FACTORS CONTRIBUTING TO DRONE ADOPTION IN MALAYSIAN CONSTRUCTION INDUSTRY

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To my mother and father

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ABSTRACT

For many years, the Malaysian construction industry is being ridiculed for their refusal to change and slow to react when it comes to adopting new technology and innovation although technology can improve their business by leaps and bounds. Using drone as new technology example, this research aims to identify the push and pull factors that influence the adoption of drone by the construction industry in Malaysia and what can be done to accelerate the speed of adoption. It is anticipated that this research will contribute to formulation of new integrated solutions within the existing ecosystem that is much needed so that early adopters who are the minorities of the industry can appreciate the benefit of drone and also to convert the non-users. This research was conducted using qualitative approach. Semi-structured interviews were deployed as data collection method and were conducted with 8 industry experts, actual users and drone service providers. The results indicate that drone is a practice among leading construction and developer companies. There is a consistent opinion among interviewees that drone will be an industry standard in another 5 years to come although the industry is currently fragmented. Furthermore this research also indicates that the actual users of drone have the traits of early adopters and visionary leaders are a major pull factor in adoption of new technology. The research further revealed that there is no shared information among the industry experts, actual users and drone service providers about estimated benefit in terms of monetary value eventhough cost has been identified as a push factor. Based on the research findings, a conceptual model of a drone industry consortium was developed with the purpose to encourage higher level of collaboration and integration among drone industry users especially in knowledge sharing.

ABSTRAK

Keengganan untuk berubah dan perlahan dalam menyerap inovasi dan teknologi baru telah menyebabkan industri pembinaan Malaysia menjadi sasaran kritikan tahun demi tahun. Menggunakan dron sebagai contoh teknologi baru, kajian ini dijalankan bagi mengenalpasti faktor-faktor yang mempengaruhi keputusan untuk menyerap dan menggunakan teknologi dron di dalam industri pembinaan di Malaysia serta apakah yang boleh dilakukan bagi mempercepatkan proses penyerapan tersebut. Kajian ini dijangka akan dapat memberikan saranan dan penyelesaian bersepadu bagi memastikan para pengguna awal teknologi yang tergolong dalam kumpulan minoriti dapat memahami faedah yang boleh diperolehi daripada dron. Kajian secara kualitatif telah dijalankan dan kaedah pengumpulan data adalah dengan menemu bual 8 orang yang terdiri daripada pakar industri pembinaan, wakil syarikat pembinaan dan pembekal perkhidmatan dron. Hasil kajian mendapati penggunaan dron telah dipraktikkan oleh syarikat-syarikat yang menerajui industri pembinaan. Pendapat mereka yang ditemu bual juga selaras apabila menjangkakan dron bakal menjadi piawaian industri dalam masa 5 tahun akan datang. Seterusnya, kajian menunjukkan bahawa pengguna dron dalam kalangan industri pembinaan ini mempunyai ciri-ciri pengguna awal. Kajian juga mendapati tidak ada perkongsian maklumat mengenai anggaran faedah dalam bentuk nilaian wang di kalangan pakar industri, syarikat pembinaan dan penyedia perkhidmatan dron meskipun kos dikenalpasti sebagai salah satu faktor penolak kepada penyerapan teknologi baru. Berdasarkan dapatan kajian, sebuah model konsortium berkaitan dron dalam industri pembinaan telah dicadangkan. Kewujudan konsortium ini adalah untuk menggalakkan kerjasama dan gabungan erat di kalangan ahli terutamanya dalam hal perkongsian maklumat.

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CHAPTER 1

INTRODUCTION

1.1   Background

The Malaysian construction industry is the major economic engine for the overall economy. It contributed 4 per cent to the Malaysian Gross Domestic Product (GDP) in 2013 and is predicted to reach 5.5 per cent by the year 2020. This prediction outpaced Malaysia's overall economy which is expected to progress at 5 to 6 per cent per year while construction industry is expected to progress at 10.3 per cent per year. Construction share of GDP is correlated with GDP per capita hence the strong ties to the economic development (CIDB, 2015).

