CONSTRUCTION
INDUSTRY DEVELOPMENT
BOARD MALAYSIA
CIDB

CIDB TECHNICAL REPORT PUBLICATION NO. 208

MALAYSIA BUILDING INFORMATION MODELLING REPORT

2019

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INDUSTRY DEVELOPMENT
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PREFACE

Over the years, the construction industry has undoubtedly gone through some transformations which have created a way for digitisation to slowly immerse into the working environment. Realising the potential for digitisation, Building Information Modelling (BIM) has been recognised as one of the future digital platforms that bring the integrated and collaborative process for creating and managing construction project information across the whole project life cycle to improve productivity, reduce project duration and cost, as well as, enhance quality and safety.

The BIM landscape has undergone significant changes throughout the years not only globally, but in the Malaysian construction industry as well. The adoption seems to slowly take up along the construction supply chain, from the design stage until the facility and maintenance stages. Although some companies are struggling to adopt it, but this has created a demand and potential for improvements to boost the productivity of the construction industry.

Listed as one of the initiatives under the Productivity Thrusts in Construction Industry Transformation Programme (CITP) 2016-2020, BIM is part of the emerging technology that has boosted the construction industry to become more productive and competitive. To evaluate the adoption of BIM in Malaysia, Construction Industry Development Board (CIDB) has published the first report that is Malaysia Building Information Modelling (BIM) Report 2016.

After three years, the current adoption of BIM has been assessed to monitor its progression in Malaysia. This report is a second look at the use and adoption of BIM which encompasses construction industry players in Malaysia. There is no denying that BIM has provided multiple benefits across the construction supply chain despite the challenges faced by the industry players to adopt BIM. However, the road to success is possibly achieved with the change of mindset and strong efforts by the industry players to transform into a collaborative BIM working environment. The results will portray a higher projection of BIM among construction industry players in the future.

Throughout this report, CIDB will continue to put all efforts to boost the implementation of BIM among the construction industry players to transform the Malaysian construction industry across the supply chain at all levels. Collaboration and support from the industry stakeholders are needed to empower the digitalisation of Malaysian construction industry to a higher level.

IBS & BIM Division,
Technology Development Sector,
Construction Industry Development Board Malaysia (CIDB)

CIDB MALAYSIA

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EDITORIAL

This report was successfully done by the Construction Industry Development Board (CIDB) Malaysia and in collaboration with Construction Research Institute of Malaysia (CREAM). We would like to thank the following members for their contribution and support to make this report successful.

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EXECUTIVE SUMMARY

The digital transformation wave has hit most of the industry sector, ranging from top level industry to bottom. It has entered a new era of digitalisation, the so-called Fourth Industrial Revolution. The transformation has moved forward at a rapid pace, with the manufacturing industry leading the way to the Fourth Industrial Revolution (WEF, 2020). Unlike other sectors, the construction sector has one of the lowest rates of technology adoption throughout the project life-cycle (WEF, 2016) but the transformations in the construction sectors are still taking place. The World Economic Forum has listed ten disruptive technologies that will shape the future of construction, one of which is Building Information Modelling (BIM) (WEF, 2018).

Over the past decade, BIM has become widely used in the construction sector especially in the United States (US), United Kingdom (UK), and China. The digital transformations have changed their industry perspectives into a modernised and mechanised construction working environment. In an effort to keep up with the global digital construction trend, Malaysia has also set up a strategic plan for robust BIM implementation in the Malaysian construction industry through the Construction Industry Transformation Programme (CITP) 2016–2020. According to The Malaysia BIM Report published in 2016, the level of BIM adoption stand at 17% (CIDB, 2017).

The Malaysia Building Information Modelling Report 2019 was published to measure the performance of BIM adoption in Malaysia after years of implementation. The survey covered various construction industry backgrounds and sizes, ranging from large to small and medium organisations. Compared with previous surveys, several new questions were added to suit the current BIM implementation level in Malaysia. The data presented were distributed among various construction industry players to gain a comprehensive and widespread opinion regarding the BIM industry in Malaysia.

The findings from this survey show that 74% of the respondents are aware of BIM which is an increase from 45% in 2016. A positive trend was recorded for BIM adoption since about 49% of the respondents have adopted BIM in their construction projects while large organisations recorded the highest adoption among the implementors. This shows a highly significant rise in BIM adopters from the previous study with 17% of adoption in 2016.

The story of the increment in BIM adoption lies behind the BIM awareness and readiness levels among the construction industry players. Based on the survey, the result shows:

- 50% of the organisations have provided a clear policy on BIM implementation
- 43% of the organisations have allocated financial incentives for BIM implementation
- 40% of the respondents were confident regarding their BIM knowledge and skills
- 60% of the respondents applied BIM model coordination among project teams

People, process, technology, and policy are the four main clusters being categorised to measure the challenges and benefits of BIM implementation in our construction industry. The survey found that high training cost, software, and technology are among the top challenges that hinder BIM implementation in organisations. Meanwhile, improvement of project visualisation, collaboration among project team members, and project understanding were listed as benefits to their organisation throughout BIM project implementation.

Embracing the incipient world of digitalisation, 72% of the respondents are willing to adopt the implementation of BIM in the future. The report also concluded that approximately 13%, 14%, and 17% of the organisations will adopt BIM within 1 year, 3 years, and 5 years, respectively, while the remaining 49% have already embedded BIM in their working environment. The forecast BIM adoption projects potentially promising data from the previous report. The changing of mindsets with digital initiatives in project implementation will surely give rise to higher BIM adoption in Malaysia. The BIM initiatives that have been implemented by both government and private sectors should be supported by industry stakeholders as a new norm of working environment.

01

BIM ADOPTION WORLDWIDE

01
BIM ADOPTION WORLDWIDE

The dawning digital transformation will require people and organisations to embrace digitalisation to keep pace with productivity and innovation. The implementation of BIM worldwide has forced many countries to face the transformations of the global construction industry. A report by the World Economic Forum (2018) has highlighted the importance of BIM as a centrepiece of the industry through the application of several technologies such as prefabrication, automated equipment, and mobile applications. The adoption of BIM throughout the whole construction lifecycle needs a collaborative and integrated platform and support from the industry players. A report by McGraw Hill (2014) revealed that more than 30% of the total projects are implemented using BIM globally, although the number varies with region. Table 1 shows the percentage of BIM adoption rate for Malaysia and the United Kingdom (UK). The result shows that the UK projected a higher BIM adoption percentage at 69% compared to Malaysia with 49%. Early BIM adoption and a mandate for the implementation of BIM in 2016 have been identified as the main factors contributing to the high BIM adoption rate. Apart from that, the UK has also provided opportunities for the implementors through a global leadership role in BIM exploitation, BIM service provision, and BIM standards development (Paul, 2018).

As Malaysia moves towards a more comprehensive BIM adoption, the high BIM awareness rate indicates that most of the industry players are already aware of BIM application in the construction industry. The improvement in the BIM adoption rate compared with the previous BIM Report 2016 paints an overall picture of the BIM industry's promising growth in Malaysia.

Table 1. Percentage of BIM Adoption in Malaysia and the UK in 2019

COUNTRY	BIM ADOPTION RATE	BIM AWARENESS RATE
Malaysia	49%	74%
UK	69%	29%

In 2016, National Building Specification (NBS) published a report that assessed the BIM adoption in five countries: the UK, the Czech Republic, Canada, Japan and Denmark. The report showed that the level of adoption varied between each conutry, with Denmark recording the highest BIM adoption rate (NBS, 2016). The BIM industry in Denmark has become more comprehensive and systematic as a result of the high demand for BIM from large-scale projects that use BIM, the transition to the digital platform by municipalities, Government incentives and initiatives to promote BIM growth, and standards set by the semi-government bodies (Paul, 2018). All results are shown in Table 2.Globally, many reports on the level of BIM adoption has been published, although in some cases the reports only tabulated data for a specific year without including the data from other year. Meanwhile, the other published reports were just starting to measure the level of adoption. In fact, until recently, the UK has been the only country measuring the annual level of BIM adoption starting from 2011 to 2019.

Table 2. Percentage of BIM Adoption in six countries in 2016

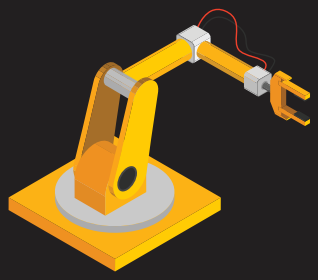
COUNTRY	BIM ADOPTION RATE	BIM AWARENESS RATE
Malaysia	17%	45%
UK	54%	42%
Canada	67%	98%
Denmark	78%	96%
Czech Republic	25%	51%
Japan	46%	92%

QUICK INFO

REVOLUTION OF CONSTRUCTION

Construction 4.0 is defined as the process to implement modern technology in order to encourage the digitistion of the construction industry and its supply chain1. Whilst, it also gives a definition of the transformation of the construction industry towards the Fourth Industrial Revolution, from automated production to a greater level of digitalisation

Mechanisation
Manual (simple tools), no technology, Intensive power
E.g.: Manual Drawing



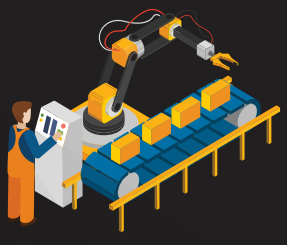
Automation
Internet based, software, fully automation, robots, modernmethod construction
E.g.: 3D drawing/ BIM

1.0 Construction

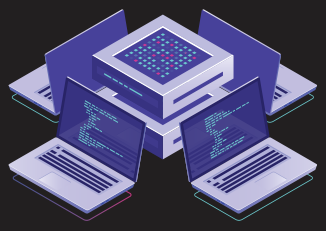
2.0

3.0

4.0



Semi-Automation
Electricity, Semi-Automation, Human and machine
E.g.: 2D Cad

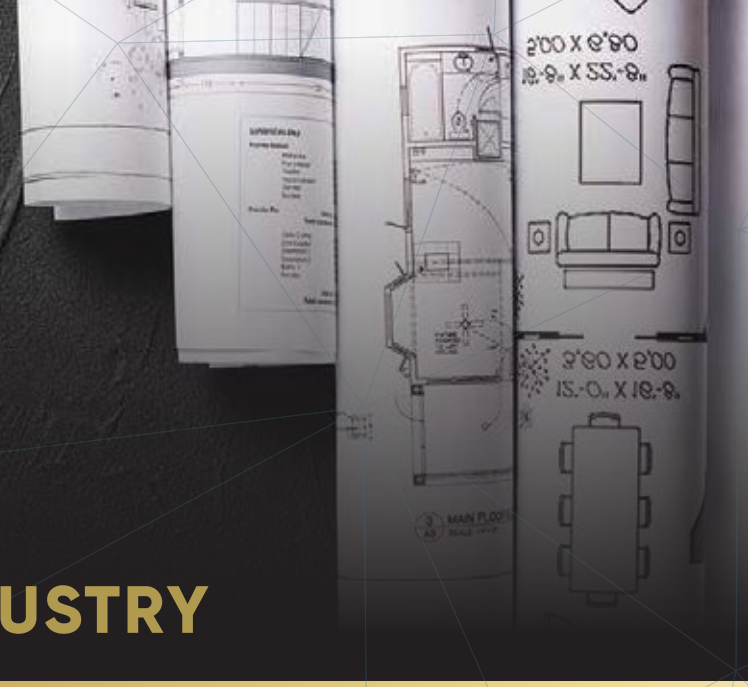


Machine Learning
Smart automation / construction, Construction 4.0 technology, less dependency on labour
E.g.: nD BIM, Interenet of Things (IoT), Artificial Intelligence (AI), Big Data, Cloud Sharing, Block Chain

Source: Construction 4.0 Strategic Plan (2021-2025)

02

BIM IN MALAYSIA CONSTRUCTION INDUSTRY



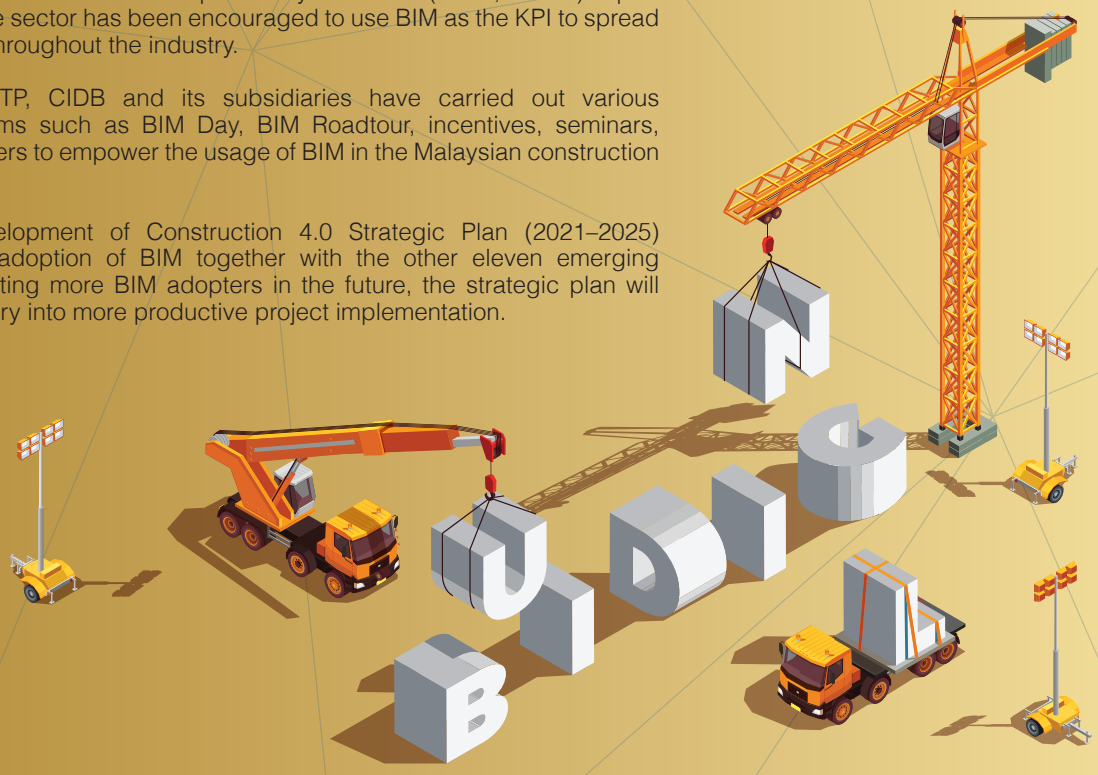
02
BIM IN MALAYSIA CONSTRUCTION INDUSTRY

A new wave of technology has already hit most of the global industries, including the ones in Malaysia. The advancement of digitalisation has swept away most of the old working methods, leaving behind collaborative and integrated working environments. In fact, a report on Shaping the Future of Construction by the World Economic Forum (2016) highlighted the implementation of BIM along the construction lifecycle for a better project outcome and cost reduction. From the international level until country level, the Ministry of Works (KKR) and its agency, Construction Industry Development Board (CIDB) Malaysia have worked together to boost the productivity of the construction industry in Malaysia. Aligning with the transformations of the construction industry, society aspects that were highlighted in the Shared Prosperity Vision (SPV) 2030 are becoming the core and foundation of the digitalisation process through the upskilling and reskilling of the workers in industry, especially in construction.

