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# Adoption of Building Information Modelling in Malaysia Road Construction

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**Abstract.** Building Information Modeling (BIM) has changed the road development industry in the most recent decades. In spite of the fact that there are activities by administration of Malaysia to improve the selection of BIM in road development, yet the usage of BIM is still not true to form because of misty guide of BIM reception plan in Malaysia. Along these lines, it is essential to recognize the issues and difficulties in usage of BIM so as to improve the selection of BIM in this industry. This paper plans to analyze the street development industry in Malaysia to build up an unmistakable comprehension about BIM execution and to give the key arrangements and system for street development industry to expand the reception of BIM in Malaysia. This paper has built up broad BIM understanding which makes ready for the investigation by means of subjective and quantitative technique where the information is gathered through study poll among the street development partners in Malaysia and the gathered information is dissected with Average Index utilizing SPSS Software. The outcomes indicated the degree of current BIM usage in Malaysia street development industry is still extremely low and the issues and difficulties of BIM are distinguished in six zones incorporate specialized, process, legitimate, return of venture, government and individuals. Government has been recognized to assume a significant job in offering help to improve appropriation of BIM in Malaysia. The result of this investigation is communicated as a system for the usage of BIM in Malaysia involving issues that require thought for association to advance on BIM development stepping stool. This investigation clears a firm establishment for association to settle on choice in the appropriation of BIM in street development inside the general association structure.

## 1. Introduction

In highway construction, changes in the project scope will bring enormous impact to the project completion time and project cost due to the size of the project. [1] For example, minor changes in road design drawing will affect the overall road design due to its complication of project. Issues, for example, absence of assets, poor contractual worker for the board, less worker, structure deferrals and planning and scheduling inadequacy are among the reasons for delay in road development which are regularly been perceived something that is unavoidable would now be able to be illuminated effectively by utilizing Building Information Modeling. Building Information



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Modelling able to solve the traditional design problems which make the all highway construction phases from inception till operation more efficient and easy to be managed. Although there is a great deal of advantages of adopting BIM in road construction and design that have been proved theoretically and practically, application of BIM is still comparatively slow in developing countries such as Malaysia due to its high investment in time and cost in the early stage of construction and lack of awareness about the software. The execution of BIM in road development still cannot be ventured into broad around the world with different answer including reluctant of more seasoned age to adapt new abilities and designer's moderate nature with regards to an innovation that presently not yet to be tried and attempted. However, a proliferation of noticeable advantages, BIM has been broadened excessively application than just building.

Although there are initiatives by government of Malaysia under Highway Authority Malaysia, but the usage of BIM in road construction is still not as expected because there is no clear road map of BIM adoption plan in Malaysia. Besides, many industry players are more conservative and not prepared to embrace new innovations such as BIM into their company because there is currently no site clear for BIM market and they are not confident in using the new technology. Over the years, many pilots and live projects have been completed in Malaysia and the acknowledgment of the advantages of BIM is dependent upon an appropriate execution of BIM at a hierarchical level and its reconciliation at the business level. Study has demonstrated the guide for usage of BIM in UK development industry [2], but currently there is still no clear BIM acknowledgement for the framework has been developed for Malaysia road construction industry. Hence, this paper provides the understanding on the adoption of BIM implementation, issues and challenges in road construction besides providing the framework based on the best implementation of BIM road construction in Malaysia.