Although the Malaysian government, through its agencies had initiated several programs in the past few years, issues such as quality in workmanship, quality assessments, level of safety and enforcement, industry constraints due to rules and regulations, and negative public perception toward the construction industry still persist. In addition to those issues, resilience of buildings toward natural disasters, high energy and carbon emission, high construction waste at landfills are also detrimental to the construction industry. The need to accelerate the adoption of technology and new construction methods, aligning the supply and demand for workforce training, and availability and accessibility to high-quality information have to be encouraged and fulfilled. Competitions from foreign players are getting stiffer; the ongoing constraints related to finance and market intelligence for companies to excel in overseas markets are a growing concern (CIDB, 2015).

Malaysian construction industry is ready, to a certain degree, to embrace technologies in limited areas such as prefabrication and assembly and in the design, planning and costing phases. Influencing factors are capacity and capability of companies, size and type of business, and existing government incentives and policies (Mahbub, 2012). Among the productivity-related issues that have been highlighted by CIDB are limited adoption of modern practices, mechanization and IBS, limited adoption of information technology such as BIM and lack of data and information-driven decision-making (CIDB, 2015). Use of software during design, scheduling and planning, costing and tendering and project management phases is more widespread compared to actual application of the technologies on site (Mahbub, 2012).

One of the main limitations to the uptake of technology is cost, which becomes apparent why contractors are reluctant to invest when it comes to the price of software licenses and training when it can go to the tune of RM20,000 per license not inclusive of annual renewal fee. However, the long-term savings that can be generated from the use of particular software will be outstripped by its returns by 8% to 10% resulting in substantial savings in multi-million ringgit project (CIDB Insights, 2015).

1.2   Problem statement

At present, the inspection method used by the construction industry is very costly and posed high risks to the workers. Construction companies sometimes have to hire third party service provider for areas of expertise that they don't have such as visualization data analysis expert or rental of specialized equipment (Mazur et al., 2016). The current trend is time consuming and not cost-effective for the construction companies (Chan, 2015). There are too many parameters to be considered when it involves humans and humans capabilities are limited (Snow, 2016).

When drone is deployed for visual inspection at construction sites, it is meant to fulfill the goal of recording images and videos from an unobstructed and strategic vantage point, analyze the images and videos with or without intervention from a specific system that holds information about project progress or quality, oversee daily activities for productivity and safety, describe the current status of the existing infrastructure systems, and visualize and communicate the most recent state of work-in-progress with great speed and constantly with project owners (Wallis et al., 2012).

Drones are able to alleviate problems related to aerial visual collection and land surveillance especially for places with difficult access or with subjects that got intimidated and can perish in total if there's any attempt by human to manually engage with it. Aerial photography can be identified as a type of remote sensing and gives a unique point of view. Images captured show exactly how it looks on the surface, making it a useful data for mapping purposes. It can magnify something that can't be identified from the ground. When compiled and distributed over the Internet, these images can be a source of ideas by governments, businesses and individuals to solve a problem (Dustin, 2015).

However, the construction industry has been slow and reluctant to adopt new technology (JB Knowledge, 2014). Understanding which technology to use for different job functions can be overwhelming (Manyika et al., 2015). While there are smaller contractors, sub-contractors and consultants getting interested in new technology because they want to have a differentiator, many adopt a 'wait-and-see' approach. More over, Malaysian construction industry is used to top-down push when it comes to introducing changes. Technology will be used when a major client that has embraced technology made it compulsory for their consultants and subcontractors to work using the same platform and tool (Karib, 2015).