BIM as one of the centrepieces in the digitalisation process assumes its role here. Highlighted as one of the technologies under Productivity Thrust in Construction Industry Transformation Programme (CITP) 2016–2020, BIM acts as a platform to allow various stakeholders to collaborate in the planning, design, and construction of buildings using 3D models (Lorek, 2018). By zooming into CITP, we find several KPIs that have been listed under the Technology Focus Area which are to implement BIM Level 2 by Q4 2020 for 100% of public building projects above RM 100 million (for JKR building projects) and 70% of private and public building projects above RM 10 million will adopt BIM by Jan 2021 (CIDB, 2019a). Apart from that, the private sector has been encouraged to use BIM as the KPI to spread the transformation throughout the industry.

Throughout the CITP, CIDB and its subsidiaries have carried out various BIM-related programs such as BIM Day, BIM Roadtour, incentives, seminars, workshops, and others to empower the usage of BIM in the Malaysian construction industry.

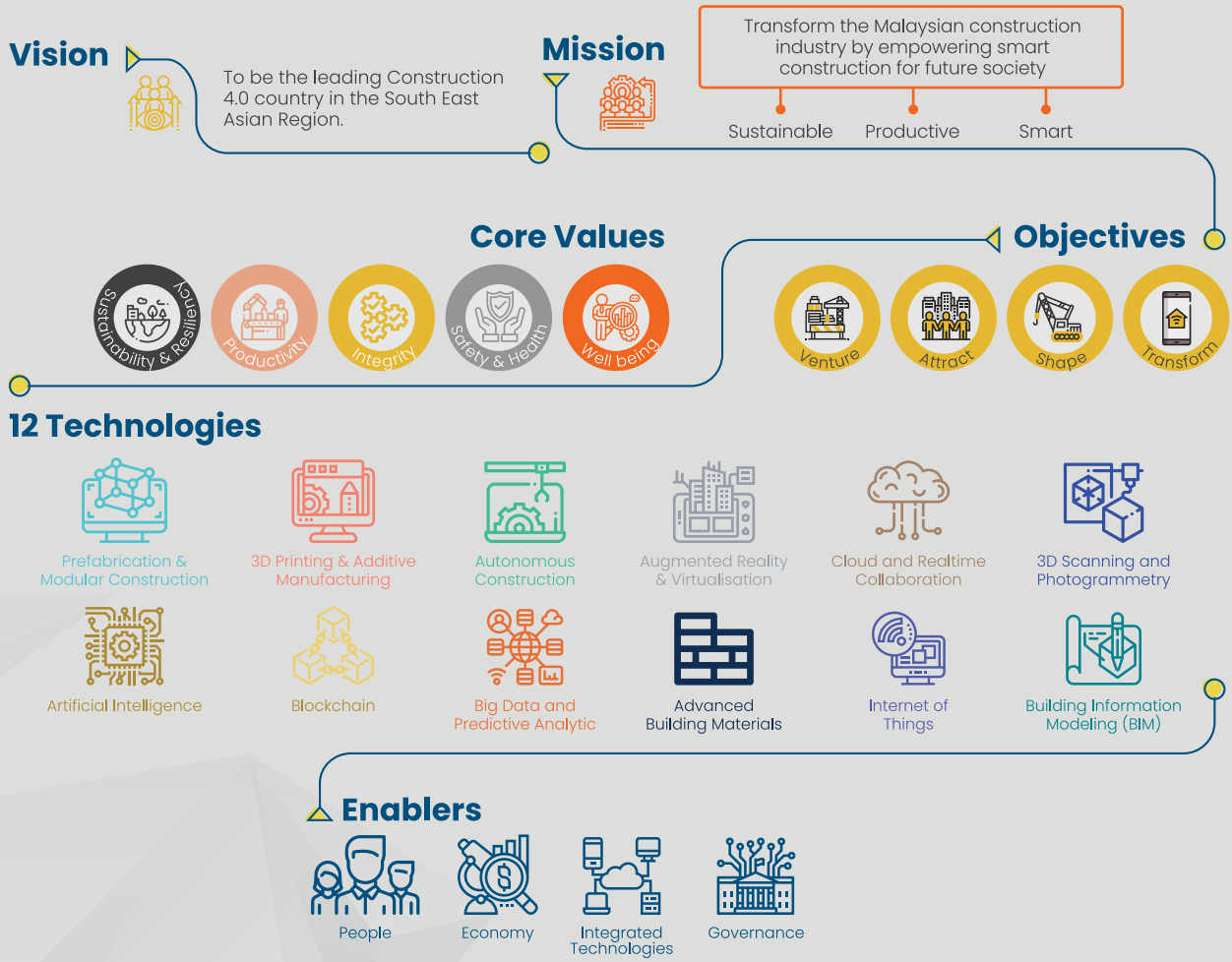
Currently, the development of Construction 4.0 Strategic Plan (2021–2025) encompasses the adoption of BIM together with the other eleven emerging technologies. Targeting more BIM adopters in the future, the strategic plan will drive the BIM industry into more productive project implementation.



QUICK INFO

A Glance Of Construction 4.0
Strategic Plan 2021-2025

In order to realise the potential and benefits of Construction 4.0, a five-year strategic plan was developed in collaboration with multiple stakeholders in the construction industry. This section will outline the overarching strategic framework for Construction 4.0



Source: Construction 4.0 Strategic Plan (2021-2025)

2.1 BIM Survey Findings

This survey has gathered respondents from various construction players including government agencies, the private sector, professional bodies, academia, and others who produced results from different perspectives and viewpoints. The results indicate the level of BIM adoption in the Malaysian construction industry 3 years after the first National BIM Report was published. The survey questionnaire was disseminated to the respondents from November 2019 until February 2020 through several platforms, for instance online surveys, seminars, digital blasting, interviews, conferences, and meetings. Towards the end, the results were collected and analysed in detail.

2.2 Respondent Profiles

Respondents by State

The survey questionnaire was distributed to the respondents in all states as shown in Figure 1. As predicted, Selangor and the Federal Territory of Kuala Lumpur recorded the highest number of responses as most of the respondents were working in the Klang Valley region. The highest distribution of respondents who answered came from Selangor (30%), The Federal Territory of Kuala Lumpur (24%), and Kelantan (18%). The states of Pahang, Johor, and Sarawak showed an average of 4%–5% respondents each answering the questionnaire. The remaining states showed almost even percentages of respondents answering with 1%-3%. As most of the construction projects and organisations were located in the Klang Valley, a high number of respondents who answered came from this region.

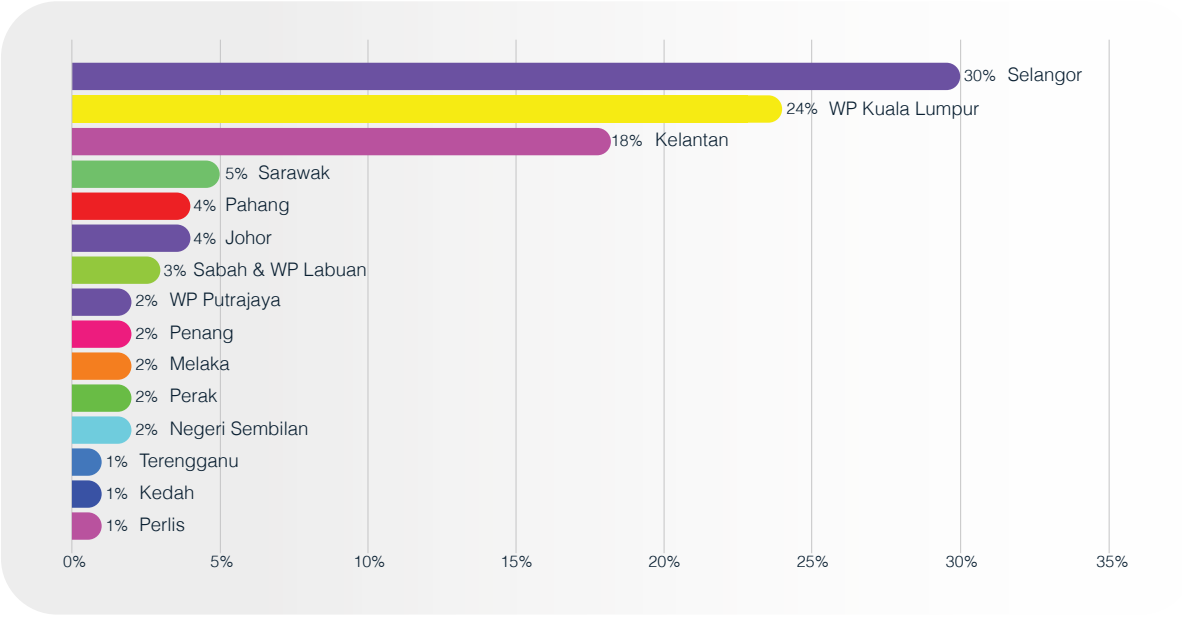


Figure 1: Respondent overview by state

Respondents by Organisation Size

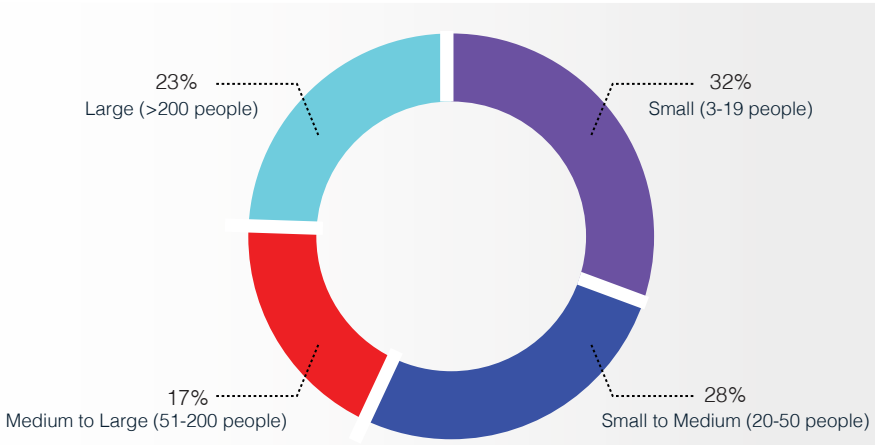


Figure 2: Size of Organisation

Figure 2 reveals the organisation size according to the number of employees in each organisation. The result shows that respondents who came from small organisations dominated the number of respondents who answered the survey (32%), followed by 28%, 23% and 17% for respondents who come from small to medium, large, and medium to large organisations, respectively. The almost equal distribution of organisation sizes is important in assessing the respondents' organisation size in Malaysia as more than half of the construction industry stakeholders are contributed by SMEs.

Respondents by Profession

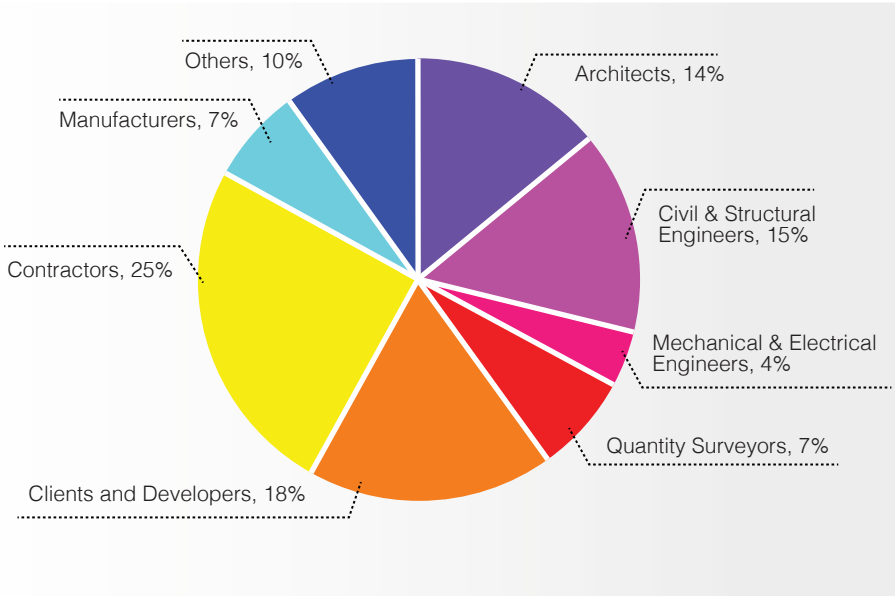


Figure 3: Nature of organisation business

In measuring the BIM adoption for the Malaysian construction industry, it is important to assess the types of professions that are currently practising BIM in their working environment. Figure 3 illustrates the distribution of respondents according to their profession. Contractors dominated the number of respondents who answered the survey at 25%, followed by other professions such as clients and developers (18%), civil and structural engineers (15%), architects (14%), others (10%), manufacturers (7%), quantity surveyors (7%), and mechanical and electrical engineers (4%). When compared with the previous BIM Report, contractors again topped the survey responses with 41% followed by civil and structural engineers (15%). One of the main reasons behind the high number of contractors responding is due to contractors being the biggest industry players in the Malaysian construction industry. The different perspectives and views from the respondents are important in ensuring that the results gained are comprehensive and cater to all construction industry players.

