Advancing Towards Delay-Free Construction Project: A Review

Richard Hannis Ansah
Faculty of Industrial Management (FIM)
Universiti Malaysia Pahang
Lebuhraya Tun Razak, 26300 Kuantan Pahang, Malaysia
richanisah13@gmail.com

Shahryar Sorooshian
Faculty of Industrial Management (FIM)
Universiti Malaysia Pahang
Lebuhraya Tun Razak, 26300 Kuantan Pahang, Malaysia
sorooshian@gmail.com

Shariman Bin Mustafa
Faculty of Industrial Management (FIM)
Universiti Malaysia Pahang
Lebuhraya Tun Razak, 26300 Kuantan Pahang, Malaysia
shariman@ump.edu.my

Gomanth Duvvuru
A. Leon Linton Department of Mechanical Engineering
Lawrence Technological University
Southfield, Michigan, USA
gduvvuru@ltu.edu

Abstract

This paper is in the form of discussion on the recent trend of construction projects delays, addressing the need for collaborative efforts among project parties and bolstering the use of robust techniques to handle the challenges confronting the industry. The paper begins with a review of delays in construction projects, trending methodologies and techniques, and highlights the potential for applying the strategies: Building Information Modeling (BIM); Computer Integrated Manufacturing (CIM); Production/Lean Techniques; Skill Development and Training; and Concurrent Supply Network (CSN). Extensive use of these approaches in many countries has proven its efficiency in construction project development process' improvement and the overall performance of the building industry.

Keywords
Construction Projects, Delays, Techniques, Performance

1. Introduction

Delays are frequently common in construction projects around the world: (Iyer and Jha, 2006; Assaf and Al-Hejji, 2006; Lowsley and Linnett, 2006; Faridi and El-Sayegh, 2006; Alaghbari et al., 2007; Sambasivan and Soon, 2007; Memon et al., 2011; Rahman et al., 2012; Ibrahim et al., 2012; Memon et al., 2014; Memon, 2014; Zayyana et al., 2014; Hannis-Ansah et al., 2015). Nonetheless, the alarming rate and the effects of delays in construction project development calls for debate and assessment into the main delay sources and practical strategies to minimize them. Maintaining construction projects within schedule needs careful judgment, sound strategies, and good practices; however, the traditional approaches to construction management fails to deliver projects on time, within budget, and the desired quality (Abdelhamid, 2004; Abdullah et al., 2010; Rahman et al., 2012; Sarhan and Fox, 2013; Marhani et al., 2013; Aziz and Hafez, 2013; Zahidy et al., 2015).

Several studies have been conducted on the problems in the construction industry (Norzima et al., 2011; Sorooshian, 2014), yet, far too little consideration has been given to the interrelationships and agreement among project parties. It is intriguing to indicate how project parties often attribute the causes of delays to one another (Assaf et al., 1995; Rohaniyati, 2009; Chan and Kumaraswamy, 1996; Mezher and Tawil, 1998; Ashwini and Rahul, 2014). Besides, construction professionals ignore the significant benefits of some of these improvement strategies (Muhammad et al., 2013) that have been recommended by researchers. In order to ensure the success of project objectives, an integrated system and improved methodologies that ensure business process flow, optimization of functions, and effective communication among project teams is key.

Amongst the numerous techniques which are trending recently is the use of prefabrication or offsite manufacturing (OSM), Building Information Modeling (BIM), Computer Integrated Manufacturing (CIM), Production/Lean Techniques, Skill Development and Training, and Concurrent Supply Network (CSN). Keen to these techniques is to ensure development and make the industry more profitable thereby improving projects' quality, ensuring more sustainable growth, and safer construction sites, and reducing the total cost and duration. It is therefore in the interest of construction project professionals (CPP) to use techniques, methods and approaches that bolster delay-free construction projects. This purpose of this paper is to present a discussion of some of the trending techniques and/or approaches used within the construction industry. It is expected that these novel solutions found through literature survey equip managers and supplement their strategies towards delay mitigation.