## 2. Literature review

### 2.1. Issues and Challenges of BIM Adoption

BIM in road construction has its own benefits however the barriers encounter needs to be solved in order to increase the adaptation of BIM in Malaysia construction industry. Majority of the players in construction industry see BIM as a “disruptive technology” that change the traditional construction process. Implementing BIM in road construction is never an easy task because there are a lot of things to be considered. Although BIM has been promoted as “one of the most promising recent developments in the architecture, engineering and construction (AEC) industry”, equipped for lessening venture cost, improving efficiency and quality and diminishing the ideal opportunity for venture conveyance, distinguishing the difficulties of execution of BIM has been viewed as a prelude for upgrading BIM appropriation [3]. There are numerous difficulties and issues in BIM selection into road development since it is accepted as a generally new innovations for road development industry in Malaysia. To begin with, specialized difficulties that incorporate the distinctions, absence of completely embraced BIM work process for street development venture, far reaching execution cost and necessity for better equipment to deal with huge volumes of information. Among all difficulties, absence of interoperability as one of the significant specialized difficulties when comes to executing BIM in street development. Interoperability can be characterized as the capacity for a framework, for example, programming to work with different frameworks with no exertion with respect to the end client of the framework, particularly with regards to trading data between frameworks. Furthermore, process-related test is likewise one of the obstructions in BIM reception. These difficulties incorporate the requirement for the business to streamline the business procedure after the utilization of BIM, change of job in the undertaking partners, absence of standard and legally binding dialects. So, it is imperative to build up an exacting benchmarks and definition that would streamline the business procedure [4]. Thirdly, legitimate difficulties. It remembers absence of understanding for the lawful provisions about the computerized marks, stamps and expectations, uprightness of information during transmission, classified data and protection strategies to cover duties of partners. So, as to defeat this difficulties, solid arrangements, for example, expressing proprietorship and obligation of the information in contracts are essential to polish the procedure of BIM advancements reception in the street development industry [5]. Ultimately, return of investment (ROI) is additionally one of the primary worried in BIM appropriation since greater expense of BIM selection will in the end increment the expense of road development. return on initial capital investment challenges incorporate expanded of speculation for procurement of BIM empowered programming, updating current IT frameworks, teaching engineers and changing current venture conveyance technique and expectations. Despite the fact that the push-pull impact of the market will in the long run lessen the cost and increment the availability of BIM innovation, yet at the present phase of advanced upheaval, there are as yet activity that has be finished by the governing body in order to grow the modification of BIM among

tremendous industry players by the organization to construct the change of BIM among colossal industry players. [2]. Table 1 has shown the identification of issues and challenges in adoption of BIM.

**Table 1.** Identification of issues and challenges in adoption of BIM.

Identification of challenges in adoption of BIM	Challenges in Implementation of BIM	References							
		1	2	3	4	5	6	7	8
Technical challenges	Lack of clear BIM workflow.		*	*	*				*
	Existing hardware incapable of running basic BIM software.		*						
	Lack of ability to exchange data with other systems.	*	*		*		*		
	BIM software is complicated to use.	*	*			*	*	*	
Process-related challenges	Change of Business Model (Type of contract bid for).		*						
	Change in responsibilities of Stakeholders.		*	*	*				
	Lack of standard regarding BIM.	*	*			*	*		
	Lack of contractual language.		*		*				
Legal Challenges	Lack of agreement on the legal clauses about the digital signatures.		*						
	Lack of insurance policies to cover responsibilities of stakeholders.		*		*				
Return of Investment Challenges	High investment for acquisition of BIM enabled software	*	*	*	*	*	*	*	*
	High cost of upgrading current IT system.	*	*		*				*
	Changing current project delivery method.	*	*	*					
	High training cost.	*	*	*					*
Governance Challenge	Lack of handouts from Government.								*
	Government departments are not ready to accept 3D submission.								*
	Building plan approval is tedious as model re-working is expensive.								*
	Lack of BIM mandate by government departments.								*
People related Challenge	Insufficient availability of BIM training.								*
	Lack of awareness of BIM benefits.		*			*			*
	Reluctant to initiate new workflows for the implementation of BIM.								*

\*References: 1= [3] ; 2= [4] ; 3= [2]; 4= [5]; 5= [6]; 6= [7]; 7= [8]; 8= [9]