Therefore, construction industry is still struggling to attain the advantages of data analytics, cloud storage services, Big Data, BIM, robotics, automation and mechanization, and drone despite the advancement in technology innovation. For many years, construction industry failed to improve in their productivity thus adoption of these technologies can definitely make a change (Armstrong et al.,

2016). A lot of construction companies have been motivated by the benefits of adopting drone to enhance the effectiveness of process at worksites. However, some of them also found that their investment in this technology has outweighed the benefits and failed to meet their expectation (Manyika et al., 2015). One of the most significant current discussions in drone-powered solutions is fragmented solution for data analysis. Currently, there aren't any particular solutions that can satisfy the spectrum of need for construction companies (Snow, 2016).

This study is attempted to look at the barriers and challenges in adopting drone within the construction industry. This study is also attempted to contribute through identification and proposal of suitable solutions for the current situation so that the speed of new technology adoption among the industry can be accelerated.

1.3   Objectives

The overall aim of this study is to investigate the factors for industry to adopt drone technology and identify factors influencing the adoption. In order to achieve the stated aims, the following objectives have been formulated:

   i.   To study on drone technology application with specific focus on its usages for visual inspection and monitoring at construction sites.

  ii.   To explore the current uses with drone service providers and construction companies that have already implemented drones at their worksites.

 iii.   To investigate the challenges in adopting and integrating drone data with new construction standard.

  iv.   To identify benefits appreciated by construction companies in using drone.

   v.   To identify early technology adopters among the industry users, this research had used the Technology Adoption Life Cycle Model by Everett Rogers and the Chasm Theory by Geoffrey Moore as reference.

1.4   Significance of research

Technology adoption in construction industry is a challenging situation for its solutions and service providers. This research is to identify an effective approach to expedite technology adoption within a fragmented ecosystem. It is expected that this study could provide meaningful information to new technology venture companies that are interested to pursue the construction industry market. The top management of construction and developer companies would be able to make an informed decision regards to future technology investment and to implement change in their business processes following new insights gathered from this research.

1.5   Scope and limitations

This study attempts to identify factors contributing to acceleration of drone technology implementation in the Malaysian construction industry. It engages government agencies, construction and developer companies, drone service providers, and drone activist society. This thesis is not intended to propose a detail formula to increase technology adoption among construction companies; a comprehensive study needs to be undertaken for such purpose. Due to limited number of actual drone users in the construction industry, a qualitative research method is selected and by using case study approach. Semi-structured interview is used as data collection technique. Although the number of respondent is limited, researcher has given her best effort to draw out the current situation.

1.6   Research questions

The objective of this research is to investigate the push and pull factors in terms of applications, uses, challenges and benefits for industry players to adopt drone technology. In order to address the said objective, these research questions are explored:

i. At which phase of construction would drone be most useful and what are the type of work that can be assisted by drone in those phases?

ii. Are drone service providers able to extract meaning and interpret visual data from drone to the satisfaction of construction companies?

iii. What the factors that is affecting drone uses in construction industry?

iv. What are the common traits of companies that have adopted drone and do they fit with traits of early technology adopters?

The research target consists of government agencies, construction and developer companies, drone service providers, and drone activist society.

1.7 Expected Outcome

This research is expected to have the following outcomes:

i. Verify that fragmented and limited type of services by drone service providers have become major challenges for them to develop bigger customer base within the construction industry. Customized solutions can be offered according to the type of work during different construction phases.

ii. Drone powered solutions will be more effective if they are to be offered as an integrated service. Combination of several service items or resource sharing would be able to satisfy the clients requirements. Drone service providers should have an integrated solution and collaborate with cloud services and data analytics companies to offer end-to-end solution. In the future, IoT and Big Data are useful to accelerate the implementation of drone.

iii. Identify which category does the adopter of technology in construction industry belong to according to Technology Adoption Lifecycle Model by Geoffrey Moore.

iv. To suggest practical combination of drone services and solutions for construction companies.

1.8 Structure of report

This study comprises of five main chapters as below:

Chapter 1: Introduction to the study

Chapter 2: Literature Review

Chapter 3: Research Methodology

Chapter 4: Findings and Analysis

Chapter 5: Conclusion

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