SOCIO-CULTURAL FACTORS OF MALAYSIA'S CONSTRUCTION INDUSTRY THAT PROCRASTINATE THE IMPLEMENTATION OF CONSTRUCTION 4.0

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ABSTRACT

Construction 4.0 that adopted industrial revolution ("IR") 4.0's concept and framework is unfolding several benefits to Malaysia's construction industry. Nevertheless, construction industry is notorious for its conservative approach towards novel technology or technology advancement, resulted immensely lags behind other industries in terms of automation processes and level of digitalization amidst cumbersome its productivity. Scholars identified that socio-cultural has the greatest influence towards the successful implementation of construction 4.0, wherein impeding the engagement of construction 4.0 that resulted dawdle productivity improvement. The purpose of this paper is enumerating and examining the influence of socio-cultural in Malaysia's construction industry in enabling country policy makers and organization decision makers possess the perspicuous insights that impeding the implementation of construction 4.0 in Malaysia. However, there are other factors contributing to the successful implementation of construction 4.0 require further research in the future such as i) Political, economic, technological, environment, and legal factors, ii) Ethical issues, iii) Management process for overall project life cycle, and iv) Operation and tactical and strategic planning.

Keywords – Construction 4.0, Malaysia Construction Industry, Socio-Cultural.

INTRODUCTION

The first three industrial revolution through mechanical (1700s), electrical (1870s), and information/digital technology (1970s) were intended for productivity improvement of operational processes and business procedures (Alaloul W. S., Liew, Zawawi, & Mohanned, 2018). Similarly, the prevailing advancement of information and communications technology ("ICT") featuring by the vogue of digitalization and automation are supporting the "Industrie 4.0" or IR 4.0 in enhancing productivity and efficiency (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020). "Industrie 4.0" – the fourth industrial revolution was published by the German Government in 2011, to create a coherent policy scheme to maintain its industrial competitiveness in the context of global marketplace (Nowotarski & Paslawski, 2017). Klaus Schwab (2016), founder and executive chairman of World Economic Forum, advocates that "Industrie 4.0" is blurring the lines between the physical, digital, and biological spheres. This advance technology digital transformation enhances communication networks, efficiency of organization and management, and production and processes across industries (Zabidin, Belayutham, & Ibrahim, 2019) amidst contributing to sustainable economic, environmental, and social development (Ghobakhloo, 2019) as well as global ecological system.

IR 4.0 forged construction 4.0, changing the apparatus of design, construction, operation and maintenance of assets / edifice (Sawhney, Riley, Irizarry, & Perez, 2020), in soaring product quality, decreasing time-to-market, enhancing operation performances and improving health and safety (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020). Construction 4.0 is the adoption and adaptation of the "Industrie 4.0" or Industrial Revolution ("IR") 4.0 scheme into the construction industry (Sawhney, Riley, Irizarry, & Perez, 2020). Construction 4.0 unfolds several benefits consisting high efficiency and productivity, accuracy and quality-centred, collaboration, sustainability, and safety, as well as recover the eroded image of construction industry (Sawhney, Riley, Irizarry, & Perez, 2020) (Kozlovska, Klosova, & Strukova, 2021). Despite of the stupendous benefits, construction 4.0 subsists its infancy stage, eminently lags behind other industries in terms of automation processes and level of digitalization (Alaloul

W. S., Liew, Zawawi, & Mohanned, 2018), especially in developing countries that imitate traditional labor-intensive industry practices (Kozlovska, Klosova, & Strukova, 2021), for example, Malaysia. Construction industry hesitant in capitalizing these innovative technologies into its common practices due to resistance to change, barriers to innovation, unpredictability, profits, and skilled workforce recruitment, resulted exiguous improvement and productivity stagnation in the construction industry for decades (Sawhney, Riley, Irizarry, & Perez, 2020).

Several factors contributed to this adversity as explicit by Oesterreich and Teuteberg (2016) such as complexity, uncertainty, fragmented supply chain, short-term thinking, and culture. The nature of construction industry is complex and unique, as it involves enormous stakeholders amid its value chains involves multiple fragmented counterparts from all levels with a diverse background in responding the specific discrete and sui generis of each projects. Moreover, the financial capability of small and medium-sized enterprises ("SMEs") and short-term thinking as well as its reluctant practices in adaptation, considering the short-term nature of construction project, increased the difficulties of construction 4.0 initiative despite of the remarkable benefits (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020).