Malaysia government specialists have effectively arranging mindfulness building exercises. Singapore and Hong Kong governments are as of now a long way ahead with BIM appropriation; notwithstanding, they embraced the ideas from Malaysia. Malaysia government is taking a gander at an approach for another economy and BIM is especially in its core. CIDB and LLM are attempting to improve the selection of BIM as they are assuming a significant job to characterize job and bearing of BIM in Malaysia development industry. There is not sufficient help for BIM by government, in contrast to Singapore. The way toward building plan endorsement is dreary in Malaysia and structures will continue changing and this impedes BIM use as changes for model is costly. Moreover, Malaysia government divisions are a long way from having the option to acknowledge 3D entry. In order to increase the adaptation of BIM in this industry, it is important for the organizations to understand that they should change the way the work currently, change in staffing needs and change in the way they use information in road construction project. According to Peter Smith in his studies on global strategies of BIM implementation has found implementation of BIM in construction has showed visible improvement by that provide consistent national standards, BIM protocols and legal contracts, quality of model, national BIM product database and libraries and changes in business model [10]. A study done by Tristan in understanding the application of BIM has suggested organization should re-evaluate and reengineer business practice, provide defined responsibility to all parties, provide consistent national standard and develop a clear adoption policy for BIM models as BIM implementation strategies [11]. Ali has suggested that implementation of BIM can be improved assigning BIM managers and lead inter-operational professional, provide BIM protocol document and provide cybersecurity for BIM tools outcome [12].

Besides, study done by Taqiadden has proposed to provide staffs with BIM training opportunity, provide consistent national standards for BIM, development of project procurement system based on Integrated Project Delivery (IPD) and provide introduction of BIM in undergraduate or graduate program in order to increase the rate of implementation of BIM in construction. There is an additionally requirements for instruction and preparing of potential BIM collaborator. A methodology to accomplish this could be through the presentation of BIM in the educational plans for undergrad and graduate projects in the fields of design, building and development. [13]. As far as government intercession in the business in connection to the selection of new advancements, there are three applicable viewpoints: data support, budgetary help and staff support [14]. An effective national procedure for advancing household advancement regularly incorporates the dynamic investment of a nation's financial improvement board. Table 2 has indicated the ID of usage procedure of BIM.

**Table 2.** Identification of usage procedure of BIM.

Identification of Usage Procedure of BIM	Strategy in BIM implementation	References										
		1	2	3	4	5	6	7	8	9	10	11
Skills	Provide staffs with BIM training opportunity.	*				*	*	*	*		*	
	Provide introduction of BIM in undergraduate or graduate program					*	*		*			
Process-related solution	Re-evaluate and re-engineer business practise by firms.		*	*								
	Provide defined responsibility of who owns and can act upon monitored performance data.			*	*				*			
	Provide free and easy access to online BIM building data and libraries with international consistency.		*							*		
	Provide a BIM protocol document.		*		*	*						
	Provide cyber security for BIM tools outcomes.				*				*			
	Support from top management of the organisation.						*				*	
	Provide contractual arrangement for BIM adoption.						*					
	Mandate the use of BIM in publicly funded project.		*						*		*	
Legal solution	Develop a clear adoption policy for BIM models				*				*	*		
	Optimization of upfront cost in BIM Implementation enhances the benefits associated with BIM.							*				
Return of Investment solution	Enhancements in college industry collective innovative work (R&D) connections and focused on innovation advancement programs											*
Government- related solution	Support in relation to taxation.											*
	Provide consistent global and national standards.		*	*		*		*	*	*	*	
	Increase of government incentives in BIM implementation.							*				
Awareness	Provide awareness of the benefits of BIM.							*		*		
	Provide chance to observe efficiency of BIM tools.		*									

\*References: 1 = [10]; 2 = [15]; 3 = [11]; 4 = [16]; 5 = [13]; 6 = [17]; 7 = [12]; 8 = [5]; 9 = [14]; 10 = [18]; 11 = [19]

