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PEOPLE CHALLENGES OF BIM ADOPTION IN CONSTRUCTION INDUSTRY IN MALAYSIA

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Abstract

BIM Technology adoption is important because it show the industry's ability to achieve high profits, good products quality, market share and good financial result over a period of time. However, Malaysian construction industry is currently under low performance in the company's BIM technology adoption due to people challenges that lead to the low performing in the BIM adoption activities that directly influence the company performance in building and construction industry Malaysia. Therefore, the purpose of this study is to describe the challenges that affect the BIM adoption in the construction industry in Malaysia and use the data management theory to further study the influencers.

The study was therefore conducted in the qualitative method by using the questionnaire to collect data, the research design and research methodology adopted in this study are to collect the data via questionnaire distribution to the construction industry in Malaysia. The results show that most construction industry-related companies lack BIM adoption. And statistical analysis shows that People challenges have a significant negative correlation with BIM adoption. In particular, management's interest in BIM has become an important part of the personnel challenges considered by the respondents.

CHAPTER 1. INTRODUCTION

1.0 Overview

This first chapter is an introductory chapter which focuses on the people challenges of BIM adoption in construction industry in Malaysia. The next following section will discuss the background of study and justifies the rationale of the study while, describes the gaps in this research. Additionally, this section will cover the problem statement of the study, and then continue to discuss the research objectives and research questions. This section also highlights the scope of study and discourse the limitations of the research. The operational definition which involves in this research paper is counted in and the organization of chapters are listed in last section of this chapter.

1.1 Background of Study

The factors that influence technology adoption have been extensively studied in the literature and also the different frameworks used to measure the determinants of technology adoption and adoption are discussed by (Shroff et. al., 2011). Technology adoption is important to all nature and types of industry including the building and construction industry such as in order to improve the Indonesian oil palm sector's competitiveness and sustainability, a technology adoption program in the processed oil palm industry must be developed (Hasibuan and Hidayati, 2019). According to (Bello, Oyedele and Akinade et. al., 2020), the building and construction industry is in a good position to make use of the adoption of technologies to gain a competitive and operational edge. Nithya and Ramasamy (2020) stated that the construction sector may achieve sustainability by effectively using zero waste management techniques. Emerging hardware advances were emphasized by Melenbrink, Werfel and Menges (2020) as illuminating a route toward completely autonomous construction.

Building Information Modelling (BIM) as one of the emerging technologies. In recent years, BIM has seen an increase in popularity in terms of adoption in the built environment throughout the world (Chan, Olawumi and Ho, 2019). For example, the Building Information Modelling (BIM) level 2 was mandated by the UK government in 2011 for all public projects by 2016 according to (Piroozafar, Farr, and Zadeh et. al., 2019). In Brazil, the expansion of BIM has been primarily driven by government initiatives like as laws and initiatives aimed at spreading BIM across the country (Viana and Carvalho, 2020). Since 2011, the Ministry of the Interior's Architecture and Building Research Institute (ABRI) has been conducting research to investigate and promote BIM applications in Taiwan's construction industry, and the ABRI has published a reference guide to encourage building sectors to use BIM in their projects (Yang and Chou, 2018). According to Ismail, Adnan and Bakhary (2019) the Construction Industry Development Board (CIDB) leads the BIM adoption in Malaysia, having been granted a mandate by the government.

However, despite significant technological improvements, BIM has yet to be completely embraced, and its clear benefits have not to be completely realized by industry players (Ghaffarianhoseini, Tookey and Ghaffarianhoseini, 2016). Because it necessitates a transition to a new way of working, BIM adoption remains a problem for the AECO industry, resulting in a present disparity in BIM adoption across the EU (Charef, Emmitt and Alaka et. al., 2019). The majority of construction practitioners in New Zealand, particularly contractors, QSs, supply chain firms, and SMEs, were found to be unaware of BIM according to Doan, Hoseini and Naismith et. al., (2020). Also, (Othman, Al-Ashmori and Rahmawati et. al., 2020) found that only 13% of participants from both the public and commercial sectors are utilizing BIM in their organizations, according to the results of the 268 replies received, indicating that Malaysia is still a long way from where it should be in terms of BIM adoption.

Therefore, according to Ghaffarianhoseini et. al. (2016), the challenges and issues that may be hindering BIM's efficacy appear to be connected to its lack of mainstream adoption. In Malaysia, Othman et. al. (2020) found that lack of knowledge, expenses, sluggish adaptation, and the lack of a clear guideline to aid companies and policymakers in transitioning to BIM, and the fact that BIM was not enforced in a timely manner were all identified as factors contributing to the slow implementation.

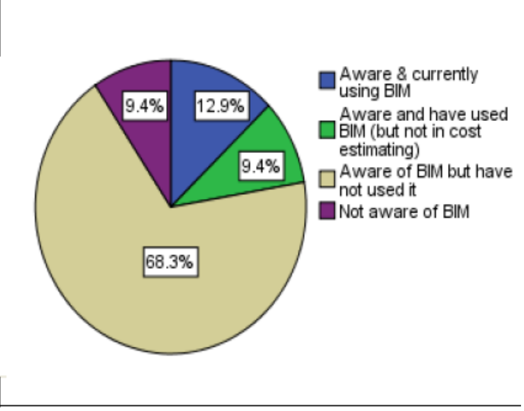
Thus, the aim of this study is to ensure that the construction industry in Malaysia can be further developed through technology adoption, it is necessary to study the people challenges faced by technology adoption, and BIM technology as an emerging technology in the construction industry, so it must use people challenges as a key research object.

1.2 Problem Statement

Prause (2019) found that small and medium sized enterprises (SMEs) could lead to late adoption of Industry 4.0 and the impact of external pressure signals could be misinterpreted or necessary technology adoption could be deferred, even SMEs may also have to tap into additional costly investments.

Figure 1.1 Distribution of respondents based on people aware of BIM usage

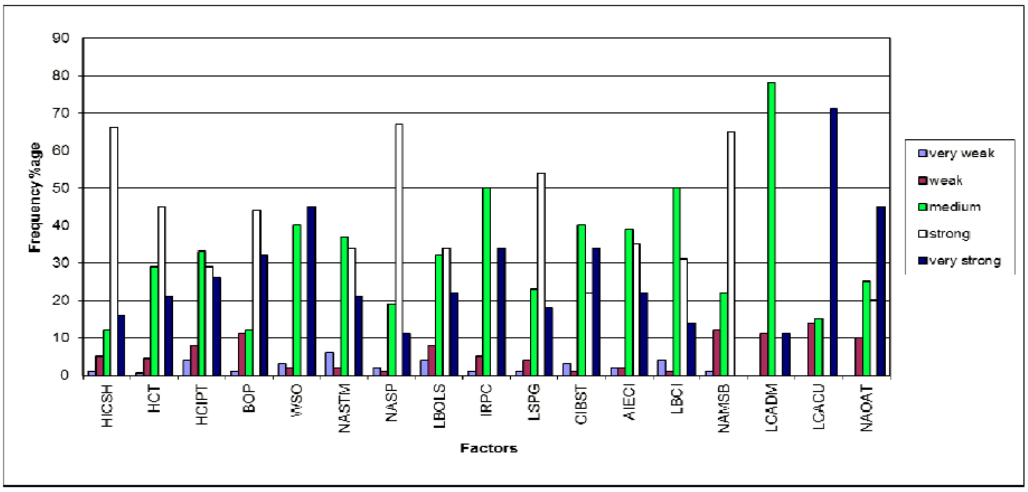
Awareness	Frequency	Percentage (%)
Aware & currently using BIM in cost estimating	26	12.9
Aware and have used BIM (but not in cost estimating)	19	9.4
Aware of BIM but have not used it	138	68.3
Not aware of BIM	19	9.4
Total	202	100.0



Source: Ismail, Adnan and Bakhary (2019)

In Malaysia the terms of awareness of BIM usage in the construction industry as shown in Figure 1.1, 68.3% of overall respondents in this survey were aware of BIM usage but had not used it in their practice, implying that even BIM awareness among respondents is high, but because the respondent's company leadership or manager did not implement BIM technology which results in, they never adopting BIM technology in their practice (Ismail et. al., 2019).

Figure 1.2 Frequency Analysis Graph.



Source: Gardezi et. al., (2017)

From Figure 1.2, the result shows that there is a high frequency of non-availability of skilled professionals (NSAP), non-availability of market support/trends for BIM implementation (NAMSB), and weak support from organization environment and culture in Malaysian construction industry. Non-availability of skilled professionals means that existing practitioners do not have enough BIM technology to support the company's adoption of BIM technology, and this is also one of the people challenges that affect the adoption of BIM technology. (Gardezi et. al., 2017).

Although there is strong significance need for this research, nevertheless, there are many problems for this study and firstly, there is abundant literature on the challenges of BIM, however rarely linked with BIM adoption in the building and construction industry of Malaysia (Gardezi, Shafiq and Farhan et. al., 2017). Secondly, many of the studies that the researcher has reviewed were done many years ago, they are rarely recent, especially during the period of time affected by the COVID-19, hence, the data and literature sources had to be examined and confirmed once and focus on the importance of the challenges of technology adoption in the building and construction industry in general, more especially focusing on the challenges of BIM adoption in the building and construction industry of Malaysia such as people challenges (Chai, Tan and Aminudin et. al., 2017; Haron, Soh and Harun, 2017).

1.3 Research Objectives

RO1: To study the influence of lack of related knowledge on BIM adoption in construction industry in Malaysia.

RO2: To investigate the influence of resistance towards change within the organization on BIM adoption in construction industry in Malaysia.

RO3: To explore the potential solution for the influence of People challenges on BIM adoption in construction industry in Malaysia.

1.4 Research Questions

RQ1: What is the lack of related knowledge influence BIM adoption in construction in Malaysia?

RQ2: How the resistance towards change within the organization influence BIM adoption in construction in Malaysia?

RQ3: What are the People challenges that influence BIM adoption in construction industry in Malaysia?

1.5 Scope of Study

Firstly, this final project is to study the challenges of Building Information Modelling (BIM) adoption in construction industry in Malaysia. In this project, focus on three main challenges which are under people challenges.

Also, considering the impact of the COVID-19 pandemic, it is not possible to go to building and construction industry companies to distribute the questionnaire. This project carried out questionnaire distribution on Google Forms to distribute the questionnaire online.

1.6 Contribution of Study

The construction industry has played a very important role in the development of human history. It not only meets the needs of people's material and cultural development, and realizes the most basic human daily activities, but also can promote the continuous development of social economy. At the same time, with the development of the Internet and other technologies, the traditional construction industry is also developing towards digitization and automation, that is, building information modeling technology. Therefore, the construction industry can better implement BIM with reference to the conclusions drawn from this research. Industry-related companies can understand the shortcomings and make relevant adjustments to make full use of the benefits of BIM

1.7 Operational Definitions

Below table 1.1 shows the primary goal of this section which is to provide the key terms and definitions to the terms stated.

Table 1.1 Operational Definitions

Key Term	Definition
Technology adoption	Emerging technologies must be preceded by the industry accepting the technology otherwise the technologies remain

	abandoned or heavily underutilized (Shroff et. al., 2011).
People challenges	Through the eyes of the industry, the drivers of human capital development and customer behavior (Sima, Gheorghe and Subic et. al., 2020).
BIM	Building Information Modelling (BIM) is a 3D model-based intelligent process that provides architects, engineers, and construction professionals with information and tools to more efficiently plan, design, construct, and manage building and infrastructure (Khorchare and Waghmare, 2018).
Construction industry	Construction is made up of a variety of sub-industries that provide products and services for one-time undertakings (Valence, 2017)

1.8 Structure of Thesis

There are 5 chapters in this thesis:

Chapter 1 is the introduction, which includes the research background, problem statement, research objectives, research questions, the scope and limitations of the research, the contribution of the research to the industry, and the definition of key areas.

Chapter 2 is the literature review, which evaluates previous research on the topic showing that there are gaps that my research will attempt to fill. In chapter 2, the research will focus on the BIM adoption from a global perspective and Malaysia's perspective, factors influencing which are technological challenges, costs challenges, and people challenges, gaps in the literature, conceptual framework, and hypotheses.

Chapter 3 is the methodology, which outlines the research design and research methods.

Chapter 4 is the result and discussion, which outlines what I found out in relation to the research questions and hypotheses. In this chapter, the results will be analyzed by using tables and graphs, and comments on the results.

Chapter 5 is the conclusion, limitation of research, and future work, which highlights that the research objectives have been achieved, and how I have contributed to all parties involved with my research. Also, to point out the limitations of the study and base on that make suggestions for future research.

CHAPTER 2. LITERATURE REVIEW

2.0 Overview

The second chapter examines current research and literature on BIM implementation and provides the theoretical foundation. The prior literature on the major aspects of this research, such as BIM awareness, BIM implementation in various countries, and BIM benefits, will be summarized in this chapter. Finally, the current project's study structure and research hypotheses are presented, based on the literature review.

2.1 BIM Adoption

Many researchers emphasized the need of raising knowledge of the BIM adoption process, its advantages, and its difficulties in order to persuade the industry to embrace it as a new way of project delivery (Zahrizan, Naslu and Haron et. al., 2017; Memon, Rahman and Memon et. al., 2017; Ozorhon and Karahan, 2017; Ennegbuma and Ali, 2017; Liao, Ai and Teo et. al., 2017). According to Memon et al. (2017), the sluggish acceptance and implementation in Malaysia is due to a lack of knowledge. Trusting new technology (Migilinskas, Popov, and Juocevicius et al., 2017; Zakaria, 2017; Zahrizan et al., 2017), developing BIM skills (Migilinskas et al., 2017; Tarmiza et al., 2017), selecting proper BIM-based tools (Won, Lee, and Dossick et al., 2017), understanding the BIM project scope, and handling (Mom, Tsai and Hsieh, 2017; Yong and Mustaffa, 2017). As a result, raising awareness will aid in overcoming barriers to BIM adoption and, as a result, benefitting from this technology (Al-ashmori, Othman and Mohamad et. al., 2019).

The construction sector has reaped considerable advantages from BIM adoption, but it has also had a major effect on existing practices, contractual policy, and business models. As a result, industries and organizations have had to restructure themselves (Azhar, Khalfan and Maqsood, 2017; Succar, 2019). Technical difficulties (Alreshidi, mourshed, and Rezgui, 2017; Gha et al., 2017; Azhar et al., 2017), managerial problems (Azhar et al., 2017), and environmental, financial, and legal concerns are all part of the BIM adoption process (Alreshidi et. al., 2017; Gha er. al., 2017).