LITERATURE REVIEW

A. Overview

Productivity growth is an essential component of economic development (Acs, Lafuente, Sanders, & Szerb, 2017), whereby it is an increase in value of outputs produced for a given level of inputs, over a given period of time (Parliament of Australia, 2009). Rao et al. (2001) advocates three key determinants of productivity growth such as i) accumulation of physical capital, ii) accumulation of human capital, and iii) rate of innovation and technological change (Rao, Ahmad, William, & Kaptein-Russel, 2001). Thereby, technology advancement is the one of the key drivers of economic development, whilst industrial revolution is crucial in escalating national productivity (Hercko, Slamkova, & Hnat, 2015).

From the beginning of industrialization, technological advances forged paradigm changes called "industrial revolution" (Forcael, Ferrari, Opazo-Vega, & Pulido-Arcas, 2020). Cambridge Dictionary (2017) defined industrial revolution as "the period of time during which work began to be done more by machines in factories than by hand at home" (Liao, Loures, Deschamps, Brezinski, & Venancio, 2018). Industrial revolution also refers to the emergence, during the transition from a pre-industrial to an industry society, of modern economic growth (Vries, 2008). Industrial revolution invariably instigate disruption to the competitive status quo as well as unequivocal novel prerequisite to workforce and infrastructure. Therefore, as a natural consequence of being a technology-oriented world coupling with economic disquietude and increasingly complex and volatile business environment, the rules for survive and success in business are diverged exponentially (Lim & Lim, 2014). Michael Burke[1] (2018) advocates "current business models, strategies, and capabilities will not be sufficient in any of these future worlds" (Buehler, Buffet, & Castagnino, 2018).

B. Industrial Revolution 4.0

First industrial revolution ("IR") or IR 1.0 in 18th century related to water and steam power on mechanical equipment in replacing the manual works, whereby was the greatest breakthrough in soaring human productivity. Second industrial revolution or IR 2.0 in 19th century was actuated by electrical energy, effectuate mass production

[1] Michael Burke is the Chairman and CEO of AECOM and Co-Chair of the World Economic Forum Infrastructure and Urban Development Community.

and assembly line production wherein tremendously increase the volume of production with lower cost. Third industrial revolution or IR 3.0 or digital revolution in 1970s, emerged with the rise of electronics, was connected with innovation of technology and information technology ("IT") switching from analogue electronic and mechanical devices to the available digital technology amid enabling partial automation (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020) (Nowotarski & Paslawski, 2017).

The fourth industrial revolution or industry 4.0 or IR 4.0 was introduced by German Government in 2011 as high technology strategies for the development of new concept of German economic policy (Roblek, Mesko, & Krapez, 2016). IR 4.0 will be marked by the full automation, digitization, and decentralized production processes through several crucial components such as i) cyber-physical systems ("CPS"), ii) internet of things ("IoT"), iii) internet of services ("IoS"), iv) advanced robotics, v) big data analytics, vi) cloud manufacturing, vii) augmented reality, simulation, viii) system integration, and ix) addictive manufacturing (Tay, Lee, Chan, Alipal, & Abdul Hamid, 2019) (Ibrahim, Esa, & Mustafa Kamal, 2019). IR 4.0 enables interconnection between all mechanized automation through technologies advancement to operate and share information without the human intervention (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020). IR 4.0 is blurring the lines between the physical, digital, and biological spheres as it devices physical and virtual manufacturing scenarios, whereby transforming factories' environment into one of intelligent manufacturing (Forcael, Ferrari, Opazo-Vega, & Pulido-Arcas, 2020) with six fundamental concepts such as interoperability, virtualization, decentralization, real-time capability, service orientation, and modularity (Alaloul W. S., Liew, Zawawi, & Mohanned, 2018).

Baur & Wee (2015) defined IR 4.0 as "a broad term consisting of a confluence of trends and technologies that are likely to reshape the way things are made" (Sawhney, Riley, Irizarry, & Perez, 2020). Hermann et al. (2016) defined IR 4.0 as "a new level of value chain organization and management across the lifecycle of product" (Sawhney, Riley, Irizarry, & Perez, 2020). Maskuriy et al. (2019) defined IR 4.0 as "the IoT and IoS integrated with the manufacturing environment where all industrial businesses around the globe connect and control their machinery, factories, and warehousing facilities intelligently through cyber-physical systems by sharing information that triggers actions" (Maskuriy, Selamat, Ali, Maresova, & Kerjcar, 2019). IR 4.0 is impelling curtailment of low-skill task and escalation of high-skill task, involving implementation of control and IT related activities and automation (Mohamad, et al., 2018). Varies industries such as manufacturing, automobile, and banking industry have benefitted from the implementation of IR 4.0 on their daily operational activities in terms of productivity, accuracy, efficiency, and customer satisfaction (Lau, et al., 2019).

