

ACCIDENT CAUSATION MODEL FOR BUILDING CONSTRUCTION SITES

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My dearest most lovely Ayahanda and Bonda,

Allahyarham Haji Asan Bin Engku Sharif Al-Rembauri and Hajjah Ramlah Binti
Mohd Yusoff Al-Naningri

and

For my beloved wife,

Pn. Zulina Intan Binti Haji Omar Gusti Napiah Al-Banjari

and

My sweet children's,

Datinur Sajidah Binti Amran, Amir Syamim Bin Amran, Amir Akmal Bin Amran,
Datinur Anati Binti Amran and Datinur Auni Binti Amran

May ALLAH S.W.T protect and bless us all of the times.. In shaa ALLAH



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“May ALLAH S.W.T Bless Us All To Achieve Excellence in Life”

ABSTRACT

Construction safety at Malaysian building and construction project sites is of utmost importance due to the nature of the construction industry. Workplace safety is a care consideration for all types of organizations or stakeholders. However, statistics shows that safety at project sites is not adequately considered. Reports on site accidents represented nearly 50% of overall fatality cases across all industries. These statistics are indications of a continuing severity of building site accidents compared to others. Malaysian building site accidents are the results of various factors which are crucial to be identified. Therefore, a comprehensive understanding of the factors or the root causes that contribute to site accidents is essential. Thus, the aim of this study was to develop an accident causation model (ACM) at building construction projects sites, focusing on determining the significant factors that cause site accidents. These factors consisted of 93 items and they were divided into seven constructs. The study was undertaken in two stages. Firstly, relevant literatures were reviewed to identify the factors. The data were gathered to assess the suitability of the factors based on experts' judgement and survey. Data obtained were statistically analyzed using the statistical tools in the Statistical Package for Science Social (SPSS) 20.0 and the proposed model was recognized. Then, data collected from actual survey involving 420 respondents were analyzed to test the research model validity and the proposed hypothesis using the Partial Least Squares - Structural Equation Model (PLS-SEM) tool. From the results, it was revealed that the seven constructs have a direct positive effect on accident causation. The developed model is fit (R^2 value) and the identification of the seven constructs are significant (t-value). The model indicates that the highest impact on construction site accidents with a path coefficient (beta) value is unsafe equipment, followed by job site conditions, natural disaster, unique nature of the industry, unsafe methods, organization and management, and human elements. In conclusion, the findings through the ACM model of this study are reliable and very useful for construction organizations or stakeholders understand the significant root cause of the project site accidents. Hence, this can assist them to further implement an appropriate control measures to prevent accidents in Malaysian building construction site projects.

ABSTRAK

Keselamatan tapak projek pembinaan dan bangunan di Malaysia adalah sangat penting disebabkan oleh sifat industri itu sendiri. Keselamatan di tempat kerja juga telah menjadi keutamaan bagi semua organisasi atau pihak-pihak berkepentingan. Walau bagaimanapun, statistik menunjukkan bahawa keselamatan di tapak projek adalah sebaliknya, dapatan mendapati kemalangan di tapak bina mewakili hampir 50% kes-kes kematian berbanding keseluruhan industri. Statistik ini menunjukkan hasil yang menakutkan dan berterusan di tapak binaan. Kemalangan di tapak pembinaan Malaysia disebabkan pelbagai faktor yang penting untuk dikenal pasti. Oleh yang demikian, memahami faktor atau punca penyumbang kepada kemalangan ini secara komprehensif adalah penting. Oleh itu, tujuan kajian ini adalah untuk membangunkan model penyebab kemalangan (ACM) dengan memberi tumpuan terhadap mengenalpasti faktor penting penyebab kemalangan di tapak pembinaan bangunan. Faktor ini terdiri daripada 93 item, dan dibahagikan kepada tujuh konstruk. Kajian telah dijalankan dalam dua peringkat. Pertama, kajian literature untuk mengenal pasti faktor sedia ada. Data yang telah dikumpul, dinilai kesesuaiannya berdasarkan pertimbangan pakar dan kaji selidik. Data telah dianalisa menggunakan kaedah statistik untuk sains sosial (SPSS) 20.0 dan model yang dicadangkan telah dibangunkan. Kemudian, data dari kaji-selidik sebenar melibatkan 420 responden dianalisis bagi menguji kesahan model dan hipotesis menggunakan kaedah persamaan Model (PLS-SEM). Dapatannya, ketujuh-tujuh konstruk mempunyai kesan positif secara langsung kepada penyebab kemalangan. Model yang dibangunkan adalah sesuai (nilai R^2) dan semua konstruk adalah signifikan (t-nilai). Model menunjukkan, impak tertinggi kemalangan di tapak bina dengan nilai (beta) adalah peralatan tidak selamat, diikuti keadaan tapak kerja, bencana alam, keunikan semulajadi industri, kaedah tidak selamat, organisasi dan pengurusan, dan unsur manusia. Kesimpulannya, dapatan dari model ACM kajian ini, boleh dipercayai dan sangat berguna untuk pihak organisasi atau pihak yang berkepentingan memahami punca utama kemalangan di tapak projek bangunan. Oleh itu, dapatan ini dapat membantu mereka untuk melaksanakan langkah kawalan yang bersesuaian bagi mengelakkan kemalangan di tapak projek pembinaan bangunan di Malaysia.