2. Discussions

Even though the causes of delays may come from the internal structures of project parties to the construction environment (Arman et al., 2009), it is noteworthy to mention that project parties sometimes attribute causes of delays on each other, a scenario that could possibly be referred to as "The Blame Game." Assaf et al. (1995) presented about 56 factors causing delays in Saudi Arabia. Factors considered as most important by the project parties included; contractors observations indicated that there were delays by owner in progressive payments, delays in drawings preparation and approvals, and changes in design by owner; the architects and engineers attributed causes of delays to financial problems, slow decision making by owners; and ineffective relationship by contractors; owners related the delays to unavailability of labours, errors in design, among others. Likewise, Mezher and Tawil (1998) confirmed that in Lebanon's construction industry, the most important issue to contractors were contractual relationships, owners were concerned about financial issues, and consultants were concerned about project management issues. Chan and Kumaraswamy (1996) in Hong Kong found inefficiencies supervision and management of the site, variations works, slow decision making, etc., among clients/owners, consultants, and contractors. Ashwini and Rahul (2014) indicated that on large construction projects in India, delays associated with project implementing agencies, owners, and contractors included; contractor's mobilization delays, delays in acquiring land for project works, problems with funding, delays in revising specification, scope changes, low technical capabilities, low coordination between contractors and consultants, ineffective decision-making, ineffective scheduling and planning, low level of experience, and others. As the construction industry evolves parties interaction and relationships are key for development and sustainability and therefore issues like responsibility, communication, concurrent or integrated functions, teamwork, among others should be a focus for researchers, project professionals and policy makers alike.

Besides, the project management techniques and methods currently used in the construction project development have not been able to address the problems (Koskela, 2000; Bashford et al., 2005; Abdelhamid et al., 2008; Sacks et al., 2010; Marhani et al., 2013; Sarhan and Fox 2013; Aziz and Hafez, 2013; Hannis-Ansah et al., 2016) that is the reason why the problems exist (Norzima et al., 2011; Sorooshian, 2014). It is, therefore, imperative that managers update themselves with the trending techniques and keep deploying strategies to ensure the achievement of project objectives. The next section discusses some contemporary solutions found across the construction industries around the world.

3. Trending Solutions

The construction industry is increasingly shifting from traditional systems to the production system, hence, productivity from a project to a product based. This remarkable transition of construction has been witnessed in countries including Singapore, Australia, Malaysia, Hong Kong, China, UK and USA (Malik and Tayyab, 2014).

Prefabrication or Off-site Manufacturing (OSM)

Often known as Prefabrication, Industrialised Building System (IBS), Off-site Fabrication (OSF), Off-site Manufacturing (OSM), according to Malik and Tayyab (2014), OSM is construction system and technology where prefabricated and standardized parts/modules are prepared in a controlled manufacturing environment (either off-site or on-site), transported, assembled and erected into a structure ready for the end user. This construction technique has been influential in the construction industry across countries. In 1998, the UK construction has witnessed immense momentum after Egan report "Rethinking construction," (Egan, 1998); the off-site construction industry in the UK recorded a growth of £2.2 billion in 2004 to £6 billion in 2006 (Goodier and Gibb, 2007). In the same way, the Australian construction industry has witnessed a massive improvement through the adoption of OSM. OSM is recognized as the key vision towards the standardization and improvement of the Australia's construction and property industry for the next decade, "The Construction 2020" (Hampson and Brandon, 2004; Blismas and Wakefield, 2009). To increase the sustainable practices in China, OSM is repeatedly promoted as a conceivably feasible alternative (Zhai et al., 2014).

Information and Communication Technology (ICT) Platforms

Integrating ICT tools to design and construction have been considered as an effective solution to the different construction processes and delivery issues. The use of IT is profound in enabling more accurate information and documentation, help clients in the selection process, support integration, cost comparison, logistics and transportation (Ang and Kasim, 2013). Besides, it enables good conditions for effective manufacturing process where errors are detected early resulting in avoidance of problems in the assembly stage (Hamid et al., 2009; Ang and Kasim, 2013). The following are a few cases where the use of ICT has shown an immense contribution to the construction industry.

Computer Integrated Manufacturing (CIM)

CIM is a term used for both a computer-automated system and a method of manufacturing which integrates engineering, production, marketing and other support functions into coherent automated manufacturing processes. Functional areas including, analysis, planning, design, purchasing, inventory control, distribution and cost accounting are linked together through the computer with factory floor capacities, such as material management and handling, monitoring and direct control of the entire operations. This state of the art tool with almost complete digital chain is utilized from the early phases of planning to production (Ang and Kasim, 2013). Moreover, the system exchanges information within the individual processes with one another and initiate the required action. According to Waldner (1992) and Laplante (2005), through CIM, manufacturing can be done faster and errors minimized to the barest minimum. Reports have shown that CIM is instrumental in mass customization in construction industries in Europe predominantly for the provision of wall and ceiling components (Ang and Kasim, 2013). Figure 1 illustrates CIM process Control System (Waldner, 1992).