### 3. Methodology

#### 3.1. Research instrument

This research focuses on assessing the current readiness and maturity level of Malaysia road construction industry in adopting BIM and their expectation towards the development in this area. Poll review was utilized as a strategy for gathering information as this is a progressively compelling methodology in gathering objective based and quantifiable information, which assume a significant job in this examination. The survey is designed into four (4) segments involving for the most part close-finished inquiry. The essential territory (1) is to perceive the respondent's profile and nuances of their enthusiasm for BIM. Area two (2) level of execution of BIM in respondent's association, three (3) issues and difficulties in selection of BIM and finally in segment four (4) usage technique for BIM in road development. Questions in section three(3) and section four (4) adopted Likert-scale questions where the respondents are asked to choose the numerical scale from "1" to "5" where "1" indicated "Strongly disagree", "3" indicated "Undecided" and "5" indicated "Strongly agree". Prior to information assortment, a pilot study had been directed with experienced academicians and related nearby specialists to get fundamental substance validation for the surveys. Average Index analysis was adopted in the data analysis of survey responses where the data was analyzed using SPSS Version 25 software.

#### 3.2. Demographic profile of respondents

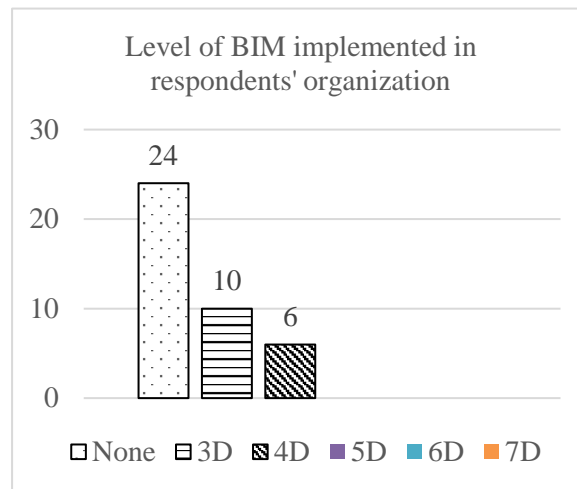
Aggregate of 85 polls were conveyed to the respondents in a time of (1) week, to whom has encountered in street development venture either from private or open association in Malaysia. Out of 85 surveys dispersed, 40 polls were finished with the portrayal of 47.67%. The reaction rate is proper for a development look into. Table 3 decide to recognize the respondent's job and association.

**Table 3.** Profile of Respondents

Profile	Category	Frequency	(%)
Number of respondents	Age 20-30	16	40
	Age 31-40	12	30
	Age 41-50	6	15
	Age more than 50	6	15
Category of organization	Government agency	8	20
	Developer	5	12.5
	Engineering consultancy	13	32.50
	Quantity Surveying firm	3	7.5
	Contractor	10	25
	Supplier and manufacturer	1	2.5
Year of experience in construction industry	Less than 1 year	6	15
	1 – 4 years	9	22.5
	5 – 9 years	5	12.5
	More than 10 years	20	50
Size of organization	3 – 19	5	12.5
	20 – 49	8	20
	59 – 199	12	30
	200 and above	15	37.5

### 4. Result and discussion

Respondents' organization on BIM implementation was investigated through section B of the questionnaire. The result has shown that the implementation of BIM in Malaysia road construction is still low. None of the respondent's organization has reached BIM level 3 where full life cycle integration considering maintenance and operation. 15% of the respondents have implemented BIM up to level 2, 27.5% reached BIM level 1 where 2D and 3D design integrated with product data management and 57.5% has not implemented BIM in their organization with just Level 0 BIM. Among the respondents who have implemented BIM in their organization, all the respondents use Autodesk Revit because it does support for topography coordinate systems just that it is better to design road below 30km to prevent precision issues. BIM is still considered a new technology in Malaysia especially road construction industry.