The building industry's connection with practitioners is characterized as a push-pull dynamic (Zakaria et. al., 2017; Succar, 2017). This connection highlights the necessity to begin BIM adoption in order to encourage information sharing across stakeholders, raise awareness, and improve preparedness for adoption in their workplace (Tarmizi et. al., 2017; Succar, 2017). The government is the driving force behind BIM implementation (Azhar et. al., 2017). All stakeholders must be included early in the BIM adoption process (Zakaroa et. al., 2017). Collaboration is aided by interoperability, and personal dedication, motivation, and practitioner conduct all contribute to the spread of BIM (He, Wang and Luo et. al., 2017). The construction stakeholders' views of the value obtained by BIM adoption are aligned with government strategy. As a result, according to this study, BIM adoption should be focused on how companies can accomplish their objectives with minimum losses and/or in a short amount of time.

The variables that influence BIM adoption include relative advantage, compatibility, complexity, trialability, observability (Tsai et. al., 2017; Rogers, 2017), perceived ease of use, and perceived utility (Ramanayaka and Venkatachalam, 2017). Rogers (2017) defined relative advantage as the degree to which an innovation is perceived to be better than the idea it supersedes; compatibility is the degree to which an innovation is perceived to be consistent with existing values, past experiences, and needs of potential adopters; complexity is the degree to which an innovation is perceived to be difficult to understand and use; trialability is the degree to which an innovation is perceived to be difficult to understand and use; trialability is the degree to which an innovation is perceived the degree to which a person thinks that utilizing a specific technology would be simple is known as perceived ease of use (Davis, 1989). The complexity construct in IDT and the perceived ease of use in TAM seem to be similar in that they frequently compliment one other (Xu et. al., 2017). Complexity, on the other hand, is a determinant of actual system use (adoption) at the implementation stage after the decision to adopt has been made (Abdul Hameed, 2017; Xu et. al., 2017), whereas perceived ease of use is a determinant of actual system use (adoption) after the decision to adopt has been made. The perceived utility of a system indicates the adopter's conviction that adopting it would improve work performance (Davis, 1989). Interoperability, compatibility, affordability, and the relative benefits connected with the usage of the invention are examples of technical considerations (Waarts et. al., 2017).

Top management support, communication behavior, financial resources and perceived cost, organizational preparedness, social motives, organizational culture, willingness/intention, and organization size are some of the internal environment characteristics of a decision unit or an organization (Peansupap and Walker, 2017; Tsai et. al., 2017; Cao et. al., 2017). The top management's support reflects their approach toward encouraging and supporting internal incentives to adopt new technology like BIM (Xu et. al., 2017). The efficacy of information flows (i.e., communication flows) inside an organization is represented by communication behavior, which influences the strength of connections with other parties (Mom et. al., 2017). A variety of economic variables linked to the deployment of BIM innovation inside organizations and projects are included in financial resources and perceived costs (Waarts et. al., 2017). The pre-implementation state of an organization or organizational unit's willingness to embrace BIM tools, processes, and standards is known as organizational readiness (Succar and Kassem, 2017). The term "readiness" refers to a person's degree of preparedness, participation potential, or ability to innovate (Succar and Kassem, 2017) and social incentives encompass a variety of factors that may be influenced by social interactions, including as individual and group attitudes and beliefs towards BIM adoption.

2.1.1 Global Perspective

BIM implementation has reached a considerable level in a number of industrialized and developing nations across the world. BIM adoption is quickly expanding in the worldwide environment, according to (Graw, 2017). BIM is required in the United States, the United Kingdom, and several European nations. Singapore has achieved 50% adoption and has mandated that all projects be filed via BIM e-submissions and since 2016, the government has published several guidelines and codes of principles for BIM deployment in native format (Corenet, 2017). In addition, Australia has a high degree of acceptance, with about 42 percent of Australian SMEs using BIM at the level 1 and 2 levels, and around 5% attempting level 3 and as a result, there is fierce rivalry in those nations' construction sectors to embrace technology and convert construction methods from traditional processes to BIM-based technology (Hosseini et. al., 2017).

Governments in the Nordic nations are interested in raising the building sector's technical operability (Hermund, 2019). Building SMART is an alliance of organizations in the construction and facilities management industries dedicated to improving processes by defining the use and sharing of information, and organizations in the alliance include architects, engineers, contractors, building owners, and facility managers and It was founded in 1996 and consists of four national groups: Denmark (38 members), Finland (18 members), Norway (55 members), and Sweden (33 members) and these national groups are not only under the Building SMART international umbrella for projects of common interest, but also carry out various and individual activities (BuildingSMART, 2019).

Finland is a pioneer in BIM and has gone beyond the pilot phase (Tekla, 2019). According to Hartmann and Fischer (2017), the Finnish AEC industry is a global leader in the use of BIM, and the Finnish government encourages the use of BIM through the Senate Properties firm, which has been given nearly half of the responsibility for managing almost all of the Finnish state's property assets. Senate Properties is Finland's largest and most comprehensive property services provider and since 2001, the company has conducted a number of pilot projects to develop and study the use of building information models, and also in October 2007, the company decided to require models that meet the Industry Foundation Classes (IFC) standard in its projects and has provided the BIM requirements (Kiviniemi, 2017).

Sweden is likewise promoting BIM and is working on an information guide on IFC (Industry Foundation Classes) standards, as well as a two-year ERAbuild project with Finland that uses web services and model servers (BuildingSMART, 2019). In comparison to other Nordic countries, there is little or very little development linked to BIM and IFC by public owners in Sweden, although large contractors play a significant role in the building industry in Sweden and have most certainly impacted the usage of BIM in Sweden (Kiviniemi et. al., 2018).

Through the government project Det Digitale Byggeri (Digital Building), the Danish government is attempting to establish the technology operability in construction (Hermund, 2019). This implies that government owners should develop information and communication technology (ICT) requests aimed at maximizing and improving knowledge exchange among construction partners and when dealing with governmental construction projects, the construction industry should use ICT communication such as electronic tendering, project web, BIM, and electronic hand-over, and public owners involved in BIM and IFC development initiatives in Denmark include the Palaces and Properties Agency, The Danish University and Property Agency, and Defence Constructio (Kiviniemi et. al., 2018).

BIM projects in Norway are backed by the whole sector as well as the government (BuildingSMART, 2019). Statsbygg is a Norwegian administrative organization that acts on behalf of the Norwegian government as a property manager and advisor in construction and property matters and it reports to the Ministry of Government Administration and Reform and follows standard business principles, and in 2007, Statsbygg decided to use digital BIM based on international standards with the final goal to adopt BIM in all Statsbygg’s projects and building processes during 2010 (Statsbygg, 2017).

2.1.2 Malaysia’s Perspective

Malaysia's construction sector contributes about 3 to 5% of the country's yearly Gross Domestic Product (GDP) (Zahrizan, Nasly and Ali, 2017). As a result, since 2007, the Malaysian construction sector has made major efforts to enhance construction performance at the national level by using BIM (Latiffi, Mohd and Kasim et. al., 2017; Latiffi, Mohd and Brahim, 2017). Since then, the Malaysian Public Works Department (PWD) has adopted BIM, aiming to apply it on 10% of public projects above RM 50 million under Rancangan Malaysia ke-11 (RMK11). Furthermore, starting in 2018, BIM would be required for any public project with a budget of RM100 million or above (PWD and CIDB, 2018). PWD has adopted BIM at various stages in 18 projects, according to Datuk Seri Dr Roslan Md Taha (Director-General of PWD). According to design authoring, visualization, design review, coordination, documentation quantity, and/or record model, the aim of BIM adoption in these projects varied (CIDB, 2018). In 2015, the construction sector embarked on a reform initiative, with BIM being pushed as a means of increasing efficiency (CIDB, 2017).

Despite the fact that the Malaysian Construction Industry Development Board (CIDB) organizes a yearly program to promote BIM among construction practitioners in order to improve construction practices, the Malaysian construction industry is still dominated by traditional processes which results in delays, cost overruns, poor quality, low performance, and low productivity, all of which have an impact on the country's development and delay its international competitiveness (Rahim, Nifa, and Nawi, 2017). While Malaysia's BIM implementation fulfilled the criteria throughout the design phase, it fell short during the building phase, according to (Memon, Raham, and Memon et al., 2017). The use of BIM in the design stage is primarily for modeling purposes, whereas it is not used in the construction stage (Memon, Azman, and Raham et. al., 2017).

Because of the fragmentation in the implementation, BIM applications are delayed, and the industry remains at a low level of BIM adoption and there are a variety of reasons for this fragmented process, including a lack of understanding of the BIM implementation process, a lack of skill in preparing BIM plans and the ability to effectively use them with stakeholders, resistance to changing current working practices, a lack of collaboration and coordination among various disciplines, and a lack of usage guidelines (CIDB, 2017) and therefore, it is important to carry out research on BIM adoption in Malaysia.

2.2 Factor Influencing of BIM

Despite the fact that the potential advantages are widely established, both in terms of increased productivity and many other possible benefits, BIM adoption in the sector is still sluggish (Gu and London, 2017; Azhar et. al., 2018; Bernstein and Pittman, 2017).

The AEC sector has a history of being reluctant to embrace new technologies, and BIM will have a significant impact on how project work processes are organized, but in order for BIM to be effectively adopted in order to increase productivity, these work procedures must be altered and the fragmented business is an issue since this change cannot be adopted by a single player; it has to impact everyone engaged, also integration, cooperation, and creativity will be emphasized as a result of BIM adoption, which will coincide with significant cultural shifts in the sector (Kiviniemi, 2017).

There are challenges with adopting BIM in the highly fragmented AEC sector, and this is due to a variety of obstacles that prevent successful adoption and Gu et. al., (2018) propose a method for classifying important variables related to the AEC industry's delayed BIM adoption. These are the Product, Process, and People categories and the reason for the delayed adoption of BIM is due to a mix of problems rather than a single one and all of these problems must be addressed in order for BIM to be embraced on a broad scale in the AEC sector (Kiviniemi, 2017; Gu et. al., 2018).

2.2.1 People Challenges

Individuals must be properly trained in the usage of new technologies while implementing BIM in order to contribute to the changing work environment (Gu et. al., 2018; Yusuf et. al., 2019). One of the most often mentioned topics in interviews was the significance of training (Aranda-Mena et. al., 2008). To ensure the effective implementation of BIM, all stakeholders must be proficient in the usage of BIM in their respective fields (Arayici et. al., 2019).

Similarly, a study by Yan and Damian (2018) found that most companies who did not use BIM believed that training would be too costly in terms of time and human resources and that the issue of training is the most significant barrier to BIM adoption because of the costs associated with the change; decisions are primarily made from a business perspective, making BIM adoption difficult (Yan and Damian, 2018).

The barrier of people's lack of BIM skill relates to the required operating knowledge that is invariably associated with any purchase and integration of a new IT application, such as BIM, into a business process, and associated with the need for training is the resulting loss of productivity; this incurs a double cost for the company, and not only are companies paying for the training, but they are also paying for the loss of productivity (London and Bavinton, 2017).

The idea that most of the software used in the AEC/FM industry has a common feature, and that proper use of these programs necessitates intricate knowledge of the application and expertise in the corresponding industry discipline (Bazjanac, 2017), and that obtaining a high level of knowledge and expertise of this software is often difficult and prohibitively expensive (Bazjanac, 2017). Because firms were only able to successfully implement 3D CAD after they were able to obtain sufficient training (Taylor and Levitt, 2017), access to BIM may be limited or inhibited if users do not have the capability or know-how in terms of connecting to the system (Burgess, Furneaux, and Vassilev, 2017) and the industry will face more expenses as a result of this.

2.2.2 People Challenges by Government Aspect

Governments may be able to help the industry upskill by building capability over time and for example, schools and hospitals may have similar, or even standardized buildings, or building elements, that could be used in ongoing programs of work, also staged migration to BIM could also help professionals use BIM in their own disciplines to develop their skills and it seems that adopting BIM necessitates addressing skills at these two levels: mastery of the technology and then building the ability to work cross disciplinary and collaboratively with other professions (Furneaux, Craig and Kivvits et. al., 2018).

According to Zakaria et. al., (2017) research, awareness programs, training, and education initiatives fall under the umbrella of organizational culture, while government assistance includes standards availability and guideline enforcement. According to Julian et. al., (2017), the organization factor describes the characteristics and resources of the organization, which include employee networking structures, intra-firm communication processes, firm size, and the number of slack resources, and the organization factor can be described by various features such as top management support, organization structure, organization's readiness, and the number of slack resources.

In contrast, Jiule et. al. (2017) stated that because there is a large amount of Architectural-

Engineering-Construction (AEC) industry available, the organizational factor is important to be considered as one of the factors that affect the BIM adoption behavior of an organization and the organizational factor includes features such as enterprise-scale, IT ability, top management support, and organizational motivation and the enterprise-scale reflects an organization's IT capability; technology adoption may be limited if the organization's IT condition is poor, and top management support is critical in adopting new technology, such as providing training, practice, and skilled personnel to increase perceptions that the technology is easier to use and it is stated that top management support will increase people's support for a new technology's usefulness, and organizational motivations can be divided into two categories: intrinsic and extrinsic motivation and thus, organizational motivations are the most important factor affecting BIM adoption in the AEC industry.

2.2.3 People Challenges by Individual Aspect

For the people who are lack of BIM knowledge, BIM education is also very important because BIM education is an effort that ranges from raising basic awareness about BIM risks and benefits to solidifying specialist BIM knowledge and skills. It facilitates collaboration between project participants of all disciplines and across all project lifecycle phases; it is the primary means of disseminating technology-enabled, process-driven, and policy-encouraged advances in deconstruction (Succar, Agar and Beazley et. al., 2017). BIM education can take place in academia as part of architectural studies, in industry and as part of professional associations' BIM implementation road maps, or within organizations as part of their BIM implementation road map and there are also numerous courses available in the form of specialized master’s or online courses that target professionals and students (Succar, Sher and Williams, 2017).