Liao et al. (2017) study showed IR 4.0 is benefitting the manufacturing through vertical integration, horizontal integration, and end-to-end engineering, as it integrates people, machines, and data amidst creating more agile and responsive supply chain (Raj, Dwivedi, Sharma, & Jabbour, 2020). Ministry of International Trade and Industry of Malaysia mentioned IR 4.0 will increase flexibility, productivity, quality, and reduction time to market (Mohd. Aripin, Zawawi, & Ismail, 2019). Sony & Naik (2018) mentioned the high level of digitization and automation of organizational supply chain enables agile, efficient, responsive, and cost effective to the manufacturing processes (Sony & Naik, 2020). Moreover, this industrial revolution not merely introduced the modern techniques in supporting and advancing every component within industry, it also embraces sustainability in terms of social, economic, and environmental (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020).

C. Construction 4.0

"Industrie 4.0" or IR 4.0 was originated in 2011 at the Hannover Fair in Germany as an alleviation stratagem in responding to the intensify competition in the global marketplace; primarily focusing on manufacturing industry.

The introduction of this novel technology revolutionizes the industries' traditional modus operandi, including construction industry. Construction 4.0 is the adoption and adaptation of IR 4.0 theoretical framework into the construction industry (Sawhney, Riley, Irizarry, & Perez, 2020), involves technological changes in associate with the engagement unorthodox modus operandi to the processes, materials, and markets (Forcael, Ferrari, Opazo-Vega, & Pulido-Arcas, 2020). Oesterreich and Teuteberg (2016) described construction 4.0 as "a variety of interdisciplinary technologies that digitize, automate, and integrate the construction process at all stage of the value chain" (Oesterreich & Teuteberg, 2016). Sawhney et al. (2020) defined construction 4.0 as "a paradigm that uses cyber-physical systems, and the Internet of Things, Data, and Services to link the digital layer consisting of Building Information Modelling ("BIM") and Common Data Environment ("CDE") and the physical layer consisting of the asset over its whole life to create an interconnected environment integrating organizations, processes, and information to efficiently design, construct, and operate assets" (Sawhney, Riley, Irizarry, & Perez, 2020). Construction 4.0 set forth the new framework in planning, designing, and delivering built environment assets / edifice in a more effective and efficient manner by focusing on the physical-to-digital transformation and vice versa (Dallasega, Rauch, & Linder, 2018).

Construction 4.0 is leveraging and optimizing the digitalization and computerization by adopting the latest technology and modern construction method to enhance construction productivity towards global competitiveness amidst contributing to country's economic status (Ibrahim, Esa, & Mustafa Kamal, 2019). Construction 4.0 enables new opportunities for companies on increasing their competitiveness, quality of works, and timely project completion as well as attaining sustainable building environment and decision making in building technology (Forcael, Ferrari, Opazo-Vega, & Pulido-Arcas, 2020). Moreover, Forcael et al. (2020) advocates that construction 4.0 is not merely a technological upgrade to traditional construction, it is a vogue of perceiving and understanding construction and transforming the concept of construction itself in the light of innovation and increased productivity (Forcael, Ferrari, Opazo-Vega, & Pulido-Arcas, 2020). Meanwhile, they suggested the two (2) pillars of construction 4.0 consisting i) digitalization and ii) industrialization.

Figure 1 Diagram of Construction 4.0 pillars (Forcael, Ferrari, Opazo-Vega, & Pulido-Arcas, 2020)

Construction 4.0 unfolds several benefits consisting high efficiency and productivity, accuracy and quality-centered, collaboration, sustainability, and safety, as well as rejuvenate the eroded image of construction industry (Sawhney, Riley, Irizarry, & Perez, 2020) (Kozlovska, Klosova, & Strukova, 2021). Construction 4.0 enables organizations in meeting new emergent needs amidst provides capabilities in preparation of the next society evolution as well as transforming the design, fabrication, usage, operation, maintenance, and services of the products or building assets (Maskuriy, Selamat, Ali, Maresova, & Kerjcar, 2019). Whilst construction 4.0 also enables easier and lesser flaw in the monitoring and controlling processes (Ibrahim, Esa, & Mustafa Kamal, 2019). The success of construction 4.0 is not inexistent; Kozlovska et at. (2021) cited You & Feng (2020) on the successful case of implementing cyber-physical system in the construction project of the Xiong'an citizen service center. The construction project completed within schedule, notably the cyber-physical system enables close collaboration between production, logistics, and assembly process by monitoring the supply chain of prefabricated components and eliminating the delay of quality inspection information, amidst promoting sustainable construction (Maskuriy, Selamat, Ali, Maresova, & Kerjcar, 2019).

