



UNIVERSITY OF LEEDS

This is a repository copy of *Towards improving schedule performance of construction projects in Uganda with lean construction*.

White Rose Research Online URL for this paper:
<http://eprints.whiterose.ac.uk/151443/>

Version: Published Version

Proceedings Paper:

Abarinda, J, Kibwami, N and Tutesigensi, A orcid.org/0000-0002-5514-1594 (2019) Towards improving schedule performance of construction projects in Uganda with lean construction. In: Gorse, C and Neilson, CJ, (eds.) Proceedings of the 35th Annual ARCOM Conference. 35th Annual ARCOM Conference, 02-04 Sep 2019, Leeds Beckett University, Leeds, UK. Association of Researchers in Construction Management , pp. 658-667.

This article is protected by copyright. All rights reserved. Reproduced in accordance with the publisher's self-archiving policy.

Reuse

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.



eprints@whiterose.ac.uk
<https://eprints.whiterose.ac.uk/>

TOWARDS IMPROVING SCHEDULE PERFORMANCE OF CONSTRUCTION PROJECTS IN UGANDA WITH LEAN CONSTRUCTION

Jerusha Abarinda¹, Nathan Kibwami² and Apollo Tutesigensi³

¹ *Construction Economics and Management, School of Built Environment, Makerere University, PO Box 7062, Kampala, Uganda*

² *School of Built Environment, College of Engineering, Design, Art, and Technology, Makerere University, PO Box 7062, Kampala, Uganda.*

³ *School of Civil Engineering, University of Leeds, LS2 9JT, Leeds, UK*

Schedule performance of construction projects in Uganda, is wanting - most projects are not completed within their original contract durations. A growing body of research suggests that such poor performance could be addressed by implementing lean construction. However, evidence suggests that such implementation needs to be carefully designed to take contextual project environment factors into account. In this paper, we report on how lean construction can be applied to ensure timely completion of construction projects in Uganda, considering the project environment factors surrounding construction practice. The research approach that was adopted was mixed-methods, and thus involved a variety of data collection methods - participant observation, structured interviews, and questionnaires. The subjects were contractors that had ongoing projects in 2016. Construction practices were assessed, project environment factors impacting their projects identified, and their compatibility with standard lean tools assessed. The findings reveal that design changes due to inadequate initial planning were among the leading causes of poor schedule performance and that contractors lacked discipline to work within timeframes. Lean tools that were found to be applicable and thus recommended were value stream mapping to remove unnecessary processes and use of the last planner and collaborative planning tools. A strategy for integrating lean construction in the construction practice, cognizant of the environmental factors, was argued for based on the most appropriate lean tools suitable for the identified project environment factors. The research contributes to the understanding that project environment factors cannot be ignored because they affect project performance and consideration of these factors enhances effectiveness of lean construction techniques.

Keywords: lean construction, project delays, schedule performance, Uganda

INTRODUCTION

The construction industry is a slow-progressing industry and is characterised by frequent problems like insufficient quality, time overruns and poor safety. These characteristics limit value delivered to customers (Latham, 1994; Forsberg and Saukkoriipi 2007; Egan, 2008; Ouwor, 2016). The construction industry is constantly facing serious concerns of delays, which are a chronic problem that has negative

¹ abarindajerusha@gmail.com

effects on projects, especially in developing countries (Ghenbasha, *et al.*, 2016). Despite new and advanced technologies such as Building Information Modelling, lean construction, modular construction (Aouad *et al.*, 2006; Lee, 2008) applied in the construction industry, the efficiency has remained quite low (Sacks and Goldin, 2007; Guo, 2009). It is observed from studies by previous scholars (see Saukkoriipi (2007) and Guo (2009)) that the construction industry has always had challenges, despite continuous attempts by participants in the industry to find remedies and improve performance.

Uganda's construction industry faces challenges similar to those faced worldwide. Alinaitwe, *et al.*, (2010) highlighted problems in productivity, innovation, slipping schedules, disputes, high costs of production and rework as some of the factors affecting the construction industry in Uganda. Meanwhile, Muhwezi, *et al.*, (2013) observe that wastage in construction extends to labour, time, capital and machinery. Ssemwogerere (2011) also observes that delay in completion of projects in Uganda is a big problem, as it is in the construction industry worldwide. Delays impact directly on contractors and clients alike because these participants incur extra costs since delays always end up in increased project cost. Additionally, the client faces revenue loss from delayed project completion. It is therefore necessary to find solutions to mitigate delays and save stakeholders such unnecessary additional costs.