Every BIM subject matter, if used within the context of educating individuals, will be referred to as a BIM competency, and according to the US Department of Education, a competency is a combination of skills, abilities, and knowledge needed to perform a specific task (NCES, 2017), and using this definition as a base, a BIM competency is a combination of skills, abilities, and knowledge needed to perform a specific task, also all BIM subjects (technical, operational, and managerial) may be found on the learning spectrum, which spans project lifecycle stages and specialties, and these themes may be classified as learning topics, teaching subjects, or individual skills, depending on the viewpoint used.

Individuals working in the design, development, and operation of the built environment may learn hundreds, if not thousands, of BIM Competencies (Succar et. al., 2017). These individuals vary in their level of responsibility and role within the construction supply chain; for example, an architect implementing a spatial program within a hospital model will require a different set of skills than an engineer performing thermal analysis on those spaces, and despite the fact that architecture schools were among the first to show interest in BIM adoption when it first became available (Barison and Santos, 2018). The underlying reason for this status could be that architecture education and practices are still divided on the value of BIM for architectural practices, and other factors contributing to this could include difficulty learning and using BIM software, an overburdened and unsuitable architectural curriculum for BIM adoption, and incompatibility of training (Deamer and Bernstein, 2017).

2.2.4 People Challenges by Organizational Aspect

People cannot survive without social interaction, and the development of BIM has created a barrier and in his 2017 research on 3D CAD adoption, Harty (2017) argues that social and organizational settings must be considered in order to fully comprehend this technology's adoption. Taylor and Levitt (2017) acknowledge this, claiming that although academics have looked at the problems of inter-organizational information system border objects in networks, there is no advice on how a network of companies would go about adopting such technical improvements. Even a quick examination of the BIM literature reveals that the implicit, and sometimes explicit, assumption is that BIM will be embraced automatically once it is ready (Batcheler and Howell, 2017), however, such adoption has not occurred in the past and will not occur in the future.

More than technical and legal enablers are required for BIM and BIM is expected to need a wide variety of modifications in the way AEC/FM companies engage and connect to one another, also the assumption that interoperability endeavors come with – as they both need and stimulate – organizational and inter-organizational arrangements is the starting point for technology adoption and new attitudes toward information, re-distribution of power structures, new organizational forms, and re-definition of words and regions are all difficulties and interoperability methods emerge from the interaction of discussions before being realized in technological artefacts and organizational structures (Baker et. al., 2017).

BIM does not drive this transformation; rather, it is a facilitator of this institutional process and people are the ones who initiate organizational changes (Spitzer 1996). As a result, project staff selection, as well as interactions and clarity of communication between stakeholders, will remain essential components of built asset project implementation (Ellis, 2017). The socio-technical perspective emphasizes that, in addition to technical and institutional components, humans must be included in the conception and design of BIM projects and based on this perspective, a change from a techno-centric to a socio-technical stance within the geographical data community is suggested (Rajabifard and Williamson, 2017), also technology can influence professions, roles, and organizations in the same way that people shape technology.

However, in order to make this transition in the built asset sector, much more effort is required to guarantee that BIM delivers on its promise and finally, as Burgess et. al., (2017) discovered, technology adoption necessitates both organizational and business process adjustments as well as technical advancement. Successful implementation requires more than a suitable IT platform and the assumption that technology will drive change, people, and so on (Burgess et. al., 2017), and Much of the work on BIM has thus far focused on the technical problems that go into making a successful product, but now the inter-organizational concerns must be addressed as well.

2.3 Gaps in the Literature

According to a 2006 study by the American Institute of Architects (AIA), 16% of AIA member-owned architectural firms have purchased BIM software, and 64% of these companies are utilizing BIM for billable work, and according to the same survey, 35% of AIA member-owned firms with an international scope of practice have purchased BIM software, also this could be due to the fact that firms with an international scope of practice tend to be larger in terms of staff and billings, and may also be working on large projects, but BIM could also simplify overseas projects by allowing for easy transmission of data (Riskus, 2017).

Practically, the number of firms using BIM is quite low, which may have something to do with the adoption cycle of any new technology and there is a useful insight into this by arguing that there is a gap between the early adopters of new technology and the majority of the field's adoption, and many inventions fail or falter because of this chasm (Moore, 2019).

The fundamental problem of BIM, as defined by Kiviniemi et. al., (2018), is another way of looking at this adoption gap such as the basic dilemma in the deployment of integrated BIM can be described as a paradoxical loop, there isn't enough market demand for integrated BIM because there isn't enough measured evidence of its benefits, because there aren't enough software tools to use integrated BIM in real projects, and some pressure is needed to pull a promising early start to wide adoption.

Whilst the BIM adoption has been investigated worldwide and locally, the context is still gaped where limited studies on challenges for BIM adoption are still underway in Malaysia and the purpose of this research is therefore to bridge a contextual gap and to be better understand and verify whether people challenge have a significant effect.

2.4 Table of Gaps in the Literature

Below table 2.1 shows the summary of the details of several representative literature such as year, author, title, methodology, and conclusion.

Table 2.1: Gaps Table

Year	Author	Title	Methodology	Conclusion
2019	Jamal, Fadhil, Hashim and Ramli	Challenges of BIM from the Malaysian Architect's Perspective	Questionnaire Distribution	Continuous support from the organization's external as well as internal environment is critical in speeding up the adoption of BIM in the Malaysian architectural sector, but small sample sizes may raise issues about generalization.
2020	Al-Ashmori, Othman, Rahmawati, Amran and Sabah	BIM benefits and its influence on the BIM implementation in Malaysia	Questionnaire Distribution	The construction sector focuses on a case study with local SMEs to uncover the challenges and limitations with BIM deployment, but

				need government support
2019	Ismail, Adnan and Bakhary	BIM Adoption by Quantity Surveyors: A Preliminary Survey from Malaysia	Questionnaire Distribution	The percentage of professionals that used BIM was still modest but need to explore the specific influencing factors.
2020	Othman, Al-Ashmori, Rahmawati and Amran	The level of BIM Implementation in Malaysia	Questionnaire Distribution and Interview	Malaysia is still a long way from where it should be in terms of BIM adoption. however, the survey subjects are only in the four states of Malaysia, and the survey subjects need to be expanded.

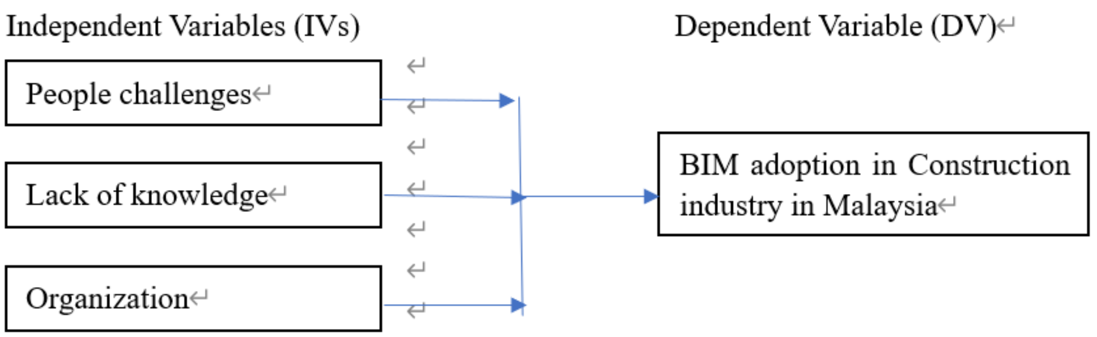
2.5 Conceptual Framework

People establish the connection between theory and practice that many researchers miss, but which Lewin simply stated: 'There is nothing so practical as a good theory' (Lewin, 1952). They claim that conceptual frameworks serve a specific purpose: 'Generalizations are produced based on the specific data that has been seen and are linked to a conceptual framework, which then leads to the explanation of new research topics and implications for future research' (Rudestam and Newton, 1992). 'A causal network is a graph showing the independent and dependent variables in naturalistic research,' they propose in their definition of 'conceptual framework.' This diagram may be used to create a conceptual framework' (Rudestam and Newton, 1992).

Glatthorn, who mixes genesis and synergy to depict conceptual frameworks, offers a similar explanation: 'A conceptual framework is usually formed from theory.' It identifies and illustrates the ideas that make up a complicated phenomenon. The connections are often shown graphically in a flowchart, web diagram, or other kind of schemata (Glatthorn, 1998). Due to the grounding of facts that gives birth to theory, Glatthorn enables for the conceptual framework to develop from naturalistic inquiry (Glaser and Strauss, 1967; Strauss and Corbin, 1990). 'Systems,' 'Venn diagrams,' and 'conceptual modelling,' according to Blackmore and Ison (1998), influence how data is understood and conceptualized.

Thus, the below figure 2.1, conceptual framework, has been designed to investigate the interrelationship between the people challenges which are the independent variables with the BIM adoption in construction industry in Malaysia as the dependent variable.

Figure 2.1 Framework



Source: Author

2.6 Hypotheses

In this chapter of the literature review, based on the previous studies and the argument, below there are three hypotheses were developed:

H1: Lack of related knowledge has a negative significant influence on BIM adoption in construction industry in Malaysia.

According to Succar, Agar and Beazley (2017), BIM education is also very important because BIM education is an effort that ranges from raising basic awareness about BIM risks and benefits to solidifying specialist BIM knowledge and skills. It facilitates collaboration between project participants of all disciplines and across all project lifecycle phases; it is the primary means of disseminating technology-enabled, process-driven, and policy-encouraged advances in deconstruction. This means that if relevant practitioners lack BIM knowledge, it will increase the difficulty of BIM technology implementation and hinder the development of BIM technology. Therefore, it is hypothesized that lack of BIM knowledge will have a negative impact on the implementation of BIM.

H2: Resistance towards change within the organization has a negative significant influence on BIM adoption in construction industry in Malaysia.

According to Ellis (2017), project staff selection, as well as interactions and clarity of communication between stakeholders, will remain essential components of built asset project implementation. This means that if the internal staff of the organization resists BIM technology, it will lead to the development of BIM within the industry, because usually a project requires different companies to be responsible for the corresponding part. Once one of the companies resists the use of BIM technology, it will not be able to connect with others. The content of the company’s projects will also make the company lose its competitiveness

H3: People challenges have a negative significant influence on BIM adoption in construction industry in Malaysia.

According to Arayci (2019), to ensure the effective implementation of BIM, all stakeholders must be proficient in the usage of BIM in their respective fields. The personnel challenge is that the stakeholders here include the three parties, the practitioners themselves, industry managers and the government. The good development of BIM technology is inseparable from the practitioners' mastery of BIM knowledge, the attitude of industry managers on whether to decide to promote the use of BIM technology in the organization, and whether the government issues policies to support the implementation and development of BIM technology in the domestic industry.

2.7 Conclusion

In this chapter, literature has been researched extensively into the people challenges as well as the variables that affect the BIM adoption. In Malaysia, there is still a contextual void in the area of people challenges in relation to BIM adoption. This research looks into data management theory to understand the factors in more depth and to find the answer on how strong those challenging factors are influencing the BIM adoption of the construction industry in Malaysia.

CHAPTER 3. METHODOLOGY

3.0 Overview

In chapter three, the study of relevant research will be expanded upon in order to get a deeper understanding of the phenomena under investigation, as well as to assess the availability of established theories and models that are directly linked to circumstances or facts that may vary over time. Because of the gaps between ideas and real practice in the workplace, chapter three will demonstrate the need of ongoing academic research. The research design, questionnaire design, and presentation of the measurement table for this research study will be divided into three sections under the framework of chapter three. As a result, in the discussion of this chapter, chapter three will also identify the measurement in this research, such as sampling method, data collecting instrument, and data analysis.

3.1 Research Design

A research design is a blueprint or strategy that is developed especially to answer the research question while also controlling variation (Kerlinger, 1986). The primary goal of any research is to answer the research question or test the research hypothesis. Control of variance implies that the researcher must take into account variables that may systematically contribute to the study results or confuse the interpretation of the findings but are not part of the research question or hypothesis. Depending on the aim of the study, research designs are classified into one of four categories: descriptive, correlational, quasi-experimental, or experimental. However, there is no general consensus or standard for classifying or grouping study designs into a defined number of categories. Each of these four main kinds of study design has a set of features that distinguishes it from the others. Furthermore, the researcher may be required to develop or include certain design elements into a study in order to answer the research question, test the hypothesis, or control variation (Helen, 1993).

According to Reichardt (1979), health education practitioners, assessors, and researchers have often used one of two paradigms when developing their studies. The qualitative paradigm studies important social phenomena using anthropological research techniques. Researchers that use qualitative techniques immerse themselves in a culture by watching people interact, engaging in activities, interviewing important individuals, collecting life histories, creating case studies, and/or evaluating existing records. The aim of qualitative data collection is to elicit an "insider's" perspective from the group being studied (Patton, 1990). An insider's perspective on a health education or health promotion program may help you understand how people perceive it, why they respond the way they do, why the program has particular impacts, and what the program's unintended implications are. Health educators may enhance future programs by analyzing why and how programs function or don't work such as process assessment.

On the other hand, the quantitative paradigm studies health behavior or other relevant social phenomena using methods borrowed from the physical sciences, including suitable statistical tools, to see whether and to what degree predefined research "variables" are causally linked. In this paradigm, numerical data on a population sample or a sample of program participants and nonparticipants is collected using experimental and quasi-experimental methods. In order to maximize impartiality, researchers that adopt a quantitative paradigm keep a safe distance from the individuals and social phenomena they're investigating. They do in-person interviews, telephone interviews, or mailings to distribute survey questions with predefined answer categories. When gathering quantitative data, the aim is to create measurements that are dependable, generalizable, and impartial.

Both the qualitative and quantitative paradigms contain flaws that are mitigated to some degree by the strengths of the other. Quantitative techniques have the advantage of producing real, trustworthy result data that can generally be generalized to a wider population. Qualitative techniques have the advantage of generating rich, comprehensive, and accurate process data while preserving the research participants' views. Qualitative approaches can help to contextualize health behavior and program outcomes. When performing certain needs assessments or when a program has reached a "finished product" stage and has a certain degree of maturity and stability, quantitative measurements are frequently the best option. After an intervention has gone through its growing pains and its goals and techniques have been tested and stabilized, it is time to compare result and baseline measures quantitatively (Steckler, 1989).

