UNIVERSITI TEKNOLOGI MARA Cawangan Perak

KUTAI

GRESAFE_CITIES
Green Safe Cities, Research Group

6th UNDERGRADUATE SEMINAR ON BUILT ENVIRONMENT AND TECHNOLOGY (USBET) 2023

SUSTAINABLE BUILT ENVIRONMENT

25 - 27 SEPTEMBER 2023

E-PROCEEDING

USBET 2023

e-Proceeding

6th UNDERGRADUATE SEMINAR ON BUILT ENVIRONMENT AND TECHNOLOGY (USBET) 2023

SUSTAINABLE BUILT ENVIRONMENT

Published by,
Department Of Built Environment Studies And Technology
Faculty Of Architecture, Planning & Surveying
Universiti Teknologi MARA Perak Branch, Seri Iskandar Campus
usbet.fspuperak@gmail.com

eISSN 2821-3076

02 October 2023 | Perak, Malaysia
Universiti Teknologi MARA, Perak Branch, Seri Iskandar Campus

EDITORIAL BOARD

Editors-in-Chief

SR. NORAZURA MIZAL AZZMI (BS)

NADIRA AHZAHAR (BS)

Editors

TS. ZURAIHANA AHMAD ZAWAWI (BS)

SR. NAZHATULZALKIS JAMALUDIN (BS)

SR. SITI ZUBAIDAH HASHIM (BS)

NURHIDAYAH SAMSUL RIZAL (BS)

SR DR. NURUL FADZILA ZAHARI (BS)

NUR FADHILAH BAHARDIN (BS)

SR TS. DR. ALIA ABDULLAH SALLEH (BS)

SR TS. DR. SURIANI NGAH WAHAB (BS)

SR TS. DR. HASNAN HASHIM (BS)

SR NOORAZLINA KAMARUZZAMAN (BS)

SR MARIATY MOHD BAHARI (BS)

SR AIDA AFFINA ABDUL GHANI (BS)

DR. NOR DIANA AZIZ (BS)

SR AMIR FASHA MAT ISA (BS)

SR DR. NOR AMIN MOHD RADZUAN (BS)

PROF. MADYA SR DR. MOHD FADZIL YASSIN (BS)

SR TS. KHAIRUL AMRI RAMLY (BS)

SR. MOHD ASRUL HASIN (BS)

SR TS. MOHD KHAZLI ASWAD KHALID (BS)

SR MOHD DZULKARNAEN SUDIRMAN (BS)

SR DR. IRWAN MOHAMAD ALI (BS)

SR DR. MOHAMMAD HASZIRUL MOHD HASHIM (BS)

DR NURHASYIMAH BT AHMAD ZAMRI (BCT)

DR. PUTERI YULIANA SAMSUDIN (TP)

Editors-in-Chief

6th Undergraduate Seminar on Built Environment and Technology 2023

- E- Proceedings-

Organized by,

College of Built Environment (KAB) UiTM Perak Branch

FACTORS INFLUENCING THE LEVEL OF READINESS OF DESIGNERS IN IMPLEMENTING IBS CONSTRUCTION PROJECTS

Imilia Husna Dilah[1], Wan Norizan Wan Ismail[1*]

[1]Department of Built Environment Studies and Technology, College of Built Environment, University Technology MARA, Perak Branch, 32610, Seri Iskandar, Perak, MALAYSIA