Respondent Working Experience

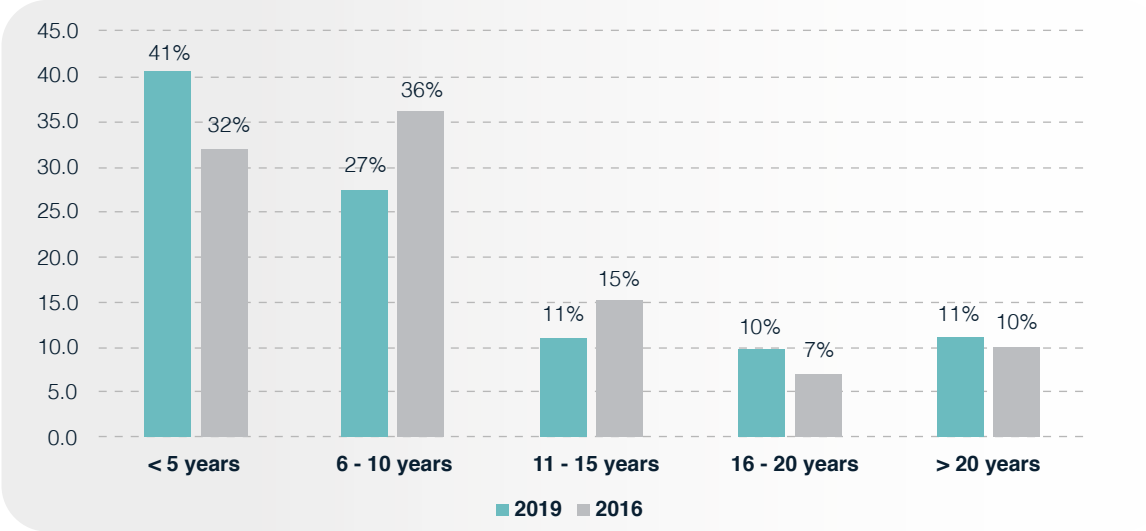


Figure 4: Working experience of respondents

The working experience of the respondents in the construction industry is crucial in assessing the average population experience of the industry players. In 2019, respondents who had less than 5 years' working experience made up the largest proportion of respondents at 41%, an increase from 32% in 2016. Meanwhile, the demographic profile also shows that the number of respondents with working experience of 6–10 years and 11–15 years were down by 9% and 4%, respectively. Interestingly, older respondents who had 16–20 years of working experience and those with more than 20 years' experience both rose in percentage to 10% and 11%, respectively. In contrast, respondents with 10 years or less working experience amounted to 68% of the total respondent population, which is considerably more than half. Hence, the new generation of respondents would require some time to gain more experience in construction. At the same time, the new generation must be trained and equipped with BIM working environment knowledge or any other digitalisation processes in the construction industry as digitalisation will drive our future construction industry. All results are highlighted in Figure 4.

2.3 BIM Knowledge

To keep up with the BIM working environment, every industry player must be fully equipped with BIM knowledge and skills. Prospective workers must be equipped with the necessary education in basic BIM skills through a proper syllabus and practical and hands-on training (World Economic Forum, 2018). Eventually, this will increase the number of BIM players in the future. This section will discuss the general percentage of respondents who know about BIM as well as the sources of information about BIM.

Respondents Who Know About BIM

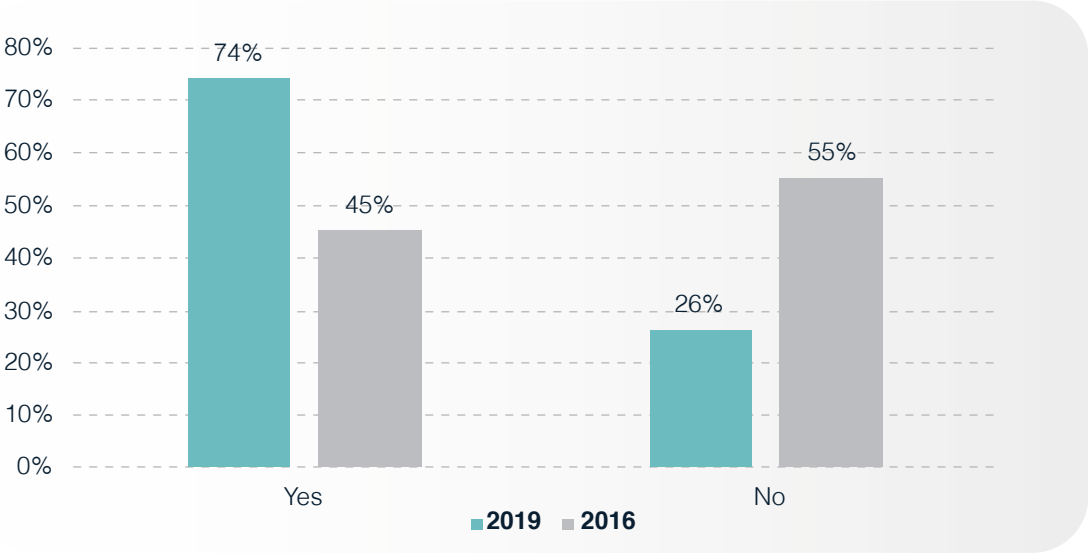


Figure 5: Respondents that know about BIM

BIM knowledge indicates the respondents' view and knowledge about BIM. In 2016, only 45% of the respondents answered Yes for knowing BIM while 55% answered No. The 2019 study found that there has been a drastic improvement in terms of these data. The survey revealed that about 74% of the respondents knew about BIM while only 26% did not as illustrated in Figure 5. Most respondents who made up the minority and did not know about BIM were categorised under the small and medium organisation size. This is where more action needs to be taken to ensure that small and medium enterprises (SME) gain at least the knowledge of BIM in the future.

Organisations play a vital role in transforming their workflow or working environment to suit the current BIM practices. Dodge Data and Analytics (2015) stated that the success of implementing BIM comprises several factors including organisational behaviour, cultural and technological changes by adopting new processes, and standards throughout the workflow. Several Government bodies and organisations currently provide information and services regarding BIM. Figure 6 shows the result from respondents' perspectives regarding the sources of BIM information.

Sources of Information about BIM

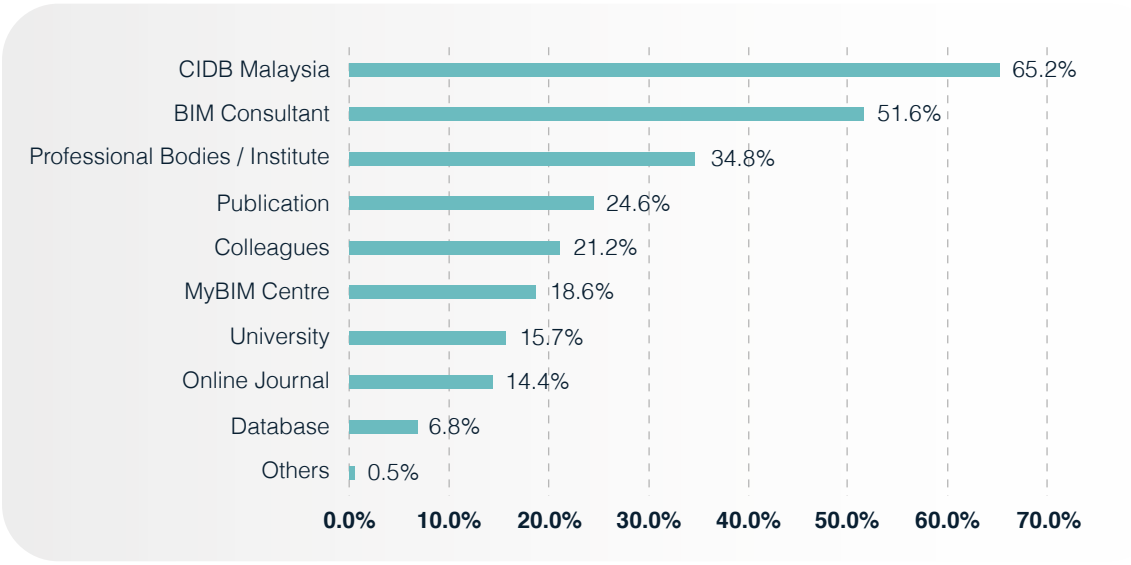


Figure 6: Sources of BIM information

In order to raise the level of BIM awareness among construction industry players, it is important to assess the sources of BIM information from various perspectives. Figure 6 represents various BIM information sources. CIDB Malaysia was cited as the source of BIM information for most of the respondents (65.2%). BIM consultants were ranked in second with 51.6% respondents citing them as sources of BIM knowledge. This was followed by professional bodies or institute (34.8%), publication (24.6%), colleagues (21.2%), and MyBIM Centre (18.6%). In comparison, CIDB has made some drastic improvement in terms of the action taken to strengthen the BIM industry in Malaysia through their training centre, MyBIM Centre which rose from 8% to 18.6%. As most BIM information were disseminated by CIDB and BIM consultants, these two parties can be the focus of more action plans and marketing to increase the respondents' knowledge of BIM. The minimum target should be more respondents at least being aware of BIM.

2.4 BIM Awareness

BIM awareness in Malaysia appears to still be rising since the first national BIM Report was published, increasing from 45% in 2016 to 76% in 2019. Numerous BIM programs and promotions being held around Malaysia either by the CIDB or private sector organisations help in growing the awareness among construction industry players. Apart from discovering the proportion of respondents who know about BIM, BIM Report 2019 also assessed various parameters with regard to the awareness level of BIM such as BIM programs and BIM training.

Attending BIM program

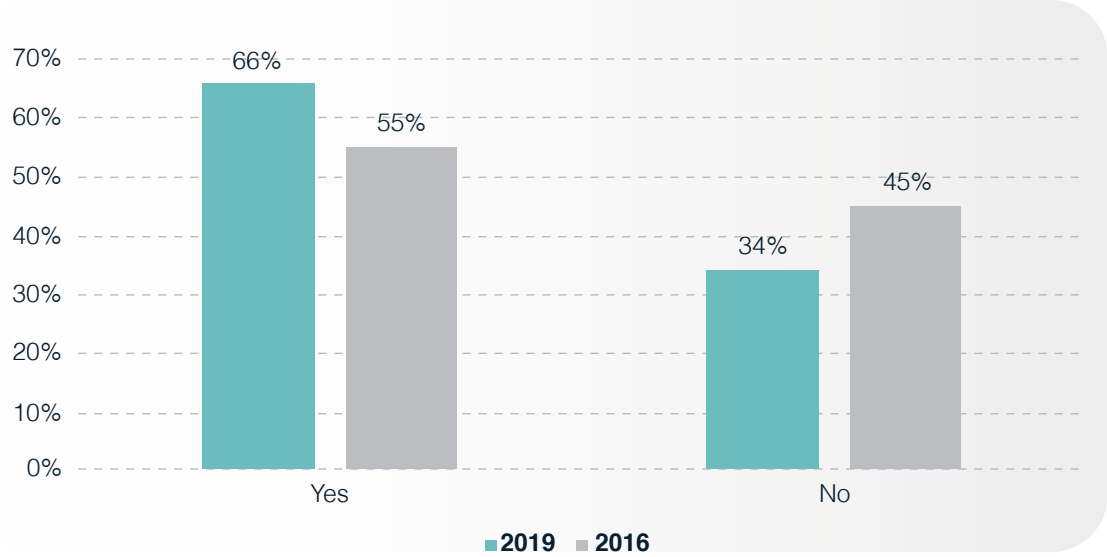


Figure 7: Attending BIM program

Figure 7 shows the percentage of BIM awareness in terms of BIM program attendance. The results revealed a rise in BIM program attendance from 55% to 66% of respondents. This increase shows that most of the respondents are likely to know and be interested in BIM-related programs. The increasing number of respondents who are interested in knowing more about BIM reflects the action taken by the construction stakeholders in empowering the usage of BIM in the projects. CIDB has taken several initiatives in enhancing the development of the BIM industry in Malaysia through CITP, for example training and hands-on guidance for BIM adoption at MyBIM centre, and certification and accreditation programs for BIM personnel (CIDB, 2016).