3.1.1 Qualitative Research

Qualitative research is a wide category of experimental methods aimed at describing and interpreting the experiences of study participants in a particular environment (Denzin and Lincoln, 2018). Qualitative research yields various types of knowledge claims than quantitative research. In contrast to nomothetic research, which focuses on standardized methods of obtaining knowledge from large samples of individuals using categories taken from existing theory and operationalization by the researcher, qualitative research is idiographic "focusing on one or a very few individuals, finding categories of meaning from the individuals studied" (Mc Morrow et. al., 2010). There is no agreed doctrine underlying all qualitative social research; the common element of qualitative research is the collection of data in the form of words and statements, which is analyzed by methods that do not include statistics or quantification; qualitative research in social and behavioral research is based on unobtrusive field observations that can be analyzed without numbers or statistics; there is no agreed doctrine underlying all qualitative social research; the common element of qualitative research is the collection of data in the form of words and statements, which is analyzed by methods that (Silverman, 1998).

A qualitative research approach also aims to maintain the real-life environment in which events occur and the way in which the many complicated factors interact, as stated by (Isaac and Michael, 1995), with little intervention and no effort to manipulate the variables. It also enables the researcher to observe the respondents in their natural environment without affecting the factors being researched (Patton, 2015). Furthermore, qualitative research topics and issues are often derived from real-world observations, difficulties, and inquiries. In contrast to if-then hypothesis generated from theory, they take the form of broad inquiry (Marshall and Rossman, 2016). Concern with the process, curiosity in people's lives, data gathered by the researcher, and immersing the researcher in the community or study environment are all hallmarks of qualitative investigations. Information must be gathered from the field before being categorized into categories, structured into a narrative, and produced as text to collect the required data (Creswell and Poth, 2018). In qualitative research, the investigator is also the main data collecting tool (Guba and Lincoln, 1994). One drawback of qualitative research is the potential that the unique variations in many such studies would allow for only a limited degree of generalization and little chance to draw causal inferences (Isaac and Michael, 1995).

Taking the above into consideration, and despite the constraints, a qualitative research method was considered suitable for this study after identifying the issue and reviewing relevant literature. The purpose of this study is aimed at describing the technology adoption of BIM and the factors influencing the adoption of BIM in construction industry in Malaysia. The current research investigation is using the quantitative baes correlation design to determine the existence or non-existence of relationships between the people challenges and the phenomenon under the study on BIM adoption. If the relationship exists, it is important to know the extent of influence of the relationship of the People challenges on the BIM adoption. Thus, the study was therefore conducted in the qualitative method by using the questionnaire to collect data, the research design and research methodology adopted in this study are to collect the data via questionnaire distribution to the construction industry in Malaysia.

For this study, there is minimal interference from the researcher into the work or the respondents as the research is only distributing questionnaire to respondents and respondents can answer at any time convenient to them. And the study setting is non-contrived because this research is not carried out in an artificial environment like the lab. Researchers carry out the data collection in the field setting.

3.2 Unit of Analysis and Time Horizon

The main subject of a research is the unit of analysis, which may be a person, a group, or an organization. Under this research, the unit of analysis is the organization as the main point to determine the BIM adoption in the construction industry in Malaysia and its relationship with People challenges. Apart from that, the questionnaire will be circulated to the respondents working as manager in the construction consulting company in Malaysia. Therefore, the unit of analysis for the present research is the organization employees as the BIM adoption refers to the adoption of companies.

The time horizon in the study is called one-shot or cross-sectional study. When data is collected in cross-sectional research, it is gathered all at once (Saunders et. al., 2012). Therefore, the study will be undertaken in one-shot where the questionnaire survey is distributed to respondents to answer for one time and gather the data just once.

3.3 Sample Size

The sample size was calculated using the table established by Krejcie and Morgan (1970), as shown in table 3.1. The target population is clients, developers, contractors, consultants, participants from the Construction Industry Development Board (CIDB), and MYBIM center from both private and governmental entities participated in the survey, providing a unique variety in the study results. Using Krejcie and Morgan's method for computing sample size from a given population, a sample size of 346 was derived from a total responder population of 3533. Only 214 legitimate survey questionnaires were returned out of 400 that were issued. The proportion of returned questionnaires is roughly 61.85%, which is within the acceptable bounds of Akadiri (2011).

Table 3.1 Krejcie and Mogran (1970) Sample Size determinant Table

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

3.4 Sampling Technique

Sampling is a technique for assessing the frequency of a condition by selecting individuals from a bigger group (Kumar, 2014). There are two types of sampling methods: probability sampling and unlikely sampling (Saunders et. al., 2016). Probability sampling employs random sorting, which ensures that each unit of a sample has an equal chance of being sampled, while impossible sampling, on the other hand, may or cannot accurately reflect the population and therefore contributes to bias (Bougie and Sekaran, 2019). This research uses the non-trustworthiness sampling method to get a high response rate by providing a simple sample strategy based on the distribution of online questionnaires, in order to produce cost-effective findings by distributing questionnaires at certain times (Saunders et al., 2016). As a result of this method, the analysis' main flaw, namely the issue of time constraint, may be addressed.

Below table 3.2 shows the target population. The target population is clients, developers, contractors, consultants, participants from the Construction Industry Development Board (CIDB), and MYBIM center from both private and governmental entities participated in the survey

Table 3.2 Target Population

No.	Types
1	Clients
2	Developers
3	Contractors
4	Consultants
5	Participants (CIDB)
6	MYBIM center

3.5 Data Collection

Finding and obtaining materials for analysis was part of the data collection process (Ellis, Strauss, & Corbin, 1992). Any protocol for data collection, according to Yin (2014), should include an overview of the case study project such as project activities, case study issues, and relevant readings about the topic being investigated; case study questions such as the specific questions that the researcher must keep in mind when collecting data, as well as potential sources of information for answering each question; and a guide for the case study report such as outline, format of the report.

When designing the plan of this study, the above-mentioned points were considered, and through a lot of reading and sorting out related documents, the questionnaire survey questions that can clarify the research goals were summarized. The questionnaire survey questions have been repeatedly refined and refined again in the research process. Finally, the final questionnaire was completed to ensure that the data collection included all necessary items. However, considering that the questionnaire cannot be distributed face-to-face, it is necessary to use the online distribution of the questionnaire.

3.6 Data Analysis

Each year, the quantity and variety of statistical software programs available increases. I've decided to use SPSS for this study. SPSS was selected because of its widespread usage in academic and commercial circles, making it the most commonly used software of its kind. SPSS is also a flexible program that provides for a wide range of analyses, data transformations, and output formats - in other words, it will be more than enough for my needs.

For this study, the scaling will be focus on Likert scale of 1-5 which 1 is strongly disagree and 5 is strongly agree. The items to be measured will be the questions inside the questionnaire.

3.7 Questionnaire Design

Below table 3.3 shows the questionnaire design table. Because the information is only collected once from respondents through a questionnaire, the research is cross-sectional. To achieve the research goals, the questionnaires would be revised based on literature reports on studies comparable to this one. The respondents' profiles are shown in Section A. BIM adoption as the dependent variable in Section B, while people problems for individuals and organizations are the independent variables in Section C. The surveys are intended to gather accurate data and are not too long for respondents to complete. To better understand the profile of responders, two questions will be presented, including educational level and job experience. For questions on the independent and dependent variables, a five-point Likert scale will be used, with 1 indicating "Strongly Disagree" and 5 indicating "Strongly Agree." Without knowing the name of each responder, questionnaires will be disseminated online through email, WhatsApp, or other social media.

Table 3.3 Questionnaire Design Table

Section	Variable	Items	Source
A	Organization Manager Profile	2	The Organization Manager Profile is required to get a better understanding of the respondents' basic background (Arditi, Nayak, and Damci, 2017). 1. Years of Experience 2. Qualifications
B (Dependent Variable)	BIM adoption	3	Adapted from: Chai et. al., 2017; Noor et. al., 2018; Haron et. al., 2017.
C (Independent Variables)	People challenges (overall)	12	Adapted from: Chai et. al., 2017; Noor et. al., 2018; Haron et. al., 2017.
	Individuals		Adapted from: Chai et. al., 2017; Noor et. al., 2018; Haron et. al., 2017.
	Organizations		Adapted from: Chai et. al., 2017; Noor et. al., 2018; Haron et. al., 2017.

3.8 Measurement

Below table 3.4 shows the measurements table. According to Mohajan (2018), the process of quantifying a phenomenon may be measured by allocating numbers. Descriptive data, preliminary tests, hypothesis tests, and other supporting tests may all be isolated from the measurements (Kumar, 2010). The Statistical Package for Statistic (SPSS) is used to chart the major tests in this research, which include preliminary tests, hypothesis testing, and so on.

Table 3.4 Measurements Table

Tests	Purpose-Function	Rule of thumb	Citations/References to support
Factor Analysis	**Preliminary test**: The purpose of the preliminary test is to gather pilot test results so that investigation inquiries may be answered. This test will be performed once all of the data has been collected. **Factor analysis**: It is a statistical method for reducing the number of variables into fewer factors and determining the IVs and DV, as well as ensuring that all information in the IVs and DV is accurate before they are included in the questionnaire. Before hypotheses testing, factor analysis is calculated during the preliminary test to verify that the factors are correct.	1. The sphericity test by KMO Barlett must be >0.6. If the value is less than 0.6, data validation is not required. 2. Factor loading should be more than 0.6. The relevant item must be deleted if the factor loading is less than 0.6. A number between >0.5 and 0.6 is still suitable for pilot testing. 3. According to the independent variables, eigenvalue > 1=3. The eigenvalues must be greater than one and equal to the number of independent variables in the research, according to the rule of thumb.	Bougie and Sekaran (2019); Cooper and Schindler (2018); Fidell and Tabachnick (1996)
Reliability Test	The goal of a reliability test is to determine whether or not pilot test data is trustworthy and internally consistent enough to anticipate future outcomes.	When the Cronbach Alpha is more than 0.7, the pilot test is reliable. When the value is less than 0.7, the items are considered unreliable and should not be used in hypothesis testing. When the numbers are less than 0.7, Cronbach alpha must be >0.6.	Anderson, Babin and Black et. al., (2019)

	The pilot reliability test is used to determine if the pilot test data is trustworthy using the Cronbach Alpha value from an internal consistency test with a sample size of 10% to 20%. Before evaluating dependability, a preliminary reliability test will be performed once all of the data has been collected to ensure that the IVs, DV, and other pertinent information are compliant with the Rule of Thumb.		
Organization Profile	Organization Profile shown in Table 3.3 Questionnaire Design Table provide a detailed information of respondent in the final project	Following the data collection for the questionnaire survey, the project will conduct a statistic on the profiles of real respondents.	Bougie and Sekaran (2019)
Hypotheses Testing (Multiple Regression)	Hypothesis testing's primary purpose is to evaluate the model's fit with the study's impact of independent and dependent variables. R-squared, a statistical measure of the fitted regression line for multiple regression, is the focus of hypothesis testing.	R-Squared has a value range of 0 to 1. When RSquared equals 0, no change in the independent variable can be ascribed to the dependent variable. R-squared goodness of fit should be greater than 0.5 in order to anticipate the impact on the phenomena under investigation. If R-squared is less than 0.5, however, the conceptual framework will not fit.	Anderson, Babin and Black et. al., (2019)
Analysis of Variance	The purpose of Regression ANOVA is to look at the extent of	At a 95% confidence level, the P-value should be less than 0.05, indicating a significant connection	Bougie and Sekaran (2019)

(Regression ANOVA)	variances and movement between independent and dependent variables.	between the dependent and independent variables. If the P-Value is more than 0.05, the combined analysis of variance cannot ascribe.	
Beta Coefficient	The beta coefficient is used to identify elements that have a significant relationship of the construct with the phenomena under investigation and the beta coefficient is also to determine the strength of influence that independent variables have on the dependent variables and is focusing on standardized data coefficient. The beta coefficient value may present as negative or positive.	The closer the value beta coefficient is to 1, the greater the impact on the phenomenon under investigation. A positive coefficient indicates a rise in both the independent and dependent variables, while a negative coefficient indicates an increase in the independent variable but a drop in the dependent variable.	Cooper and Schindler (2018); Keith (2019)
Multicollinearity	The goal of multicollinearity is to figure out how much skewness data there is. The tolerance value and the variance inflation factor (VIF) are two commonly used methods for detecting multicollinearity.	The value of the Variance Inflation Factors (VIF) is < 10, which indicates that the data is properly distributed, and a tolerance value of >0.10 indicates that there was no multicollinearity in the research that caused skewness. If the VIF value is more than 10, the data is deemed highly overlapped, and the interconstruct correlation is very strong, contributing to a skewed result owing to the type 1 error. Type 1 error is an alternative hypothesis to null hypotheses that may be accepted. The standard errors of the impacted coefficients tend to be high, which is one of the characteristics of multicollinearity.	Bougie and Sekaran (2019)

		In such scenario, failing to reject a false null hypothesis of no effect of the explanator, a type II error, may result from the test of the hypothesis that the coefficient is equal to zero.	

3.9 Summary

In conclusion, the study technique is summarized in three tables at the end of the chapter: research design, questionnaire table, and measurement table. There are some other parts provided follow the research design, such as the unit of analysis, time horizon, sample size, sampling technique, and data analysis. The following is a table from the questionnaire that shows whether the items were incorporated or modified from prior studies. The pilot tests were then detailed in detail under the measurement table, which included factor analysis, reliability testing, and correlation matrix analysis. Measurements provide top-to-bottom quantifiable data that may be used to draw inferential conclusions about the phenomena under investigation. This part documents all of the methods utilized in this study, as well as a hypothetical setting for future chapters.

CHAPTER 4. RESULT AND DISCUSSION

4.1 Overview

This chapter contains an analysis of the data and a discussion of the results gleaned from the distributed questionnaire and is dedicated to achieving the goal of exploring the impact of personnel challenges on the implementation of BIM in the Malaysian construction industry. SPSS would be used to determine the analyses' findings using categorized data from a 5-point Likert scale utilized in distributed surveys. Tables may be used to present the data obtained from the respondents. A standard set of questionnaires is distributed via online Google Forms. Out of 300 survey questionnaires that were distributed, only 214 valid ones were returned and are used for the analysis of this study. Relevant information and additional elaboration of the results will be added in order to clarify and convey a comprehensive knowledge of the relationship between the data acquired and the research offered.