**Figure 1.** Level of BIM used in respondent's organization BIM tools.

#### 4.1. Issues and challenges in adoption of BIM

As summarized in Table 4, the data collected from the questionnaire were analysed to delineate the issues and challenges in adoption of BIM in road construction. A total of twenty-one (21) variables are categorized into six BIM factors (Technical, Process, Legal, Return of Investment, Government and People). As it is, the procedure output has an overall raw alpha of 0.764 which is good considering that .70 is the cut off value for being acceptable. According to the findings from the respondents, five (5) challenges that are most frequently chosen by the respondents are lack of standard regarding BIM (mean = 4.325), high investment for acquisition of BIM enabled software (mean = 4.225), government departments are not ready to accept 3D submission (mean = 4.200), insufficient availability of BIM training (mean = 4.175) and lack of BIM mandate by government departments (mean = 4.15). The top challenge among all is the lack of standard regarding BIM. Although Malaysia local authorities Jabatan Kerja Raya (JKR) has built a reference document aiming at providing a unified BIM standard by JKR (Garis Panduan dan Piawaian BIM JKR and Garis Panduan Penggunaan Template JKR) that can easily be adopted to suit different projects, but the consultants and contractors are still fail of using those standards that creates better information exchange and communication because it is not compulsory for them to use it since currently our government has not mandate the use of BIM in construction industry yet. This study also focuses government-related factors in the issues and challenges of BIM adoption that is ignored in the development of roadmap for implementation of BIM in the UK construction industry [2]. Two out of top five challenges listed above are governance related challenges which showed that our government should come out with more initiative to boost the adoption of BIM in Malaysia. Neighboring nation, for example, Singapore had effectively actualized BIM in nearby specialists from BIM consistence to administrative prerequisite which helped in boosting the reception of BIM in Singapore. Hence, local authorities need to play a significant role in increasing the adoption of BIM in road construction.

Within the Process context, all respondent agreed that there is lack of standard regarding BIM with the mean value at 4.325. Inside the process setting, all respondent concurred that there is absence of standard in regard to BIM with the mean an incentive at 4.325. Despite BIM has been in the market for quite a long while, there is still no institutionalization BIM rule for organizations in Malaysia. BIM achievement factor is exceptionally controlled by investment of government in setting the standard for BIM so as to clear uncertainty for all partners in street development industry. In relation, respondents believe that there is lack of contractual language in BIM with mean at 4.100. Prior developing any contract language, the most important item is to consider the overall purpose of BIM implementation and there is no standard of what should be added in BIM contract language in Malaysia since it is considered a new tool in road construction industry. In terms of technical challenges, all respondents agree that there is lack of clear workflow for BIM in Malaysia which shows the same challenges faced in the implementation of BIM in UK. During the implementation of BIM, there is no clear factor like model exchange, storage, naming conventions and organization of model that allows seamless inclusion of

models throughout the life of documentation process. Importantly there is a need to have a clear plan for implementation and support for organization to fully leverage the benefits of using BIM tools in road construction.

In the area of legal challenges, all the respondents agreed there is a lack of agreement on the legal clauses about the digital signatures with mean of 4.000. Under Malaysia law, although a written signature is not necessarily required for a valid contract, but the use of digital signatures in road construction is still in a grey area because there are cases that are specifically barred from digital signatures such as instrument effecting any dealing with real property under the Malaysian National Land Code. Besides, it was agreed that legal were among the least areas of understood and will represent notable risks to the project management team.

The return of investment challenges is high investment for acquisition of BIM enabled software which ranked second overall with mean of 4.225. The respondents also agreed that adoption of BIM requires high cost of upgrading current IT system (mean=4.075) and high training cost (mean=4.025). As BIM requires investment of equipment, software, hardware and training, it would greatly impact on the cost of project.