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LIST OF SYMBOLS AND ABBREVIATIONS

<i>CIDB</i>	Construction Industry Development Board
<i>PLS-SEM</i>	Partial Least Square-Structural Equation Modelling
<i>SEM</i>	Structural Equation Modelling
<i>JKR</i>	Public Works Department (<i>Jabatan Kerja Raya</i>)
<i>UTHM</i>	<i>Universiti Tun Hussein Onn Malaysia</i>
<i>BPKU</i>	<i>Bahagian Pembangunan Kontraktor dan Usahawan</i>
<i>csv.</i>	Comma Separated Value
<i>AVE</i>	Average Variance Extracted
<i>CR</i>	Composite Reliability
<i>CA</i>	Cronbach's Alpha
<i>GDP</i>	Gross Domestic Product
<i>Q²</i>	Predictive Relevancy
<i>CV Red</i>	Cross Validated Redundancy
<i>CV Com</i>	Cross Validated Communality
<i>SPSS</i>	Statistical Package for Social Science
<i>CIMP</i>	Construction Industry Master Plan
<i>DOSH</i>	Department of Safety and Health
<i>SOCISO</i>	Social Security Organizations
<i>EPU</i>	Economic Planning Unit
<i>OSHA</i>	Occupational Safety and Health Act
<i>FMA</i>	Factories and Machinery Act
<i>NIOSH</i>	National Institute of Occupational Safety and Health
<i>OSH</i>	Occupational Safety and Health
<i>SHASSIC</i>	Safety and Health Assessment System in Construction
<i>MBAM</i>	Master Builders Associate Malaysia
<i>JPM</i>	Information Department of Malaysia (<i>Jabatan Penerangan Malaysia</i>)

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CHAPTER 1

INTRODUCTION

1.1 Research Background



Malaysian construction industry plays an important role in stimulating economic activities and plays an essential role in arbitrating between wealth creations and raising quality of life (Dato' Seri Abdullah Ahmad, CIMP 2007). Compare to other countries, Malaysia moves fast to keep pace with the changes of time as the country aspires to achieve strong economic growth and to chart its course, as a developed nation by the year 2020 (Malaysia Information Department, 2016). Therefore, one of the common ways to drive economic growth is to increase investment in the construction sector. According to Malaysian Prime Minister, Datuk Seri Najib Razak, Malaysia's construction sector will be transformed into a modern, highly productive and sustainable industry under Construction Industry Transformation Programme (New Straits Times, 2015).

Meanwhile, as Malaysian population is expected to reach 35 million in the year 2020 (Department of Statistic Malaysia, 2015), the nation's building sector with interrelated of building project's property development is presence as a key construction subsector, as it caters to the basic needs of the people (Malaysian Institute of Architect, 2015). It is estimated that a total of one million new residential units will be required to be built by 2020 (Construction Industry Development Board,

2013). In the meantime, data from the Economic Planning Unit (UPU) show that from 2011-2015, the overall development expenditure in the Malaysian building construction sector exceeded more than RM216.96 billion funded by both public and private sectors, in various building projects including residential, community infrastructure, hospitals and schools. Furthermore, according to Urban Wellbeing, Housing and Local Government Minister, a total number of 723,000 affordable homes are being built nationwide as part of the Federal Government's initiatives to build by 2018 (The Sunday, 2016). In fact, the construction sector registered positively on the economic and social front with a yearly employment growth of more than 1,000,000 employed person and accounted for 9.3% of total employment since 2010 (Department of Statistics Malaysia, 2015; Akasah *et al.*, 2015; Ramli *et al.*, 2015).