4.2 Data Cleaning

Data cleaning, also called data cleansing or scrubbing, deals with detecting and removing errors and inconsistencies from data in order to improve the quality of data and data quality problems are present in single data collections, such as files and databases, e.g., due to misspellings during data entry, missing information, or other invalid data (Rahm and Do, 2000).\

A data cleansing strategy should meet a number of criteria. To begin with, it should identify and correct any significant flaws and inconsistencies in individual data sources as well as when combining several sources. The strategy should be backed up with tools to save manual inspection and programming time, and it should be readily expandable to include other sources. Furthermore, data cleaning should be done in conjunction with schema-related data transformations based on full information, not in isolation. Data cleaning and other data transformations should include declarative mapping methods that may be reused for various data sources as well as query processing. A workflow architecture should be enabled, especially for data warehouses, to perform all data transformation stages for numerous sources and big data sets in a reliable and efficient manner.

In general, data cleaning includes 2 stages in this research:

a) Data analysis: A rigorous data analysis is necessary to discover which types of mistakes and inconsistencies must be eradicated. Analysis programs should be used in addition to a human evaluation of the data or data samples to get information about the data attributes and discover data quality issues. The data of this study comes from online questionnaires, so it is necessary to manually check whether the results of each questionnaire are complete. For example, some questionnaires have unanswered individual questions, so incomplete questionnaires are regarded as invalid questionnaire results.
b) Verification: The validity and efficacy of a transformation process, as well as the transformation definitions, should be verified and assessed, for example, on a sample or copy of the source data, in order to update the definitions if required. Multiple repetitions of the analysis, design, and verification phases may be required, for example, because certain faults are only visible once certain transformations are applied. After excluding the questionnaire results with incomplete answers, the next step is to further confirm whether the data results of each questionnaire are meaningful, for example, to exclude all 1 or 5 in the questionnaire, because this is not consistent with common sense and therefore is invalid data result

4.3 Response Rate

The response rate in survey analysis refers to the number of respondents who were separated from the total number of persons that responded to the survey as shown in table 4.1. The replying rate usually refers to the sample's consistency and increased response rates. If the non-response rate is uniform across participants' exposures and outcomes, sampling bias, also known as non-response bias, may result in a lower response rate. The results can't all be the same, which adds to increased mistake rates and a lower response rate. As a result, greater response rates are desired.

Table 4.1: Response rate of the study

Sample Size (Krejcie and Morgan, 1970)	Total Questionnaire Distributed	Total Questionnaire Received	Total Usable Questionnaire	Total Unusable Questionnaire	Response Rate in Percentage
346	400	222	214	8	61.85

A total of 400 surveys were disseminated to the target group through Google Forms. Despite this, just 214 answers have been received from respondents. The table for determining population-sized samples for the total of a usable questionnaire is 214, which is less than the 346 requirements and contradicts Krejcie and Morgan's findings (1970). However, the response rate of 61.85% is reasonable and broad since it surpasses Fincham's (2008) assumption of 60% for the target demographic.

4.4 Demographic Data (Section A: Respondents Profile)

Demographic data refers to socioeconomic statistics such as population, race, income, education, and employment that reflect particular geographic places and are often linked to time. In this research, there are 2 questions which include the information about the respondents.

4.4.1 Respondents Qualifications Distribution

The first question identifies the qualifications of each respondent. The study found that determining the academic qualifications of the respondents is essential to ensure the reliability of the data. Understand the views of respondent with different academic qualifications on the impact of personnel challenges on the adoption of BIM in the construction industry in Malaysia. The results of qualification distribution are shown in table 4.2 and figure 4.2, according to the results, we found that the respondents with the highest number of educational qualifications are bachelors (72%), followed by masters (15%), then others (13%), and the least are PhD (0%) with zero number. It can be concluded that the bachelor's degree is the main target of the questionnaire's educational qualifications, the master's degree is not much different from others, and the number of doctoral degrees is very small. This can also reflect the general distribution of academic qualifications in the construction industry in Malaysia.

Table 4.2: Respondents Qualifications Distribution

Qualification	Frequency	Percentage (%)
Bachelors	154	72%
Masters	32	15%
PhD	0	0%
Others	28	13%
Total	214	100%

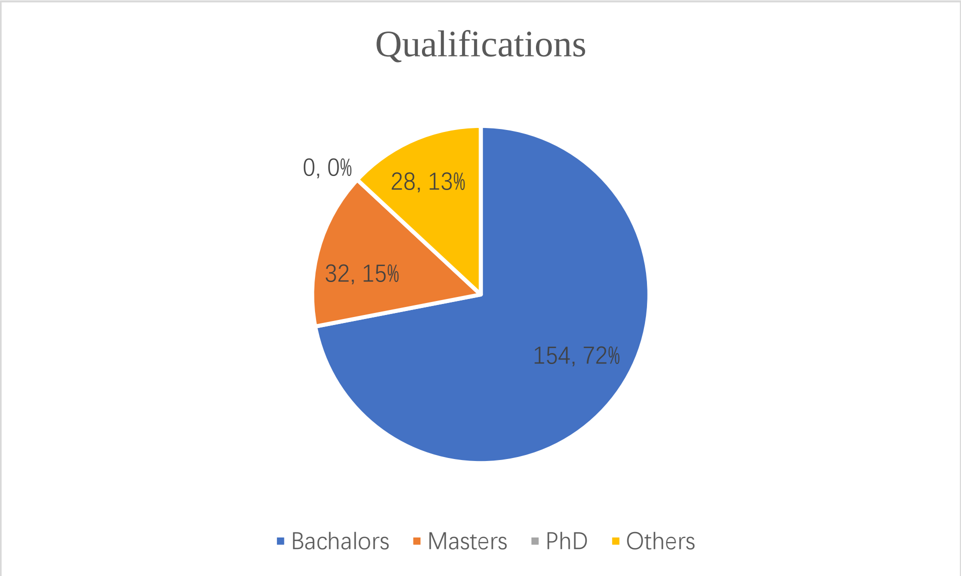


Figure 4.2: Respondents Qualifications Distribution

4.4.2 Respondents Working Experience Distribution

The second question determines the work experience of each respondent. The study found that determining the work experience of the respondent is equally important to ensuring the reliability of the data, so as to understand the views of respondents with different time of work experience on the impact of people challenges on the adoption of BIM in the Malaysian construction industry. The results of working experience distribution are shown in table 4.3 and figure 4.3, according to the results, we found that most of the respondents have less than 5 years of work experience (64%), followed by 5 to 10 years of work experience (24%), and the least are more than 10 years of work experience (12%). It can be concluded that respondents with less than 5 years of work experience are the main target of this questionnaire, because the number is far greater than the sum of 5 to 10 years of work experience and greater than 10 years of work experience. This data also reflects that the work experience of Malaysian construction industry practitioners is generally not long. There are two reasons for this phenomenon. One is the influx of many university and college graduates into the construction industry, and they have almost no work experience. The other is that because the questionnaire is distributed online, young people will be more interested on the Internet, so there will be a large number of young people who do not have much work experience.

Table 4.3: Respondents Working Experience Distribution

Working Experience	Frequency	Percentage (%)
Less than 5 years	137	64%
5-10 years	51	24%
More than 10 years	26	12%
Total	214	100%

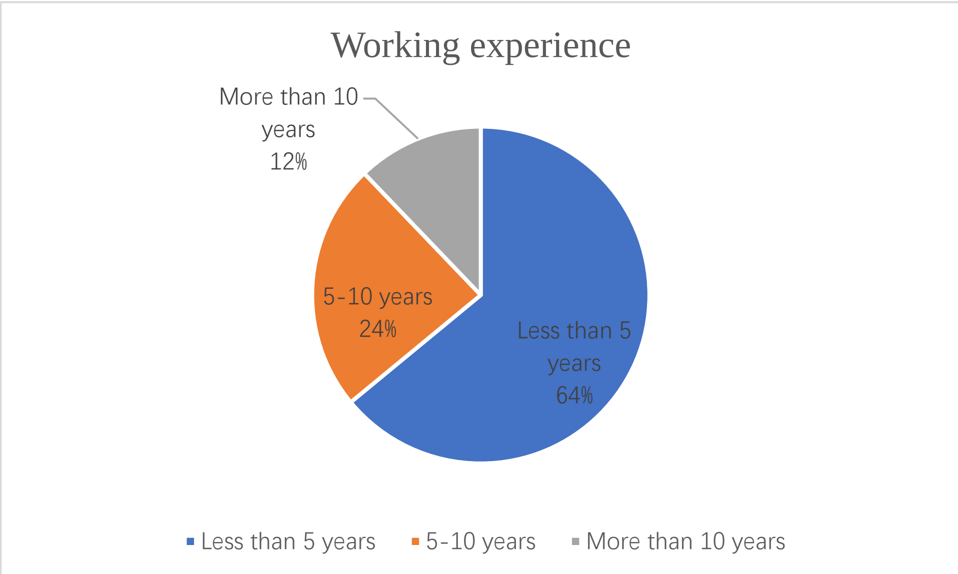


Figure 4.3: Respondents Working Experience Distribution

4.5 BIM Adoption (Section B: Dependent Variable)

In this part, section B of the questionnaire results will be displayed and analyzed. Section B is also the dependent variable studied in this article which is about BIM adoption. In this section B, there are 3 questions which include the awareness of BIM, BIM usage, and BIM experience in organization.

4.5.1 Awareness of BIM

Below table 4.4 and figure 4.4 show the results of awareness of BIM from the respondents.

According to the results, the largest number of respondents chose neutral (31.3%), followed by agreeing (28%), and then disagreeing (25.7%), and the number of respondents who chose to strongly disagree and strongly agree are the same (7.5%) among the remaining respondents. This part is about the adoption of BIM, which is the dependent variable of this research. This question is about the survey respondents' awareness of BIM. In other words, it is a comprehensive survey of respondents' understanding and mastery of BIM. The '1' or 'Strong Disagree' in the option means that the respondents are completely unaware of BIM. The '2' or 'Disagree' means that the respondents have less awareness of BIM. The '3' or 'Neutral' means that the respondents have a certain sense of BIM but is one-sided. The '4' or 'Agree' is equivalent to respondents are more aware of BIM, and the '5' or 'Strongly Agreement' is equivalent to respondents having a comprehensive awareness of BIM. Therefore, it can be concluded that most of the practitioners in the construction industry in Malaysia have a certain BIM awareness, but there are certain limitations. There are many reasons for this phenomenon, which will be further analyzed in the later part of this research.

Table 4.4: Awareness of BIM

Likert Scale	Rating	Frequency	Percentage (%)
1	Strongly Disagree	16	7.5%
2	Disagree	55	25.7%
3	Neutral	67	31.3%
4	Agree	60	28%
5	Strongly Agree	16	7.5%
Total		214	100%

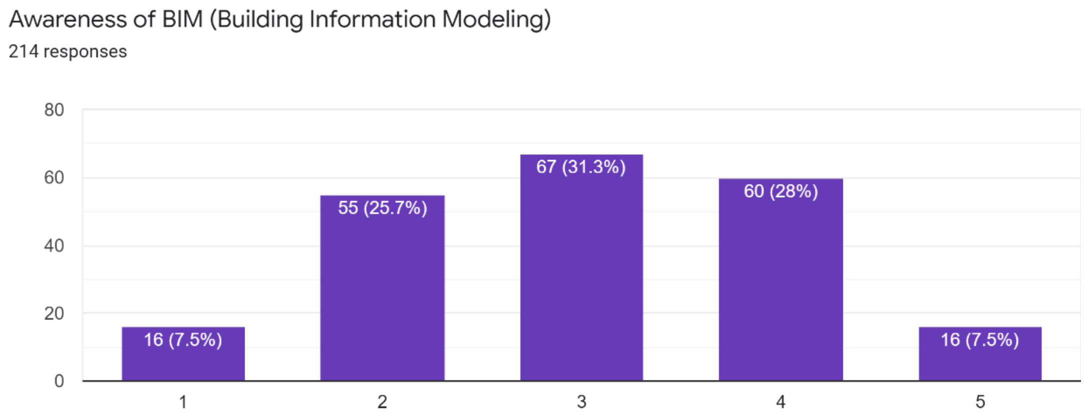


Figure 4.4: Awareness of BIM

4.5.2 BIM Usage

Below table 4.5 and figure 4.5 show the results of BIM usage from the respondents. According to the results, the largest number of respondents chose neutral (32.2%), followed by disagreeing (23.4%), then strongly disagreeing (20.6%), and then agreeing (19.2%) and the number of respondents who chose to strongly agree (4.7%) is the least. This question is about the extent to which the respondents use BIM at work. On the other hand, it also reflects the extent to which the practitioner's organization uses BIM. The '1' or 'Strongly Disagree' means that the respondents do not use BIM at all in their daily work. The '2' or 'Disagree' means that the respondents rarely use BIM in their daily work. The '3' or 'Neutral' means that the respondents use BIM at work but not frequently. The '4' or 'Agree' means that the respondents often use BIM at work, and the '5' or 'Strongly Agree' means that the respondents must use BIM to complete the daily work, so the frequency of use is higher. Therefore, it can be concluded that although most respondents use BIM at work, the frequency or dependence is not high. This also reflects that the adoption of BIM in the organization is not extensive. Also, that BIM is not used at all and BIM is rarely used of respondents are second only to those who choose neutral.