**Table 4.** Mean score and rank of issues and challenges in adoption of BIM.

No.	Factors	Issues and Challenges in Adoption of BIM	Mean	S.D	Rank
C1		Lack of clear BIM workflow	4.100	0.871	10
C2	Technical challenges	Existing hardware incapable of running basic BIM software	3.625	1.191	20
C3		Lack of ability to exchange data with other systems	3.925	0.997	14
C4		BIM software is complicated to use	3.850	1.026	16
C5		Change of Business Model (Type of contract bid for)	3.600	1.057	21
C6	Process-related challenges	Change in responsibilities of Stakeholders	3.675	0.997	17
C7		Lack of standard regarding BIM	4.325	0.656	1
C8		Lack of contractual language	4.100	0.778	9
C9	Legal Challenges	Lack of agreement on the legal clauses about the digital signatures	4.000	0.716	13
C10		Lack of insurance policies to cover responsibilities of stakeholders	3.625	0.868	18
C11	Return of Investment Challenges	High investment for acquisition of BIM enabled software	4.225	0.733	2
C12		High cost of upgrading current IT system	4.075	1.022	11
C13		Changing current project delivery method	3.625	1.102	19
C14		High training cost	4.025	0.831	12
C15	Government-related Challenge	Lack of handouts from Government	4.100	0.672	8
C16		Government departments are not ready to accept 3D submission	4.200	0.758	3
C17		Building plan approval is tedious as model re-working is expensive	4.150	0.735	5
C18		Lack of BIM mandate by government departments	4.150	0.770	6
C19	People-related Challenge	Insufficient availability of BIM training	4.175	0.747	4
C20		Lack of awareness of BIM benefits	3.925	1.022	15
C21		Reluctant to initiate new workflows for the implementation of BIM	4.125	0.723	7

#### 4.2 Implementation strategy for BIM

Table 5 summaries the overall strategic solutions according to related factors. According to the findings from the respondents, five (5) strategic solutions that are most frequently chose by the respondents are provide staffs with BIM training opportunity (mean = 4.55), increase of government incentives in BIM implementation (mean = 4.425), provide cyber security for BIM tools outcomes (mean = 4.325), provide introduction of BIM in undergraduate or graduate program (mean = 4.325) and improvements in university–industry collaborative research and development (R&D) relationships and targeted technology development programs (4.300). Overall, the findings show that all the implementation strategy has a mean score more than 3.500.

Skill-related solutions are the most impactful solution as two out of top five solutions are related to this factor. All the respondents are strongly agreed that providing staffs with BIM training opportunity (mean = 4.55) is able to improve the adoption of BIM in Malaysia. There are a lot of factors that need to be considered such as size of firm and existing of expertise when it comes to planning for BIM training for staffs in order to teach right skills to the right set of people with minimal disruption to the on-going project. Provide introduction of BIM in undergraduate or graduate program (mean = 4.325) is also one of the most impactful implementation strategies as it ranked third overall. As the technology that evolved rapidly in the construction industry, it is important to constantly expose undergraduate with new construction technology in their curriculum in order to meet the future needs of the construction industry.

In terms of process related solutions, providing cyber security for BIM tools (mean = 4.325) is perceived as good solution as it is agreed by all respondents. A shared 3D model may expose to intellectual property to



competitors where a fly-through visualization of a building could share sensitive information about the building design-key structural components, locations of key building services, placement of CCTV or other security equipment. A shared 4D model might expose period when assets could be susceptible to sabotage, or sites could be vulnerable to thieves.

In the area of legal-related solution, mandate the use of BIM in publicly funded project (mean = 4.225) is agreed by all respondents. Government role in implementation strategy of BIM has not been studied by the UK roadmap case study before. Currently, Malaysia government is trying to mandate the use of BIM in government project that worth more than RM100 millions by 2020 because BIM system could optimize the cost of a project in line with the Construction Industry Transformation Program (CITP) according to Construction Industry Development Board (CIDB).