*wanno134l@uitm.edu.my

ABSTRACT

IBS is a system and technique that require as little additional site work as possible. Their components can be manufactured on-site or off-site before being transported, positioned, and assembled into a structure. Many incentives have been given to encourage the adoption of IBS in Malaysian construction projects, primarily through government schemes. However, the problems may exist within the construction team itself, especially for the designer team on their readiness to shift from designing and managing conventional projects to IBS projects. To construct an IBS project, it is necessary to have a designer ready physically and mentally for the project. Therefore, this study aims to identify the readiness level of designers to adopt IBS in Malaysian construction projects. The objectives of this study are to identify the readiness level of designers to adopt IBS in Malaysian construction projects and to determine factors influencing the readiness of designers to adopt IBS in Malaysian construction projects. This study used a quantitative method of data collection via questionnaire distribution to the architect and engineers who registered with their umbrella organizations. The data collected from the survey were analysed descriptively using the Statistical Package for the Social Sciences (SPSS) version 28. This study found that the readiness level of the designer for implementing the IBS project was at a high level. The most significant factor influencing the readiness of the designer to implement the IBS project was the designers' eagerness to gain knowledge and experience about IBS. Thus, it is hoped that this study will benefit, contribute to, and increase the level of readiness among designers as well as other project parties especially the contractor.

Keywords: *IBS, Readiness, Designer, Level, Construction Industry*

INTRODUCTION

Industrialised Building System or IBS is a technique that requires as little additional site work as possible, and their component can be manufactured either onsite or off-site before being transported, positioned, and assembled into a structure. The components of the IBS are materials that are produced in factories where quality control is not compromised but compared to conventional methods, the quality of the product or component cannot be controlled (Othuman Mydin et al., 2014). So that is why IBS is highly recommended nowadays in the Malaysian construction industry by our government through various platforms such as Malaysia Plan and Scheme.

The industrialised Building System is an alternative approach to construction that will definitely change the current local construction industry's scenario towards a systematic method of mass production of construction materials. Prefabricated components of buildings that are conceived, planned, and fabricated from factories were transported and erected on site. With this approach, the production process would be designed, managed, and continuously improved to reduce or eliminate waste and guarantee the necessary components are developed, made, and delivered at the right time, in the proper sequence, and defect-free (Setiani, 2009). Apart from that, the structural classification of IBS is divided into five main IBS groups or categories that are popularly used in Malaysia, which include precast concrete framing, panel, and box systems, formwork systems, steel framing systems, prefabricated timber framing systems and block work systems (Mohammad, 2013).

However, the benefits of the IBS technique are ineffective without the participants to the construction projects being ready, as this would ultimately result in project failure. Therefore, this study aims to investigate how prepared the designers are to design and manage the IBS projects. The outcome of this study would benefit the Malaysian Construction Industry in enhancing the quality and productivity of IBS Projects.

LITERATURE REVIEW

What Is IBS?

IBS is a building method that uses minimal additional site work to manufacture, transport, place, and assemble building components in a controlled environment (Mahika, 2021). It originated in Malaysia in the 1960s to address the housing crisis and housing shortage. However, it was not widely accepted due to incompatible systems with Malaysia's climatic conditions. The government promotes IBS to reduce foreign labor dependency and prevent loss of foreign cash in the building sector (Abdul Rahim & Latif Qureshi, 2018). IBS offers advantages such as cost and time certainty, improved construction quality and productivity, decreased occupational safety and health risks, and reduced overall construction costs (Lou & Kamar, 2012).

However, some construction industry stakeholders, particularly housing developers, may view IBS construction as more expensive than traditional methods. Then, based on article by Mohd Amin et al. (2017) IBS is a transition from conventional methods to a new technique, requiring synchronization of design, production, and construction phases.

What Are the Advantages or Disadvantages of IBS?

IBS has numerous advantages for the construction industry, including shorter building times, better site management, and reduced waste. It generates better products for clients using fewer materials, a cleaner and more orderly environment, controlled quality, and cheaper overall construction costs (Mahika, 2021). Proper site management reflects the project manager's skills and knowledge in managing the site. With better site management implemented, it not only reduces costs but also increases the safety of workers on the construction site.

IBS can reduce the number of unskilled workers, reduce material waste, enhance environmental cleanliness, and strengthen quality control. This benefits hastens the completion of construction and encourages a safer and more organized worksite (Tamrin, 2018). The reduction of foreign workers can increase the employment of local workers, particularly skilled local labor with experience in constructing IBS projects and this statement has been supported by an article by Lui (2020).