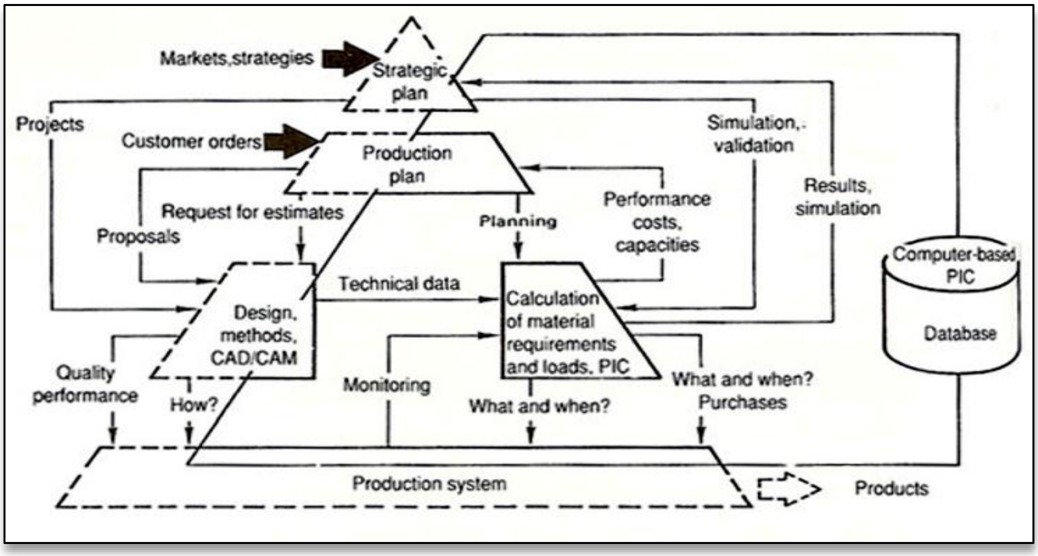

Figure 1: CIM Control System (Source: Waldner, 1992)

Building Information Modeling (BIM)

BIM, a three-dimensional (3D) parametric modeling software is said to have the capacity to resolve numerous technical difficulties in prefabrication and construction processes. For instance, BIM can minimize the cost of engineering and rework due to defects in prestressed/precast concrete companies. It significantly changes the conventional planning process and offers perfect solutions to the mass customization approach to manufacturing (Ang and Kasim, 2013). The benefits of BIM include pre-programming design intent, enabling systems to automatically maintain consistency between diverse building parts. It also leads to enhancement of engineering productivity, minimizing lead times between start of design and production, uninterrupted flow of information from sales through estimating to engineering, removal of costs of rework due to design errors, improvement of customer service resulting from better accommodation of frequent changing demands initiated by clients and more reliable in delivering pieces for projects within short notice, streamlines procurement of materials or component parts for production. BIM is intended to upkeep interactive and automated design and engineering, data storage, and editing all through a building's design, assembly and construction life cycle (Sacks et al., 2005). Likewise, through BIM framework, 2D drawings, and 3D models can be extracted from any perspective, reducing time, errors and mistakes caused by project modifications (Andújar-Montoya et al., 2015). A research conducted by the Construction Training Fund (Construction Training Fund, 2014) in Australia reported that the impact of BIM has been tremendous across project boundaries. In a response to the CPSISC 2014-2015 Environment scan, Business Review Weekly indicated that:
" ... The use of BIM in construction has the potential to save firms between 3% and 5% in costs...BIM could have a huge effect not just in design and construction, but on the economy...could boost gross domestic product by 0.2 basis points above the "business as usual scenario" rising to 5 points by 2025" (Construction Training Fund, 2014).