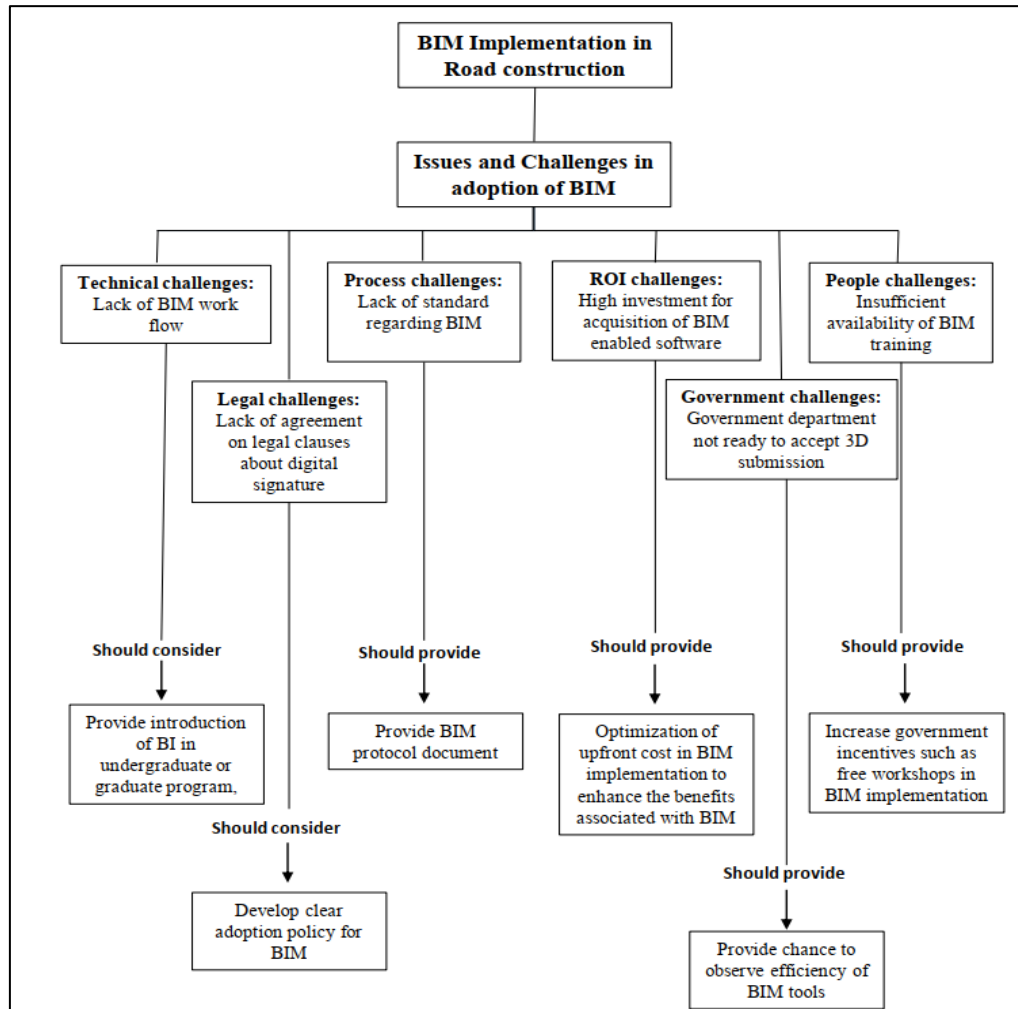
Optimization of upfront cost in BIM implementation enhances the benefits associated with BIM is a significant solution for return of investment related challenges. It is important for construction industry participants to optimize the upfront cost of BIM as the gain of BIM implementation does not reflect immediately upon the point of implementation because it is considered as a long- term investment to be more cost effective and efficient in project delivery.

Improvements in university–industry collaborative research and development (R&D) relationships and targeted technology development programs (4.300) that is related to government initiative is ranked fifth in overall. This strategy has not been studied by the UK roadmap case study. Such collaborative research programs increase the importance of the research opportunities, results and knowledge transfers between the participating companies and universities. Companies are beginning to realize the importance of collaborative research in evolving their core competencies and in making sound strategic decisions on how to best deploy their R&D resources to maintain competitive advantage.

