIT University.
- Love P. E. D., Li H. & Mandal P. (1999). Rework: a symptom of a dysfunctional supply chain. *European Journal of Purchasing and Supply Management*, **5**(1), 1–11.
- Love, P. E. D., Davis, P., London, K. & Jasper, T. (2008). Causal Modelling of Construction Disputes. *Association of Researchers in Construction Management 2008 Conference Proceedings*, Cardiff, UK.
- Love, P. E. D., Gunasekaran, A. & Li, H. (1998). Putting an engine into re-engineering: toward a process based organisation. *International Journal of Operations & Production Management*, **18**(9), 937-49.
- Love, P. E. D., Irani, Z. & David, J. E. (2004). A seamless supply chain management model for construction. *Supply Chain Management: An International Journal*, **9**(1), 43-56.
- Mitchell, B. & Trebes, B. (2005). *Managing reality: Book 1 – Introduction to the engineering and construction contract*. London: Thomas Telford Limited.
- Munns, A. K. & Bjeirmi, B. F. (1996). The role of project management in achieving project success. *International Journal of Project Management*, **14**(2), 81-87.
- Naoum, S. (2003). An Overview into the Concept of Partnering. *International Journal of Project Management*, **21**(1), 71-6.
- NEDO. (1998). *Faster Building for Industry*. UK: HMSO.
- Netto, A. (2006). Malaysia's newfangled privatization fudge. (*EPU. 2006*).
- Nooteboom, B. (2000). *Inter-Firm Alliances: Analysis and Design* (2<sup>nd</sup> Ed.). New York: Routledge.
- O'Brien, W. J., London, K. & Vrijhoef, R. (2002). Construction supply chain modelling: A research review and interdisciplinary research agenda. *Proceedings from IGLC-10*, Gramado, Brazil.

- Ofori, G. (2000). Greening the construction supply chain in Singapore. *European Journal of Purchasing and Supply Management*, **6**(3-4), 195-206.
- Pearson, A. (1999). Chain reaction. *Building*, pp.54-5.
- Pratt, R. (2000). Project management in Malaysia, some ideas on the way ahead. *Paper presented at Asia Pacific Diligence Sdn Bhd seminar, Project management: strategies, techniques, operations and control*, Kuala Lumpur, Malaysia.
- Rahman, M. & Kumaraswamy, M. (2002). Joint Risk Management through Transactionally Efficient Relational Contracting. *Construction Management and Economics*, **20**(1), 45-54.
- Ranganathan, C. and Lertpittayapoom, N. (2002). Towards a conceptual framework for understanding strategic alliance in e-commerce. *Proceedings of the 35th Hawaii International Conference on System Sciences*. Hawaii: Computer Society.
- Rashid, K. B. A. (2002). *Construction procurement in Malaysia: processes and systems constraints and strategies*. Kuala Lumpur: Research Centre, IIUM.
- Rowlinson, S. (1999). A Definition of Procurement Systems. *In Procurement Systems: A Guide to Best Practice in Construction*, ed. S. Rowlinson and P. McDermott., 27-51. London: E & FN Spon.
- Rungtusanatham, M., Salvador, F., Forza, C. & Choi, T. Y. (2003). Supply-chain linkages and operational performance: A resource-based-view perspective. *Journal of Operations and Production Management*, **23**(9), 1084-1099.
- Sambasivan, M. & Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management*, **25**(5), 517-526.
- Strategic Forum (2002). *Rethinking Construction: Accelerating Change*. Consultation paper. London: Strategic Forum for Construction.
- Vrijhoef, R. & Koskela, L. (1999). Roles of supply chain management in construction. *Proceedings of the Seventh Annual Conference of the International Group for Lean Construction*. Berkeley, US: IGLC-7, 133-146.
- Vrijhoef, R. & Koskela, L. (2000). The four roles of supply chain management in construction. *European Journal of Purchasing & Supply Management*, **6**, 169-178.
- Wright, J.N. (1997). Time and budget: The twin imperatives of a project sponsor. *International Journal of Project Management*. **15**(3), 181-186.