BIM training provided by organisation

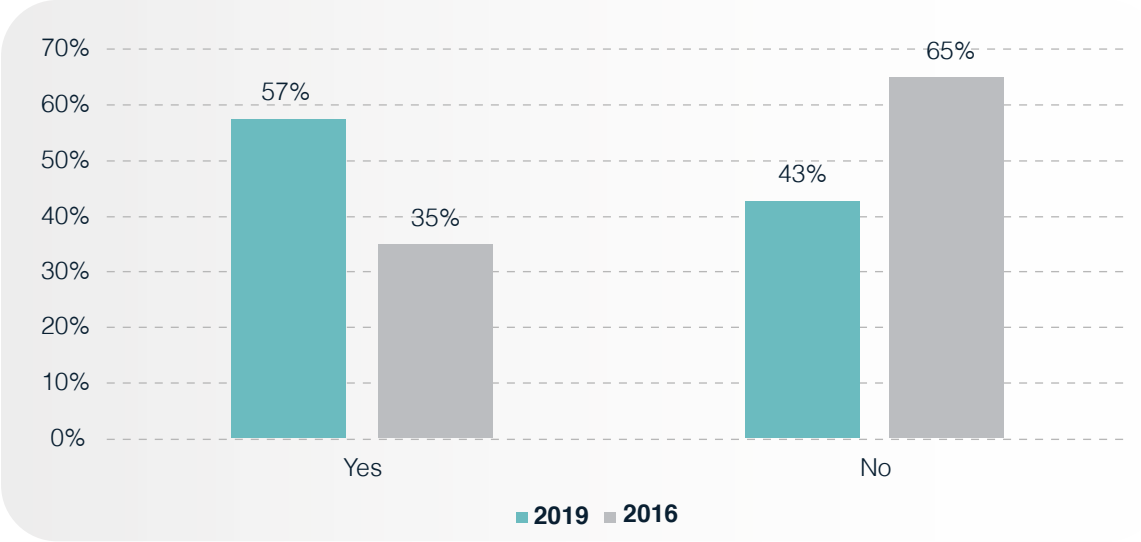
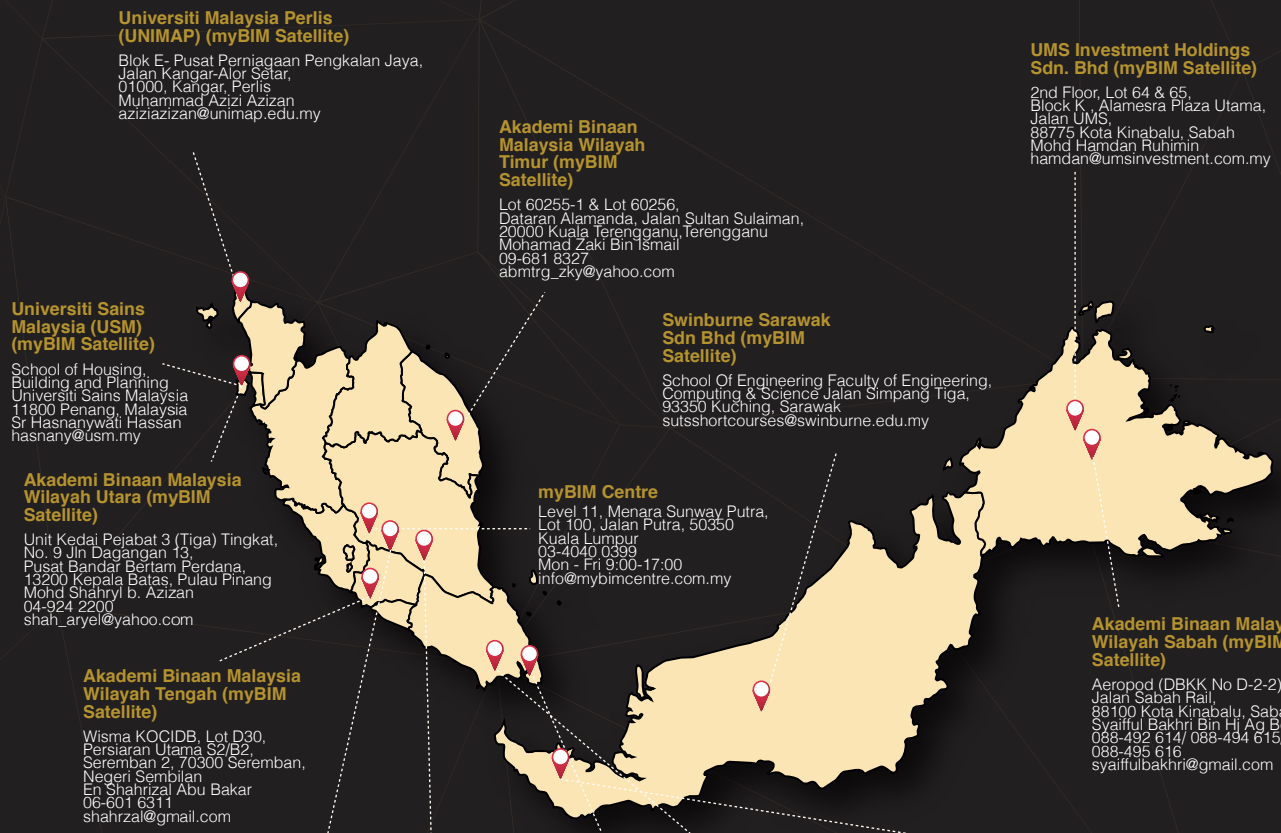


Figure 8: BIM training provided

Training is one of the core elements that needs to be equipped by every worker in each organisation to ensure the competency of construction industry players. CIDB (2016) highlighted the lack of skilled talent to prepare plans in BIM and integrate it with the other stakeholders across the value chain. To overcome this issue, BIM personnel training at accredited training organisations must be consistently conducted. As the awareness level of BIM is increasing over the years, there is some correlation with the awareness level in the organisation as shown in Figure 8. The increase in BIM training given by organisations as evidenced by the increase from 35% to 57% in the survey responses prove that the organisations are aware and willing to change their BIM implementation approach.

QUICK INFO

BIM TRAINING HUB



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QUICK INFO

myBIM SATELLITE

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ABM Wilayah Sarawak

ABM Wilayah Selatan

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ABM Wilayah Utara

2.5 BIM Readiness

BIM readiness assessment is crucial in order to gauge the level of readiness among construction industry stakeholders, especially the SMEs. There are several factors that need to be taken into consideration for the readiness assessment: collaborative processes, knowledge management, people-enhanced skills, and integration of information and automated systems (Ghaffarianhoseini et al., 2016). In this section, some of the components from the key factors mentioned above were asked of the respondents to see their readiness level for BIM implementation.

Interested in establishing BIM

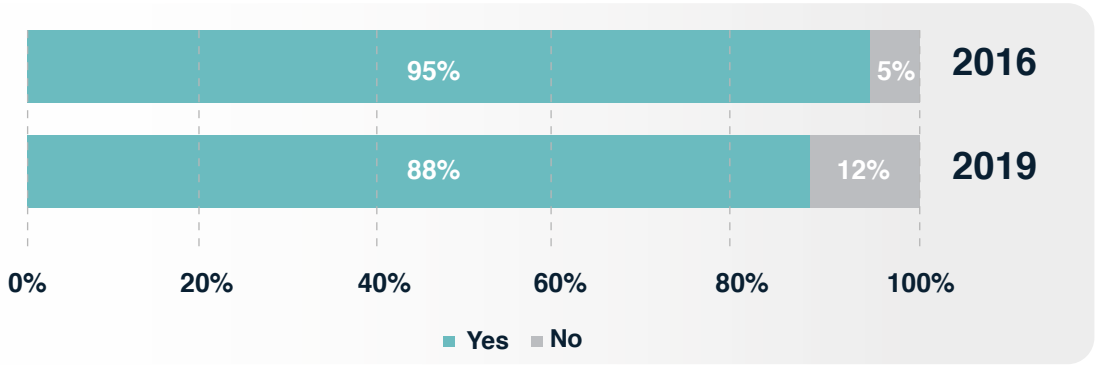


Figure 9: Respondents interested in establishing BIM

The migration of the construction industry players from the conventional working environment into the BIM working environment needs promoted from the foundations. For the new generation, the syllabus at the institutional level needs to include at least a snapshot of the BIM working environment, or if possible, hands-on training to use BIM as in a real project. However, for people who are already in the industry, the change of mindset and willingness to change to BIM must be accelerated by upskilling and reskilling to suit the current technological advancement. All of this will affect the level of interest of the individual in implementing BIM in their project as well as organisation. Figure 9 reveals that the level of interest from the respondents was high. More than 85% of the respondents in both survey years were interested in establishing BIM in their projects.

BIM provides benefits

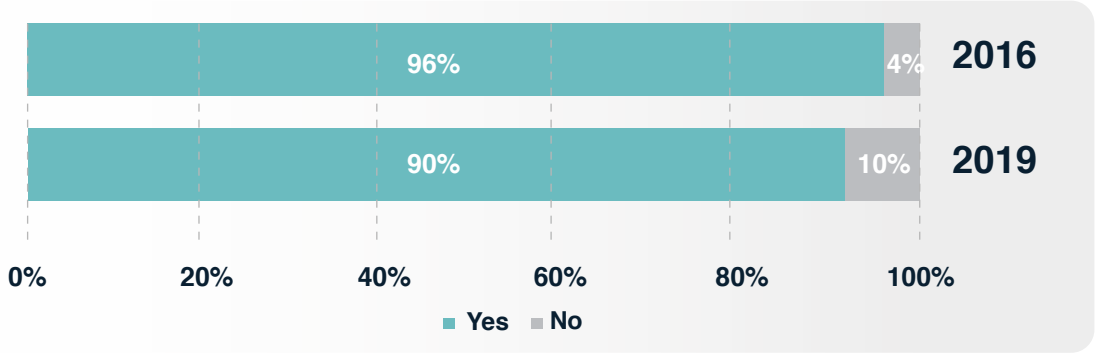


Figure 10: BIM provides benefits for project implementation

In measuring the benefits of BIM, there are three main criteria that need to be taken into account to see whether they have a positive or negative impact on the individual or organisation. Time, cost, and quality are the three crucial criteria that will affect the BIM project implementation (Latiffi, Mohd, & Rakiman, 2016). Figure 10 displays the percentage of benefits provided by BIM for project implementation. More than 90% of the respondents agreed that BIM can provide good benefits for their project implementation as it caters to the time, cost, and quality criteria.

Willingness to change for BIM Implementation

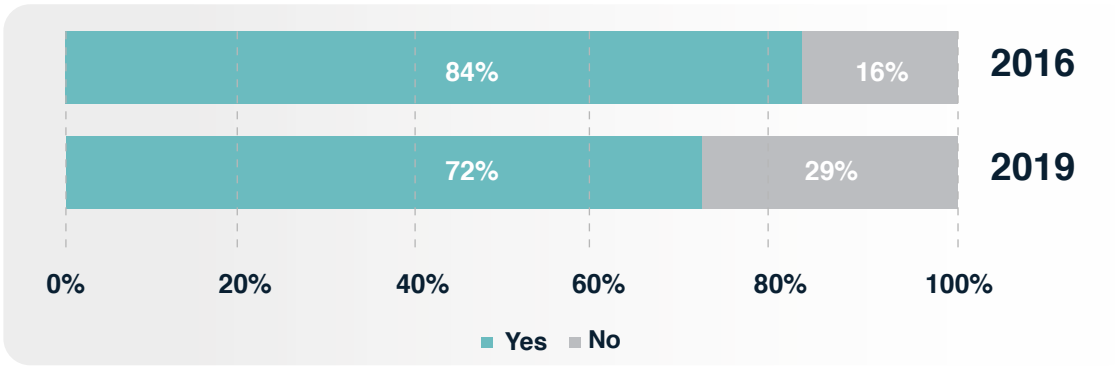


Figure 11: Willingness to change for BIM implementation

People, process, technology, and policy are four main pillars that contribute to improve the performance of the construction industry, especially in BIM (Vukovic, 2015). People are always associated with the change in mindset from the old way of working to the new working style. Here, Figure 11 illustrates the willingness of the respondents to change for BIM implementation. Both survey years show a positive level of willingness to change for BIM (72% in 2019 and 84% in 2016). Both figures are good indications of BIM advancement in the future.

Investment in BIM

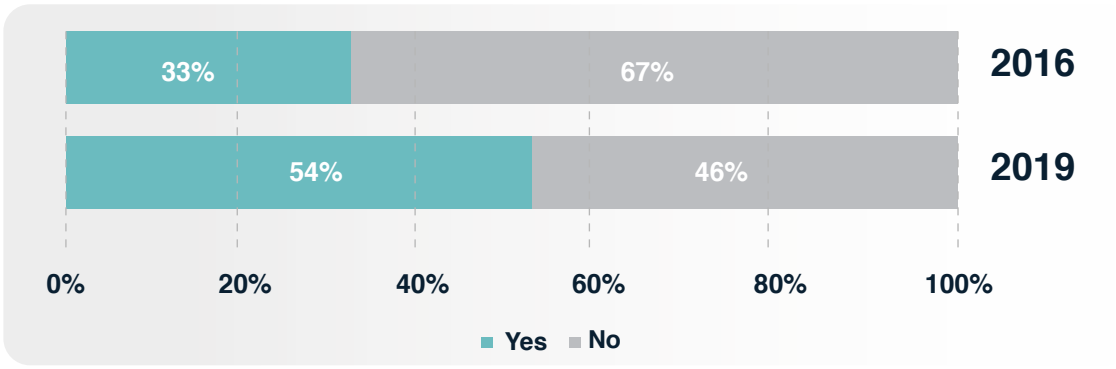


Figure 12: Investment in BIM

Figure 12 illustrates an interesting figure to consider in BIM implementation. From 2016 to 2019, the respondents showed an increase in BIM investment from 33% to 54%. Although the investment in BIM will incur some financial setback, it will provide a beneficial impact to the individual and organisation in the future. The return of investment (ROI) will definitely be gained by the organisation if BIM is fully and wisely utilised throughout the construction project lifecycle. This is supported by the statement from McGraw Hill (2014) where the surveyed report from three quarters of the constructors showed a positive ROI on their investment in BIM.

Organisation financial allocation for BIM

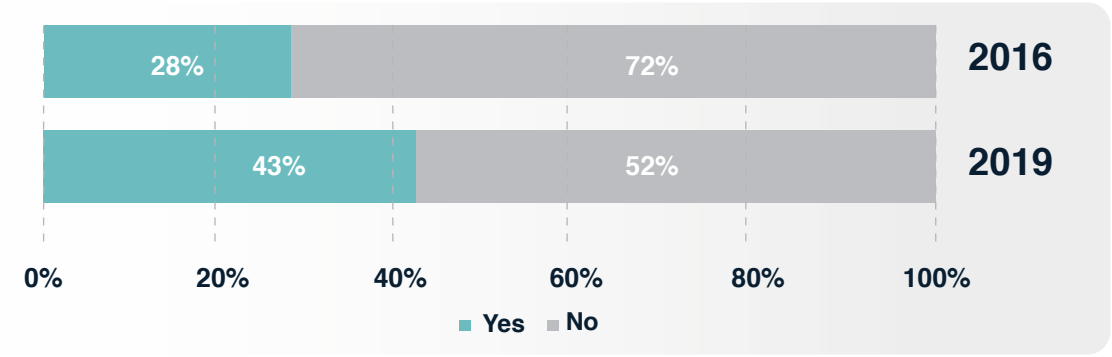


Figure 13: Organisation financial allocation for BIM

Along with the investment into BIM in the organisation, the financial allocation for BIM is also important to measure the readiness level of BIM implementation in Malaysia. Figure 13 shows that almost 43% of the respondents agreed with allocating some financial expenditure in their organisation to improve or to kick-start the BIM working environment. The rise in the percentage of organisation financial allocation for BIM also reflects the increased BIM awareness rate as a higher investment and financial allocation for BIM means that BIM is a concern and has gained the attention of the organisation, especially the top management.