Table 4.5: BIM Usage

Likert Scale	Rating	Frequency	Percentage (%)
1	Strongly Disagree	44	20.6%
2	Disagree	50	23.4%
3	Neutral	69	32.2%
4	Agree	41	19.2%
5	Strongly Agree	10	4.7%
Total		214	100%

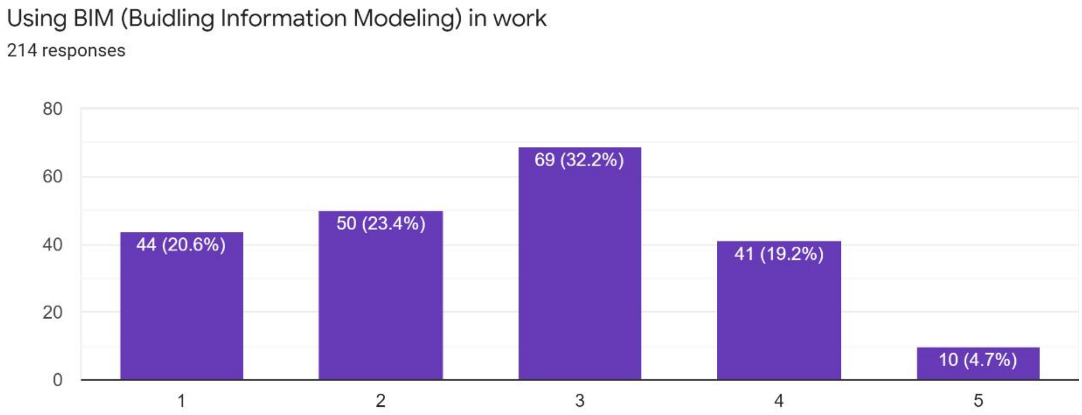


Figure 4.5: BIM Usage

4.5.3 BIM Experience in Organization

Below table 4.6 and figure 4.6 show the results of BIM experience in organization from the respondents. According to the results, the most BIM experience of the respondent's organization is less than 2 years (48.6%), followed by 2-5 years (37.9%), followed by no BIM experience in the organization (9.3%), and the least BIM experience in the organization is more than 5 years (4.2%). This question is about the BIM experience of the respondent's organization. From the results of this question, it can be concluded that the BIM experience of most of the respondents' organizations is generally less than 2 years, which reflects the incomplete adoption of BIM in the construction industry in Malaysia. Because of this, this research is dedicated to exploring the factors that hinder the adoption of BIM in the Malaysian construction industry. However, considering the complexity of the factors, this research focuses more on the impact of people challenges on the adoption of BIM in the Malaysian construction industry.

Table 4.6: BIM Experience in Organization

BIM Experience in Organization	Frequency	Percentage (%)
Less than 2 years	104	48.6%
2-5 years	81	37.9%
More than 5 years	9	4.2%
None	20	9.3%
Total	214	100%

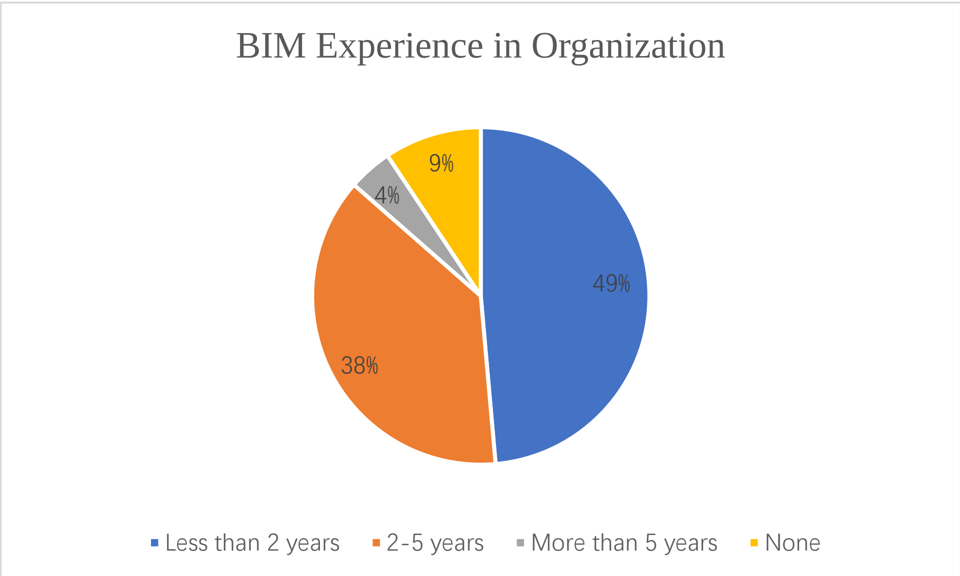


Figure 4.6: BIM Experience in Organization

4.6 Goodness of Measure

Researchers across disciplines often fail not merely to report the dependability of their instruments, but also to comprehend the inextricable relationship between scale validity and good research (Henson, 2001; Thompson, 2003). It's critical to ensure that the instrument we created to measure a certain idea properly measures the variable, i.e., that we're measuring the concept we're trying to measure. The scales that are created are often inaccurate, and mistakes in the measurement of scale variables are common. The use of improved equipment will guarantee that findings are more accurate, improving the scientific quality of study. As a result, we must analyze the "goodness" of the measures generated and be relatively certain that the instrument properly measures the variables it is designed to measure (Shekharan and Bougie, 2010). The reliability and validity of the measures are determined once item analysis of the replies to the questions tapping the variable is completed.

4.6.1 Validity Test

Validity is a measure of how successfully a designed instrument measures the topic it is supposed to measure. To put it another way, validity is concerned with whether or not the measure is measuring the correct idea (Shekharan and Bougie, 2010). For example, how can we be confident that we are measuring the idea we set out to test and not something else when we ask a series of questions in the hopes of accessing the notion? Certain validity tests may be used to establish this. To evaluate the quality of measurements, many sorts of validity tests are utilized, and different names are used to describe them:

a) Content Validity: It assures that the metric has a sufficient and representative selection of elements that capture the idea. The stronger the content validity, the more scale items that reflect the domain or universe of the idea being assessed. It is determined by how thoroughly a concept's dimensions and components have been defined.
b) Criterion-Related Validity: When a measure distinguishes people on a criterion that it is predicted to predict, it is said to be established. Concurrent validity or predictive validity may be used to accomplish this.
c) Construct Validity: The construct validity of a measure refers to how closely the findings produced from using it match the beliefs that the test is based on. Convergent

and discriminate validity are used to test this. For example, if a test to evaluate intelligence is developed that accurately measures IQ, then the test is legitimate. Construct validity is a continuous process in which one refines a theory as needed in order to produce test score predictions in a variety of contexts and scenarios.

Pearson Product Moment Correlations were used in SPSS to test the questionnaire's validity. By comparing the total scores of each item questionnaire with the overall scores, the validity test Product Moment Pearson Correlations was performed. The validity of the items is shown by an item-by-item questionnaire that is substantially associated with the overall score. We need to check and determine two conditions between each question about the independent variable and the total source. The first condition is that the significance value is less than 0.05, and the second condition is that the value of Pearson Correlation is greater than the value in the r table. Only when these two conditions are met at the same time can the questionnaire survey result be considered valid. Below table 4.7 shows the correlation results from SPSS software, and according to the results, based on the significant value between each question and total source obtained by the Sig. (2-tailed) of 0.000 < 0.05, so it can be concluded to each question is valid by the first condition. For the value r table product moment can be searched on the distribution of the r table product moment 5% significance with N = 214, then the value will be r table product moment equal to 0.138 (table 4.8). From the results we found that the Pearson Correlation value for Q1 is 0.402, Q2 is 0.434, Q3 is 0.434, Q4 is 0.382, Q5 is 0.320, Q6 is 0.385, Q7 is 0.415, Q8 is 0.456, Q9 is 0.497, Q10 is 0.464, Q11 is 0.427, Q12 is 0.480. All the Pearson Correlation values for each question are more than 0.138 which can be concluded to each question is valid by the all the conditions.

Table 4.7: Correlations

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total

Q1	Pearson Correlation	1	.172*	.052	-.128	.153*	.208**	.171*	.078	.134	.147*	.059	.123	.402**
	Sig. (2-tailed)		.012	.446	.061	.025	.002	.012	.258	.050	.032	.390	.073	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q2	Pearson Correlation	.172*	1	.133	.048	.044	.002	.154*	.138*	.115	.199**	.146*	.105	.434**
	Sig. (2-tailed)	.012		.053	.483	.524	.975	.024	.043	.094	.004	.033	.126	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q3	Pearson Correlation	.052	.133	1	.079	-.037	.239**	.044	.203**	.197**	.011	.072	.087	.434**
	Sig. (2-tailed)	.446	.053		.250	.588	.000	.517	.003	.004	.877	.291	.202	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q4	Pearson Correlation	-.128	.048	.079	1	.109	.121	.103	.056	.102	.140*	.097	.123	.382**
	Sig. (2-tailed)	.061	.483	.250		.110	.078	.134	.412	.137	.040	.156	.073	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q5	Pearson Correlation	.153*	.044	-.037	.109	1	.078	.092	.105	.172*	.033	-.058	.095	.320**
	Sig. (2-tailed)	.025	.524	.588	.110		.256	.180	.124	.012	.635	.399	.164	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q6	Pearson Correlation	.208**	.002	.239**	.121	.078	1	.183**	.086	.077	.066	-.150*	.133	.385**
	Sig. (2-tailed)	.002	.975	.000	.078	.256		.007	.210	.264	.335	.028	.052	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q7	Pearson Correlation	.171*	.154*	.044	.103	.092	.183**	1	.154*	.040	.050	.088	.172*	.415**

	Sig. (2-tailed)	.012	.024	.517	.134	.180	.007		.024	.561	.468	.199	.012	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q8	Pearson Correlation	.078	.138*	.203**	.056	.105	.086	.154*	1	.159*	.108	.138*	.172*	.456**
	Sig. (2-tailed)	.258	.043	.003	.412	.124	.210	.024		.020	.115	.044	.012	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q9	Pearson Correlation	.134	.115	.197**	.102	.172*	.077	.040	.159*	1	.171*	.180**	.164*	.497**
	Sig. (2-tailed)	.050	.094	.004	.137	.012	.264	.561	.020		.012	.008	.016	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q10	Pearson Correlation	.147*	.199**	.011	.140*	.033	.066	.050	.108	.171*	1	.261**	.109	.464**
	Sig. (2-tailed)	.032	.004	.877	.040	.635	.335	.468	.115	.012		.000	.111	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q11	Pearson Correlation	.059	.146*	.072	.097	-.058	-.150*	.088	.138*	.180**	.261**	1	.161*	.427**
	Sig. (2-tailed)	.390	.033	.291	.156	.399	.028	.199	.044	.008	.000		.019	.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Q12	Pearson Correlation	.123	.105	.087	.123	.095	.133	.172*	.172*	.164*	.109	.161*	1	.480**
	Sig. (2-tailed)	.073	.126	.202	.073	.164	.052	.012	.012	.016	.111	.019		.000
	N	214	214	214	214	214	214	214	214	214	214	214	214	214
Total	Pearson Correlation	.402**	.434**	.434**	.382**	.320**	.385**	.415**	.456**	.497**	.464**	.427**	.480**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	214	214	214	214	214	214	214	214	214	214	214	214	214

*. Correlation is significant at the 0.05 level (2-tailed).

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

Table 4.8: Pearson's R

df\α	0.2	0.1	0.05	0.02	0.01	0.001
1	0.951057	0.987688	0.996917	0.999507	0.999877	0.999999
2	0.800000	0.900000	0.950000	0.980000	0.990000	0.999000
3	0.687049	0.805384	0.878339	0.934333	0.958735	0.991139
4	0.608400	0.729299	0.811401	0.882194	0.917200	0.974068
5	0.550863	0.669439	0.754492	0.832874	0.874526	0.950883
6	0.506727	0.621489	0.706734	0.788720	0.834342	0.924904
7	0.471589	0.582206	0.666384	0.749776	0.797681	0.898260
8	0.442796	0.549357	0.631897	0.715459	0.764592	0.872115
9	0.418662	0.521404	0.602069	0.685095	0.734786	0.847047
10	0.398062	0.497265	0.575983	0.658070	0.707888	0.823305
11	0.380216	0.476156	0.552943	0.633863	0.683528	0.800962
12	0.364562	0.457500	0.532413	0.612047	0.661376	0.779998
13	0.350688	0.440861	0.513977	0.592270	0.641145	0.760351
14	0.338282	0.425902	0.497309	0.574245	0.622591	0.741934
15	0.327101	0.412360	0.482146	0.557737	0.605506	0.724657
16	0.316958	0.400027	0.468277	0.542548	0.589714	0.708429
17	0.307702	0.388733	0.455531	0.528517	0.575067	0.693163
18	0.299210	0.378341	0.443763	0.515505	0.561435	0.678781
19	0.291384	0.368737	0.432858	0.503397	0.548711	0.665208
20	0.284140	0.359827	0.422714	0.492094	0.536800	0.652378
21	0.277411	0.351531	0.413247	0.481512	0.525620	0.640230
22	0.271137	0.343783	0.404386	0.471579	0.515101	0.628710
23	0.265270	0.336524	0.396070	0.462231	0.505182	0.617768
24	0.259768	0.329705	0.388244	0.453413	0.495808	0.607360
25	0.254594	0.323283	0.380863	0.445078	0.486932	0.597446
26	0.249717	0.317223	0.373886	0.437184	0.478511	0.587988
27	0.245110	0.311490	0.367278	0.429693	0.470509	0.578956
28	0.240749	0.306057	0.361007	0.422572	0.462892	0.570317
29	0.236612	0.300898	0.355046	0.415792	0.455631	0.562047
30	0.232681	0.295991	0.349370	0.409327	0.448699	0.554119

df\α	0.2	0.1	0.05	0.02	0.01	0.001
35	0.215598	0.274611	0.324573	0.380976	0.418211	0.518898
40	0.201796	0.257278	0.304396	0.357787	0.393174	0.489570
45	0.190345	0.242859	0.287563	0.338367	0.372142	0.464673
50	0.180644	0.230620	0.273243	0.321796	0.354153	0.443201
60	0.164997	0.210832	0.250035	0.294846	0.324818	0.407865
70	0.152818	0.195394	0.231883	0.273695	0.301734	0.379799
80	0.142990	0.182916	0.217185	0.256525	0.282958	0.356816
90	0.134844	0.172558	0.204968	0.242227	0.267298	0.337549
100	0.127947	0.163782	0.194604	0.230079	0.253979	0.321095
125	0.114477	0.146617	0.174308	0.206245	0.227807	0.288602
150	0.104525	0.133919	0.159273	0.188552	0.208349	0.264316
175	0.096787	0.124036	0.147558	0.174749	0.193153	0.245280
200	0.090546	0.116060	0.138098	0.163592	0.180860	0.229840
250	0.081000	0.103852	0.123607	0.146483	0.161994	0.206079
300	0.073951	0.094831	0.112891	0.133819	0.148019	0.188431
350	0.068470	0.087814	0.104552	0.123957	0.137131	0.174657
400	0.064052	0.082155	0.097824	0.115997	0.128339	0.163520
450	0.060391	0.077466	0.092248	0.109397	0.121046	0.154273
500	0.057294	0.073497	0.087528	0.103808	0.114870	0.146436
600	0.052305	0.067103	0.079920	0.094798	0.104911	0.133787
700	0.048427	0.062132	0.074004	0.087789	0.097161	0.123935
800	0.045301	0.058123	0.069234	0.082135	0.090909	0.115981
900	0.042711	0.054802	0.065281	0.077450	0.085727	0.109385
1000	0.040520	0.051993	0.061935	0.073484	0.081340	0.103800
1500	0.033086	0.042458	0.050582	0.060022	0.066445	0.084822
2000	0.028654	0.036772	0.043811	0.051990	0.057557	0.073488
3000	0.023397	0.030027	0.035775	0.042457	0.047006	0.060027
4000	0.020262	0.026005	0.030984	0.036773	0.040713	0.051996
5000	0.018123	0.023260	0.027714	0.032892	0.036417	0.046512

Source: Freedman, Pisani and Purves, 2007

4.6.2 Reliability Test

It is a measure of the instrument's stability and consistency in measuring the notion, and it aids in determining a measure's "goodness" (Malhotra, 2004). A measuring equipment or process is deemed dependable if it consistently gives the same score to persons or items of equal value. In other words, a measure's reliability reveals how free of bias it is and so provides consistent measurement throughout time and across the many components in the instrument.