However, according to a news reported by the New Strait Times (NST), despite the nation's economic growth and numbers of employees depending on them, there have been significant number of construction accidents taking place in the country over the years, leading to a high accident rate of injuries and fatalities (Deputy Human Resources Minister, 2015; Chong & Low, 2014; Tan & Nadeera, 2014; Majid *et al.*, 2008). Indeed, working at construction sites is still considered as an extremely dangerous, dirty and difficult job and exposes workers to a lot of occupational hazards and risks (Zakaria *et al.*, 2012; Chan *et al.*, 2012; Adel *et al.*, 2012; Abdullah *et al.*, 2011). Construction accidents cause damages, losses of properties, plants, materials and lead to delays in project completion, increase cost and tarnish reputation of constructors' (Targhabeh & Hosseinian, 2012; Manu *et al.*, 2010; Wang *et al.*, 2006). The accidents also cause problems to construction workers such as loss of ability to work, long-term absenteeism, risk of exclusion from the labour market and even death due to sickness and injury (Talib, 2012; Spangenberg, 2010).

The issues and burden of work at workplace which lead to injuries, illness and fatalities have been widely discussed in the media especially the ones related to the construction industry. Studies by various researchers demonstrated that statistical rate of major injuries and fatal accidents related to the construction industry is higher than other industries in many countries (Dumrak *et al.*, 2013; Chi *et al.*, 2012; Zakaria *et al.*, 2012; Adel *et al.*, 2012; Manu *et al.*, 2010). The risks of major injuries

and fatal accidents in this industry is higher than any other industries and have been identified as one of the most hazardous industrial activities at the workplace in many parts of the world (Chong & Low, 2014; Nden *et al.*, 2014; Himadri & Partha, 2013; Ching *et al.*, 2012; Edwin *et al.*, 1999).

Statistical data on fatalities available from local government agencies showed that from 2007 to 2014 total fatality rates in the Malaysian construction industry accounted for an average of 50% of total fatality cases involving Malaysian employed workforce (Department of Safety and Health, 2015; Department of Statistics Malaysia, 2015; Asan & Akasah, 2014). According to Deputy Human Resources Minister, a total of 518 foreign workers' were reported death at construction sites from 2006 until September 2015 (New Straits Times, 2015). Furthermore, the Director General of the Department of Safety and Health (DOSH) revealed that construction industry sector has one of the worst safety and health records with 89 fatalities in 2014 and 140 in 2015 (The Sun, 2016). This figure strengthens the claim that Malaysian construction industry is the most dangerous industry, measured by workers' safety, risks of accidents and workplace hazards.

The building sector is one of the major categories and a key sub-sector in the Malaysian construction industry. However, it is also the sector where major site accidents take place. Therefore, a critical intervention to improve safety and health at sites is needed (Construction Industry Development Board, 2016; Department of Safety and Health, 2016; The Sun, 2016; Malaysian Institute of Architect, 2015). According to the Director General of DOSH, despite many regulations, specifications, job safety programmes have been implemented at workplaces, accidents at construction sites which resulted in fatalities and injuries continue to occur in recent years and this sector remains a dangerous place where frequent workplace accidents take place (The Sun, 2016). In this regards, the president of the Institute Engineering Malaysia (IEM) strongly suggested that there is a need to upgrade and amend the related local acts, regulations, guidelines and codes of practice (The Malay Mail, 2016).

In facts, in recent years there has been a number of tragedy construction accidents occurred at building construction site projects in Malaysia. In 2017, an eight floor building which was under construction collapsed at Kuala Lumpur that claimed major injuries to workers (New Straits Times, 2017). In another incident,

some workers were killed when a 17 floor apartment that was under construction collapsed at Bukit Jalil (The Malay Mail, 2017). In another case, the plaster ceiling of a mall building that was under construction in Klang suddenly collapsed (The Malay Mail, 2017). These are some indicators of how serious accidents at building construction sites in the country. These also serve as stem reminders that more actions need to be done to protect the workers and provide them a safer workplace that will prevent such accidents from happening. Researchers also need to examine various strategies for enhancing safety at building construction sites.