IBS can reduce construction wastage, which contributes to pollution and increases the cost of disposing of site waste properly. In Malaysia, the Construction Industry Development Board of Malaysia (CIDB) has released a proper guideline on waste management in construction sites. IBS has been proven to reduce construction material wastage significantly compared to other methods of construction, such as conventional and mixed construction methods.

IBS has shown significant progress in the construction period, as it is a fast construction method. Multiple components or sections of construction parts can be constructed at one period of time without delays, making it an excellent method of construction in reducing the time needed for construction and lowering the risk of delay. This statement has been supported by Haron et al. (2009)

However, IBS has its weaknesses, such as being highly capital-intensive, requiring expert labour at the construction site, and not leading to total satisfaction. In some cases, IBS has been less productive due to the lack of quality, transportation and storage risks, and delays due to supply delays, bad weather, and a shortage of raw materials. Delays in IBS construction in Malaysia are caused by the new construction methods and the labour force's unfamiliarity with the erection procedures required by these systems. This can lead to increased costs and delays in projects.

IBS faces disadvantages due to insufficient scientific research and a lack of clauses in the Malaysian standard form of contract. Based on the article by Fateh & Mohammad (2017), the lack of specific regulations and guidelines for contract agreements and procurement processes makes it difficult for designers to refer to their guidelines. Additionally, there is a lack of compliance with government policy, as there are no specific IBS building regulations or standard guidelines for tendering, design, construction, and operation (Baharuddin et al., 2017). This lack of organized information could negatively impact project approval authorities and professionals in the construction sector. Further research is needed to overcome these disadvantages and improve IBS's effectiveness.

IBS Construction in Malaysia

IBS in Malaysia is recognized for its benefits and potential, with continuous promotions by the Malaysia Ministry of Work (CIDB) and the Public Works Department. The IBS Steering Committee has been formed to address IBS-related issues and provide a guideline for its implementation (Lou & Kamar, 2012). IBS aims to bring about industry practice and think transformation. Current IBS systems used in

Malaysian housing projects include large panel systems, metal form systems, and modular systems (Ern et al., 2011). The government has taken the lead in implementing IBS in the industry, requiring at least 50% IBS content in all new government-initiated building projects.

However, the government has now exempted this levy for contractors who incorporate IBS in at least 50% of building components (Lou & Kamar, 2012). An article by Mohd Amin et al. (2017) stated that IBS has been utilized in Malaysia since the 1960s, and its adoption depends on factors such as design, standard, volume, and consistency. The philosophy of IBS is based on volume or mass production, focusing on modular systems and the quality of finished products, resulting in a reduction in production costs. However, most housing projects in rural areas are constructed on relatively small and medium scales, and recent statistics show a decline in demand and volatility in the building market for large public housing projects (Mohd Nawi et al., 2011). Additionally, Mohd Amin et al. (2017) have stated the construction industry has embraced IBS as a method to achieve better construction quality, productivity, occupational safety and health risks, skilled worker issues, and reduced overall construction costs.

The Factor Influencing the Readiness of Designer in Implementing IBS for Construction Project in Malaysia

There are many factors contributing to the level of readiness of the designers in the implementation of IBS projects that can be found in the literature. Among the factors discussed are the suitability of the IBS based on their natural characteristics, knowledge to implement the IBS, contractual and procurement issues, ability of a designer to implement IBS, level of workforce skill, education level and working experience comparison, lack of awareness and lack of government interest.

Suitability of the IBS Based On Their Natural Characteristic

Tamrin (2018) emphasized the importance of considering factors like cost, location, and design when constructing an IBS project. The chosen project should be appropriate for analyzing implementation and solving problems, while maintaining reasonable costs. However, not all projects are suitable for IBS methods, especially complicated ones. Using the method may affect implementation costs and time, making it a less advisable choice.