After the questionnaire results are declared valid in the validity of the test, then the next section is to test the Reliability Method Alpha by using SPSS. Reliability is a criterion for determining whether or not an instrument is suitable for collecting data for the instrument. A decent instrument will not try to persuade respondents to choose certain responses.

Reliable entails both trustworthiness and dependability. So, repeating the process multiple times, the result will stay the same or constant. From the first output which is table 4.9, we found that all 214 results are valid to participate in the test. From the second output which is table 4.10, we found that for all 12 items, the Cronbach's Alpha is 0.685 which is more than 0.6. According to Griethuijsen et. al., (2015), the accepted value of Cronbach's Alpha is 0.7, however, values above 0.6 are also accepted. Also, in table 4.11, we can check Cronbach's Alpha for each item if item deleted and we found that all the values are less than 0.685. Thus, it can be concluded that the data is reliable.

Table 4.9: Case Processing Summary

		N	%
Cases	Valid	214	100.0
	Excluded[a]	0	.0
	Total	214	100.0

a. Listwise deletion based on all variables in the procedure.

Table 4.10: Reliability Statistics

Cronbach's Alpha	N of Items
.685	12

Table 4.11: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	36.7664	17.448	.233	.666
Q2	36.6215	17.194	.266	.659
Q3	37.1729	16.829	.224	.669
Q4	37.1028	17.360	.179	.679
Q5	36.5093	18.091	.153	.681
Q6	36.7757	17.555	.211	.670
Q7	36.6822	17.438	.257	.662
Q8	36.9579	17.111	.298	.653
Q9	36.8551	16.594	.327	.645
Q10	36.8972	16.750	.278	.656
Q11	36.1215	16.858	.214	.672
Q12	36.6682	16.692	.305	.650

4.7 Testing Parametric Analysis

Tests that make assumptions about the characteristics of the population distribution from which the sample is derived are known as parametric tests. The assumption that the population data is regularly distributed is often made. In this section, there are three tests which are normality test, linearity test, and outliers.

4.7.1 Normality Test

Various statistical approaches for data analysis, such as correlation, regression, t-tests, and analysis of variance, involve assumptions regarding normality. The central limit theorem implies that when a sample size of 100 or more observations is used, normality violations are not a big concern (Altman and Bland, 1995; Ghasemi and Zahedials, 2012). Although, regardless of sample size, the assumption of normalcy should be observed for useful findings. We report continuous data in mean value if it follows a normal distribution. This mean value is also used to compare between/among groups in order to determine the significance level (P value). The resulting mean is not a representative value of our data if our data are not normally distributed. A faulty selection of a data set's representative value and subsequent calculation of the significance level using this representative value may result in incorrect interpretation (Indrayan and Satyanarayana, 1999) As a result, we must first determine if the data is normal, and then determine whether the mean is a representative value of the data. If appropriate, means are compared using parametric tests; otherwise, nonparametric approaches are employed to compare the groups using medians. From table 4.13, we found that the significance value (P value) for each question is 0.000 in both Kolmogorov-Smirnov and Shapiro-Wilk normality test. According to 0.000 is less than 0.05, it can be concluded that all the factors have a significant relationship with BIM adoption in construction industry in Malaysia.

From below table 4.12, we found that all the independent variables have negative value for both awareness and usage of BIM and it can be concluded that all the factors have a negative significant influence on BIM adoption in construction industry in Malaysia. Thus, all the 3 hypotheses are accepted which are lack of related knowledge has a negative significant influence on BIM adoption in construction industry in Malaysia, resistance towards change within the organization has a negative significant influence on BIM adoption in construction industry in Malaysia, and People challenges have a negative significant influence on BIM adoption in construction industry in Malaysia.

Table 4.12: Correlations

		Awareness	Usage
Q1	Pearson Correlation	-.051	-.066
Q2	Pearson Correlation	-.030	-.025
Q3	Pearson Correlation	-.077	-.034
Q4	Pearson Correlation	-.097	-.073
Q5	Pearson Correlation	-.017	-.018
Q6	Pearson Correlation	-.057	-.069
Q7	Pearson Correlation	-.068	-.077
Q8	Pearson Correlation	-.007	-.025
Q9	Pearson Correlation	-.105	-.014
Q10	Pearson Correlation	-.019	-.048
Q11	Pearson Correlation	-.077	-.002
Q12	Pearson Correlation	-.039	-.021
Awareness	Pearson Correlation	1	.214**
Usage	Pearson Correlation	.214**	1

Table 4.13: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Q1	.233	214	.000	.860	214	.000
Q2	.232	214	.000	.868	214	.000
Q3	.215	214	.000	.895	214	.000
Q4	.280	214	.000	.872	214	.000
Q5	.300	214	.000	.839	214	.000
Q6	.253	214	.000	.865	214	.000
Q7	.256	214	.000	.849	214	.000
Q8	.292	214	.000	.854	214	.000

Q9	.225	214	.000	.880	214	.000
Q10	.215	214	.000	.869	214	.000
Q11	.253	214	.000	.825	214	.000
Q12	.240	214	.000	.875	214	.000

a. Lilliefors Significance Correction

4.7.2 Linearity Test

The purpose of the linearity test is to assess whether or not the connection between the independent variables and the dependent variable is linear. In correlation and linear regression analysis, the linearity test is required. There should be a linear connection between the free variable and the dependent variable in a good regression model. From below table 4.14, we found that Deviation from Linearity values for all independent variables and dependent variables are more than 0.05. Thus, it can be concluded that the relationship between the independent variables are linearly dependent variables.

Table 4.14: ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q1	Between Groups	(Combined)	2.264	3	.755	.659	.578
		Linearity	.621	1	.621	.542	.462
		Deviation from Linearity	1.643	2	.821	.717	.490
	Within Groups		240.620	210	1.146		
	Total		242.883	213			
Usage * Q1	Between Groups	(Combined)	2.220	3	.740	.561	.641
		Linearity	1.227	1	1.227	.930	.336
		Deviation from Linearity	.993	2	.497	.376	.687
	Within Groups		277.074	210	1.319		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q2	Between Groups	(Combined)	1.211	3	.404	.351	.789
		Linearity	.218	1	.218	.190	.664

			Sum of Squares	df	Mean Square	F	Sig.
		Deviation from Linearity	.993	2	.497	.432	.650
	Within Groups		241.672	210	1.151		
	Total		242.883	213			
Usage * Q2	Between Groups	(Combined)	.413	3	.138	.104	.958
		Linearity	.179	1	.179	.134	.714
		Deviation from Linearity	.234	2	.117	.088	.916
	Within Groups		278.882	210	1.328		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q3	Between Groups	(Combined)	6.347	4	1.587	1.402	.234
		Linearity	1.456	1	1.456	1.286	.258
		Deviation from Linearity	4.891	3	1.630	1.441	.232
	Within Groups		236.536	209	1.132		
	Total		242.883	213			
Usage * Q3	Between Groups	(Combined)	1.859	4	.465	.350	.844
		Linearity	.330	1	.330	.248	.619
		Deviation from Linearity	1.529	3	.510	.384	.765
	Within Groups		277.436	209	1.327		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q4	Between Groups	(Combined)	7.438	4	1.859	1.651	.163
		Linearity	2.297	1	2.297	2.039	.155
		Deviation from Linearity	5.141	3	1.714	1.521	.210
	Within Groups		235.445	209	1.127		
	Total		242.883	213			
Usage * Q4	Between Groups	(Combined)	7.857	4	1.964	1.512	.200
		Linearity	1.505	1	1.505	1.159	.283
		Deviation from Linearity	6.352	3	2.117	1.630	.183
	Within Groups		271.437	209	1.299		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q5	Between Groups	(Combined)	6.270	3	2.090	1.855	.138
		Linearity	.073	1	.073	.065	.799
		Deviation from Linearity	6.197	2	3.098	2.750	.066
	Within Groups		236.613	210	1.127		
	Total		242.883	213			
Usage * Q5	Between Groups	(Combined)	1.193	3	.398	.300	.825
		Linearity	.087	1	.087	.066	.798
		Deviation from Linearity	1.106	2	.553	.418	.659
	Within Groups		278.101	210	1.324		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q6	Between Groups	(Combined)	2.768	3	.923	.807	.491
		Linearity	.790	1	.790	.691	.407
		Deviation from Linearity	1.978	2	.989	.865	.423
	Within Groups		240.115	210	1.143		
	Total		242.883	213			
Usage * Q6	Between Groups	(Combined)	1.527	3	.509	.385	.764
		Linearity	1.333	1	1.333	1.008	.317
		Deviation from Linearity	.194	2	.097	.073	.929
	Within Groups		277.767	210	1.323		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q7	Between Groups	(Combined)	1.551	3	.517	.450	.718
		Linearity	1.122	1	1.122	.976	.324
		Deviation from Linearity	.429	2	.215	.187	.830
	Within Groups		241.332	210	1.149		
	Total		242.883	213			
Usage * Q7	Between	(Combined)	1.742	3	.581	.439	.725

			Sum of Squares	df	Mean Square	F	Sig.
	Groups	Linearity	1.640	1	1.640	1.241	.267
		Deviation from Linearity	.102	2	.051	.039	.962
	Within Groups		277.552	210	1.322		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q8	Between Groups	(Combined)	1.393	4	.348	.301	.877
		Linearity	.012	1	.012	.011	.918
		Deviation from Linearity	1.381	3	.460	.398	.754
	Within Groups		241.490	209	1.155		
	Total		242.883	213			
Usage * Q8	Between Groups	(Combined)	2.663	4	.666	.503	.734
		Linearity	.177	1	.177	.134	.715
		Deviation from Linearity	2.486	3	.829	.626	.599
	Within Groups		276.631	209	1.324		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q9	Between Groups	(Combined)	6.414	4	1.604	1.417	.229
		Linearity	2.663	1	2.663	2.354	.127
		Deviation from Linearity	3.751	3	1.250	1.105	.348
	Within Groups		236.469	209	1.131		
	Total		242.883	213			
Usage * Q9	Between Groups	(Combined)	4.130	4	1.032	.784	.537
		Linearity	.053	1	.053	.040	.841
		Deviation from Linearity	4.077	3	1.359	1.032	.379
	Within Groups		275.165	209	1.317		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q10	Between Groups	(Combined)	.324	3	.108	.093	.964
		Linearity	.088	1	.088	.076	.783

			Sum of Squares	df	Mean Square	F	Sig.
		Deviation from Linearity	.236	2	.118	.102	.903
	Within Groups		242.559	210	1.155		
	Total		242.883	213			
Usage * Q10	Between Groups	(Combined)	2.018	3	.673	.509	.676
		Linearity	.656	1	.656	.497	.482
		Deviation from Linearity	1.362	2	.681	.516	.598
	Within Groups		277.277	210	1.320		
	Total		279.294	213			

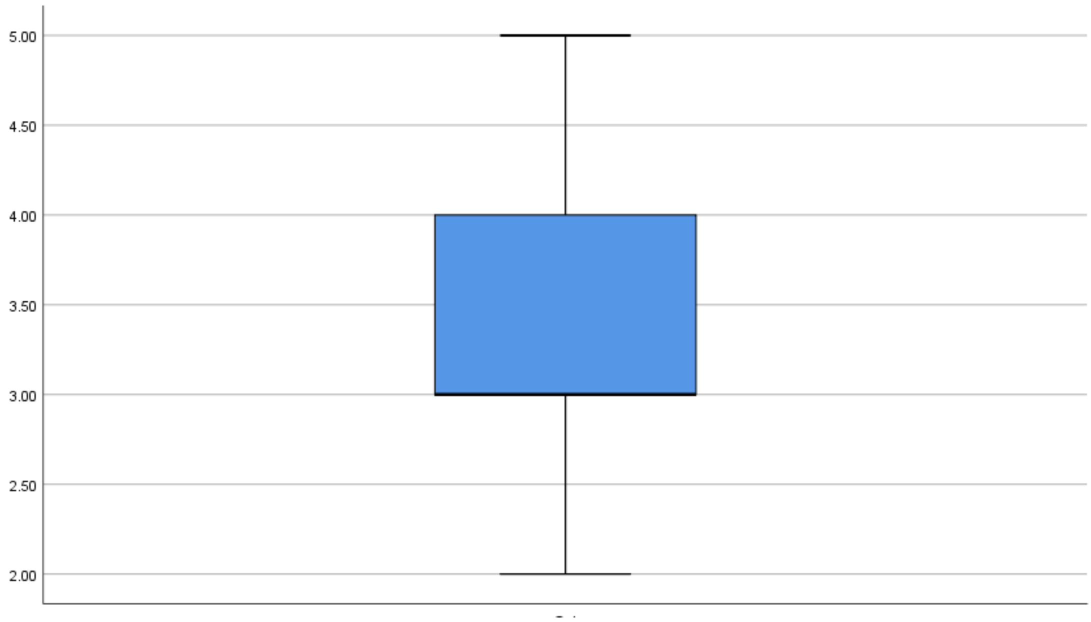
			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q11	Between Groups	(Combined)	5.802	3	1.934	1.713	.165
		Linearity	1.458	1	1.458	1.291	.257
		Deviation from Linearity	4.344	2	2.172	1.924	.149
	Within Groups		237.081	210	1.129		
	Total		242.883	213			
Usage * Q11	Between Groups	(Combined)	4.753	3	1.584	1.212	.306
		Linearity	.001	1	.001	.001	.979
		Deviation from Linearity	4.752	2	2.376	1.818	.165
	Within Groups		274.541	210	1.307		
	Total		279.294	213			

			Sum of Squares	df	Mean Square	F	Sig.
Awareness * Q12	Between Groups	(Combined)	3.672	3	1.224	1.075	.361
		Linearity	.368	1	.368	.323	.571
		Deviation from Linearity	3.304	2	1.652	1.450	.237
	Within Groups		239.211	210	1.139		
	Total		242.883	213			
Usage * Q12	Between Groups	(Combined)	6.067	3	2.022	1.554	.202
		Linearity	.120	1	.120	.092	.762
		Deviation from Linearity	5.947	2	2.974	2.285	.104
	Within Groups		273.228	210	1.301		
	Total		279.294	213			

4.7.3 Outliers

From below figure 4.7 shows the box plot of each result, and we found that there are no circles or asterisks on either end of the box plot. Thus, it can be concluded that no outliers are present.

