The Advantages and Barriers of Automation in Malaysia Construction Industry

Nik Fatma Arisya Nik Yahya[1*], Mazura Mahdzir [2] Jack Ho Yong Jie[1]

[1]Faculty of Engineering and Quantity Surveying, INTI International University, 71800 Negeri Sembilan, Malaysia
[2] Faculty of Built Environment, Tunku Abdul Rahman University College, 50728 Kuala Lumpur, Malaysia

*Email: fatmaarisya.yahya@newinti.edu.my

Abstract

Malaysian construction industry is still familiar with the conventional system and the technology that suits them well and therefore they are unwilling to switch to a modern construction system like Industrialised Building System (IBS). Conventional system always associates with low quality and productivity, high risk on worker's safety, and excessive reliance on labors if the project adopting conventional system. Other than that, on site work normally involves extreme activities on the site that cause constant nuisances to local communities such as messy environment, traffic chaos, noise, and air pollution. The aim of this research is to encourage the implementation of automation in Malaysia construction industry. The objectives of this paper are; to identify the benefits of automation in construction industry, secondly, to identify the barriers on the implementation of automation works in construction industry and finally to recommend the implementation of automation which may improve the quality of workmanship. Questionnaire survey were conducted to collect the viewpoints among developers, contractors and manufacturers of IBS to ensure the richness of the data collected. Frequency analysis and Mean Score Indices were used to analyse the results. Results revealed that majority of the respondents agreed on the most critical barrier to the implementation of automation in Malaysian construction industry and they were not ready to move forward.

Keywords

IBS, Automation, Workmanship, Barriers, Advantages

Introduction

The construction industry is complex and has become more so during the late 20th century due to the failure of planning mechanisms and the apparent inability of plans to represent the reality of on-site construction (Kamaruddin, 2015). According to Abdul Rahman et al. (1996), workmanship was classified as one of the most frequent non-conformances on construction site and the causes of poor quality of workmanship in construction projects are poor project management, complicated

role of subcontractor, lack of experience and competency of labours, language barrier to communication and lack of communication, unsuitable construction equipments, poor weather condition, limited time, limited cost and etc.

Construction automation has shown the potential to increase construction productivity after years of technical development and experimenting in its field and the possible benefits and challenges of construction automation, though is unclear and missing from current research efforts (Chen, 2018). Malaysian construction industry is still familiar with the conventional system and the technology that suits them well and therefore they are unwilling to switch to a modern construction system like Industrialised Building System (IBS). Conventional system always associates with low quality and productivity, high risk on worker's safety, and excessive reliance on labors if the project adopting conventional system (Bakri, 2008). Other than that, on site work normally involves extreme activities on the site that cause constant nuisances to local communities such as messy environment, traffic chaos, noise, and air pollution (Yee, 2001). Some successful mega-projects that applied the IBS are Petronas Twin Towers, Bukit Jalil Sports Complex and The Malaysian Light Rail Transit (Mydin, 2014). Therefore, technology along with IBS such as automation can provide reduced labour dependability higher output and increased productivity, less variability, reduced human errors, greater control & consistency, safe working environment, flexibility etc (Divyesh Joshi, 2015).

Methodology

Advantages of Automation
The construction industry is still seen as one of the most dangerous industries due to the number of accidents recorded yearly (Jaselskis, 1994). The Construction industry in most developing and developed countries have been adjudged to be performing very badly in the area of safety by international standards (Lingard 1994; Spillane et. al 2011). According to Omran et al. (2010), that the construction industry is characterised as one with a poor safety culture globally. A very serious safety problem in construction site is the problem of defect in building because of poor workmanship which leads to fatal site accidents. Hence, automation can provide a higher safety for both worker and public through developing and deploying machines for dangerous jobs (Joshi, 2015). Furthermore, by approaching automation in construction, it can provide uniform quality with higher accuracy than that provided by skilled worker (Joshi, 2015) which lead to reduce poor workmanship problems.In the view on construction site, automation will improve work environment as conventional manual work is reduced to minimum, so the workers are relieved from uncomfortable work positions and at the same time, it will also be eliminating complains about noise and dust concerning works such as removal, cleaning or preparation of surfaces because of manual work is reduced to minimum (Joshi, 2015). Automation may also benefit in increasing productivity and work efficiency with reduced costs (Joshi, 2015). Reduction of costs, mostly due to the decrease in work load per task, and eliminating or cutting down the need to use scaffolding, security system and additional transport equipment (Kamaruddin, 2012).According to CIDB (2012), the potential and advantages of the use of modern machineries (adoption of mechanisation, automation and robotics) to construction contractors in Malaysia are: Implementation of government mega projects under the Entry Points Projects (EPPs), under the Economic Transformation Programme (ETP) may be performed with optimal cost in a shorter