Lean construction has been recommended by many researchers as one of the approaches that can be adopted to improve overall performance in the construction industry in general, and adherence to schedules in particular (Koskela 1992, 2000; Ballard, 2000; Koskela and Howell, 2011). However, it is not enough to just copy methods of practice. For instance, Engineer Ohno, the father of the Toyota Production System framework, observed that it was dangerous to copy existing models without understanding their importance and how they fit in the grand scheme. Therefore, methods must be adapted to the existing practices and should be practical. Lean construction therefore ought to be viewed as a process undergoing continuous improvement with applications tailored and adapted to suit different environments and cultures.

Lean construction has received little to no attention in the Ugandan construction industry. Given the benefits that have been derived from applying lean construction around the world (Aziz and Hafez, 2003, Luo *et al.*, 2005, Womack and Jones, 2010), we contend that the Ugandan construction industry is missing out and it is high time lean construction was considered seriously as a means to improve project schedule performance in the construction industry in Uganda. Although the Ugandan construction industry has similar characteristics as the industry in other countries, processes of delivery differ because of cultural and environmental differences. As such, successful implementation of lean construction in Uganda requires one to, not only, understand the methods and processes used to execute projects, but also consider project environment factors affecting practice in order to facilitate harmonious integration. Against this background, the research reported in this paper was aimed at exploring the potential of lean construction to improve project schedule performance in Uganda's construction projects. To facilitate achievement of this aim, the following specific objectives were set:

1. To identify project environment factors which are critical for project schedule performance in Uganda;

2. To identify lean approaches that can be applicable to the critical environment factors that influence project schedule performance; and
3. To propose a strategy for lean construction integration into construction projects so as to improve project schedule performance.

This paper focuses on objectives 1 and 2, and findings from the first two objectives will inform objective 3, which forms part of broader ongoing research.

Lean Construction and Its Limitations

Lean construction has received attention as a modern method to improve construction performance and productivity (Abd el-Razek *et al.*, 2008). The promises of lean - using smaller workforces, less space while transforming existing operations and obtaining great improvements in the areas of quality, productivity and others (Womack and Jones, 2010) - drew attention from construction practitioners (Koskela, 1992; Ballard and Howell, 1998). Lean tools are regarded as means through which lean theory is implemented. The main aim of lean theory is to maximize value while reducing waste, by using appropriate lean tools. Lean construction provides a proactive rather than reactive approach in construction, thereby identifying potential problems before they occur and ensuring their occurrence is controlled (Gamal, 2013). A systematic review of lean implementation by Babalola *et al.*, (2018) mentions the commonly used tools like value stream mapping, autonomation, pull system signalling, last planner system, Just in Time and collaborative planning. These tools could be implemented as standalone practices or integrated systems. However, despite the lean recommendations by researchers and attempts to implement them, the construction industry continues to face problems of delays. This calls for further research on context in which lean should be applied as there are potentially many variables that influence its application.

The transition to lean requires radical change, which involves total reshaping of purpose, systems and work culture. Nordin and Deros (2017) suggest that a company that intends to implement lean must put emphasis on change readiness, leadership and management, change agent systems and communication, among others. Alinaitwe (2009) notes that although lean construction efforts could prove to be highly rewarding in Uganda's construction industry, application of lean construction is risky and can be disastrous if not properly managed. Implementation of lean construction requires leadership commitment and is sustained by a culture of continuous improvement (Aziz and Hafez, 2013). Although lean is now popular in the construction industry, there are cultural and structural barriers against its implementation despite the geographical area (Sarhan and Fox, 2013). Forsberg and Saukkoriipi (2007) argue that measuring performance is not highlighted well in the lean concept but they agree that there are exceptions. They advocate for involvement of other parts of the organization in lean measurement, not just focusing on production at site. In their study on competitiveness of local construction contractors in Uganda, Ocen, *et al.*, (2011) observed that coordination gaps in the construction industry resulted in poor performance and slow growth and development. These gaps led to development of weak teams that could not tackle the needs of projects and contracts.

These observations suggest that for lean to be effectively implemented, processes in construction have to be considered not in part, but holistically. Variables that affect delivery of construction projects can be at any phase of the process, not necessarily during production on the site. Project environment factors affect the delivery process, even when they may be outside the control of project participants. This therefore

necessitates understanding project environment factors that potentially affect project performance. In this paper we focus on schedule performance.