Clear policies to support BIM Implementation

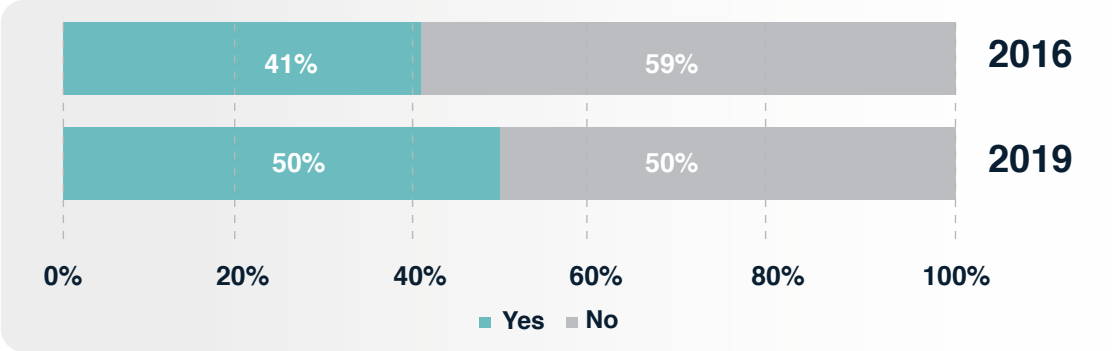
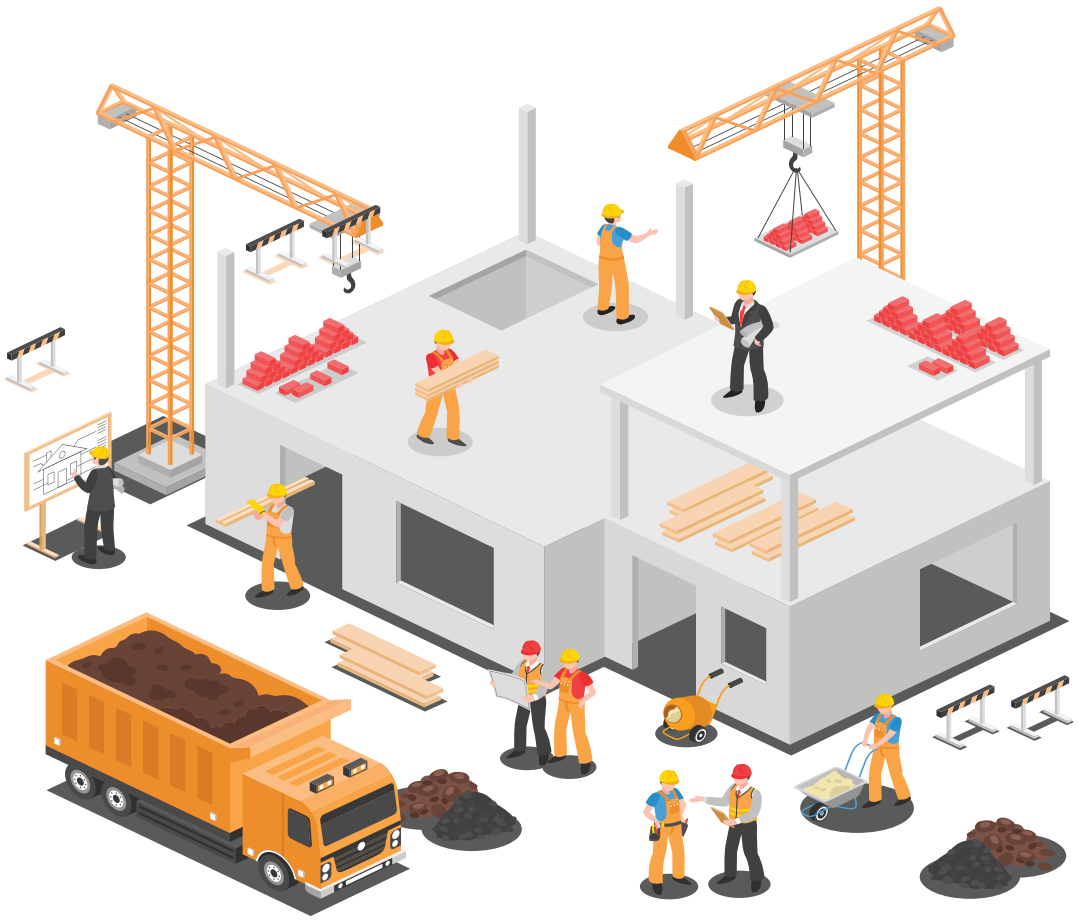


Figure 14: Policies on BIM implementation

As mentioned earlier, policy is one of the main pillars that is crucial to support BIM implementation. To date, most of the BIM implementors are having difficulties in terms of the structured policy interventions to drive BIM implementation. Figure 14 shows that there has been an improvement in clear policies either from the Government or organisation to support BIM implementation. The number of respondents who answered in the affirmative rose from 41% in 2016 to 50% in 2019. To fully drive the BIM implementation in the projects, several mechanisms such as policy and government involvement are needed to push the industry forward into a collaborative and integrated BIM working environment (NBS, 2016).



QUICK INFO

HRDF CLAIMABLE

CCd points Approved

myBIM CIDB MALAYSIA

BIM PROFICIENCY TRAINING

01	BIM CONCEPT & THEORY
02	FUNDAMENTAL MODELLING OF ARCHITECTURE
03	FUNDAMENTAL MODELLING OF STRUCTURE
04	FUNDAMENTAL MODELLING OF ELECTRICAL
05	FUNDAMENTAL MODELLING OF MECHANICAL & PLUMBING
06	FUNDAMENTAL MODELLING OF INFRASTRUCTURE (ROADS & HIGHWAYS)
07	BIM COORDINATOR PART 1: SETUP
08	BIM COORDINATOR PART 2: COORDINATION
09	BIM COORDINATOR FACILITIES MANAGEMENT
10	BIM MANAGER PART 1
11	BIM MANAGER PART 2
12	BIM PROJECT QUANTIFICATION

FOR MORE INFORMATION:

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- Website: mybim.cidb.gov.my
- Email: training@econstruct.com.my
- Location: myBIM Centre, 11th Floor, Menara Sunway Putra, 100, Jalan Putra, 50350 Kuala Lumpur
- HRDF claimable and CCD points approved

2.6 BIM Adoption Rate in Malaysia

BIM adoption rate is important for measuring the level of implementation among construction industry players in Malaysia. Currently, the developments and major projects are located mostly in the Klang Valley region. Due to this, the area has accumulated a large number of construction industry players within its boundaries. The previous report on BIM adoption rate showed that 17% of the respondents had experience in using BIM. After 3 years, a positive increment has been recorded with 49% of BIM adoption by respondents as shown in Figure 15. The percentage of BIM adoption in 2019 showed a drastic improvement as it increased by almost triple from the previous figure. This could indicate a bright future of the BIM industry in Malaysia as the result portrays a good impact.

Respondent BIM Adoption

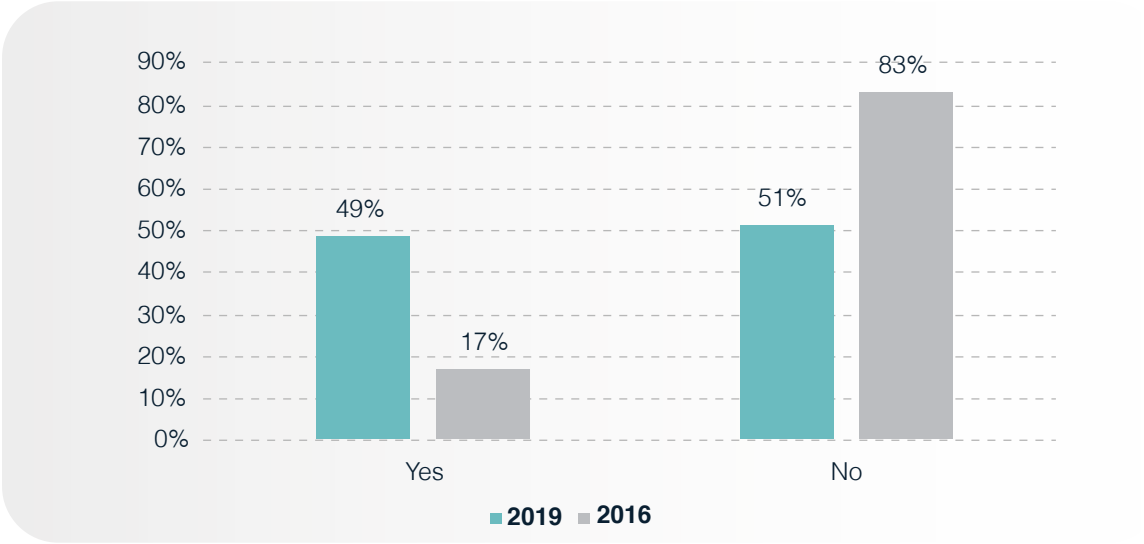

Figure 15: BIM adoption rate

BIM Adoption by Region

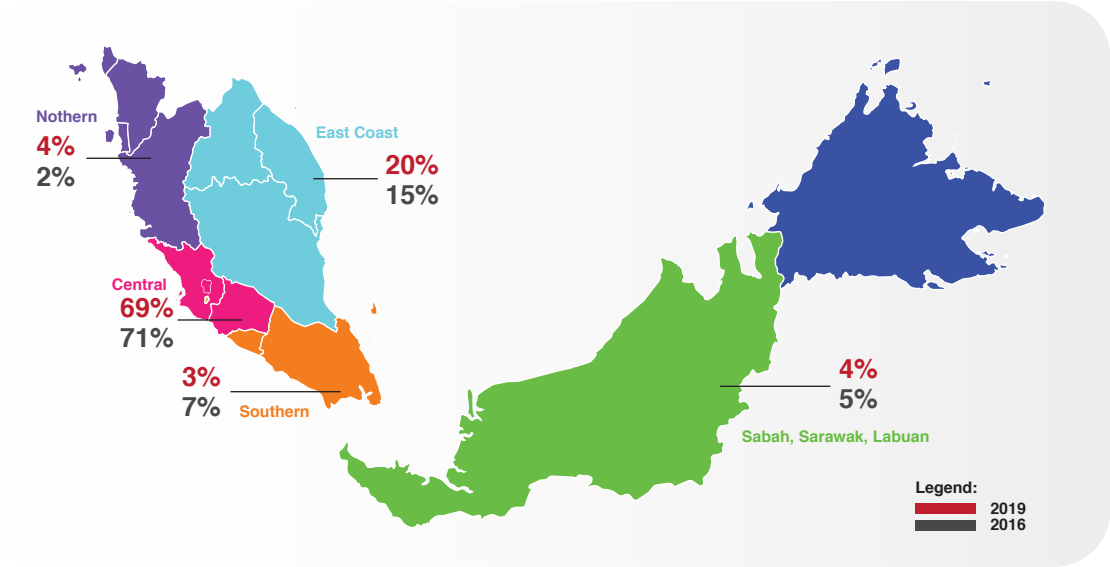

Figure 16: BIM adoption by region

Figure 16 illustrates the distribution of BIM adopters according to several regions based on the response rate: Northern, Central, East Coast, Southern, and Borneo East. According to the result, a high number of implementors are located in the Central region which consists of five states: The Federal Territory of Kuala Lumpur, The Federal Territory of Putrajaya, Selangor, Malacca, and Negeri Sembilan with almost 69% BIM adoption rate. Selangor recorded the highest number of BIM implementors with 35%, followed by The Federal Territory of Kuala Lumpur (28%), Malacca (3%), The Federal Territory of Putrajaya (2%), and Negeri Sembilan (1%). Since most mega projects are ongoing in the Klang Valley region, there are many BIM implementors in this region. The East Coast region (Terengganu, Kelantan, and Pahang) showed a positive increment to 20% in 2019 compared with the 2016 report at 15% BIM adoption. The Southern region (Johor) recorded about 3% BIM adoption rate by respondents while the Northern region (Kedah, Perak, and Penang) showed an increment to 4% of BIM adoption. In Borneo East, a slight change in the percentage of BIM implementors occurred as it had about 4% BIM adoption compared with the previous 5%. The rate of respondents' BIM adoption broken down by region is important in empowering the low percentage of BIM adoption in certain targeted regions as well as driving more BIM advancement for the others. It must be noted that the percentage of adoption by region is only based on the number of respondents from the data collection.