In addition, with emerging technologies and increasing complexity of the Malaysian building construction projects, there is an urgent need for developing a new model of framework to determine the significant factors that cause accidents at building sites in order to prevent such problems from occurring. Due to this reason, the main purposes of this research were to identify and determine the significance factors of accident causation factors at building construction site projects. The research also attempted to create awareness and safety at workplace. A simple and practical model of framework for understanding the factors that contribute to accident causation of building projects would be proposed. Furthermore, the aim of such model of framework is to provide an objective indicator for significant factors of accident causations that which can be used as a reference for construction practitioners to provide safety and health awareness at building construction project sites in Malaysia.

1.2 Problem Statement

The construction industry is also known as an industry that involves the most hazardous activities. A common phenomenon at construction sites is the occurrence of accidents which is a key problem in the industry (Adel *et al.*, 2012). Thousands of people have either been killed or become disabled in construction industrial accidents every year (Pejman *et al.*, 2013). Construction industrial accidents also cause huge injuries and loss of human lives, leading to terrible environmental damages and deep financial losses (Berend, 2002). Studies carried out in many countries such as USA, Finland, Turkey, China and South Korea revealed that high rates of accidents in the

construction industry are largely caused by poor performance in safety and health provisions (Pejman *et al.*, 2013; Phoya, 2012; Chi *et al.*, 2012; Manu *et al.*, 2010). In South Africa, many recent workplace accidents involving losses of limbs and lives occurred at construction sites (Monsingh & Haupt, 2007). These accidents were not only very devastating but could also lead to major adverse impact on construction companies' production and reputation (Zakaria *et al.*, 2012).

This situation is similar in Malaysia, where the construction industry has also been considered as one of the most hazardous industries (Kamal *et al.*, 2013; Zakaria *et al.*, 2012; Abdullah *et al.*, 2011; Hamid *et al.*, 2008). According to official statistics by the Ministry of Human Resources Malaysia, the number of fatality and disability cases involving construction workers in Malaysia is the highest compared to in other sectors (Department of Statistic Malaysia, 2013). In fact, the actual number could be much higher due to unreported accidents. Majid *et al.* (2008) suggested that this figure could go as high as 80 per cent of Malaysian construction workers, as the majority of construction workers in this country are foreign workers. Many of them working with expired or without any work permit and therefore were afraid to report such incidents to the authorities. In this regard, chairman of National Institute of Occupational Safety and Health (NIOSH), Tan Sri Lee Lam Thye, confirmed that only 20 per cent of accidents at construction sites nationwide were reported to DOSH between 2009 and 2014 (New Straits Times, 2017).

Statistical data retrieved for the year 2007 until 2015 show that accidents in the construction industry represented only 5% of total industrial accidents but accounted for nearly 50% of overall fatality cases across all industries. This was despite the industry only employed an approximately 10% of the total employed workforce (Department of Safety and Health, 2016; Department of Statistic Malaysia, 2016). Therefore, these statistics are indications of a continued severity of construction site accidents compared to others. The statistics on accidents and fatality cases in all industrial sectors kept by local government agencies are available from 2007 until 2015 (Department of Safety and Health, 2016; Department of Statistic Malaysia, 2016).

In order to design a fully effective and appropriate preventive action plan for construction site accidents, the root causes of accidents must be investigated and fully understood. Effective and appropriate preventive actions against accidents can

be taken only by understanding and identifying these root causes. (Chong and Low, 2014; Keng and Razak, 2014); Targhabeh and Hosseinian, 2012; Jantanee *et al.*, 2013; Suraji *et al.*, 2001). Nevertheless, most accidents are preventable (Akasah *et al.*, 2015; Ramli *et al.*, 2012; Majid *et al.*, 2008; Monsingh and Haupt, 2007). By knowing the accident causation factors, a safer, healthier and more conducive working condition and environment at construction workplaces can be created.