Increase of government incentives in BIM implementation (mean = 4.425) was ranked second overall. This implement strategy is not mentioned in the Roadmap for implementation of BIM in the UK construction industry case study. This strategy is vital because it shows the importance of Malaysia government initiatives in improving the adoption of BIM in Malaysia. Local road construction authorities such as Highway Authority Malaysia (LLM) has just started BIM initiative last year where they are still at data collection phase and has yet to run any campaign to create awareness about use of BIM in road construction project. Thus, with the increasing initiatives, Malaysia government will be able to produce more construction industry players that are equipped with BIM knowledge which allowed tendering for BIM project to avoid the probability of project failure. With the identified strategy in BIM implementation, framework for BIM adoption has been identified in Figure 2.

**Table 5.** Mean score and rank of implementation strategy of BIM

No.	Factors	Strategy in BIM implementation	Mean	S.D	Rank
S1	Technical-related solution	Provide staffs with BIM training opportunity.	4.55	0.597	1
S2		Provide introduction of BIM in undergraduate or graduate program.	4.325	0.730	4
S3		Re-evaluate and re-engineer business practice by firms.	3.975	0.947	17
S4		Provide defined responsibility of who owns and can act upon monitored performance data.	4.175	0.675	12
S5	Process-related solution	Provide free and easy access to online BIM building data and libraries with international consistency.	4.225	0.862	10
S6		Provide a BIM protocol document.	4.150	0.770	15
S7		Provide cyber security for BIM tools outcomes.	4.325	0.693	3
S8		Support from top management of the organization.	4.275	0.640	6
S9		Provide contractual arrangement for BIM adoption.	4.150	0.700	13
S10	Legal-related solution	Mandate the use of BIM in publicly funded project.	4.225	0.768	9
S11		Develop a clear adoption policy for BIM models	4.150	0.736	14
S12	Return of Investment- related solution	Optimization of upfront cost in BIM Implementation enhances the benefits associated with BIM.	4.225	0.577	7
S13	Government-related solution	Improvements in university–industry collaborative research and development (R&D) relationships and targeted technology development programs	4.300	0.791	5
S14		Support in relation to taxation	4.225	0.630	8
S15		Provide consistent global and national standards.	4.200	0.608	11
S16	Awareness- related	Increase of government incentives in BIM implementation.	4.425	0.630	2
S17		Provide awareness of the benefits of BIM.	4.025	0.800	16

**Figure 2.** BIM implementation framework in road construction.

BIM has proven to be an effective technology with numerous studies had highlighted its potential capabilities. However, in the context of Malaysia road construction industry, the implementation of BIM is still in very slow pace. There are several factors that can be concluded that hinders the adoption of BIM has been identified in this research (1) lack of standard regarding BIM, (2) high investment for acquisition of BIM enabled software, (3) government departments are not ready to accept 3D submission, (4) insufficient availability of BIM training and (5) lack of BIM mandate by government departments. As Malaysia government is looking to increase adoption of BIM to prepare the industry for the future before 2020, it is important that the issues and challenges are to be addressed for the improvement of the road construction industry in Malaysia. Therefore, strategic BIM solutions should be implemented in order to increase the pace of BIM adoption in the Malaysia road construction industry. Several implementation strategies have been identified in this research (1) provide staffs with BIM training opportunity, (2) increase of government incentives in BIM implementation, (3) provide cyber security for BIM tools outcomes, (4) provide introduction of BIM in undergraduate or graduate program and (5) improvements in university–industry collaborative research and development (R&D) relationships and targeted technology development programs. Finally, several limitations need to be acknowledged. In general, the time constraint and relatively small sample size may lead to concerned on generalizations of the research.

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