Production/Lean Techniques

Lean management (LM) is a continuous process improvement approach used to systematically improve quality and efficiency thereby reducing delays in activities and processes. According to Anvari et al. (2014), the principles of lean or lean thinking are equally applicable regardless of the fact that supply chains and construction operations are different from those used in manufacturing. It should be noted that lean is as much a philosophy and culture as a set of principles or methodologies and therefore could be applied to any industry. As the construction industry is advancing towards manufactured construction, thus, lean construction (LC), lean production techniques makes this possible by integrating and engaging the effort of all the project participants.

Generally, lean construction projects are intended to improve the processes and delivery systems by reducing wastes, ensuring health and safety and increasing productivity. Lean construction concepts lead to a value-added and better delivery systems and processes through the removal of wastes including; unnecessary movements, overproduction, lead time, inappropriate processing, transportation, inventories, and rework, hence, improving financial and project performance (Hannis-Ansah et al., 2016). For instance, through bespoke techniques like concurrent engineering (design), different tasks are executed parallelly by multi-disciplinary teams with the goal of optimizing engineering cycles for functionality, quality, and efficiency (Hannis-Ansah et al., 2016). It was found that Danish contractors had expanded efficiency by 20%, and enhanced profitability 20% - 40%, minimized project duration by 10% and increased productivity by 20% on projects where lean principles were adopted. Other comparative techniques include Kaizen, Business Process Modeling (BPM), Business Process Re-engineering (BPR), Workflow Mapping (WM), 5S, Kanban, Last Planner, Work Structuring, Daily Huddle Meetings, among others. The choice for a specific process improvement technique will depend on particular circumstances (Anvari and Sorooshian, 2014) and the existing needs of the workplace, including improvement objectives, knowledge, skills, type of processes and the available resources (Schweikhart and Dembe, 2009).

Concurrent Supply Network (CSN)
Supply network and process designs as demonstrated by Lisa et al. (2007) comprise: logistics systems, for example, types of transportation and their effect on the supply chain; inventory control processes, regarding the place and amount of inventory to be kept all through the supply chain; information technology and information exchange processes, and the conversion of raw materials into completed components and products in the manufacturing processes. It has been reported that the relationship between main contractors and suppliers in the industry is deteriorated in the sense that there are no shared information and togetherness. Specifically, the current condition of the supply network (SN) are fragmented and hindered by poor communication, absence of trust and commitment, and the relationship between parties is cost driven (Hamid et al., 2009). However, in order to ensure reliable and predictable process flow, there should be a strong alignment of functions and coordination of the whole SN delivery system in such a way that bottlenecks in processes are reduced and value maximized. Concurrent engineering advances that products and processes ought to be simultaneously designed, and heavily rely on the early engagement of multi-functional disciplines (Lisa et al., 2007). Thus, if the entire SN is designed simultaneously, with shared information and collaboration among parties most issues in the SN will be eliminated. As reported by Faizul (2006), better collaboration with suppliers and manufacturers in the early phases of the project is substantial to guarantee effective and on time delivery of material supply and better quality products. Good SN characteristics comprise of planning and management of the entire SN and activities including logistics, procurement, conversion, and coordination between the contractor, suppliers, third party solution providers and intermediaries within the structure of the supply network.

Skill Development and Training
The construction industry is seen as having a history of a poor record in making an investment into skill development and training. Whiles skill development and training has been considered as one of the critical success factors for projects, Hamid et al. (2009) indicated that a proportional number of workforce in the industry are laborers with limited training and narrow skills. Consequently, a more comprehensive and extensive training programs should be undertaken to address the vast demands in such specialized areas in the construction industry (Hamid et al., 2009).

Other Solutions
Research and Development (R&D) (Hamid et al., 2009), Supply Chain Integration (Abd Shukor et al., 2011), among others.

4. Conclusion
The paper discussed the recent trend of construction projects delays and highlighted the need for collaborative efforts among project parties and the use of trending solutions to handle the challenges confronting the industry. It was found that construction industry faces several challenges that impede on the delivery process flow and achievement of project objectives. Meanwhile, review analysis indicated that in order to integrate and optimize functions and processes, and avoid delays, there is the need for more robust approaches, tools, models, and techniques. The authors through a literature survey have recommended tools and techniques including Building Information Modeling (BIM); Computer Integrated Manufacturing (CIM); Production/Lean Techniques; Skill Development and Training; and Concurrent Supply Network (CSN). Extensive use of these tools and techniques in many countries has proven its efficiency in construction project development process and the overall performance of the building industry. Now that we are aware and have more understanding, managers and practitioners can look into these solutions, in any case, the choice is ours.