Without any doubt, building construction site projects in Malaysia remain as dangerous places where frequent workplace accidents take place. The occurrence of Malaysian accidents at building construction sites in Malaysia arose recently resulting in worker injuries, fatalities and damages to properties. Reports from the local news on accidents at building under construction revealed that many of the accidents caused injuries and fatalities. Three workers were badly injured when a building which was under construction collapsed (New Straits Times, 2017). A worker was killed when the structure of an apartment under construction collapsed (The Malay Mail, 2017). Fifty seven workers escaped accidents at a construction site where the plaster ceiling collapsed (The Malay Mail, 2017). Several workers were killed when scaffolding at a building construction in Bangi collapsed (New Straits Times, 2017). Six workers were badly hurt after a temporary structure of a building construction collapsed (The Malay Mail, 2016). Three were killed and six were injured after a shopping mall under construction collapsed (Astroawani, 2015). Safety at workplace is considered very crucial. Unfortunately there are still many accidents occurred at building projects in the country. This suggests, a critical and detailed analysis of factors that cause accidents at building construction site projects is of immense important.

Previous studies on Malaysian construction industry accidents have looked into the causes of accidents, types of injuries and their magnitudes and places of injuries. Based on the findings in the past studies, most of the research focused, concerned and approached the area of study on Malaysian construction industry (Chong & Low., 2014; Keng & Razak., 2014; Kamal *et al.*, 2013; Zakaria *et al.*, 2012; Salleh *et al.*, 2012; Abdullah *et al.*, 2011; Kuang *et al.*, 2010; Hamid *et al.*, 2008; Rahman & Hassan., 2008; Majid *et al.*, 2008). Nevertheless, the significant factors affecting of causes of accidents at building construction sites sector remain understudied and unclear. For this reason, it is worth to investigate further in order to

identify the significant accident causation factors in the Malaysian building construction sector. This is to ensure Malaysian building site projects are sufficiently safe and healthy for workers and workplace environment respectively.

Therefore, understanding, identifying and determining the significant root causes of accident causation factors can effectively prevent errors, failures, mislead and accidents that could lead to injuries and fatalities (Nden *et al.*, 2014; Ramli *et al.*, 2013; Kamal *et al.*, 2013; Zakaria *et al.*, 2012; Adel *et al.*, 2012; Majid *et al.*, 2008). Additionally, preventive actions can reduce site accidents, injuries, fatalities and would be highly beneficial for the nation's economy, society, rising quality of life and betterment of workplace environment. Indeed, the nation's building construction sector can strive for a better improvement, redefine its image and minimize accidents in the near future by improving or enhancing safety at project sites. Therefore, this study sought to develop and generate a model based on the actual needs for a proper and complete identification of the significant root causes of accident causation factors in Malaysian building construction site projects (Construction Industry Development Board, 2015; Akasah *et al.*, 2016; Asan & Akasah, 2014)

1.3 Research Questions

Upon identifying the issues and the study's problem statement, a list of research questions were developed to guide and help the researcher formed an achievable objective. This research focused on the following research questions:

Research question 1: What are the factors causing accidents in the construction industry?

The literature suggested that the number of construction accidents remains high and need to be minimized. It also highlighted the need to improve sites' safety awareness in organizations undertaking construction and developments projects. For these reasons, this study sought to investigate the factors causing of site construction accidents. In order to answer question 1, the factors were conceptualized based on the literature review and through expert judgement (quantitative approach). The

expert judgement approach refers to the process of seeking opinions from the construction professionals and construction practitioners to enhance and develop further knowledge on the factors causing accidents. Furthermore, the accident causation model of framework was then developed in order to provide a better understanding of the factors covered in this study.

Research question 2: What are the main factors causing accidents at building construction sites in Malaysia?

This question was premised on the hypothesis that the factors causing accidents in the construction industry are closely related to the attributes that would potentially cause accidents at building construction sites in Malaysia. Furthermore, this research question addressed the completion of accident causation factors model (ACM) by identifying relevant factors to be included in the model. Hence, the second hypothesis was developed to support this effort. In addition, it aimed to develop reliable and valid measurement scales in order to develop the ACM model for Malaysian building construction sites. Content reliability, construct validity, mean ranking relevancy analysis of factors were assessed in order to develop the significant measures in an initial ACM for Malaysia's building construction project sites. Thus, the initial ACM model was highly important to be used for testing the validity of the ACM.

Research question 3: How to evaluate the relationship between accident causing factors and accident causation_for building construction sites?

This question aimed to develop a reliable and valid measurement scale in order to develop significant measures in an accident causation model (ACM) for Malaysian building construction site projects.

Research question 4: Is the accident causation model (ACM) valid for measuring the significant accident causation factors for building construction sites in Malaysia?