Knowledge to Implement IBS

Knowledge is crucial for designers to implement IBS, including design stage, process flow, and expert consultants (Tamrin, 2018). Negative perceptions, readiness concerns, cost and equipment issues, poor planning, regulations, and knowledge and awareness issues influence IBS adoption in Malaysia according to an article by Tamrin et al. (2016b). Common knowledge issues arise from lack of coordinated training, lack of past experience, and technical knowledge in the field (Mahika, 2021).

Contractual and Procurement Issues

Research indicates that designers' readiness to adopt IBS in projects is influenced by contractual and procurement issues. The Malaysian standard form of contract lacks clauses specifically suited for IBS construction, causing difficulties according to an article by Fateh & Mohammad (2017). Lack of government policy enforcement and lack of specific regulations affect construction professionals and authorities in project approval (Baharuddin et al., 2017). Standardization efforts are recommended for long-term strategic initiatives to drive IBS standards adoption. However, low implementation is due to approving authorities' reluctance to change to IBS due to lack of proper guidelines in contractual matters (Algumaei & Sarpin, 2022).

Ability of a Designer to Implement IBS

The readiness of a designer to implement IBS depends on their ability to provide necessary resources, hire skilled design teams, and hire strong mental health. This includes financial resources for hiring skilled designers and equipment, such as software for design or calculation according to an article by (Tamrin, 2018). Additionally, a designer's mental health is crucial to prevent burnout during the design stage, which can lead to delays and increased sick leave and this statement has been supported by Cedstrand et al. (2022). Besides, the construction industry has a 25% higher rate of stress-related sick leave compared to other occupations, making it essential for designers to possess the necessary skills and mental strength to overcome stress during the design stage for the project's success.

Level of Workforce Skill

Designers in IBS projects require IT expertise for design, production, and erection, as it requires knowledge and skills and this statement has been supported by Abdullah & Egbu (2010). Based on an article by Mohd Nawi et al., (2011) has stated that construction firms have been trained in conventional construction methods for decades, making transitioning to IBS difficult. However, the lack of incentive training among existing construction professionals in Malaysia may hinder the widespread adoption of IBS. Government policies or mandatory quotas may help address this issue (Mohd Nawi et al. 2011).

Education Level and Working Experience Comparison

The study compares education levels to determine the impact of education on organizational readiness to implement IBS. Five groups of education levels are analyzed: certificate, diploma, bachelor's degree, master's degree, and doctorate. The study found that education level does not affect designers' readiness to implement IBS, as they are not involved in decision-making (Hanafi et al., 2016). Working experience during the design stage influences understanding of IBS concepts and decision-making involvement. Working experience is crucial for decision-makers to acquire knowledge and positive perceptions about IBS. Therefore, understanding and role of organizational members in implementing IBS are crucial in determining the readiness of construction projects (Hanafi et al., 2016).

Lack of Awareness

The lack of awareness of innovative procurement approaches in Industrialized Building Systems (IBS) projects is a significant challenge to the construction industry's adoption. This lack of knowledge and awareness hinders the system's implementation and benefits. To overcome this, there is a need to promote, awareness programs, and educate the public on IBS (Algumaei & Sarpin, 2022). In Malaysia, the level of awareness is still low, but studies by Kassim & Walid (2013), have shown that it is crucial to spread knowledge and understanding of IBS to benefit the construction industry's future.

Lack of Government Interest

The traditional cast-on-site method is still in use in construction industry practices due to lack of government support and concerns about IBS adoption (Algumaei & Sarpin, 2022). The early adoption of IBS is influenced by government interest, insufficient manufacturers, and industry players' resistance to change. Nevertheless, this factor influence in lowering the implementation and affects designers' readiness to implement IBS, as many architects and engineers are unaware of essential elements like modular coordination (Haron et al., 2009).