BIM Adoption by Working Experience

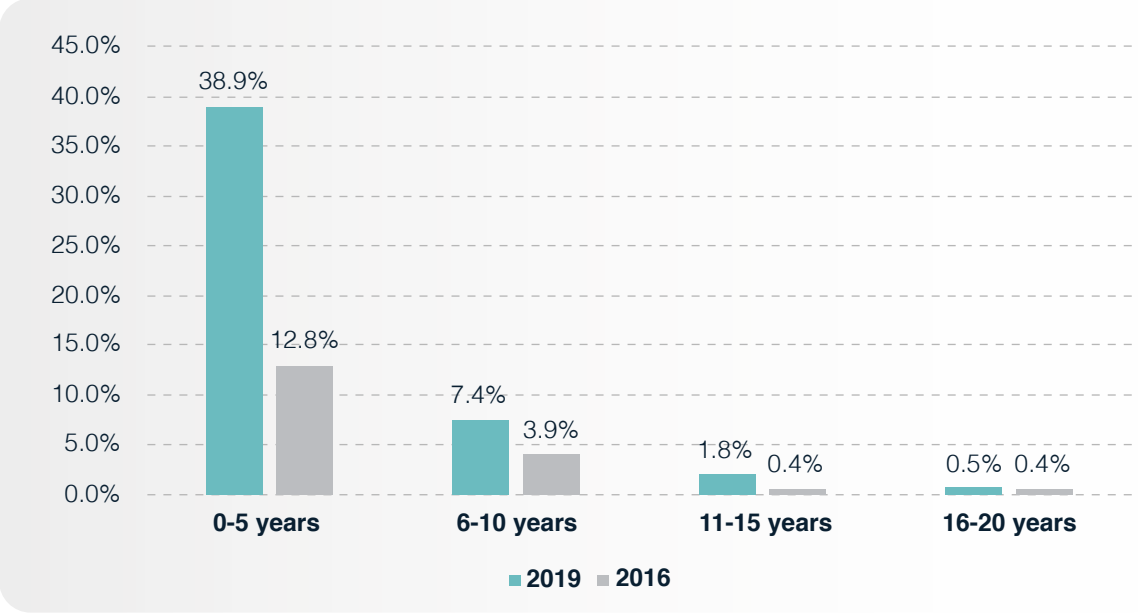

Figure 17: Respondents with working experience in BIM

To assess the competency of BIM personnel, one of the main components that needs to be looked into is their working experience. Figure 17 demonstrates the distribution of BIM adoption according to the respondents' working experience in BIM. As the BIM industry in Malaysia is still in the middle stages of implementation, the result shows about 1.8% and 0.5% of respondents had 11–15 years and 16–20 years of working experience, respectively. However, the main thing to be highlighted here is the percentage of respondents with less than 10 years of working experience in BIM. These two groups will drive the BIM industry in the future as most of the new generation are already aware and some of them are already implementing it in their projects. Most of the respondents with 6–10 years of working experience will lead BIM projects in the future. This is one the important aspects to be taken care of because most of them will become a 'mentor' to the new generation with 0–5 years of working experience. The highest percentage was recorded for respondents with 0–5 years of working experience followed by 7.4% for those with 6–10 years of working experience.

2.6.4 BIM Adoption by Profession

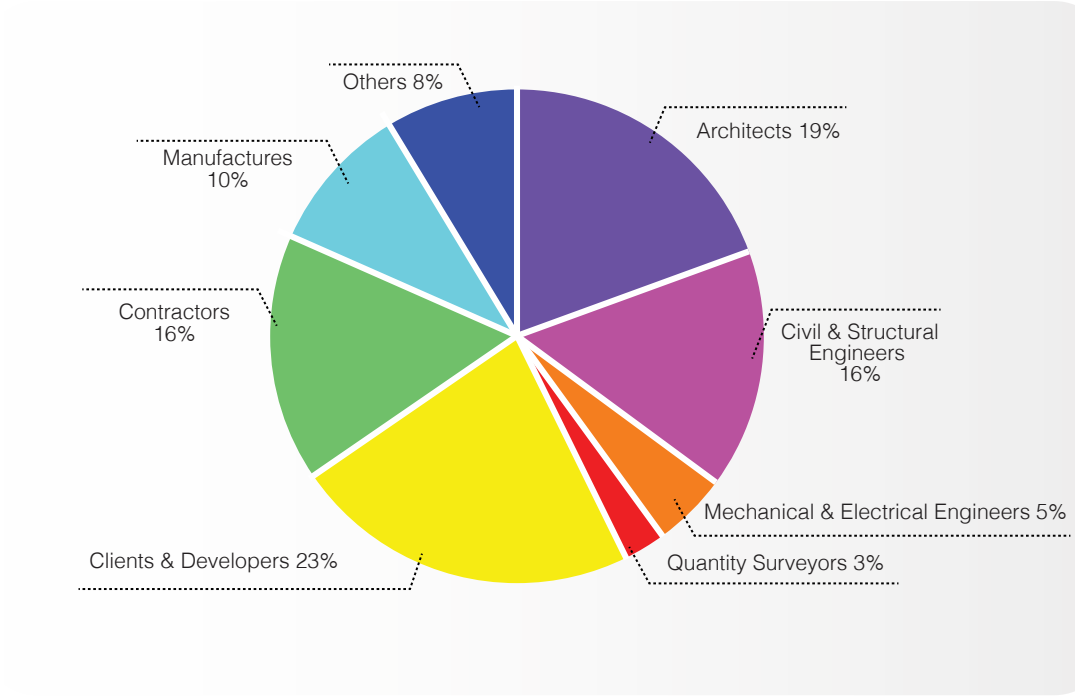

Figure 18: BIM adoption by profession

Figure 18 demonstrates the adoption of BIM according to the professions of the respondents. The result shows that clients and developers are the top BIM implementors with 23% and followed by the architects (19%), civil and structural engineers (16%), and contractors (16%). The survey questionnaire also captured that about 10% of the manufacturers are using BIM in their projects as well as others (8%), mechanical and electrical engineers (5%), and quantity surveyors (3%). By looking into the result, it can be seen that most of the BIM adopters are clients and developers. These two groups have the power to include BIM in the project requirements. Eventually, this can drive the industry to change and adapt to the new working environment by using BIM. CITP has highlighted some of the requirements set by the Public Works Department (PWD) Malaysia to implement BIM for all public building projects including hospitals and schools which cost more than RM 100 million (CIDB, 2019b).

BIM Adoption by Organisation Size

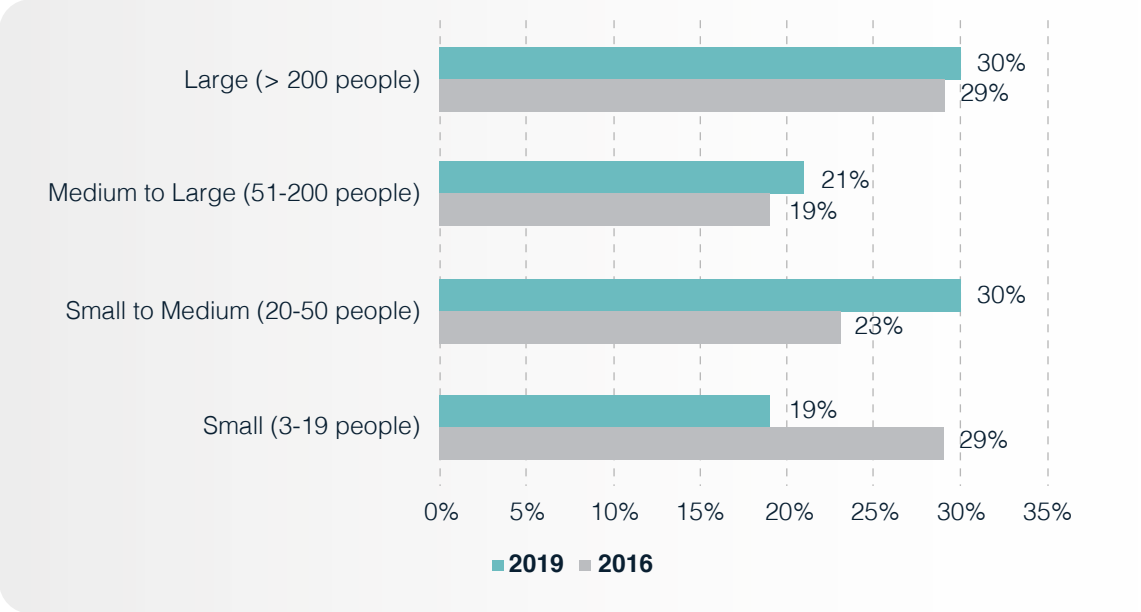

Figure 19: BIM adoption by organisation size

Figure 19 shows the organisation size of BIM adopters. Large and small to medium organisations dominate the result from the survey questionnaire with 30% each. For medium to large and small organisations, only 21% and 19% adopted BIM. Overall, for future BIM implementation, attention should be paid to small and medium enterprises (SMEs) because their numbers dominate the proportion of construction industry players in Malaysia. Apart from that, industrial engagement between the SMEs and the big players in the industry in terms of knowledge transfer and BIM attachment programs should be enhanced to drive the SMEs into BIM implementation. This collaborative working environment will create and effect some changes with the capabilities of the newcomers and their exposure to BIM especially for the SMEs. In fact, the BIM Incentive Scheme provided by the CIDB also helps the SMEs in kick-starting and building the capabilities to implement BIM in Government projects.

Tools used in models/drawings

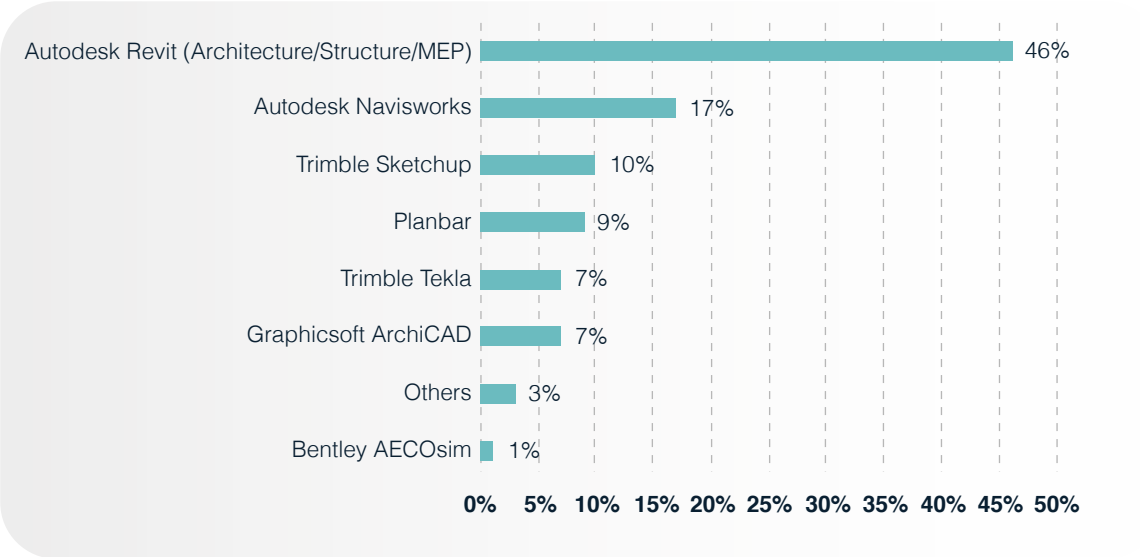

Figure 20: Tools used in models/drawings

In the BIM working environment, there are two essential components in the implementation of BIM: 3D modelling software and Common Data Environments (CDEs) (NBS, 2019). Figure 20 shows the most common tools used by the respondents. Autodesk Revit continues to lead as the most used software for the production of models or drawings with about 46% of the respondents using it. Less repetition of building model and multidiscipline coordination are listed as two of the main reasons for the high number of respondents using Autodesk Revit in their daily work and projects (Shah, 2020). Another product used for design and clash detection, Autodesk Navisworks is favoured by 17% of the respondents and followed by Trimble Sketchup (10%), Planbar (9%), Tekla (7%), and Graphisoft ArchiCAD (7%).

BIM models coordination between all disciplines for projects

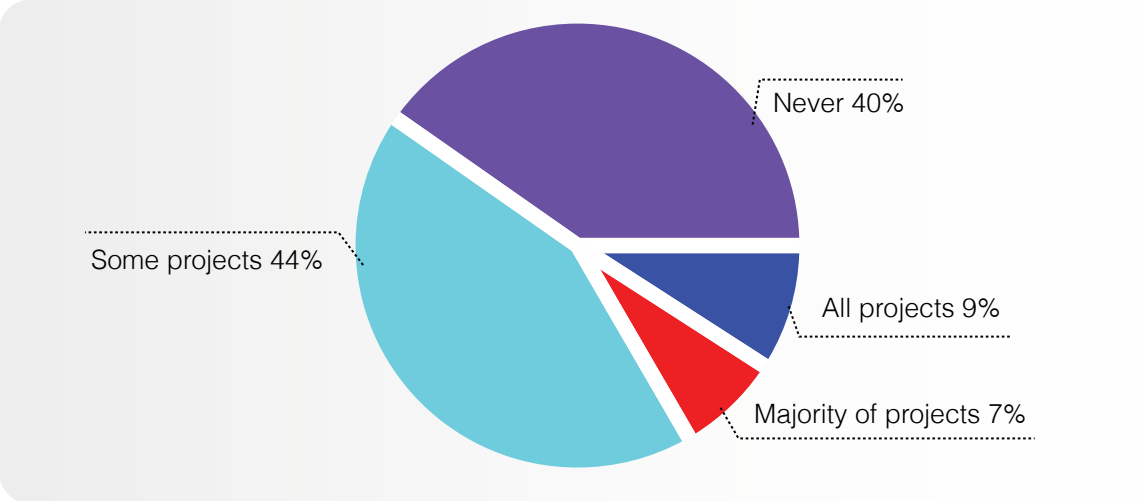

Figure 21: BIM models coordination for projects

Figure 21 illustrates the proportion of BIM models coordination for projects as answered by the respondents. Most of the respondents answered Some Projects (44%) as the integration and collaboration of BIM in Malaysia is still at a moderate stage. A slightly fewer number of respondents (40%) said that they have never been involved in coordination between all disciplines for projects, which can be considered as working in-silo. There is a bright future for the Malaysian BIM industry as 9% of respondents said they have used full models coordination while 7% said they used it for the majority of the projects. BIM models coordination typically involves the ability of the BIM implementors to collaborate and work together with the other disciplines and also depends on the type of BIM tools being used throughout the whole project (NBS, 2019). Interoperability between different BIM tools also plays an important role to ensure a smooth coordination for the success of projects.