Project Environment Factors and Schedule Performance

The project environment is the aggregate of surrounding things, conditions, or influences (Youker, 1992). Project environment factors may be internal or external. Internal environment factors are factors within the organization/company that determine the way the organization operates, such as organizational culture and leadership styles, which have an effect on performance and effectiveness (Alnaseri, *et al.*, 2013). External environment factors are those factors that are outside the organisation, about which management of the organisation has no control. (Kumaraswamy and Chan 1998; Gudiene, *et al.*, 2013). These factors provide unique challenges to projects. Saad and Chafi (2018) listed some challenges limiting project performance in the Moroccan construction industry, classifying them into; 1) external factors (e.g. price rigidity, low cash, foreign cash), and 2) internal factors (e.g. high expense, local sourcing and debt collection and unsatisfactory competitive environment). Fawcett and Cooper (2001) mention the fragmented and cyclic nature of the construction industry as a barrier to benchmarking, which is considered key in application of lean. Table 1 below provides a summary of these environment factors that affect project schedule performance.

Table 1: Environment factors affecting schedule performance in the construction industry

| Category | Factors |
|---------------------------------|--|
| Internal Factors | Communication, Collaboration and team work (Ocen <i>et al.</i> , 2011), Leader support and reward system (Polat and Adit, 2005), skills and active leadership (Fawcett and Cooper, 2011) |
| External Factors: Political | Safety, community perception (Ho and Pike, 1991) |
| External Factors: Economic | Accessibility of materials, finance, equipment, labour, degree of demand (Ho and Pike, 1991), economic growth, interest rates, exchange rates, inflation rates (Ocen, <i>et al.</i> , 2011). |
| External Factors: Technological | Locally made plant and equipment, magnitude of local material resources, level of utilization of local resources, skilled manpower resources (Kangari and Riggs 1989) |

These factors present inherent risks that can interfere with the planned progress of the project, impacting performance, yet they remain largely unpredictable. They have to be taken into consideration and measures put in place to manage them during construction, to avoid delays and other hitches on the project. Having the project environment factors in mind, it is necessary for accurate forecasting of trends to be done during planning, in order for lean application to be a viable solution to delays caused by these factors. That way, alternative approaches to processes can be put in place for any eventualities that threaten project progress. That said, these environment factors are clearly context specific - and that is why an empirical study of the Ugandan context was warranted.

METHODS

Research Approach

The study adopted a mixed method approach (Denzin and Lincoln, 2005; Patton, 2005), studying Uganda's construction in its natural form; using questionnaires, semi structured interviews and participant observation. The approach was chosen because it generates rich, detailed data and provides context for the phenomena being studied, since phenomena can be viewed from different viewpoints. Moreover, findings would be validated by the different sources (Bailey-Beckett and Turner, 2001), thus minimizing the inadequacy of using a single research method and ensuring corroboration and clarification of results.

Identifying Project Environment Factors in Relation to Schedule Performance

Questionnaires were administered to contractors registered with Uganda National Association of Building and Civil Engineering Contractors (UNABCEC), a trade body for contractors in Uganda, in Class A and B categories. The classification criteria is based on number and contract sum of projects a company handles in a year, equipment capacity and human resource. Companies in A and B categories were chosen because they are believed to have the ability and financial strength to implement lean (Alinaitwe, 2009). Eighty contractors were registered in Class A and B categories at the time of data collection in March 2016. Sample selection was according to Amin (2005); at a significance level of 5%, the sample size was 67 contractors out of 80 companies in classes A and B. Interviews were also conducted to look out for participants' narratives about their experiences working on construction projects as far as project timelines were concerned. Respondents also provided information about project environment factors that affected their projects. The researcher also participated in one public construction project in Uganda, working for the Main Contractor. The processes of project delivery were observed, and compared with recommended best practice, as well as studying parameters within which the project was executed. Also considered were the organisational structure, available infrastructure and resource availability on the project, all which are factors that impact project schedule performance.

Identification of Lean Approaches

Past researchers have studied lean and its implementation to improve performance in the construction industry in many parts of the world. Successfully implemented lean approaches were identified through review of existing literature, which were further studied in context of Uganda's construction industry to find their applicability in Uganda. These factors were then matched with favourable project environment factors identified above, in order to isolate those that could contribute positively to schedule performance. This information was then used to argue for the need of a strategy towards improving schedule performance of construction projects with lean construction, cognizant of the project environment factors.

