

AN EMPIRICAL INVESTIGATION THE  
ADOPTION FACTORS OF BUILDING  
INFORMATION MODELLING (BIM) FROM  
THE PERSPECTIVE OF MALAYSIAN CIVIL  
AND STRUCTURE CONSULTANT FIRMS

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### SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and, in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Doctor of Philosophy (Construction).



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## STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

  
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ZHRIZAN ZAKARIA

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In the name of God, the Merciful praise is to God and prayers and peace on our master and our beloved Muhammad the Messenger of Allah (may Allah bless him and grant him peace) and his honourable companions and those who followed for him.

## ABSTRAK

Dalam Revolusi Industri ke-Empat (IR 4.0), industry pembinaan sepatutnya menumpukan terhadap kerja-kerja pembinaan yang berkaitan dengan kemahiran menggunakan teknologi terkini berbanding penggunaan tenaga buruh secara berlebihan. Tetapi industri pembinaan di Malaysia masih lagi menggunakan kaedah tradisional yang mana ianya banyak menggunakan tenaga buruh berbanding menggunakan teknologi terkini. Kesan dari kaedah ini menyebabkan isu pengasingan antara ahli projek dan menyebabkan produktiviti menurun dan tidak efektif. Untuk mengatasi masalah tersebut, Pemodelan Maklumat Bangunan (BIM) boleh dikategorikan sebagai pendekatan inovatif yang menawarkan platform untuk mengintegrasikan antara pihak-pihak yang berkepentingan di dalam sesuatu projek pembinaan. Selain itu BIM juga berupaya meningkatkan produktiviti kerja dan menghasilkan kerja yang sangat efektif. Walaupun banyak faedah boleh diperolehi oleh industri pembinaan dengan penggunaan BIM dan pelbagai usaha telah dilakukan oleh pihak kerajaan untuk mempromosi BIM seperti pengajuran seminar, bengkel dan insentif namun kadar penggunaan BIM masih lagi rendah jika dibandingkan dengan negara-negara Asia yang lain. Sehubungan dengan itu, adalah penting untuk mengkaji faktor yang boleh menyebabkan pihak industri menggunakan BIM terutama dari perspektif firma perunding sivil dan struktur (C&S). Banyak kajian sebelum ini telah mengkaji dari perspektif seni bina, pengurusan kemudahan, juru ukur kuantiti dan kontraktor namun sangat sedikit kajian dari sudut perspektif firma perunding C & S. Ini sangat penting kerana firma perunding C & S memainkan peranan penting dalam memastikan rekabentuknya boleh dibina, dikendalikan dan dikekalkan. Oleh itu, tujuan kajian ini adalah untuk mengkaji hubungan antara organisasi, orang dan teknologi dalam membuat keputusan untuk menggunakan BIM dari sudut perspektif firma perunding C&S. Kajian ini menggunakan pendekatan kualitatif dan kuantitatif didalam usaha untuk memahami keadaan semasa terhadap isu-isu yang melibatkan penggunaan BIM. Dan pada masa yang sama dapat meneroka faktor-faktor yang mempengaruhi penggunaan BIM dalam industri pembinaan Malaysia. Ketiadaan garis panduan untuk melaksanakan BIM, kurangnya permintaan dari pelanggan atau kerajaan dan kurang sokongan teknikal dari pakar BIM adalah cabaran yang dihadapi oleh para pengamal BIM selain harga yang mahal dalam membiaya pembelian teknologi BIM. Analisis dari regresi linear berganda mendapati faktor yang mempunyai hubungan yang kuat dalam mempengaruhi organisasi untuk mengamalkan BIM adalah; mempunyai sokongan yang kuat dari pihak pengurusan atasan, paksaan atau tekanan, mempunyai pelan pelaksanaan BIM yang jelas, menawarkan skim latihan, mempunyai pasukan BIM yang kompetent, mempunyai spesifikasi pekerjaan yang jelas, teknologi BIM harus bebas dari isu keboleherasian, biaya teknologi tidak membebani organisasi dan teknologi itu harus mempunyai keserasian dengan teknologi terkini. Hasil dari kajian ini menawarkan satu pandangan baru dari perspektif firma perunding C & S dalam mengenal pasti faktor-faktor yang mempengaruhi penggunaan BIM. Pada masa yang sama, ia boleh mengisi jurang dari kajian terdahulu dengan memperluaskan kajian penerimaan BIM dari sudut pandangan firma perunding C & S dan ianya melengkapkan keseluruhannya sudut penerimaan BIM daripada semua pemain industry pembinaan.