D. Obstacles

Construction industry is one of the most dynamic and responsive industrial sectors of any economy (Osunsanmi, Aigbavboa, & Oke, 2018) and also one of the largest industries in the world, accounting 13% annual turnover of the global Gross Domestic Product ("GDP") (Axelsson, Froberg, & Eriksson, 2019). Construction industry is playing an important role in national economic growth through strengthening and enabling other sectors amidst provides basic amenities and infrastructure in supporting social development such as road, railways, ports, and buildings. Those amenities and infrastructure are crucial in improving social living standards and quality of life, resulting promote better utilization of physical and human resources (Mirawati, Othman, & Risyawati, 2015). Nonetheless, construction industry has been traditionally labeled as unproductive (Forcael, Ferrari, Opazo-Vega, & Pulido-Arcas, 2020), wherein heavily rely on manual labor, mechanical technology, and established operating and business model (Buehler, Buffet, & Castagnino, 2018). Compare to manufacturing's 3.6% productivity growth per annum, construction industry's productivity improvement rate of 1% per annum for the past 20 years is piteous and dreadful (Axelsson, Froberg, & Eriksson, 2019).

Oesterreich and Teuteberg (2016) concluded several factors spurred the dilatory in engaging construction 4.0 resulting slow productivity improvement such as complexity, uncertainty, fragmented supply chain, short-term thinking, and culture (Oesterreich & Teuteberg, 2016). Moreover, the nature of construction industry is complex and unique, as it involves enormous stakeholders amid its value chain involves multiple fragmented counterparts from all levels with a diverse background in responding the specific discrete and sui generis of each projects. Beside the financial capability of SMEs and short-term thinking as well as its reluctant practices in adaptation, considering the short-term nature of construction project, increased the difficulties of construction 4.0 initiative despite of the remarkable benefits (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020).

Notwithstanding of the challenges, construction industry must improvise and adapt the ever-changing global economy (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020). Thereby, construction industry must embrace the opportunities afforded by technology (i.e., construction 4.0) to enhance the efficiency and productivity, as well as improve performance of construction industry and the consistency and quality of its outputs (i.e., amenities and infrastructure) (Sawhney, Riley, Irizarry, & Perez, 2020). Liao et al. (2018) mentioned that construction industry's organizations must prepared in transforming their production environment by capitalizing the emergence of technologies, to foster integration, collaboration, flexibility, cognition, and connectivity, whereby action from governments to organizations is crucial (Liao, Loures, Deschamps, Brezinski, & Venancio, 2018). These will positively influence the national economy by ensuring infrastructure gap is narrowed and boosting the overall economic development (Maskuriy, Selamat, Ali, Maresova, & Kerjcar, 2019) by providing an atmosphere where resources such as equipment, materials, labor, and capital are traded in creating an infrastructure within an economy (Osunsanmi, Aigbavboa, & Oke, 2018).

Socio-cultural theory was put forth by a Russian psychologist, Lev S. Vygotsky in 1979. He explained human cognitive development is connected with culture and society as well as institutional and historical context (Aliyu & Yakubu, 2019). Historically formed settings such as family life and peer group interaction and in institutional contexts like schooling, organized sports activities, and workplaces (Lantolf & Thorne, 2007). Vygotsky (1979) suggested the "genetic law of development" that encompasses two (2) stages in cultural development. First stage is intermental then following by intramental, the former start from social then the psychological and the latter is within the learner. In brief, as learners participate in joint activities and internalize the effects of working together, they acquire new strategies and knowledge of the world and culture (Aliyu & Yakubu, 2019). The first stage is

having strong link with institutions, whereby North (1990) defined institutions as "humanly devised constraints that structural political, economic, and social interaction" (Hopp & Stephan, 2012), consisting formal and informal. Wherein, formal can be political and economic rules and contracts, whereas informal includes codes of conduct, conventions, attitudes, value, and norms of behavior (Thornton, Ribeiro-Soriano, & Urbano, 2011). Institutions are constituted by culture and social relations, whilst human, social, and cultural capital are pre-requisite in acquiring financial capital and other resources needed to start a business (Thornton, Ribeiro-Soriano, & Urbano, 2011). In this case, it will be the resources needed in implementing construction 4.0 in companies or within construction industry.