Level of confidence regarding knowledge and skill in BIM

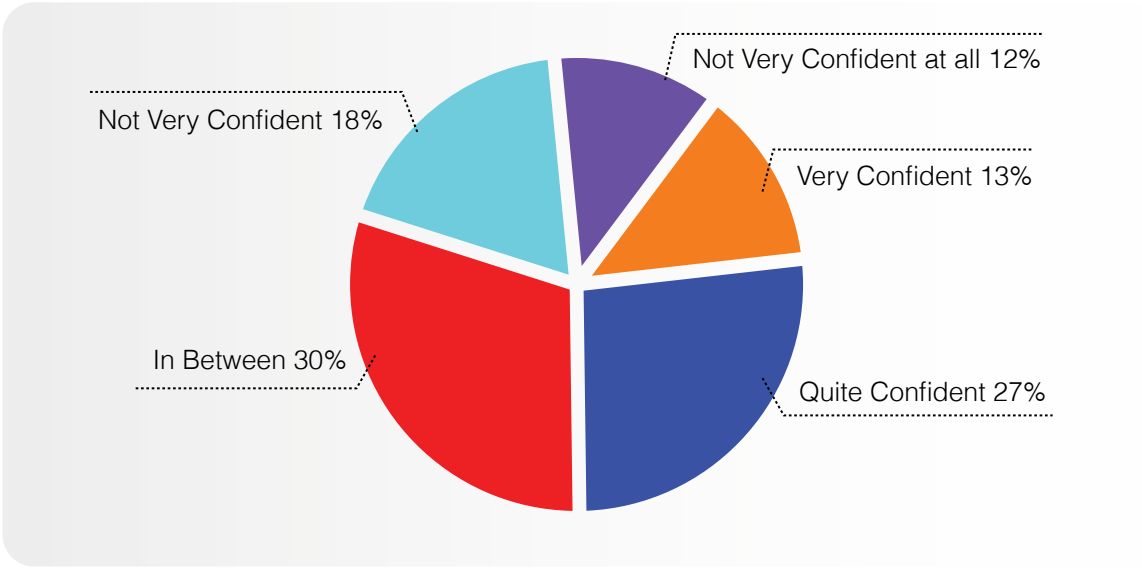

Figure 22: Level of confidence in using BIM

BIM knowledge and skills are important to display the level of confidence for BIM implementors. The results in Figure 22 show that 30% of the respondent had an average level of confidence in their BIM skill and knowledge. Confident and very confident respondents made up 40% of the respondents, which is proof of promising growth and development in the BIM industry in Malaysia. To reduce the 30% of respondents with low level of confidence in their BIM skill and knowledge, it is important to have more training, seminars, and sharing discussions with these industry players to boost their confidence and knowledge in BIM. In fact, the 30% of respondents who have low confidence level in using BIM might feel that they understand the whole processes of BIM operation in their projects but they possess little confidence or are not familiar with the usage of BIM tools as they are more comfortable in a conventional working environment (Toronto, 2019).

QUICK INFO

Government Initiative towards Building Information Modelling (BIM) Under the Eleventh Malaysia Plan (11th MP):

Number of Government projects using BIM

BUILDING PROJECTS

20 *Projects RM 50 million and above*

6	6	6	2
In Construction stage	*In Design stage*	*In Planning stage*	*In Tender stage*

INFRASTRUCTURE PROJECTS

6 *Projects RM 50 million and above*

1	1	2	2
In Construction stage	*In Design stage*	*In Planning stage*	*In Tender stage*

Under Productivity Thrust in Construction Industry Transformations Programme (CITP), it focused on the implementation of BIM for JKR building projects only. Besides, 6 infrastructure projects worth RM 50 million and above also applied BIM throughout the project implementation.

2.7 Challenges in Implementing BIM

This report presents the current BIM adoption level among construction industry players in Malaysia. Several initiatives implemented by the CIDB together with multiple stakeholders in CITP can be achieved by continuous monitoring, evaluation, and modification. To measure the effectiveness of each initiative implementation, an in-depth understanding of current challenges faced by the industry players is vital. This finding enables the CIDB to improve future strategies in supporting the digital transformation in the construction industry.

Table 3 presents the challenges highlighted after several initiatives implemented under CITP from 2016–2019. Challenges in BIM are always associated with four main pillars, which are people, process, technology, and policy (Vukovic, 2015). The result indicates that the high cost of technology, high cost of software, high training cost, lack of knowledge, and lack of experience to coordinate the construction documents by using BIM are among critical challenges that need to be overcome. Based on the results, technology pillars are listed among the top for both identified challenges in BIM implementation. Cost remains the most challenging issue highlighted by the construction players in both reports. Cost issues will remain critical if the construction industry does not perceive the value of BIM. In 2019, a study on cost benefit analysis was conducted by the CIDB together with CREAM. This study aimed to measure BIM costs/benefits by analysing data extracted from organisations that have implemented BIM. It was found that the revenue for several organisations increased in certain year. However, this depended on the number of BIM projects. The demand side for BIM projects need to be increased to realise industry transformation towards BIM.

The limited number of professionals who are competent and capable of implementing BIM, which is regarded as resistance based on the “human factor”, is another factor that limits the adoption of BIM. This factor falls under People pillars. The result shows the lack of BIM knowledge and experience as critical issues for BIM adoption. This phenomenon occurs when the industry is not equipped with a set of BIM knowledge. Organisations should develop the capability of people with the set of skills and knowledge of BIM. Most organisations are concerned that the learning curve in adopting BIM could affect their respective businesses. In addition, the lack of experience to coordinate BIM implementation tends to cause problems and extend the period of the learning curve. This is supported by a study conducted by Latiffi et al. (2016) which showed that lack of knowledge and skills in BIM will contribute to lower productivity among the construction players. The availability of references and handholding programs will empower organisations with sources of information that will aid them during the learning process.

Process is also identified as one of the challenges faced by the construction industry players in implementing BIM throughout the whole construction stage. Looking at Table 3, the reluctancy to initiate new workflows for BIM implementation is ranked higher in 2019 compared to the result in 2016. Apart from that, “no established contractual framework for BIM” is also highlighted as one of the biggest challenges to implement BIM. NBS (2019) also recorded that almost 36% and 48% of the respondents in UK and Ireland, respectively agreed about having the same issues when there is no established contractual framework for working with BIM.

Moreover, issues on policies also contribute to the barriers and challenges to implement BIM. The issue of lack of clear policies that support BIM implementation is one the central issues because it could lead to unproductive and slow adoption of BIM for the projects. Latiffi et al. (2016) also mentioned the personal BIM guideline that has been developed by most of the construction industry players which has an impact in terms of confusion among the construction industry players. Almost 26% of the respondents agreed that lack of guideline contribute to the main barriers to use BIM based on the report from Toronto (2019). To enhance the usage of BIM in the future, the step taken by other countries such as the UK, Italy, Dubai, Singapore, Sweden, Australia and Hong Kong that mandates BIM for certain requirements should be taken as an exemplar in empowering the usage of BIM in the Malaysian construction industry.

Table 3: Identified challenges in BIM implementation

No	2019	2016
1	High cost of technology	High cost of technology
2	High cost of software	High training cost
3	High training cost	Lack of BIM knowledge
4	Lack of BIM knowledge	High cost of software
5	Lack of experience to coordinate the construction documents by using BIM	Insufficient BIM training available
6	Lack of clear policies that support BIM implementation	Lack of time for experimentation and implementation in fast paced project
7	No established contractual framework for working with BIM	Lack of references to assist in implementing BIM
8	Reluctance to initiate new workflows for implementation of BIM	Lack of awareness of BIM benefits
9	Lack of organisation familiarisation to implement BIM	Lack of time to implement
10	Lack of time for experimentation and implementation in fast paced project	Lack of competency among team members in using BIM
11	Lack of time to implement	Existing hardware not capable to run basic BIM software
12	Lack of awareness of BIM benefits	Reluctance to initiate new workflows for implementation of BIM
13	Lack of references / sources to assist in implementing BIM	Lack of direction of BIM in industry
14	There is no BIM requirement / mandate in the industry	Our organisation is not familiar enough with BIM usage
15	Insufficient BIM training available	There is no BIM requirement/mandate in the industry
16	Resistance to change for new technology	BIM software is complicated to use
17	Lack of direction of BIM in industry	Resistance to change for new technology
18	Existing hardware not capable to run basic BIM software	The assumption that conventional methods are better than new processes
19	The assumption that conventional methods are better than new processes	
20	Hard to implement BIM coordination	

2.8 Expected Benefits

There are several benefits gained by the BIM adopters throughout the construction lifecycle. The level of benefits varies for every personnel, depending on what tasks are being done and the objective of the projects. All the result is tabulated in Table 4. The potential benefits that could be reaped from the BIM implementation include improving the visualisation of the projects. A normal working environment does not allow for the visualisation of the project compared to using BIM which allows for the visualisation and simulation of the building even before the projects starts. This actually is important for the stakeholders especially the client to make decisions and make some changes or amendments if there is a need to do so without doing it on-site.

Moreover, BIM also allows a collaborative and integrated working environment among project team members which can increase the capacity and capability of the other stakeholders indirectly. Here, the sharing of data between the team members is enhanced as it can save time and money without spending too much time on meetings. The digital platform will allow the team members to collaborate across the design and constructions stages (Hore, McAuley, & West, 2017). NBS (2019) also highlighted that adopting BIM would increase the coordination of construction documents and this was agreed by almost 81% of the respondents based on their survey questionnaire.

Clash detection has been identified as one of the major problems that always occurs during the design and construction stages. In the conventional approach, overlapping design on the tracing papers will project all the collision intersections. The same method is used in CAD 2D systems where layers in different colours will be overlaid and compared to solve the clash issue (Czmoch & Pękala, 2014). But in the modern method, clash detection could be solved mostly during the design stage by using BIM tools. This is one of the crucial potential benefits than can be reaped from the implementation of BIM as it can save cost and time rather than solving it during the construction stage. Most of the respondents agreed that improving the clash detection by using BIM models is beneficial to the user as it can result in cost efficiencies (NBS, 2019).

Table 4: Expected benefits

No	2019	2016
1	Improve visualisation of the project	Improve project understanding
2	Improve collaboration among project team members	Improve construction planning and monitoring
3	Improve project understanding	Improve coordination between client-consultant-contractor
4	Improve construction planning and monitoring	Improve visualisation of the project
5	Improve clash detections by using BIM models	3D/4D clash detection
6	Better quality control of project	Improve collaboration among project team members
7	Improve information sharing for all stakeholders throughout project life cycle	Decision making tools
8	As a decision-making tools	Transparency of design for all stakeholders
9	Improve coordination between stakeholders	Greater predictability of project
10	Promotes early and accurate decision making	Increase organisation competitive advantage
11	Increase productivity of construction project	Better quality control of project
12	Easier to adopt different design options and concepts	Increased productivity of construction project
13	Reduced information request (RFI) during construction process	Promotes early decision making
14	Greater predictability of project success (cost, time, quality, etc.)	Provide cost information for early decision making
15	Reduce dispute between parties involve	Reduce RFI (Request for Information) during construction process
16	Increase organisation competitive advantage	Implication of different design options and concepts
17	Increase project turnover	Increase project turnover
18	Ability to reduce the overall project duration	Ability to reduce the overall project duration
19	Improve regulatory approval	Improve regulatory approval
20		Dispute avoidance

QUICK INFO

BIM GUIDE BOOK SERIES AND BIM REPORT

BIM GUIDE 1 – AWARENESS

BIM GUIDE 2 – READINESS

BIM GUIDE 3 – ADOPTION

BIM GUIDE 4 – BIM EXECUTION PLAN

BIM GUIDE 5 – BIM PROJECT GUIDE

BIM REPORT 2016

03

FUTURE DIRECTIONS BIM

03
FUTURE DIRECTION OF BIM

3.1 BIM in CITP

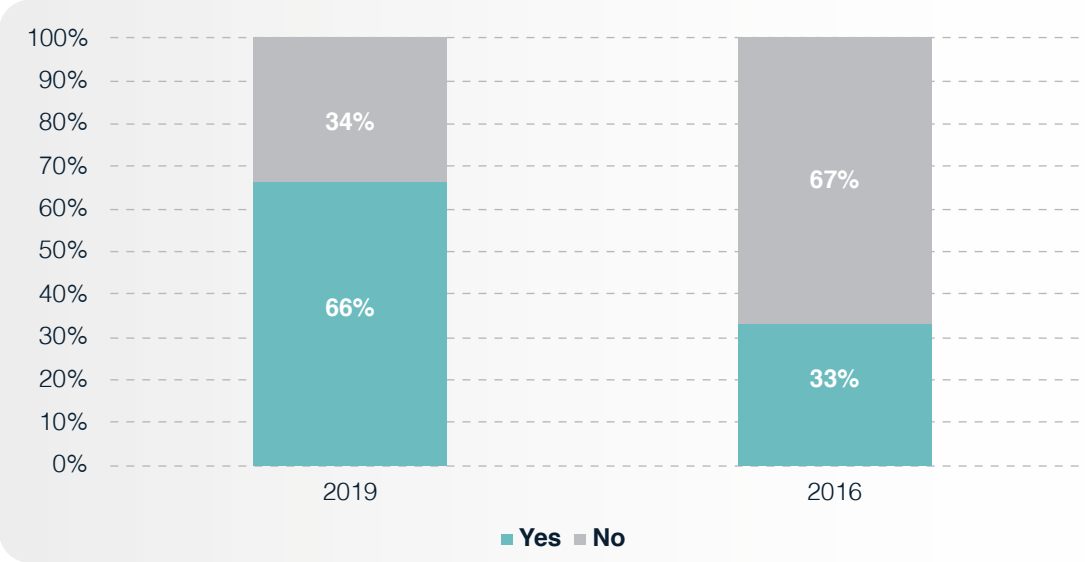

Figure 23: Awareness of BIM in CITP

CITP will reach its end in 2020. By the end of this year the effectiveness of CITP in driving the Malaysian construction industry, in this case for the BIM industry, will be shown. As CITP has gone through some reviews in 2019, it can be seen that one of the goals is to achieve 70% BIM adoption in private and public building projects above RM 10 million by January 2021 and 100% of all public building projects above RM 100 million (for PWD building projects) using BIM Level 2 by the 4th quarter in 2020. Along with the implementation of CITP, the survey questionnaire also caters to the awareness of respondents regarding BIM in CITP. The result in Figure 23 shows that there is a doubling of BIM awareness in CITP from 33% to 66%. This shows that more than half of the respondents are aware of the BIM initiatives in CITP. As the Government now is more focused on empowering the usage of BIM in the future, this could be an early indicator that most of the respondents are aware that BIM will drive the Malaysian construction industry and more requirements to use BIM will be enforced in the future.