period of time; Reduction of dependency on foreign workers; With the implementation of the minimum wage limit, the construction industry can no longer rely on cheap labour. Amongst the perceived impacts and achievements that will greatly affect the application of mechanisation and automation are resolving the foreign labour workforce issues, improving the quality of the product, minimising the volume of material consumed in finishing the projects, and promoting a better perception towards the construction industry, where it is currently known to be dirty, low quality and dangerous (Kamaruddin, 2012). Besides that, getting robotic machinery to carry out menial tasks can help reduce labour costs, human error and improve the quality of products (The Star, 2013).

Barriers of Automation

Cost would be a major factor in deciding on whether take or not to take on a technology. Cost consideration should include not only the purchasing cost, but also the maintaining the automation technologies and see that it can improve overall efficiency and productivity (Joshi, 2015). Implementation of automation required high costs/financial commitments in acquiring and maintaining the technologies (Mahbub, 2012). Still, these techniques are so expensive to update and maintain the progress of automation techniques. This is because, the application of mechanisation and automation is descended to be a specialized area that requires high technology machines and high skilled operators which will always lead to high overall cost, whether it is produced locally or abroad (Kamaruddin, 2013). With the high maintenance cost, most of the developer refuse to invest in such expensive technologies, especially the smaller companies. Small companies are hard to implement automation due to the funding is insufficient to purchase the automation technology according to their turnover. The small or even medium size firms are unable to purchase new technologies because of fund available is very less as compared to big firms (Joshi,2015).

Kamar et al. (2009) established the belief that it is extremely hard for new local companies to compete for opportunities with international competitors that are stronger in terms of financial capability, availability of technology or specialisation. Therefore, the technological cost is the foremost concern in the global industry as the optimum or feasible development costs of using IBS will depend on the number of projects secured the from public and private sectors (Kamaruddin, 2012). Furthermore, technologies are difficult to use and not easily understood. The techniques are not easily accepted by workers due to they have no knowledge about automation. Nowadays, there is need to train the workers to operate these techniques in proper manner. According to Mahbub (2012), low technology literacy of project participants/need for re-training of workers is also consider a barrier to implement the automation in construction industry. Besides that, technologies are not easily accepted by workers due to the complexity of procedure in automation technology. According to Kamar et al. (2009) and Nawi et. al. (2005), a lack equipment and machineries prove to be a difficult hurdle that hinders work in the construction industry. Malaysian construction industry also facing a problem to implement automation which is those machineries are unavailable locally and difficulties in acquiring the technology. Other than that, there are still some developer rely with traditional construction method which incompatibility of the technologies with existing practices and current construction operations (Mahbub, 2012).

The problems associated with the construction industry such as, decreasing quality and productivity, labour shortages, occupational safety and inferior working condition have

highlighted the need for innovative solution within the industry, including the push for further use of industrialisation and construction automation and robotics application on site (Mahbub, 2012).