## ABSTRACT

The construction industry in the Fourth Industrial Revolution (IR 4.0) have to focus on high-technology jobs such as technological skill rather than labour-intensive approach and low-skilled job. But, most of the construction industries in Malaysia are using traditional approach which is labour-intensive approach and it has resulted in fragmentation issue among the project participants resulting less productivity and inefficiency in delivering the project. In order to tackle this issue, Building Information Modelling (BIM) can offer a platform to integrate between different parties in the construction industry. It also offers a lot of benefits to construction industry in term of productivity and efficiency. Even though there are a lot of benefits that can be gained by BIM utilisation and many efforts to increase the adoption of BIM in construction projects such as conducting the seminars, workshops and incentives but, the rate of BIM adoption by the Malaysian construction players is still low compared to other Asians countries. Therefore, there is a need to study the adoption factors within Malaysian construction industry that could facilitate the pace of BIM adoption in Malaysia especially from the perspective of civil and structure (C&S) consultant firms. Several studies had explored the way to increase the pace of BIM adoption from the perspective of architectures, facilities management, quantity surveyor and contractors, and very little effort to identify the adoption factors and its relationship that could facilitate the adoption of BIM especially from the perspective of C&S consultant firms. C&S consultant firm plays a vital role to ensure the design is constructible, operable and maintainable. Thus, the aim of this study is to examine the relationship between organizations, people and technology towards making decisions in adopting BIM from the perspective C&S consultant firm. In this study, qualitative and quantitative approaches have been utilised as research method to develop in-depth understanding of the happening by obtaining the views on the subject studied especially the current application of BIM in the Malaysian construction industry. At the same time, this study is conducted to explore what are the factors that affecting the adoption of BIM in the Malaysian construction industry. Lack of national guideline for implementing BIM, pressure from clients or governments and lacking of technical support from BIM experts are the vital challenges faced by the adopters besides having a higher cost of early investment in BIM technology. Analysis from multiple linear regression revealed the factors that have a strong relationship in influencing organisation to adopt BIM are; having a strong support from the top management, having a coercive pressure, having a clear BIM implementation plan, undergo training, having a BIM competency team, having a clear job specification for new roles, BIM technology must free from interoperability issue, less cost of technology, and the issue of compatibility. This study offers a new insight from the perspective of C&S consultant firms on the adoption of BIM and could improve the rate of BIM adoption. At the same time, it could fill the gap from previous studies by extending the study of BIM adoption by investigating from C&S consultant firm's point of view and it complementing the overall view of BIM adoption from all participants.

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## LIST OF ABBREVIATIONS

2D	2 Dimensional
3D	3 Dimensional
4D	4 Dimensional
5D	5 Dimensional
n-D	n Dimensional
AEC	Architectural, Engineering and Construction
AGC	The Associated General Contractors of America
BIM	Building Information Modelling
C&S	Civil and Structure
CAD	Computer Aided Design
CIMP	Construction Industry Master Plan of Malaysia
CIDB	Construction Industry Development Board of Malaysia
CITP	Construction Industry Transformation Plan
CREAM	Construction Research Institute of Malaysia
EPU	Economy Planning Unit of Malaysia
GDP	Gross Domestic Product
IBS	Industrialised Building System
ICT	Information & Communication Technology
IFC	Industry Foundation Classes
IS	Information System
ISO	International Organisation for Standardisation
IT	Information Technology
MEP	Mechanical, Electrical and Plumbing
PWD	Public Work Department of Malaysia
R&D	Research and Development
RAM	Random Access Memory
RICS	Royal Institution of Chartered Surveyor
RM	Ringgit Malaysia
U.S	United States of America
U.K	United Kingdom
VDC	Virtual Design and Construction

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