Acknowledgements
This project is financially supported by the Universiti Malaysia Pahang, under the FRGS Research Grant RDU150304.

References

Abdelhamid, T.S., El-Gafy, M., and Salem, O. 2008. Lean Construction: Fundamentals and Principles. *American Professional Constructor Journal*. 4. pp. 8-19.

Abdul-Rahman, H.; Wang, C.; and Lim, I. Y. W. 2012. Waste processing framework for non-value-adding activities using lean construction. *J. Front. Constr*. 1, 8–13

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

Alireza, A., and Sorooshian, S. 2014. *Lean Manufacturing Tools*. UMP Publisher, Kuantan, Malaysia.

Andújar-Montoya, M., Gilart-Iglesias, V., Montoyo, A. and Marcos-Jorquera, D. 2015. A Construction Management Framework for Mass Customisation in Traditional Construction. *Sustainability*. Vol. 7. pp. 5182–5210.

Ang, P. S. E. and Kasim, N. 2013. ICT-readiness in Industrialised Building System (IBS) management processes: case studies. *1st FPTP Postgraduate Seminar 2013, 23 December 2013, Fakulti Pengurusan Teknologi dan Perniagaan, UTHM* , Malaysia.

Arman, A. R., Jaafar, M., Shardy, A. and Samsiah, M. 2009. Work Environment Factors and Job Performance: The Construction Manager's Perspective. *International Conference of Construction Industri, 30 Julai-1 Ogos,* Padang Indonesia.

Aziz, F.R., and Hafez, M.S. 2013. Applying lean thinking in construction and performance improvement. *Alexandria Engineering Journal.* 52(4). pp. 679–695.

Ballard, G., and Howell, G., A., (1994). Implementing Lean Construction: Stabilizing Work Flow. *Proceedings of the 2nd Annual Meeting of the International Group for Lean Construction,* Santiago, Chile.

Ballard, G., and Howell, G.A. 2003. Competing Construction Management Paradigms. *Proceedings of the 2003 ASCE Construction Research Congress,* Honolulu, Hawaii.

Ballard, G., and Howell, G.A., 2004. Competing Construction Management Paradigms. *Lean Construction Journal*, 1(1), pp. 38-45.

Ballard, G., Tommelein, I., Koskela, L. & Howell, G. 2000. Lean construction tools and techniques. *Design and Construction: Building*, 227-255.

Bashford, H., Walsh, K. and Sawhney, A. 2005. Production system loading - cycle time relationship in residential construction. *Journal of Construction Engineering and Management*. 131, 1. pp. 15– 22.

Bertelsen, S., Christoffersen, A.K., Jensen, L.B. and Sander, D. 2001 Studies, standards and strategies in the Danish construction industry implementation of the lean principles. In: Getting it Started Keeping it Going, *Proceedings of the 3rd Annual Lean Construction Congress, Lean Construction Institute,* August, Berkeley, CA.

Burton, T. T. and Boeder, S.M. 2003. *The lean extended enterprise: Moving beyond the four walls to value stream excellence.* Boca Raton, Fla: J. Ross Publications, 2003.

Evbuomwan, N. F. and Anumba, C. 1998. An integrated framework for concurrent life-cycle design and construction. Adv. Eng. Softw. 29, 587–597.

Faizul, N. A. 2006. Supply chain management in IBS industry. Malaysia International IBS Exhibition 2006 (MIIE06), Kuala Lumpur, Malaysia (CIDB-ibsdigest).

Gibb, A. G. F. 2001. Standardization and pre-assembly- distinguishing myth from reality using case study research. Construction Management and Economics, 19(3), 307-315.

Hamid, Z. A.; Kamar, K. A. M.; Mustafa, A. 2009. The Critical Success Factors (CSFs) to IBS. *Proceedings in IBS International Seminar, Malaysian IBS International Exhibition 2009 (MIIE 2009),* Kuala Lumpur, 21st – 23rd January.

Hannis-Ansah, R., Sorooshain, S. and Mustafa, S. Bin. 2016. Lean Construction: An Effective Approach for Project Management. *ARPN Journal of Engineering and Applied Sciences,* 11(3), 1607-1612.