Figure 4.7: Outliers Detection



4.8 Descriptive Analysis

The survey determined to identify the people challenges that hinder the adoption of BIM within their respective practices. Respondents are required to identify the most prominent BIM people challenges by selecting within the scale of agreement of '1' as strongly disagree and '5' as strongly agreed. A total of 12 variables are tested in this section: Q1 is resistance towards change within the organization, Q2 is lack of skilled and experienced BIM workforce, Q3 is clients do not demand or enforce BIM in projects, Q4 is lack enforcement by local authorities on BIM, Q5 is difficult learning curve to those unfamiliar with BIM, Q6 is lack of support and incentive from government and professional bodies, Q7 is lack of training and awareness programs, Q8 is no legal or contractual agreement on BIM, Q9 is non-availability of support from top management in organization for implementation of BIM, Q10 is absence of interoperable environment in the construction industry, Q11 is top management's interest on BIM, Q12 is lack of BIM-related courses in university or college. From the overall results as shown in below table 4.15, we found that the majority of respondents agreed that the most impactful factor is top management's interest on BIM with the mean value at 3.9813 (SD 1.01513) and the least impactful factor is clients do not demand or enforce BIM in projects with the mean value at 2.9299 (SD 1.00222).

Table 4.15: People Challenges of BIM Adoption (Overall)

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Mean	3.3364	3.4813	2.9299	3.0000	3.5935	3.3271	3.4206	3.1449	3.2477	3.2056	3.9813	3.4346
Rank	6	3	12	11	2	7	5	10	8	9	1	4
Std. Deviation	.81008	.82058	1.00222	.94943	.76799	.81966	.76958	.78874	.87176	.91660	1.01613	.88436

Below table 4.16 shows the results of 5 individual variables and we found that within 5 individual variables, we found that the majority of respondents agreed that the most impactful factor is lack of skilled and experienced BIM workforce with the mean value at 3.4813 (SD 0.82058) and the least impactful factor is clients do not demand or enforce BIM in projects with the mean value at 2.9299 (SD 1.00222). Therefore, it can be concluded that most respondents believe that the lack of skilled and experienced BIM staff in individual factors is the main reason leading to the adoption of BIM in the construction industry. This is also in line with the viewpoints in the second chapter of the literature review. Because employees lack BIM experience and knowledge are related to many factors, for example, companies have to invest a lot of time and money to train employees to acquire BIM experience and knowledge. And because of the scarcity of employees with BIM experience and knowledge, the salary requirements are high, which small businesses cannot afford. Most of the respondents believe that in the individual factors, clients do not require or enforce the implementation of BIM in the project is the least important reason to affect the implementation of BIM in the construction industry. This is because most customers only pursue project results, as long as the project results meet expectations, they do not care how the contracting company completes the project.

Table 4.16: People Challenges of BIM Adoption (Individual)

	Q2	Q3	Q5	Q7	Q12
Mean	3.4813	2.9299	3.5935	3.4206	3.4346
Rank	1	5	4	3	2
Std. Deviation	.82058	1.00222	.76799	.76958	.88436

Below table 4.17 shows the results of 7 organizational variables and we found that within 7 organizational variables, we found that the majority of respondents agreed that the most impactful factor is top management's interest on BIM with the mean value at 3.9813 (SD 1.01613) and the least impactful factor is lack enforcement by local authorities on BIM with the mean value at 3.0000 (SD 0.94943). Therefore, it can be concluded that most of the respondents believe that in the organizational factors, managers' interest in BIM is the main issue that affects the adoption of BIM in the construction industry, because the adoption of BIM requires a certain amount of early investment such as the cost of BIM-related software and support equipment to run BIM software, training costs for employees. In addition to these costs, managers must also consider whether these investments can be exchanged for substantial returns, often because managers need to consider too many factors and risks are too high, which slows down the progress of BIM adoption. Even some managers of small and medium-sized enterprises cannot pay the upfront expenses, thus losing interest in implementing BIM. Also, most of the respondents believe that the enforcement of BIM by local authorities is the least important issue that affects the adoption of BIM in the construction industry in terms of organizational factors. The current Malaysian government's support for BIM is good, such as proposing myBIM initiatives which is supported by CIDB, government owned construction board panel.

Table 4.17: People Challenges of BIM Adoption (Organization)

	Q1	Q4	Q6	Q8	Q9	Q10	Q11

Mean	3.3364	3.0000	3.3271	3.1449	3.2477	3.2056	3.9813
Rank	2	7	3	6	4	5	1
Std. Deviation	.81008	.94943	.81966	.78874	.87176	.91660	1.01613

4.9 Summary

From all the statistical analyses carried out, the findings indicated that the People challenges which include both individual perspective and organizational perspective have a negative significant influence the BIM adoption in construction industry in Malaysia. The results set the stage for a statistical analysis of the scope and feasibility of particular linkages related to the phenomena under investigation.

CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Overall

This chapter discusses the report's conclusions and repercussions to academics and practitioners, in which the findings will be examined in detail in relation to existing literature, and recommendations for the construction industry will be made based on the study findings. Last but not least, research limitations are discussed, as well as possible analytical suggestions.

5.2 Limitation of the Study

There are a few flaws in this research. First and foremost, time constraints are a constraining issue for this research, since the deadline for completion of this study was just 13 weeks, implying that the study may not be comprehensive. In general, all firms do not profit from insights and analysis since only Malaysian practitioners have gathered data, and this research does not reflect all practitioners throughout the world because only Malaysian data was obtained. Furthermore, particularly under the effect of the pandemic, getting those who are able to participate to complete the questionnaire is a tremendous challenge. The sole method utilized to collect data for this research is an internet questionnaire, which may limit respondents' participation. There's a chance that, owing to time constraints, respondents won't be able to reply honestly and thoughtfully to the questionnaire.

5.3 Summary and Conclusion

The purpose of this study is to comprehend the People challenges that influence BIM adoption in the construction industry in Malaysia. Throughout this study, People challenges which include overall people challenges, individual aspects, and organizational aspects are examined to see if there is any relationship with the BIM adoption in the construction industry in Malaysia.

In the previous chapter, 3 hypotheses were presented together with the component in order to achieve the study goal. In this part, the hypothesis's result is shown; subsequent conclusions will be developed for each hypothesis separately, with relevant proof and supporting evidence from current research and literature.

H1: Lack of related knowledge has a negative significant influence on BIM adoption in construction industry in Malaysia.

Hypothesis 1 is to examine if lack of related knowledge which is the individual aspect of the people challenges has a negative significant influence on BIM adoption in construction in Malaysia. For the purpose of this study, statistical analysis shows there is a negative significant relationship between lack of related knowledge which is the individual aspect of the people challenges and adoption of BIM in construction in Malaysia. According to Succar, Agar and Beazley (2017), BIM education is also very important because BIM education is an effort that ranges from raising basic awareness about BIM risks and benefits to solidifying specialist BIM knowledge and skills. In addition, the shortage of skilled workers is the most significant hurdle, according to the majority of respondents (Khairool et. al., 2019), which is also support the first hypothesis.

H2: Resistance towards change within the organization has a negative significant influence on BIM adoption in construction industry in Malaysia.

Hypothesis 2 is to examine if resistance towards change within the organization which is the organizational aspect of the people challenges has a negative significant influence on BIM adoption in construction in Malaysia. For the purpose of this study, statistical analysis shows there is a negative significant relationship between resistance towards change within the organization which is the organizational aspect of the people challenges and adoption of BIM in construction in Malaysia. According to Ellis (2017), if the internal staff or manager of the organization resists BIM technology, it will hinder the development of BIM within the industry which is also support the second hypothesis.

H3: People challenges have a negative significant influence on BIM adoption in construction industry in Malaysia.

Hypothesis 3 is to examine if the overall people challenge have a negative significant influence on BIM adoption in construction in Malaysia. For the purpose of this study, statistical analysis shows there is a negative significant relationship between overall people challenges and adoption of BIM in construction in Malaysia. According to Arayci (2019), to ensure the effective implementation of BIM, all stakeholders must be proficient in the usage of BIM in their respective fields. The personnel challenge is that the stakeholders here include the three parties, the practitioners themselves, industry managers, and the government. In addition, within 4 BIM factors which are People, Technology, Process, and Policy, the most significant obstacle in BIM deployment, according to all respondents, is the People aspect (Khairool et. al., 2019), this is also supporting the third hypothesis.

5.4 Contribution of the Study

5.4.1 Contribution to Academia

Other academics might benefit from the study's findings in order to better grasp the link between factors. Furthermore, it will serve as a source of reference for other researchers in the future who want to focus on doing relevant investigations. BIM adoption or implementation on various issues or in a different geographical region is emphasized in several of the research evaluations. As a result, this research will assist other researchers in filling up the gaps in the literature in Malaysia.

5.4.2 Contribution to Industry

This research can help industry practitioner to gain a better understanding of the impact and effect the factors has on BIM adoption in Malaysia. The industry can reconsider whether to face these challenges to better apply BIM technology. Especially in the specific factors of people challenges, the industry can formulate corresponding strategies to overcome the challenges and implement BIM technology in the work most efficiently.

5.5 Recommendations for Future Research

Based on the results and findings, People challenges have a significant negative impact on the implementation of BIM in the Malaysian construction industry.

- Individual Aspect

In the individual aspect of people challenges, the lack of professional knowledge and skills related to BIM among practitioners has become the main influencing factor. Therefore, improving the professional knowledge and skills of practitioners' own BIM is the focus of solving this challenge. Practitioners are encouraged to use the Internet to learn BIM-related knowledge by themselves, such as graphic teaching, video teaching, etc. Because once practitioners master BIM-related knowledge and skills, they will also enhance their competitive strength.

- Organizational Aspect

In the organizational aspect of people challenges, the lack of interest in BIM by organizational managers is the main problem that hinders the industry from implementing BIM. Large companies have to force themselves to accept new technology, because with the development of technology, the reform of technology within the company becomes more important, because it means their own industry competitiveness. For small and medium-sized enterprises, they should choose the right BIM software for their main projects, rather than covering all aspects like large enterprises. At the same time, the local government should strongly support local enterprises to implement BIM, such as some subsidies or fee reductions. At the same time, local universities and colleges should also pay more attention to BIM-related courses in construction-related majors. This will also increase graduates' BIM-related knowledge and use them more efficiently in enterprises.

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Appendix 1 – Questionnaire

A survey for people challenges of BIM adoption in construction industry in Malaysia

Dear participants:

Thank you for taking time to complete this questionnaire.

I am a master's degree student in INTI INTERNATIONAL UNIVERSITY (MALAYSIA) and I am doing a research project focusing on the people challenges of BIM (Building Information Modeling) adoption in construction industry in Malaysia. I would appreciate if you could spend a few minutes in completing the questionnaire regarding the topic above. The aim of this study is to ensure that the construction industry in Malaysia can be further developed through BIM technology adoption and to determine the factor that influence BIM adoption in people challenges.

The only thing that will cost you is your time. There will be no risk or side effects in taking part as the questionnaire is designed in a way that you could answer the questions directly without playing with your emotional thoughts.

You may choose to withdraw from answering the questionnaire survey at any time and there will be no impact to you. The choice for whether to complete the questionnaire survey is entirely up to you as it is voluntary.

The data collection is done by the researcher personally. The result only used for statistical analysis purposes and your answer will not be released to others for viewing. Your name is not needed to protect your privacy.

Without your cooperation and support, this research cannot be accomplished. Please take your time to participate in this survey. Thank you very much.

Sincerely,

INTI International University, Malaysia

Researcher: Liu Lin Bo

ID: I15009646

Part A - Respondents Profile

1. Qualifications

   A. Bachelors B. Masters C. PhD D. Others

2. Working experience

   A. Less than 5 years B. 5-10 years C. more than 10 years

Part B - Dependent Variable Questions

Please indicate how strongly you agree or disagree with each by using the following statements:

1=strongly disagree 2=disagree 3=neutral 4=agree 5=strongly agree

No.	Dependent Variable Questions	1	2	3	4	5
1	Awareness of BIM (Building Information Modeling)					
2	Using BIM (Building Information Modeling) in work					

3. BIM experience in organization

   A. Less than 2 years B. 2-5 years C. More than 5 years D. None

Part C - Independent Variable Questions (People challenges)

Please indicate how strongly you agree or disagree with each by using the following statements:

1=strongly disagree 2=disagree 3=neutral 4=agree 5=strongly agree

No.	Questions	1	2	3	4	5
1	Resistance towards change within the organization					
2	Lacked skilled and experienced BIM workforce					
3	Clients do not demand or enforce BIM in projects					
4	Lack enforcement by local authorities on BIM					
5	Difficult learning curve to those unfamiliar with BIM					
6	Lack of support and incentive from government and professional bodies					
7	Lack of training and awareness programs					
8	No legal or contractual agreement on BIM					
9	Non-availability of support from top management in organizations for implementation of BIM					
10	Absence of interoperable environment in the construction industry					
11	Top management’s interest on BIM					
12	Lack of BIM-related courses in university/college					

Appendix 2 – Plagiarism Check

MYI1.ENT6998.9BIM1.SEP2021.IIU - PROJECT

Thesis Submission

LIU Linbo - on Sat, Nov 20 2021, 10:50 PM

9% highest match

Submission ID: 2108b511-0dca-4b57-9eb2-43eeeb3e5565

People Challenges ...

Word Count: 17,634

Attachment ID: 4986063412

9%