Thereby, it is in line with the several scholars' studies, wherein Oesterreich and Teuteberg (2016) explicit short-term thinking and culture are the factors contributing to slow implementation of construction 4.0 (Oesterreich & Teuteberg, 2016). Alaloul et al. (2020) identified social factors, particularly cultural habits, has the greatest influence towards the successful implementation of construction 4.0 (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020). Lau et al. (2019) suggested several social factors that prolonged the implementation of construction 4.0 (Lau, et al., 2019). Mohd. Aripin et al. (2019) concluded that acceptance of technology and individual hesitance are among the potential barriers in implementing industry 4.0 technologies due to conservatism and adoption of new knowledge and skills (Mohd. Aripin, Zawawi, & Ismail, 2019). Kozlovska et al. (2021) cited other studies concluding that the social factor was proved to be the most important factor influencing the successful implementation of IR 4.0 technologies in the construction industry (Kozlovska, Klosova, & Strukova, 2021). These studies alongside the socio-cultural theory above, proven socio-cultural is the crucial factor of implementation of construction 4.0 in Malaysia.

PROBLEM STATEMENT

The conservative approach of construction industry is leading to inertia in the context of technology advancement and change, in this case construction 4.0. Alaloul et al. (2020) identified social factors, particularly cultural habits, has the greatest influence towards the successful implementation of construction 4.0 because it has a permeant effect throughout the construction processes involving multiple stakeholders and parties (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020). Lau et al. (2019) suggested several social factors that retarded the implementation of construction 4.0 encompassing low awareness, gaps between academy and industry, employees' acceptance and adaptability, and training and development (Lau, et al., 2019). Kozlovska et at. (2021) cited other study, mentioned that the social factor was proven to be the most important factor influencing the successful implementation of construction 4.0 (Kozlovska, Klosova, & Strukova, 2021). Mohd. Aripin et al. (2019) concluded that acceptance of technology and individual hesitance are among the potential barriers in implementing industry 4.0 technologies due to conservatism and adoption of new knowledge and skills (Mohd. Aripin, Zawawi, & Ismail, 2019). Sony and Naik (2020) mentioned that top management involvement and commitment is the main determinant for the readiness of IR 4.0 and sustaining new initiative. Unequivocally, employees must adapt to multifaceted of adaptability by virtue of the changes in the traditional nature of employment and works structural (Sony & Naik, 2020).

Since IR 4.0 and construction 4.0 are in its precursory, pertinent publications are meagre. Research in associated with IR 4.0 can only be discerned from year 2013, wherein only 8 publications were found in connected with construction 4.0 in year 2017 (Nowotarski & Paslawski, 2017). Kozlovska et al. (2021) found 195 publications related to the interconnection of IR 4.0 and construction 4.0 in year 2021 (Kozlovska, Klosova, &

Strukova, 2021). The finite publications related to construction 4.0 signifies farther research in this filed is desideration and pivotal (Nowotarski & Paslawski, 2017). Bearing in mind that the above-mentioned publications are studies from researchers and scholars over the world. Hence, scanty publications in related to construction 4.0 that focusing on Malaysia's construction industry is anticipated. Therefore, it could be concluded that construction 4.0 in Malaysia is in the process of formation and there are needs for further investigation.

As a summary to the above, social factor is the main influential on procrastinating the implemention of industry construction 4.0 in Malaysia amidst studies of socio-cultural that influence the implementation of construction 4.0 in Malaysia is sparse. Coupling with the current research is focusing on technical aspect of technologies associated with IR 4.0 rather than ethical, economical, socio-cultural, or environmental (Kozlovska, Klosova, & Strukova, 2021), this paper serve in closing the gap by focusing on socio-cultural of construction industry that impeding the implementation of construction 4.0 in Malaysia, aim to enumerate and examine the influential in socio-cultural of construction industry.

RESEARCH OBJECTIVES

This study aims to enable country policy makers and organization decision makers possess the perspicuous insights that impeding the implementation of construction 4.0 in Malaysia. Wherein hoping the insights will facilitate in gambit pragmatic strategy to diminish the balk that engendered by social or cultural factors.

The following proposed conceptual framework aims to explore the relationships among the four independent variables that engender the late implementation of construction 4.0 in Malaysia.