RESEARCH METHODOLOGY

The target populations of this study were the architects and engineers who registered with Board of Architects and Board of Engineers Malaysia in Malaysia respectedly. The questionnaire survey was distributed to the target population with obtaining 109 returns, the minimum sample size calculated based on Raosoft Software (Raosft, 2004). The collected data then were analysed using descriptive analysis using SPSS version 28. The limitation for this paper was the time constraint to collect futher data for analysis.

ANALYSIS OF FINDING

Demographic Respondent

Organization

Table 1 : Organization

Type of Firm	No	Percentage (%)
Architect Firm	59	54.1
Engineer Firm	50	45.9

Total	**109**	**100**

The percentage of the respondent's organization that was separated into two organizations is shown in Table 1. The company is an engineering and architectural firm. The Architect Firm accounts for the most significant share at 54.1%. While Engineering Firm comes in second place with 45.9% of the market. According to the data above, 59 respondents, as opposed to 50 respondents from engineering firms, represent the respondents' organizations in the majority.

Current Position

Table 1 : Respondent's Positioned

Current Position	No	Percentage (%)
Architect	28	25.7
Assistant Architect	31	28.4
Assistant Engineer	26	23.9
Engineer	24	22
Total	**109**	**100**

The percentage of the respondent's current position in their company that was divided into four positions is shown in Table 2. An architect, an assistant architect, an engineer, and an assistant engineer are in those positions. With 28.4%, the assistant architect represents the most significant percentage. With 25.7%, architects come in second. With a score of 23.9%, the respondent from the assistant engineer will come in third. Engineers made up the final 22%. According to the data above, assistant architects make up the majority of respondents, 31 respondents. The next is 28 respondents from the architect, 26 respondents are the assistant engineer, and another 24 respondents are as engineers.

Experience Working

Table 2: Experience Working by Respondents

Experience Working	No	Percentage (%)
1 – 5 years	40	36.7

5 – 10 years	30	27.5
Above 10 years	15	13.8
Below 1 years	24	22
Total	**109**	**100**

Table 3 shows the percentage of respondents' experience in designing the construction project. The highest percentage is 36.7%, which ranges between 1 – 5 years and is rated by 40 respondents and then followed by years in the range of 5 –10 years, representing 27.5% that have been rated by 30 respondents in this study. The third highest range below 1 year is represented by 22% that 24 respondents have rated. Lastly, 13.8% is from the range above 10 years, only rated by 15 respondents. The data above shows that most of the respondents have experience working in designing construction projects, ranging from 1 to 5 years of experience.

Experience Designing

Table 4: Experience Designing

Experience Designing	No	Percentage (%)
No	37	33.9
Yes	72	66.1
Total	**109**	**100**

The Table 4 above shows the percentage of the respondents' experience designing IBS projects throughout their careers. That was separated into two, which are yes or no. The highest percentage that has been chosen or rated by the respondent is they have experience in designing an IBS project with 66.1%, compared to the respondent that does not have any experience in designing an IBS project with 33.9%. According to the data above, 72 respondents, as opposed to 37 respondents who have experience designing IBS projects, represent the majority of respondents' experience.

Factor Influencing level of Readiness

Table 3: Factor Influencing the Level of Readiness

Factor Influencing Readiness Level	Mean Score	Ranking
Designer want to gain knowledge and experience about IBS	4.2	1
Company requirement for designer to be ready in implementing IBS	4.09	2
Level of workforce skill (e;g in terms of software skill)	4.08	3
Ability of designer company/firm to implement IBS (e;g has skilled designer, software)	4.05	4
Education level and working experience	4.01	5
Communication barrier between designer and other construction team (e;g contractor, IBS manufacture)	3.93	6
Designer self interest	3.87	7
The knowledge of designer to implement IBS	3.85	8
Suitability of their natural characteristic (e;g the cost budget on the design not suitable/relevant with IBS method)	3.68	9
Contractual and Procurement issue for guideline	3.54	10
Training cost higher for company to train their workers	3.24	11

There are 11 factor has been listed that the idea came from Literature Review that has been done before. The table above shows the mean score for all eleven questions to identify the factor influencing the readiness level of designer and all archive a high rating score, with the highest mean score of 4.20 and the lowest mean score of 3.24. The ranking shows that the respondents highly agree that the factor that has been stated in the table above are influencing the level of readiness of designers in adopting IBS. Based on the table above, it show that the highest ranking for the element above would be the factor by which the designer wants to gain the knowledge and experience about IBS, with a mean score of 4.20—then, followed by the company requirement for the designer to be ready in implementing IBS with a mean score of 4.09 to be as second highest ranking.