RESULTS AND DISCUSSION

General

Out of 67 questionnaires given to contractors, 63 were returned, making the response rate 94%. Site Engineers were the highest respondents of questionnaires (37%), followed by Architects (22%) and Foremen (20%). Other professions (project managers, surveyors, clerk of works, draughtsmen) were distributed over the

remaining 21%. Regarding experience in construction, 48% of respondents had less than 10 years' experience, 46% had experience of 10 - 15 years, and the least number was those with over 15 years (6%) of experience. The project on which the researcher participated was a public hospital rehabilitation that started in November 2014, with an initial budget of \$29 million, and two years' contract duration.

Despite contractual obligations to have organisation structures for construction projects, with specific qualifications and requirements for team leaders, respondents who led projects had different professional backgrounds, some of them less than desirable. For example, most contracts require that project managers should lead project teams, but from interviews, it was observed that some project managers did not have full presence on sites as per contractual obligations, while others did not have the requisite qualifications. This showed laxity in enforcing requirements to run construction projects and explains why there are many problems facing projects. Employees' experience plays an important role in running projects, because work tends to get done quicker and easier with more experience. It also influences decision making with more experienced managers taking quicker decisions that can save project time and being able to predict outcomes easily. From the findings, it is clear that some delays occur because participants lack adequate experience in construction processes. These findings agree with past research that the ratio of technical staff to non-technical staff is an internal factor which impacts technical capability and therefore productivity on a project (Ocen, *et al.*, 2011). Inexperienced project leaders are more likely to make mistakes that lead to reworks, take long to make decisions for fear of associated risks, all which are likely to lead to wastage of time, hence delays.

Project Environment Factors in Relation to Schedule Performance

A number of factors that affect project schedule performance were identified. Majority (70%) of the respondents said projects exceeded their original contract duration and faced problems of time overruns, giving top 3 reasons for delays as use of unprofessional contractors and managers (30%), delayed payment of contractors (26%) and design changes (20%). Material price fluctuations and unavailability of resources were also common factors said to affect project schedule performance. Through participant observation, the researcher observed the external and internal project environment factors which impacted the project which included: the organisation structure, communication channels, nature of meetings held and who participated in these meetings and adherence to the work program. Also studied were the procurement processes for materials; procedures for material requisitions and their delivery to the site. The project in which the researcher participated was a public project where client meetings were attended by major stakeholders; funders, ministry officials, the consultants and only the Project Manager from the Main Contractor's team. Actual versus planned durations were compared and, it was observed that, often, work did not go according to plan. There were delays in material and equipment deliveries and activities took longer than planned, affecting their successors. For example, imported materials like floor and wall tiles, vinyl flooring, ceiling tiles, electrical equipment, among others all did not arrive on time, which subsequently delayed related works. Reworks were many because of lack of coordination among subcontractors, and this inevitably affected the work program. Although the original contract duration was two years, an Extension of Time was granted three times; twice with costs and the third time without cost, bringing the project duration to 6 years; 3 times the original planned duration. This was majorly due to design changes. There were also many variations on the project, which showed

that the project scope was not well established at the time of commencement. The contract faced a cost overrun of \$13 million, due to variations and scope increase on the project. Casual labour was affected too because the longer the project took, the less morale workers had, which affected productivity on the project. Lack of coordination among subcontractors, broken communication channels, and poor initial project planning, all impacted project schedule performance because the project deviated from the original plan and was difficult to get back on track.

Lean Approaches to Improve Schedule Performance

Whereas lean is a popular theory among researchers and scholars, as earlier discussed in literature, little is known about it in Uganda's construction industry, much less its application understood. For instance, many interview participants had varying interpretations of Lean, such as "the manufacture of parts that are later assembled", "team work in a construction project" and "minimizing wastage of resources on a construction site", among many uncoordinated interpretations. Some, however, had totally no idea regarding lean and how it applies in construction. However, the Lean tools identified in literature can be applicable, if tailored to project environmental factors in Uganda's Construction industry. With problems leading to poor schedule performance and low productivity on construction projects in Uganda in mind, lean tools identified to address these problems, cognizant of project environmental factors, were the last planner system, collaboration planning, value stream mapping and Just in Time. The last planner is a system used to prevent plan failure on projects through assignment level planning or look ahead scheduling. Collaborative planning improves communication and collaboration among participants to improve project delivery. A value stream map divides the process into smaller sub-processes, activities or tasks to clarify how the product flows between the activities. Just in time application in construction requires management and employee commitment to eliminating waste of any kind by adhering to schedules, clearly planning out tasks and ensuring ready supply of materials to ensure no time is wasted through waiting. It enables prompt delivery of materials, information and drawings to the point of usage.