REFERENCES

- A, Field. (2009). *Discovering Statistics Using SPSS: 3rd Edition*. SAGE Publications Asia-Pacific Pte Ltd.
- Aaltonen, K. (2010). *Stakeholder Management in International Projects*, Ph.D. Thesis, Aalto University, Espoo.
- Abdelnaser, O., Abu Hassan, A. B. and The, H. S. (2008). The Implementation of OSHAS 18001 in Construction Industry in Malaysia., *Journal of Engineering, ANNALS of Faculty of Engineering Hunedoara.*, Tome VI, Fascicule 3, (ISSN 1584 – 2673)
- Abdelnaser, O., Mousa, M., Ilias, S., Abdul Aziz, H. (2008). Impementation of Safety Requirements by the Contractors in the Construction Industry in Libya: Case Studies; *Journal of Engineering. Annals*, Tome VI (Year 2008). Fascicle 2 (ISSN 1584 – 2665)
- Abdul Hamid, A.R., Yusuf, W.Z W. and Sigh. (2003). Hazards at Construction Sites. *Proceedings of the 5thAsia_Pacific Structural Engineering and Construction Conference (APSEC 2003)*.26-28 August 2003 Johor Bahru, Johor.
- Abdullah, A. D. N. M., Gloria, C. M. W. (2011). An Analysis of Accidents Statistics in Malaysian Construction Sector: *International Conference on E-business, Management and Economics IPEDR vol.3*
- Adel, B., Sylvie, N., André, G. (2012). Proposal of a risk-factor-based analytical approach for integrating occupational health and safety into project risk evaluation; *Accident Analysis and Prevention* 48 (2012) 223– 234
- Affendi, R., Chia, H. T. (2012). The Weakness of OSHA 1994 Implementation in Malaysian Construction Industry. *Department of Civil Engineering, Universiti Malaysia Sarawak. UNIMAS c-Journal of Civil Engineering: Volume 4, Issue 2.*
- Agarwal, R. and Karahanna, E. (2000). Time Flies When You're Having Fun: Cognitive Absorption and Beliefs about Information Technology Usage. *MIS Quarterly*, Vol. 24, No. 4, 665-694

- Aibinu, A. & Al-lawati, A. (2010). Using PLS-SEM Technique to Model Construction Organizations Willingness to Participate in ER-bidding. *Automation in Construction*, 19(6). Pp. 714-724, doi: 10.1016/j.autcon.2010.02.016.
- Ajibade, A. A. and Ahmed, M. A. (2010). Using PLS-SEM Technique to Model Construction Organizations' Willingness to Participate In E-Bidding; *Automation in Construction*, Volume 19, Issues 6, Pages 714 - 724
- Akasah, Z. A., Asan, A., Nagapan, S. (2016). Accident Causation in Malaysian Building Construction Sites: An Exploratory Factor Analysis”, *International Graduate Conference On Engineering, Science And Humanities: IGCESH2016*, @ School of Graduate Study, Universiti Teknologi Malaysia, Johor. Program Book; Page 8 (ID 153), 15 -17th August 2016, Johor, Malaysia.
- Akasah, Z. A., Asan, A. (2015). Construction Site Safety: Stakeholders and Effects, *International Joint-Conference SENVAR-iNTA- AVAN 2015 @ Faculty of Built Environment, Universiti Teknologi Malaysia, Johor (SiA2015)*. Conference Proceeding; Page ST5:5/34-5/40, November 2015, Johor, Malaysia.
- Alberta Municipal Affairs. (2014). Pressure Equipment Safety Regulation. User Guide AB-516 REV. 6, 2014-01-09
- Ali, A.S., Kamarulzaman, S.N., Sulaiman, R. & Peng, Y.C. (2010). Factors Affecting Housing maintenance Cost in Malaysia. *Journal of Facilities Management*, 8(4), 285-298. Doi: 10.1108/14725961011078990
- Allan St. John Holt (2001). *Principles of Health and Safety at Work* (1ST Edition Publishing). Technology & Engineering
- Al-Najjar, J.M. (2008). Factors Influencing Time and Cost Overruns on Construction Project in the Gaza Strip. Master of Science in Civil Engineering, Faculty of Engineering, The Islamic University - Gaza
- Amirudin, R., Alhaji, K. M., Abdullah, F. (2013). Knowledge Sharing Practices in Construction in Nigeria. *International Journal Engineering Research & Technology (IJERT)*. ISSN: 2278-0181. Vol. 2 Issue 1, January-2013
- Amirudin, R., Mukhtar, M. M. (2016). The Success Criteria of Public Housing Project in Nigeria. *International Journal of Built Environment and*