Besides, the third highest ranking that highly agree by the respondents is the level workforce skill such as in terms of software skills, with a mean score of 4.08. Then, followed by the factor of the ability of the designer's company or firm to implement IBS in terms of the company hiring skilled designers or possessing access to software with a mean score of 4.05. Education level and working experience are factors that influence the readiness level of designer in adopting IBS in a construction project in Malaysia and has been highly agreed upon by the respondent, with a mean score of 4.01.The

communication barrier between the designer and other construction teams, such as contractors or IBS manufacturers, came in sixth place with a mean score of 3.93. They were then followed with self-interest by the designer with a mean score of 3.87, and the designer's knowledge to implement IBS with a mean score of 3.85. The ranking of ninth and tenth that been agreed by the respondent as factors that influence the level of readiness of designers in adopting IBS for construction projects are the suitability of their natural characteristics of IBS itself, such as the cost budget or the design not suitable or relevant with IBS method and the contractual and procurement issues for guideline with both mean score of 3.68 and 3.54.

Last but not least, the training cost that is higher for the company to train their workers be in the lowest ranking, with a mean score of 3.24. When the mean scores for all eleventh questions are added together, a total average score of 3.867 is obtained, which shows a strong response rate from the respondents. This fact demonstrates that the respondent highly agrees that the factors mentioned above influence the level of readiness of designers in adopting IBS in construction project in Malaysia.

DISCUSSION OF FINDING

This is a growing concern as multiple articles have stated that lack of experience in IBS is a concern to the future of IBS projects in Malaysia. This statement is supported by Tamrin et al. (2016a), which state that readiness concerns have been identified as a factor influencing of IBS adoption in Malaysia. Another article which supported this is Mahika (2021) which stated that designers in Malaysia lack past experience in IBS and their professionalism is lack of technical knowledge in this area.

In addition, the company requirements for a designer to be ready to implement IBS is another factor influencing a designer to be ready in adopting an IBS project, as many IBS projects are now can now be found in the government project. With more government projects adopting the IBS construction system, many companies are now preparing their designers to be ready to adopt IBS. This is supported by Lou & Kamar (2012), which stated and quoted, “full utilization of IBS in government projects. The use of IBS components in government projects must not be less than 70%, and the IBS had to be included as part of contract documents for all government building works”. Thus, this is an important reason and factor in which has influenced the company to prepare their designer to implement IBS design.

Furthermore, the workforce skill level is another top factor in influencing the designer in adopting IBS. Technology plays an important role in designing projects. It is essential that designers to have and possess excellent skills in designing projects, especially with the adoption of IBS design in construction projects. This is supported by the article by Abdullah & Egbu (2010), which stated that designers and managers at the IBS manufacturing facilities and on-site needed an IT background or expert in using designing software such as CAD/CAM Software. This sums up that the designer must possess high IT skills in order to adapt to IBS.

In conclusion, the overall result of factors influencing readiness showed a significant positive result and feedback from respondents. Most respondents agree on the main criteria or the main factor influencing the readiness of designers to adopt IBS.

CONCLUSION

It can conclude that the level of readiness of the designer is at a high level due to it being influenced by the factor that has been stated above. The readiness of designer is important to ensure high among the designer and ensuring the good output of work. The designer needs to improve themselves so that the readiness level is at the maximum level. However, all other parties, such as the company or firm and government, need to hold the initiative to increase the readiness among designers. The designer should implement the main factor of readiness that has been analysed in this paper towards their work which will overcome the lack of readiness among them.