Results and Discussion

A total of 100 questionnaires were distributed to developers and contractors G7 in Johor state through email and mobile apps. Only 41 respondents gave feedback. The result is analyzed below;
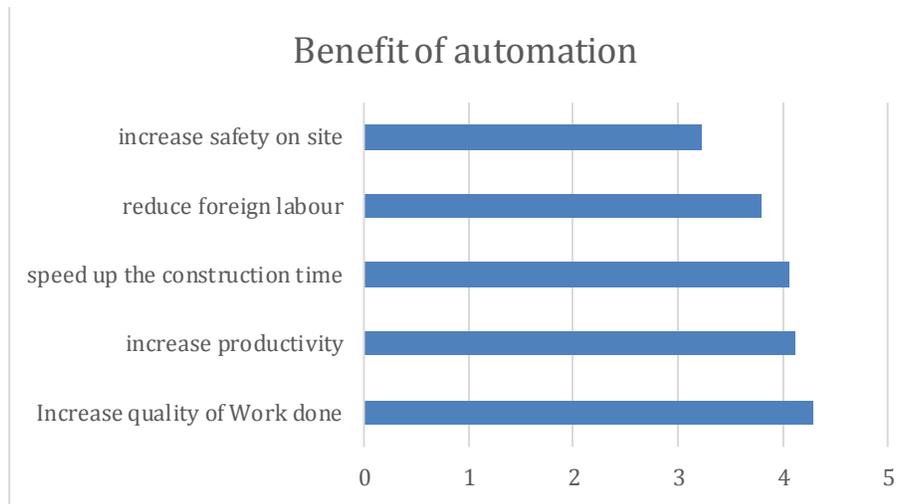

Figure 1. Benefits of automation

Figure 1 indicated the rank among 5 benefits to be discuss in this research. The most get attention benefit among 41 respondents was increase work done quality and the least attention was increase safety on site. Joshi (2015) have stated that, by approaching automation in construction, it can provide uniform quality with higher accuracy than that provided by skilled worker.
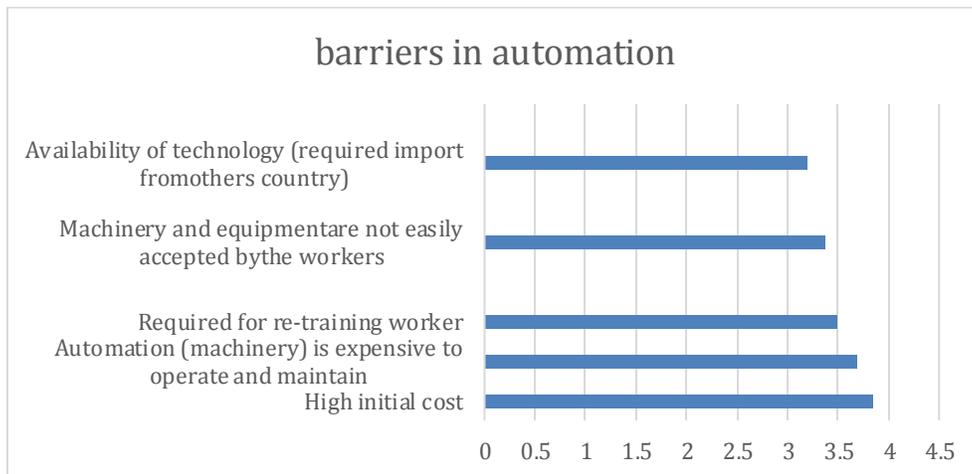

Figure 2. Barriers in automation

Figure 2 indicated the rank among 5 barriers to be discuss in this research. The most extreme barrier among 41 respondents is high initial cost and the least barrier is availability of

International Conference on Innovation and Technopreneurship 2020
Submission: 4 September 2020
Acceptance: 5 October 2020

©INTI International University 2020
Intijournal.newinti.edu.my

technology. The most extreme barrier is indicating the implementation of automation required high costs/financial commitments in acquiring and maintaining the technologies (Mahbub, 2012).

The top 3 recommendations concluded from 41 respondents are finance assistant and tax exemption from government, required to upgrade contractors' skills to be involved in mechanisation, automation and robotics and expanding the construction machinery manufacturing industry. The finance assistant and tax exemption from government might help a lot to the new developer or even for bigger developer to adopting more IBS system included automation technology in order to achieve the shorter construction time, lower cost and higher quality project. Nowadays, most of the contractors are still rely with conventional system because of new technology might cost higher than expected and required for re-training skills.