Hannis-Ansah, R., Sorooshian, S. and Shariman, B. M. 2015. The 4Ps: A Framework for Evaluating Projects Delays. *Proceedings of Engineering Technology International Conference (ETIC 2015),* 10-11 August 2015, Bali, Indonesia.

Hines, P. and Rich, N. 1997. The seven value stream mapping tools. International Journal of Operations and Production Management, Vol. 17, Iss. 1. pp. 46-64.

Johnston, R., B., and Brennan, M., (1996). Planning or organizing: the implications of theories of activity for management of operations. Omega, International Journal of Management Science, 24 (4), 367–84.

Koay, B. H. and Sorooshian, S. 2013. Study on Impact of Lean Six Sigma. J. Manag. Sci. 3. pp. 91–96.

Koskela, L. 2000. An exploration towards a production theory and its application to construction. Espoo: VTT Publications. www.inf.vtt.fi/pdf/publications/2000/P408.pdf

Koskela, L., and Howell, G. 2001. Reforming project management: the role of planning execution and control. In: Proceedings 9th Annual Conference of the International Group for Lean Construction (IGLC-9), 6–8 August, Singapore.

Koskela, L., Bølviken, T., and Rooke, J., (2013). Which are the Wastes of Construction? Proceedings IGLC-21, Theory, Fortaleza, Brazil, pp. 3-11, http://core.ac.uk/download/pdf/18410348.pdf (Retrieved on 25 March, 2015).

Koskela, L., Howell, G., Ballard, G., and Tommelein, I. 2002. Foundations of Lean Construction. In Best, Rick; de Valence, Gerard. Design and Construction: Building in Value. Oxford, UK: Butterworth-Heinemann, Elsevier. ISBN: 0750651490.

Lajevardi, A., Endut, I. R. and Paydar, S. 2011. Application of lean model to reduce waste of time in construction: Case study of concreting taskin Malaysia. IEEE Colloquim on Humanities, Science and Engineering. pp. 345-350.

Laplante, P. A. 2005. Comprehensive Dictionary of Electrical Engineering, Second Edition. (CRC Press, 2005).

Lean Construction Institute. 2014. What Is Lean Construction? http://www.leanuk.leanconstruction.org/whatis.htm,

LeanProduction.com. 2015. Online Resource for Lean-Based Information and Tools. http://leanproduction.com/

Lee, S. H., Diekmann, J. E., Songer, A. D. and Brown, H. 1999. Identifying Waste: Application of Construction Process Analysis. Proceedings IGLC7.University of California, Berkeley, CA, USA. 63-72.

Li, C. 2011. A customised lean model for a Chinese areospace OEM (original equipment manufacturer). MSc Thesis. Cranfield University, UK. : 130.

Lisa, E. M.; Tate, W. L.; and Carter, C. R. 2007. Product-process-supply chain: an integrative approach to three-dimensional concurrent engineering. *Int. J. Phys. Distrib. Logist. Manag*. 37, 305–330

Marhani, M. A., Jaapar, A., Nor-Azmi, A. B. and Zawawi, M. 2013. Sustainability through Lean Construction Approach: A Literature Review. AMER (ABRA Malaysia) International Conference on Quality of Life. 101. 90–99.

Muhammad, W.M.N.W., Ismail, Z. and Hashim, A.E. 2013. Exploring lean construction components for Malaysian construction industry. Business Engineering and Industrial Applications Collooquium (BEIAC), 7-9 April 2013, Langkawi, Malaysia.

Nikakhtar, A., Hosseini, A. A., Wong, K. Y. and Zavichi, A. 2015. Application of lean construction principles to reduce construction process waste using computer simulation: A case study. International Journal of Service and Operations Management. Vol. 20, Iss. 4. pp. 461-480.

Sacks, R., Eastman, C. M., Lee, G. and Orndorff, D. 2005. A Target Benchmark of the Impact of Three-Dimensional Parametric Modeling in Precast Construction. *PCI J.* 50. 126–139.

Sacks, R., Radosavljevic, M., and Barak, R. 2010. Requirements for building information modeling based lean production management systems for construction. Automation in Construction. 19(5): 641–655.

Salem, O., Solomon, J., Genaidy, A. and Luegring, M. 2005. Site Implementation and Assessment of Lean Construction Techniques. Lean Construction Journal. Vol. 2, Iss. 2. pp. 1-21.