REFERENCES

Abdul Rahim, A., & Latif Qureshi, S. (2018). A Review of IBS Implementation In Malaysia and Singapore Asiah Abdul Rahim 1 & Sara Latif Qureshi 2. *Journal of the Malaysian Institute of Planners*, *16*(2), 323–333.

Abdullah, M. R., & Egbu, C. (2010). The Role of Knowledge Management in Improving the Adoption and Implementation Practices of Industrialised Building System (IBS) in Malaysia. *CIB World Congress*, 1–12. http://usir.salford.ac.uk/12837/

Algumaei, M. S., & Sarpin, N. (2022). Critical Success Factors of Industrialized Building System (IBS) Implementation for Construction Industry in Yemen. *Research in Management of Technology and Business*, *3*(1), 522–536. http://publisher.uthm.edu.my/periodicals/index.php/rmtb

Cedstrand, E., Augustsson, H., Alderling, M., Sánchez Martinez, N., Bodin, T., Nyberg, A., & Johansson, G. (2022). Effects of a co-created occupational health intervention on stress and psychosocial working conditions within the construction industry: A controlled trial. *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.973890

Ern, P. A. S., & Kasim, N. B. (2011). E-READINESS IN IBS COMPONENTS MANAGEMENT FOR CONSTRUCTION PROJECTS Peniel Ang Soon Ern. *Sixth International Conference on Construction in the 21st Century (CITC-VI)*, *2008*, 893–900.

Fateh, M. A. M., & Mohammad, M. F. (2017). Industrialized building system (IBS) provision in local and international standard form of contracts. *Journal of Construction in Developing Countries*, *22*(2), 67–80. https://doi.org/10.21315/jcdc2017.22.2.5

Hanafi, M. H., Abas, A., Ibrahim, F. A., & Abdullah, S. (2016). Readiness for industrialized building system implementation among Malaysian architectural firms' members. *Jurnal Teknologi*, *78*(7), 195–203. https://doi.org/10.11113/jt.v78.4960

Kassim, U., & Walid, L. (2013). Awareness of the Industrialized Building System (IBS) implementation in Northern Malaysia - A case study in Perlis. *Procedia Engineering*, *53*, 58–63. https://doi.org/10.1016/j.proeng.2013.02.010

Lou, E. C. W., & Kamar, K. A. M. (2012). Industrialized Building Systems: Strategic

Outlook for Manufactured Construction in Malaysia. *Journal of Architectural Engineering*, *18*(2), 69–74. https://doi.org/10.1061/(asce)ae.1943-5568.0000072

Lui, J. W. (2020). *The Impact of Industrialised Building System (IBS) On Local Labour*.

Mahika, T. (2021). *Kamarul Barriers to Industralized Building Ssystem (IBS): THE CASE OF*.

Mohammad, M. F. (2013). Construction Environment: Adopting IBS Construction Approach Towards Achieving Sustainable Development. *Procedia - Social and Behavioral Sciences*, *85*, 8–15. https://doi.org/10.1016/j.sbspro.2013.08.332

Mohd Amin, M. A., Abas, N. H., Shahidan, S., Rahmat, M. H., Suhaini, N. A., Nagapan, S., & Abdul Rahim, R. (2017). A review on the current issues and barriers of Industrialised Building System (IBS) adoption in Malaysia's construction industry. *IOP Conference Series: Materials Science and Engineering*, *271*(1). https://doi.org/10.1088/1757-899X/271/1/012031

Mohd Nawi, M. N., Lee, A., & Nor, K. (2011). Barriers to implementation of the industrialised building system (IBS) in Malaysia. *The Built & Human Environment Review*, *4*(November), 22–35. http://tbher.org/index.php/tbher/article/view/64

N. Baharuddin, M., Fadhilah Bahardin, N., Reeza Yusof, M., Azian Zaidi, M., & Lokman, I. (2017). *Identification of Critical Factors and Difficulties of Industrialised Building System (IBS) Formwork in the Malaysian Construction Industry-A Literature Review Maintenance of Historic Building View project Historic Timber Conservation View project Identif*. *October*. https://www.researchgate.net/publication/313600184

Nuzul Azam Haron, H. A. R. and M. H. (2009). Malaysian Construction. *Malaysia Construction Research Journal*, *4*(September).