These four tools identified above all require participants' total involvement in the process, for better coordination of activities. They call for prior planning before the project construction commences such that resources are received as and when they are required, unnecessary processes that waste time are removed, and follow ups are made daily, to ensure adherence to the program. Some practices (e.g. frequent meetings, proper communication channels, schedule updates) are often applied but participants have no idea that these are Lean practices, which perhaps justifies why these practices are not implemented as should be. For instance, most interview respondents noted that both consultants and contractors were highly involved in meetings but the other parties, such as the client and sub-contractors, attended on a less frequent basis.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This research was conducted in response to the need for improved schedule performance on construction projects in Uganda. Both internal and external project environment factors that are critical for project schedule performance were identified. Lean construction was proposed as a modern method of construction that can improve schedule performance if properly implemented, that is, cognizant of the project environment factors. However, it was realised that participants are stuck to

old/traditional methods of delivering projects and are reluctant to change and adopt new management methods yet lean requires implementation of new tools and concepts to construction processes. It was also observed that the concept of lean is still novel in Uganda, and for the benefits of lean construction to manifest, industry participants should be willing to move away from what has been known to be the norm in project delivery and to try something new. Lean construction has not been widely applied in Uganda partly because it is not very clear what lean construction is and what the principles of its application are

This research suggests that understanding the environmental variables affecting construction projects makes it easier to implement lean holistically to improve performance. Construction projects in Uganda are micromanaged, and there are hierarchal boundaries established between participants on the same team. This directly affects communication among the team and the result of poor communication is seen through inconsistencies in the way projects are run. Traditional hierarchical structures curtail functional interface, which results into project schedule delays.

Recommendations

Now that we have identified the major causes of delays on projects and environmental factors affecting project schedules as well as the appropriate lean approaches to address them, a strategy for lean construction integration into construction projects should be developed. The strategy should be flexible to cater for uncertainties caused by project environment factors that are inevitable in the construction industry. In addition, the strategy should be codified into a lean construction application manual.

REFERENCES

- Abd El-Razek, M E, Bassioni, H and Mobarak, A M (2008) Causes of delays in building construction projects in Egypt, *Journal of Construction Engineering and Management*, 134(11), 831-841.
- Alinaitwe, H M (2009) Prioritizing Lean Construction Barriers in Uganda's Construction industry, *Journal of Construction in Developing Countries*, 14(1), 15 - 30.
- Alinaitwe, H M, Mwakali, J and Hansson, B (2010) Assessing the degree of industrialization in construction - A case of Uganda, *Journal of Civil Engineering and Management*, 12, 221-229.
- Alnasser N, Osborne A and Steel G (2013) Organizational culture, leadership style and effectiveness: A case study of Middle Eastern construction clients. In: Smith, S D and Ahiaga-Dagbui, D D (Eds.), *Proceedings 29th Annual ARCOM Conference*, 2-4 September 2013, Reading, UK, Association of Researchers in Construction Management, 393-403.
- Amin, M E (2005) *Social Science Research; Conception, Methodology and Analysis*. Makerere University, Kampala.
- Aouad, G, Lee, A and Wu, S (2006) *Constructing the Future: Building Information Modelling*. London: Taylor and Francis.
- Aziz, R F and Hafez, S M (2013) Applying lean thinking in construction and performance improvement, *Alexandria Engineering Journal*, 52(4), 679-695.
- Babalola, O D, Ibem, E O and Ezema, I C (2018) Assessment of and adoption of lean practices in the Nigerian building industry, *International Journal of Civil Engineering and Technology*, 9(13), 1626-1640.