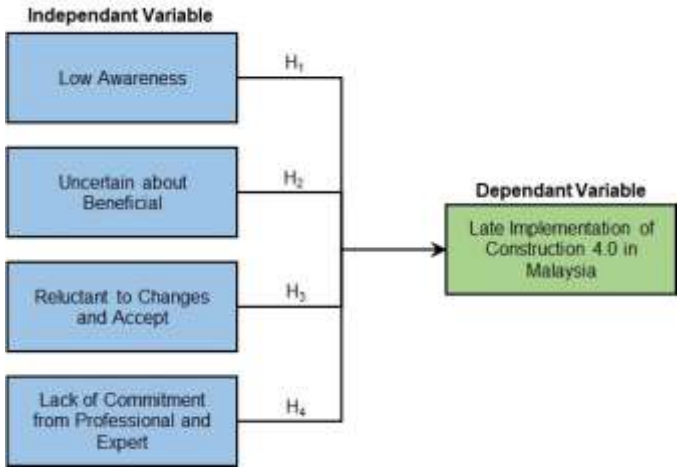

Figure 2 Conceptual Framework

The followings hypotheses were developed for this study: -

Hypotheses 1 : There is a relationship between **low awareness** and late implementation of construction 4.0 in Malaysia.

Hypotheses 2 : There is a relationship between **uncertain about beneficial** and late implementation of construction 4.0 in Malaysia.

Hypotheses 3 : There is a relationship between **reluctant to changes and accept** and late implementation of construction 4.0 in Malaysia.

Hypotheses 4 : There is a relationship between **lack of commitment from professional and expert** and late implementation of construction 4.0 in Malaysia.

RESEARCH FINDINGS

		PAR[14]	AWR[15]	BNF[16]	CHG[17]	CMT[18]
Pearson Correlation	PAR[2]	1	0.062	0.041	0.092	-0.1688**
	AWR[3]	0.062	1	0.421**	0.469**	0.070
	BNF[4]	0.041	0.421**	1	0.645**	-0.084
	CHG[5]	0.092	0.469**	0.645**	1	-0.062
	CMT[6]	-0.168**	0.070	-0.084	-0.062	1

**. Correlation is significant at the 0.01 level (2-tailed).

The results of Pearson Correlations Matrix show H_4 – Lack of Commitment from Professional and Expert has negative correlation (correlations=-0.168) to the dependent variable – late implementation of construction 4.0 in Malaysia. Whereas H_3 – Reluctant to Changes and Accept (correlations=0.092) has the highest correlations to the late implementation of construction 4.0 in Malaysia, following by H_1 – Low Awareness (correlations=0.062) and H_2 – Uncertain about Beneficial (correlations=0.041). However, only H_3 – Reluctant to Changes and Accept is significantly correlate with late implementation of construction 4.0 in Malaysia, whereas the relationship between H_1 – Low Awareness and H_2 – Uncertain about Beneficial, and late implementation of construction 4.0 in Malaysia are not significant.

In view of that, the hypothesis on there is a relationship between reluctant to changes and accept and late implementation of construction 4.0 in Malaysia is accepted. Whereby, reluctant to change and accept engender late implementation of construction 4.0 in Malaysia.

MODEL	R	R^2	ADJ.R^2[7]	STD.ER[8]
1	0.781[a]	0.610	0.580	0.8622

a. Predictors: (Constant), Commitment, ChangeAcceptance, OrgAware, Beneficial

The model summary above indicated R: multiple correlation coefficient = 0.781 and R^2: coefficient of determination = 0.610, wherein the model account for 61.0% of variance which indicate the regression equation are considered reliable.

MODEL		UNSTD.B[9]	CO.STD.ER[10]	STD.CO.B[11]
1	(Constant)	12.325	3.194	
	Awareness	0.104	0.058	0.179
	Beneficial	0.050	0.062	0.054
	Changes	0.530	0.156	0.394
	Commitment	-0.162	0.110	-0.144
MODEL		T	SIG.[12]	
1	(Constant)	3.859	0.000	

[2] PAR = Participants
[3] AWR = Low Awareness
[4] BNF = Uncertain about Beneficial
[5] CHG = Reluctant to Changes and Accept
[6] CMT = Lack of Commitment from Professional and Expert
[7] Adj.R^2 = Adjusted R Square
[8] Std.Er = Standard Error of the Estimation
[9] Unstd.B = Unstandardized B
[10] Co.Std.Er = Coefficients Std. Error
[11] Std.Co.B = Standardized Coefficients Beta
[12] Sig. = Significant; P-value