Othuman Mydin, M. A., Sani, N. M., & Taib, M. (2014). Industrialised building system in Malaysia: A review. *MATEC Web of Conferences*, *10*, 1–9. https://doi.org/10.1051/matecconf/20141001002

Setiani, Y. (2009). Implementation of Industrialised Building System (Ibs) in Malaysia Construction Industry. *Seminar Nasional Universitas Budi Luhur Agustus Jakarta*, 1–5.

Tamrin, N. (2018). *A Readiness Framework In Implementation of Industralised Building Ssytem (IBS) In Malaysian Construction Indusrty Master of Science (Technology Management)*. 100.

Tamrin, N., Nasrun, M., Nawi, M., Akmar, F., & Nifa, A. (2016a). Readiness in Knowledge and Ability for Implementation of Industrialised Building System (IBS) In Malaysian Construction Industry. *Revista Tecnica De La Facultad De Ingenieria Universidad Del Zulia*, *December*, 46–53. https://doi.org/10.21311/001.39.9.07

Tamrin, N., Nasrun, M., Nawi, M., Akmar, F., & Nifa, A. (2016b). Readiness in Knowledge and Ability for Implementation of Industrialised Building System (IBS) In Malaysian Construction Industry. *Revista Tecnica De La Facultad De Ingenieria Universidad Del Zulia*, *July 2018*. https://doi.org/10.21311/001.39.9.07

Raosft. (2004). Retrieved from Sample size calculator: http://www.raosoft.com/samplesize.html

Pejabat Perpustakaan
Librarian Office

Universiti Teknologi MARA
Cawangan Perak
Kampus Seri Iskandar
32610 Bandar Baru Seri Iskandar,
Perak Darul Ridzuan, MALAYSIA
Tel: (+605) 374 2093/2453 Faks: (+605) 374 2299

UNIVERSITI TEKNOLOGI MARA

Surat kami : 700-KPK (PRP.UP.1/20/1)
Tarikh : 20 Januari 2023

UNIVERSITI TEKNOLOGI MARA PERAK
TERIMA
25 JAN 2023
Tindakan
Universiti Teknologi MARA Perak
PEJABAT REKTOR

Prof. Madya Dr. Nur Hisham Ibrahim
Rektor
Universiti Teknologi MARA
Cawangan Perak

Tuan,

PERMOHONAN KELULUSAN MEMUAT NAIK PENERBITAN UiTM CAWANGAN PERAK MELALUI REPOSITORI INSTITUSI UiTM (IR)

Perkara di atas adalah dirujuk.

2. Adalah dimaklumkan bahawa pihak kami ingin memohon kelulusan tuan untuk mengimbas (*digitize*) dan memuat naik semua jenis penerbitan di bawah UiTM Cawangan Perak melalui Repositori Institusi UiTM, PTAR.

3. Tujuan permohonan ini adalah bagi membolehkan akses yang lebih meluas oleh pengguna perpustakaan terhadap semua maklumat yang terkandung di dalam penerbitan melalui laman Web PTAR UiTM Cawangan Perak.

Kelulusan daripada pihak tuan dalam perkara ini amat dihargai.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

SITI BASRIYAH SHAIK BAHARUDIN
Timbalan Ketua Pustakawan

nar

Setuju.

27.1.2023

PROF. MADYA DR. NUR HISHAM IBRAHIM
REKTOR
UNIVERSITI TEKNOLOGI MARA
CAWANGAN PERAK
KAMPUS SERI ISKANDAR