- Ballard, G (2000) *The Last Planner System of Production Control*. School of Civil Engineering, Faculty of Engineering, the University of Birmingham.
- Ballard, G and Howell, G (1998) Shielding Production: Essential step in production control, *Journal of Construction Management and Engineering*, 124(1), 11-17.
- Bailey-Beckett, S and Turner, G (2001) *Triangulation: How and Why Triangulated Research Can Help Grow Market Share and Profitability*, Beckett Advisors Inc.
- Denzin, N K and Lincoln, Y S (2005) Introduction, *In: The Discipline and Practice of Qualitative Research. the Sage Handbook of Qualitative Research 2nd Edition*. Thousand Oaks, CA: Sage.
- Egan, J (1998) *Rethinking Construction*. London: Department of Environment, Transport and the Region.
- Fawcett, S E and Cooper, M B (2001) Process integration for competitive success, benchmarking barriers and bridges, *Benchmarking*, 8(5), 396-412.
- Forsberg, A and Saukkoriipi, L (2007) Measurement of Waste and Productivity in Relation to Lean Thinking, *In: C L Pasquire and P Tzortzopoulos (Ed.), Proceedings of 15th Annual Conference of the International Group for Lean Construction*, East Lansing, Michigan, 67-77.
- Gamal, M S (2013) *Improving Project Performance Using Lean Construction in Egypt: A Proposed Framework*. The American University of Cairo, Egypt.
- Ghenbasha, M, Omar, W, Sabki, M and Afizah, A (2016) Causes of construction delay in developing countries: A theoretical review, *In: The 1st International Conference on Invention and Design (ICID) 2016*.
- Gudiene, N, Banaitis, A and Banaitiene, N (2013) Evaluation of critical success factors for construction projects - An empirical study in Lithuania, *International Journal of Strategic Property Management*, 17(1),21-31.
- Guo, H (2009) *Rethinking Construction Project Management Using the VP-Based Manufacturing Management Model*, PhD Thesis, The Hong Kong Polytechnic University, Hong Kong.
- Ho, S S and Pike, R H (1992) The use of risk analysis techniques in capital investment appraisal, *In: J Ansell, F Wharton (Eds.) Risk Analysis Assessment and Management*. Hoboken, NJ: John Wiley and Sons, 71-94.
- Kangari, R and Riggs, L S (1989) Construction risk assessment by linguistics, *IEEE Trans Engineering Management*, 362 126-131.
- Koskela, L (1992) *Application of the New Production Theory to Construction*, CIFE Technical Report, Issue 72, Stanford University.
- Koskela, L (2000) *An Exploration Towards a Production Theory and Its Application to Construction*. Technical Research Centre of Finland. Available from <https://www.vtt.fi/inf/pdf/publications/2000/P408.pdf> [Accessed 28/07/2019].
- Koskela, L and Howell, G (2011) *Reforming Project Management: the Role of Planning, Execution*. University of Salford, UK
- Kumaraswamy, M M and Chan D W (1998) Contributors to construction delays, *Construction Management and Economics*; 16(1), 17-29.
- Latham, M (1994) *Constructing the Team*. London: HMSO.
- Lee, C (2008) BIM: Changing the AEC Industry, *In: Project Management Institute Global Congress 2008*, Denver, Colorado, USA.

- Luo, Y, David, R R and Michael, J H (2005) Lean principles for pre-fabrication in green design-build (GDB) projects, *In: 13th International Group for Lean Construction Conference Proceedings*, International Group on Lean Construction, 539.
- Muhwezi, L, Chamuriho, M and Lema N M (2013) Materials wastage estimations on building construction projects in Uganda, *Caspian Journal of Applied Sciences Research*, 2, 285-291.
- Nordin, N and Deros, B (2017) Organizational change framework for lean manufacturing implementation, *International Journal of Supply Chain Management*, 6(3), 309-320.
- Ocen, S J, Alinaitwe, H and Tindiwensi, D (2011) An analysis of the competitiveness of local construction contractors in Uganda, *In: Second International Conference on Advances in Engineering and Technology*, 346 - 352.
- Ouwor, D O (2016) *Factors Influencing Completion of Construction Projects in Kenya: A Case of Government Buildings, Construction Projects in Nairobi County, Kenya*. Master's Thesis, University of Nairobi.
- Patton, M Q (2005) *Qualitative Research*. Hoboken, NJ: John Wiley and Sons, Ltd.
- Polat, G and Arditi, D (2005) The JIT materials management system in developing countries, *Construction Management and Economics*, 23 (7) 697-712.
- Saad, M B and Chafi, A (2018) Empirical study of schedule delay in Moroccan construction projects, *International Journal of Construction Management*. Available from <https://doi.org/10.1080/15623599.2018.1484859> [Accessed 28/07/2019].
- Sacks, R and Goldin, M (2007) Lean management model for construction of high-rise apartment buildings, *Journal of Construction Engineering and Management*, 133(5), 374-384.
- Sarhan, S and Fox, A (2013) Barriers to implementing lean construction in the UK Construction industry, *The Built and Human Environment Review*, 6.
- Ssemwogerere, K (2011) A case for acceleration rather than extension of time on construction projects in Uganda, *In: 2nd International Conference on Construction and Project Management*, IACSIT Press, Singapore.
- Womack, J P and Jones, D (2010) *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, New York: Free Press.
- Youker, R (1992) Managing the international project environment, *International Journal of Project Management*, 10(4), 219-226.