	Awareness	1.796	0.091
	Beneficial	0.801	0.424
	Changes	3.393	0.002
	Commitment	-1.469	0.149

The self-explanatory beta coefficient's table above show H_3 – Reluctant to Changes and Accept (p-value=0.002; <0.05 and t=3.393) has significant effect to the dependent variable – late implementation of construction 4.0 in Malaysia. Wherein, one unit increase in H_3 – Reluctant to Changes and Accept, the effect to late implementation of construction 4.0 in Malaysia will increase by 0.530. This result is consistent with the Pearson correlations matrix above, wherein H_3 – Reluctant to Changes and Accept is significantly correlate with late implementation of construction 4.0 in Malaysia. Whereas H_4 – Lack of Commitment from Professional and Expert does not have significance effect (p-value=0.149; >0.05 and t=-1.469) to the dependent variable – late implementation of construction 4.0 in Malaysia. Wherein one unit increase in H_4 – Lack of Commitment from Professional and Expert, the effect to late implementation of construction 4.0 in Malaysia will decrease by 0.162. This result is consistent with the Pearson correlations matrix above, wherein H_4 – Lack of Commitment from Professional and Expert has negative correlation with late implementation of construction 4.0 in Malaysia. Likewise, H_1 – Low Awareness (p-value=0.091; >0.05 and t=1.796) and H_2 – Uncertain about Beneficial (p-value=0.424; <0.05 and t=0.801) does not have significance effect to the dependent variable – late implementation of construction 4.0 in Malaysia. Wherein, one unit increase in H_1 – Low Awareness and one unit increase in H_2 – Uncertain about Beneficial, the effect to late implementation of construction 4.0 in Malaysia will increase by 0.104 and 0.050 respectively.

Reluctant to changes and accept is the main determinant that impeding the implementation of construction 4.0 in Malaysia, wherein the low awareness and uncertain about the benefit of construction 4.0 are significantly contribute to the reluctant of changes and accept. Thereby, it proved reluctant to changes and accept is one of the most influence cultural habits within Malaysia's construction industry that impeding the implementation of construction 4.0 in Malaysia. Wherein the cultural habit of reluctant to changes and accept is significantly influence by the low awareness and uncertain about the beneficial of construction 4.0.

Nevertheless, the professional and expert are exempted from the above cultural habit, as there is reverse relationship between lack of commitment from professional and expert and late implementation of construction 4.0 in Malaysia. Consider the multiple fragmented counterparts from all levels with a diverse background, perhaps it is other industry practitioners (i.e., developer, main contractor, sub-contractor, and suppliers) that refuse to embrace and accept the changes engendered by construction 4.0 in Malaysia despite of the remarkable benefits which have been witness in other industries such as manufacturing, automobile, and banking industry. Thereby, this may be one of the area or topics or future study.

Further to Alaloul et al. (2020) studies that proven social factors and cultural habits is the main impediment of construction 4.0 in Malaysia (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020), this study has identified one of the most influencing social factors namely reluctant to changes and accept that engender the late implementation of construction 4.0 in Malaysia. Therefore, future study may focus on other social factors and cultural habits that impeding the construction 4.0 in Malaysia, such as operational modus operandi, personal training, and development in related to the construction 4.0, resistance attitude, etc. The future study could also focus on the elements within reluctant to changes and accept from developer, main contractor, sub-contractors,

and suppliers, including changes of responsibility, adaption to various dimensions of adaptability, or potential job losses due to automation.

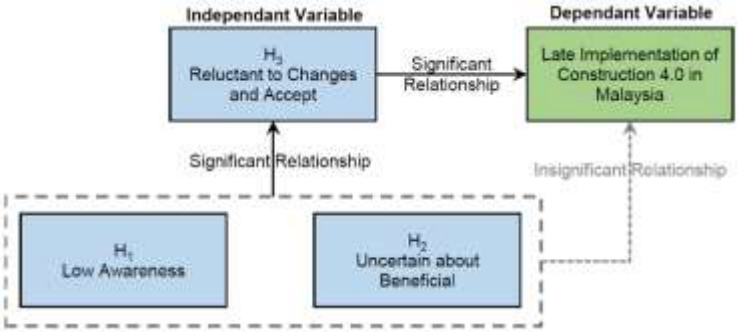

Figure 3 Findings of Relationships Between Independent Variable and Dependant Variable

CONCLUSION AND RECOMMENDATION

The resistant to changes and adoption of new technology is the key socio-cultural factors that impeding the successful implementation of construction 4.0 in Malaysia, notwithstanding the apparent benefits as witness in varies industries such as manufacturing, automobile, and banking industry. The conservative approach of the construction industry practitioners enduring the traditional unproductive construction's modus operandi and derelict health and safety policy by excessively counting on manual labor, mechanical technology, and established operating and business model, except the professional and expert such as architects, engineers, and consultant quantity surveyors who leverage the technology advancement (i.e., construction 4.0) towards flexibility, productivity, and quality.