Conclusion

As a conclusion, the main ranking barrier on implement automation was high initial cost. Due to the automation required all those high and new technology to be implemented which the consideration is not only the purchase cost, but also the operate and maintenance cost and also the availability of machinery in Malaysia. It is always a no for the new or small company because of their capital is low. The second ranking barrier was required for re-training worker. After adopting the automation, the next problem was the operation of the machinery. Even automation has done all the work automatically, but it is still required an operator and programmer to ensure the machine or robot running smooth. The third ranking barrier was automation is expensive to operate and maintain. Because of the high operate and maintenance cost, most of the developer refuse to adopt automation due to the expensive technologies. However, if there are some assist or support from government, it is possible to implement automation in a cheaper and easier ways. To assuage the criticality of the barriers that are preventing the implementing automation, the most effective recommendation should be considered. Namely; is finance assistant and tax exemption from the government. The result from previous chapter shows that most of the respondents agreed with this solution because capital and availability of a company have been limited. If government have proposed more scheme on encourage the use of automation with solving the critical barriers face by industry player, most of the developers would consider. Moreover, it is also important to upgrade contractors' skills to be involved in mechanisation, automation and robotics because he/she is the one who construct the buildings. If the contractor is not in the field, then it must be a waste of resources if automation was conducted on site. Others recommendation should not be ignored as well even the responses were not so popular, but it also a worth to conduce a deep research for that area.

Acknowledgements

International Conference on Innovation and Technopreneurship 2020
Submission: 4 September 2020
Acceptance: 5 October 2020

©INTI International University 2020
Intijournal.newinti.edu.my

References

A. A. Shittu, A. D. Adamu, A. Mohammed, B. Suleiman, R. B. Isa, K. Ibrahim, & M. A. Shehu (2013). Appraisal of Building Defects Due To Poor Workmanship In Public Building Projects In Minna, Nigeria.

Alejandro Grisales Pachon (2012). Construction Site Automation: guidelines for analyzing its feasibility, benefits and drawbacks. [

Ayodeji Oke, Clinton Aigbavboa, Siphiwe Mabena (2017). Effects of Automation on Construction Industry Performance.

Construction Industry Development Board (CIDB) (2012). Final Report Phase 1; Mechanisation, Automation and Robotics in Construction.

Construction Industry Development Board (CIDB) (2013). Construction Industrialisation: Mechanisation, Standardisation and Value Creation

Divyesh Joshi, Rushabh Shah (2015). Automation in Construction Industry.

Edgar C.Tamayo, Yasir Imtiaz Khan, Ahmed Jawad Qureshi, Mohamed Al-Hussein (2018). Design automation of control panels for automated modular construction machines.

Edmundas Kazimieras Zavadskas (2010). Automation and robotics in construction: International research and achievements.

M.A. Othuman Mydin, N.A. Othman, N. Md. Sani (2014). A Prospective Study on Building Quality: Relationship between Workmanship Quality and Common Building Defects of Low-cost Construction Projects.

M.A. Othuman Mydin, N. Md Sani, M. Taib (2014). Industrialised Building System in Malaysia: A Review.

Pentti Vähä*, Tapio Heikkilä, Pekka Kilpeläinen, Markku Järviluoma, Ernesto Gambao (2013). Extending automation of building construction — Survey on potential sensor technologies and robotic applications.

Phang Ah Tong (2016). Facilities, incentives and challenges in the adoption of Industrialised Building System in Malaysia.

QianChen, BorjaGarcía de Soto, Bryan T.Adey (2018). Construction automation: Research areas, industry concerns and suggestions for advancement.

S. S. Kamaruddin, M.F. Mohammad, R. Mahbub and R. M. Yunus (2013). Perception Towards Cost Implication of Mechanisation and Automation Approach In IBS Projects In Malaysia.

Siti Syariazulfa Kamaruddin*, Mohammad Fadhil Mohammad, Rohana Mahbub (2016). Barriers and Impact of Mechanisation and Automation in Construction to Achieve Better Quality Products.

Siti Syariazulfa Kamaruddin*, Mohammad Fadhil Mohammad, Rohana Mahbub, Khairani Ahmad (2013). Mechanisation and Automation of the IBS Construction Approach: A Malaysian experience.