3.2 Mandating usage of BIM in the future

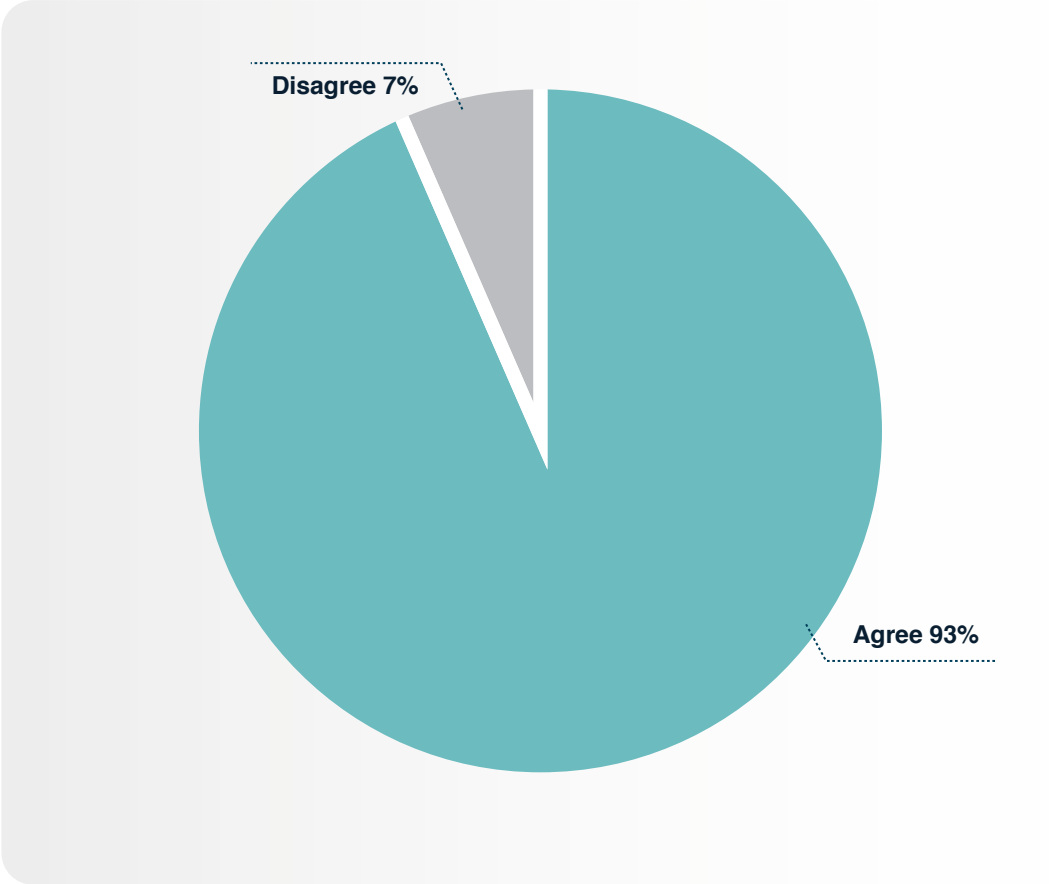

Figure 24: Mandate usage of BIM

A new set of questions were asked to the respondents to discover their opinion regarding mandating the usage of BIM in the future as shown in Figure 24. About 93% of the respondents agreed that BIM should be mandated in some projects to help grow the BIM industry in Malaysia. There are examples of success stories from other countries such as the UK and Sweden where the governments mandated the usage of BIM (according to the requirements) starting in 2016 (Hore et al., 2017). This should be one of the initiatives to be implemented by our Government in developing and empowering the BIM industry in Malaysia. Eventually, this will create a forced demand situation for the industry including the SMEs to change into the BIM working environment and supported by several initiatives and strategic plans to make sure no one is left behind in the digital transformation.

3.3 Adequacy of resources to assist BIM implementation

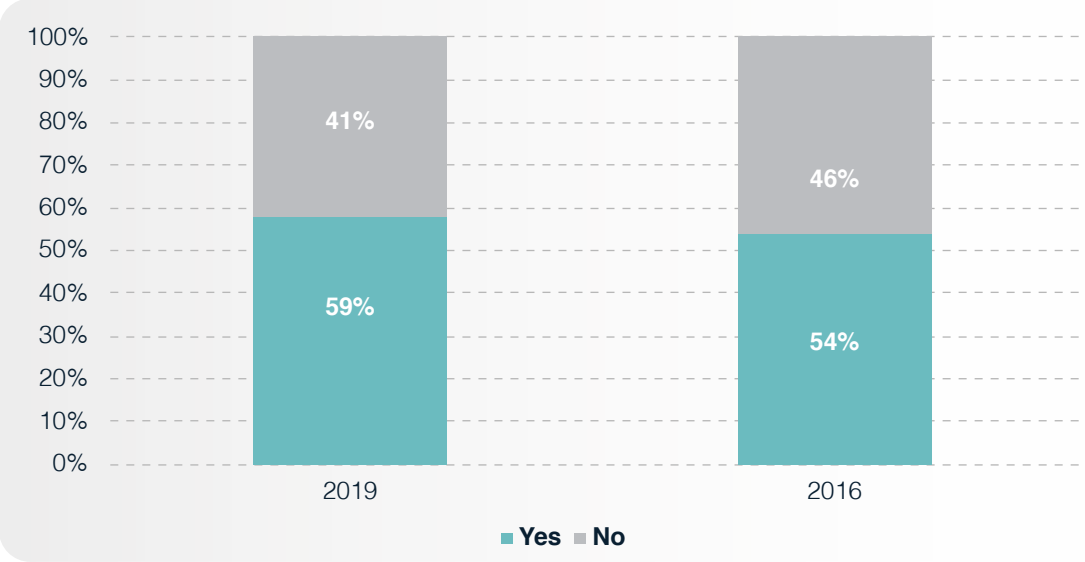

Figure 25: Adequacy of resources to implement BIM

Resources are important to start or sustain the BIM working environment for every organisation. Resources which could be in terms of financial, infrastructure, and BIM personnel must be fully equipped and supported by top management to fully reap the BIM benefits. Petrullo et al. (2017) mentioned that there are several resources that would contribute to increasing the BIM benefits. For example, more BIM training and support, more BIM personnel and more quantified data that demonstrate the business value of BIM. Figure 25 represents the opinion of the respondents on the adequacy of resources to implement BIM. Almost 59% of the respondents agreed that there are adequate resources to implement BIM in the future. Apart from this, it is important for the individual and the organisation itself to change their mindsets and prepare for the advancement of technology that is already available in the construction industry.

3.4 Readiness to implement BIM

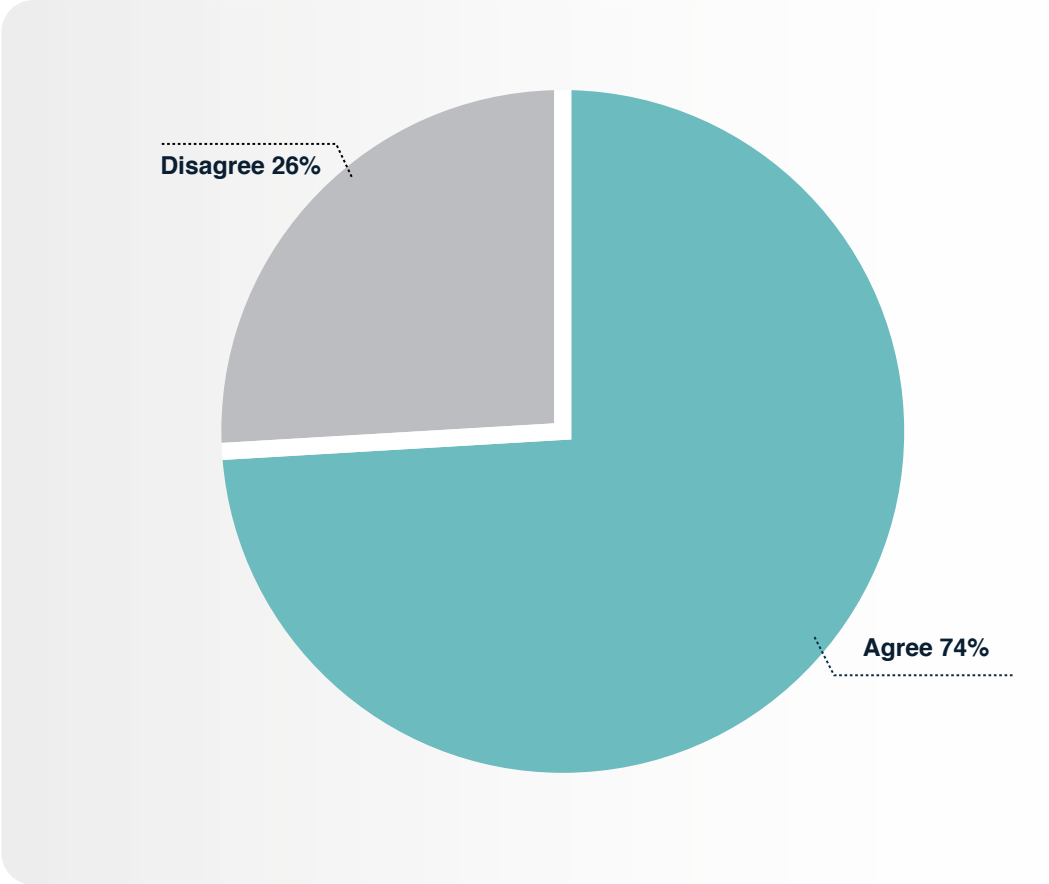

Figure 26: Readiness of organisation

The level of readiness could be an indicator of how much each organisation is ready to execute BIM in their organisation and project. To configure the level of readiness, several aspects such as adequacy of resources, awareness level, financial performance, BIM policies, and others should be looked into in detail to ensure that the outcome from the BIM implementation is positive. According to this study, 74% of the respondents agreed that their organisations are ready to implement BIM while the remaining 26% are not ready to implement BIM in their organisation as shown in Figure 26. The readiness level can be assessed from several aspects such as process change, policy, management awareness, skills enhancement, training and education, hardware, software and technical support which serve as a crucial foundation to carry out BIM in their organisation (Ghaffarianhoseini et al., 2016).

3.5 Future use of BIM in Malaysia

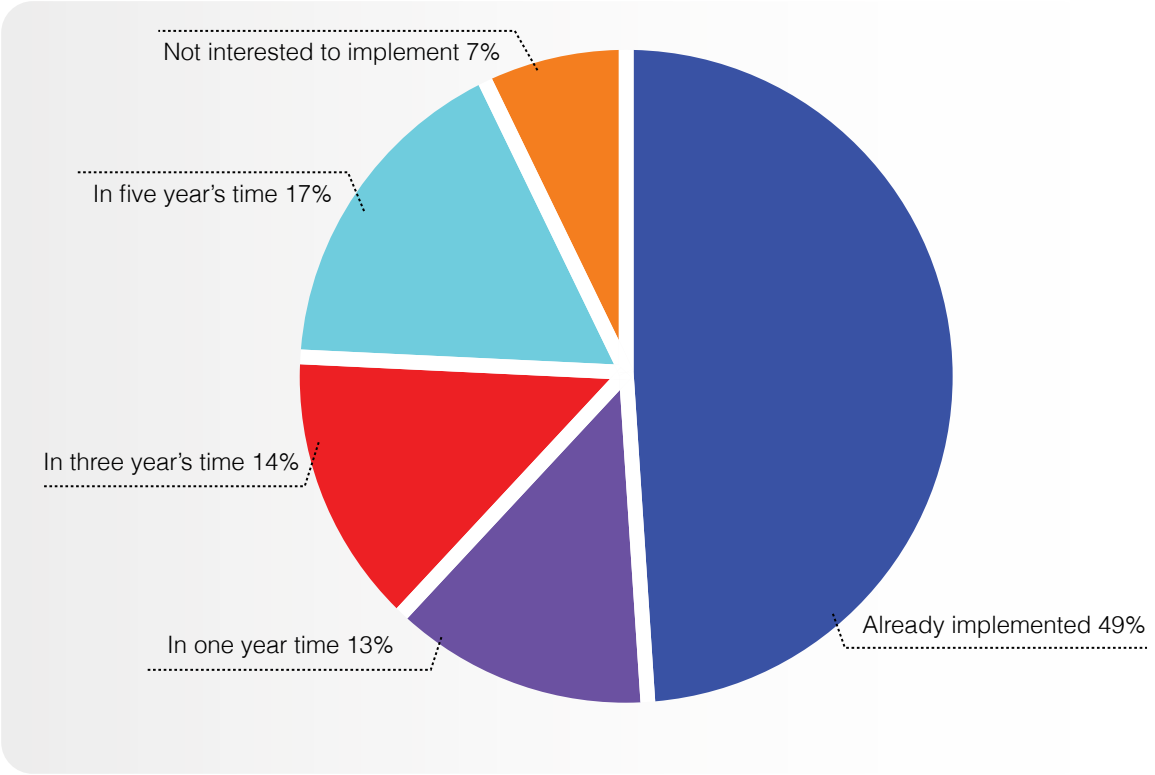

Figure 27: Future use of BIM

Figure 27 illustrates the future use of BIM in the Malaysian construction industry. The result clearly shows that 49% of the respondents are already implementing BIM in their organisation while only 7% recorded that they are not interested to implement BIM. About 13% of the respondents will implement BIM in a year, 14% in three years and 17% in five years. As BIM is one of the twelve emerging technologies that are listed in Construction 4.0, it is expected that the usage of BIM will be enforced and mandated in the future to drive our construction industry into a more digitalised approach. In order to keep up with the bloom of Construction 4.0, the remaining period of future use of BIM must be emphasised and strengthened to push the Malaysian construction digital transformation forward.

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