Two (2) determinants dictate the conservative approach of resistant to changes and adoption of new technology, such as i) low awareness of construction 4.0, and ii) uncertainty of beneficial and perceived valued of construction 4.0. Resulted, the attributes of construction 4.0 including high efficiency, productivity, accuracy and quality-centered, collaboration, cost effective, agile, responsive, sustainability, and safety as well as the capabilities in preparation of next society evolution are not appreciated by the construction industry practitioners (expect professional and expert), resulting impede the successful implementation of construction 4.0 in Malaysia. The attitude of status quo restrains the industry players towards business sustainability in the prevailing economic disquietude amidst volatile business environments.

Scholars advocate the importance of construction 4.0 on enhancing construction productivity towards global competitiveness amidst positively influence the national economy (Ibrahim, Esa, & Mustafa Kamal, 2019) (Maskuriy, Selamat, Ali, Maresova, & Kerjcar, 2019). Thereby, government's gambit and intervention are crucial to organizations' awareness in arousing the beneficials and perceive values of construction 4.0. Moreover, collaborations with professional and expert can be convened to initiate multifarious activities and campaigns in associate with the beneficials and perceive values of construction 4.0, as they are one of the core industry practitioners who embrace the technology advancement. Bearing in mind that, public awareness campaigns are pivotal in shaping people's attitudes, promoting environment actions, positive changes in behavior and general awareness of ecological issues (Borawska, The Role of Public Awareness Campaigns in Sustainable Development, 2018). Furthermore, government funding and incentive on implementation of construction 4.0 is imperative, as companies are hesitated to invest in construction in view of the perception of high investment cost amid uncleared benefits. For example, fund or subside training and development programs on top of tax incentives.

Bearing in mind that, education and training are the driver of productivity improvement (Liao, Loures, Deschamps, Brezinski, & Venancio, 2018).

LIMITATION

This paper is aiming the responds from personnel of Malaysia's consultancy firms in private sectors, including architects, engineer, and consultant quantity surveyors. However, construction industry is fragmentation in natural; fragmented counterparts from all levels of supply chain with a diverse background, including developers, main contractors, sub-contractors, specialist contractors, suppliers, etc. Resulted, the outcome of this paper is the result from singular perspective (i.e., professional and expert), without considering the lens of other practitioners within construction industry. Moreover, this paper is focusing on the feedback from private sector, not the combination of private and public sectors.

In the aspect of socio-cultural, the list in related to traits of culture and habits are inexhaustive; not limited to the four (4) independent variables in this paper. Short-term thinking, attitude of veteran practitioners, constraints of fresh graduate, behaviors towards learning and development, behavior in relate to disruption on status quo, adaption to various dimensions of adaptability, etc. may be one of the key socio-cultural barriers towards success of construction 4.0 in Malaysia. Moreover, cited the studies from several scholars, socio-cultural is only of the barriers towards success of construction 4.0 in Malaysia. The barriers must be scrutinized in a holistic manner in considering other pertinent factors such as political, economic, technological, environmental, legal, and ethical (Alaloul W. S., Liew, Zawawi, & Kennedy, 2020) (Kozlovska, Klosova, & Strukova, 2021).

Project development and construction consisting of design, construct, operate, and maintain of assets / edifice (Sawhney A. , Riley, Irizarry, & Perez, 2020). Thereby, facilities manager or specialist should take part during the design stage in facilitating proper design from the maintainability, cost of operations, safety, etc. perspective (Jenuwa, Misnan, & Abdullah, 2019). In a nutshell, facilities manager should be considered as one of the construction industry practitioners.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Liong Chee Gin and Dr. HJ Kamal Abd Razak jointly developed the conceptual model. Liong Chee Gin conducted the literature review and wrote the paper. Both authors worked jointly to develop the proposed hypothesis for this study. The authors have approved the final version.

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