Salimi, M., Hadjali, H., R., Sorooshian, S. 2012. A Lean Production Framework for Malaysian Automotive and Heavy Machinery Industry. Journal of Applied Sciences. Vol. 12, Iss. 13. pp.1402-1407.

Sarhan, S. and Fox, A. 2013. Barriers to Implementing Lean Construction in the UK Construction Industry. The Built and Human Environment Review. 6. 2013.

Schweikhart, S. A. and Dembe, A. E. 2009. The applicability of Lean and Six Sigma techniques to clinical and translational research. J. Investig. Med. 57. pp. 748–55.

Sorooshian, S. 2014. Delay-based Reliability Analysis on Construction Projects, Life Science Journal. Vol. 11, Iss. 3. pp. 104–113.

Tsao, C. C. Y., Tommelein, I. D., Swanlund, E. S. and Howell, G. A. 2004. Work Structuring to Achieve Integrated Product-Process Design. Journal of Construction Engineering and Management. Vol. 130, Iss. 6. pp. 180-189.

Waldner, J.-B. 1992. *CIM: Principles of Computer-Integrated Manufacturing*. Wiley and Sons

Zahidy, A., H., Azlinna, A. and Sorooshian, S 2015. Predictors for the Success and Survival of Entrepreneurs in the Construction Industry. International Journal of Engineering Business Management. Vol. 7, Iss. 12.

Biography

Richard Hannis Ansah. Research and Teaching Assistant at the Faculty of Industrial Management, University of Malaysia Pahang. He holds Postgraduate Diploma in HRM from ICM-UK, Postgraduate Certificate in HRM from Management Development and Productivity Institute (MDPI) and Petroskills, BA in Political Science and Linguistics from University of Ghana. Currently pursuing a postgraduate degree in Industrial Management at University of Malaysia Pahang. Published and reviewed a number of journal and conference papers, worked with Ghana Statistical Services, University of Ghana, Legon, SASCO GROUP-Qatar, etc. Research interests: built environment, supply chain and logistics, operations research, lean, project management, operations management, human resources management, HSE, environmental engineering, technology management, climate change, etc.

Shahryar Sorooshian. Senior Lecturer at the Faculty of Industrial Management, University of Malaysia Pahang. Ph.D. in Industrial Engineering. Published a wealth of books, journal and conference papers with honors and awards. Research interests: industrial management, managerial decision makings, business/management performance, operational management, SMEs, simulation, optimization, reliability, scheduling, construction, supply chain and logistics, E-commerce, balance scorecard, counseling and psychotherapy, manufacturing, lean, etc. Member of board of Research Journal of Business Management, Asian Journal of Industrial Engineering, Singapore Journal of Scientific Research, Journal of Applied Sciences, International Journal of Operations and Logistics Management, Iranian Journal of Management Studies, Scientific Journal of Management Science and Engineering, Asia Pacific Journal of Management & Entrepreneurship Research, International Journal of Research in Business and Technology, The East Asian Journal of Business Management, The Journal of Industrial Distribution and Business, etc.

Shariman Bin Mustafa. Senior lecturer at the Faculty of Industrial Management, University of Malaysia Pahang. Published a number of books, journal and conference papers with honors and awards. Research interests: industrial management, Solar Cell System Design, Mechanical engineering, manufacturing engineering, simulation, optimization, construction, Lean, Socio-Economic issues, , construction, operations research, Ship Navigation System, FMEA, among others. He is a member board of a number of journals and conferences. Served as Deputy Dean of the Faculty of Industrial Management, University of Malaysia Pahang.

Gomanth Duvvuru. Master of Science student in Industrial Engineering at the Lawrence Technological University, Michigan, USA. He holds a Bachelor Degree in Mechanical Engineering from Jawaharlal Nehru Technological University, Anantapur, India. During his Bachelors, he actively participated in organizing many events including TEDx Tirupathi and UAV's Modelling. His research interests include simulation (Arena), Apple Inc. Technology Management, Minitab, Six Sigma (Greenbelt), and 3D Modeling (Pro/E, AutoCAD). He is an Active member of IEOM.

Cite this Paper

Hannis-Ansah et al. 2016. Advancing Towards Delay-Free Construction Project: A Review. Proceedings of the 2016 International Conference on Industrial Engineering and Operations Management Detroit, Michigan, USA, September 23-25, 2016