- Sustainability. Published by Faculty of Built Environment, Universiti Teknologi Malaysia. IJBES 3 (2)/2016, 102-110
- Aref, C. and Alireza, A. (2012). Enhancement of Safety Performance at Construction Site; International Journal of Advances in Engineering & Technology, (Nov. 2012). IJAET ISSN: 2231-1963
- Asan, A. (2010). Safety and Accident Causation at Malaysian Construction Project, Department of Civil Engineering Seminar, Polytechnic Melaka.
- Asan, A., Akasah, Z. A. (2014). Developing an Accident Causation Model for Accident Prevention at Building Construction Sites". International Civil & Infrastructure Engineering Conference 2014 (INCiEC 2014). Springer Science + Business Media Singapore 2015, ISBN 978-981-287-289-0, DOI: 10.1007/978-981-287-290-6_24, Book Part II, pp. 273-279, 28th September-1st October, 2014, Kota Kinabalu, Sabah.
- Asyraf, W. M. (2013). A Comparison of Partial Least Square Structural Equation Modelling (PLS-SEM) and Covariance Based Structural Equation Modelling (CB-SEM) for Confirmatory Factor Analysis . Department of Mathematics, Universiti Malaysia Terengganu, Malaysia. International Journal of Engineering Science and Innovative technology (IJESIT), Volume 2, Issue 5, ISSN: 2319-5967. ISO 9001: 2008 Certified.
- Awang, Z. (2012). Structural Equation Modelling Using AMOS Graphic. Shah Alam, Selangor: UiTM Press
- Ayodeji, E. O., Deji, R. O. and Stephen, O. (2012). Establishing a Common Ground for the Use of Structural Equation Modelling for Construction Related Research Studies; Australasian Journal of Construction Economics and Building, 12 (3) 89-94
- Bahagian Pembangunan Kontraktor dan Usahawan (BPKU) Kementerian Kerja Raya Malaysia (KKR). <http://www.kkr.gov.my/node/464>
- Banerjee, A., Chitnis, U.B., Jadhav, S. L., Bhawalkar, J. S. & Chaudhury, S. (2009). Hypothesis Testing, Type I and Type II Errors. Industrial Psychiatry Journal, 18(20), pp. 127-131. doi: 10.4103/0972-6748.62274.
- Bansal, V. K. (2011). Application of Geographical Information Systems in Construction Safety Planning. International Journal of Project Management, 29(2011), 66-77.

- Barron's Real Estate Dictionary. (2012)
- Bartholomew, D., Knotts, M. & Moustaki, I. (2011). Latent variable models and factor analysis: A unified approach. (3rd ed.). West Sussex, UK: John Wiley & Sons.
- Beasley, D. (2011). The Most Common Causes of Workplace Injuries: Protecting Employees. Retrieved March 8, 2012, from <http://www.articlesnatch.com/Article/Machinery-Accidents-In-The-Workplace>.
- Behm, M. (2005). Linking Construction Fatalities to the Design for Construction Safety Concept. *Journal of Safety Science*, Vol.43
- Bendixen, M.T. and Sandler, M. (1995). Converting verbal Scales to Interval Scales Using Correspondence Analysis., *Management Dynamic*, 4(1): 31-49
- Berend Kneegtering. (2002). Safety Lifecycle Management in the Process Industries: The Development Of A Qualitative Safety-Related Information Analysis technique, ISBN 90-386-1747-X; University Press Facilities, Eindhoven.
- Bergstrom, C. (2006). Safety and Sustainability in the Community Planning Process; PhD Thesis, Inuversitetsservice US AB, ISSN 1402-7453, Stockholm, Sweden.
- Bin, F. Y. (2011). Optimizing Safety Investments For Building Projects In Singapore. Thesis for the Degree of Doctor of Philosophy, Department of Building, National University of Singapore.
- Bock, G. W., Zmud, R. W., Kim, Y. G., Lee, J. N. (2005). Behavioural Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces and Organizational Climate. *MIS Quarterly*, 29, no (1), 87-111.
- Bock, G.W., Zmud, R.W., Kim, Y.G. & Lee, J.-N. (2005). Behavioural Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces, and Organizational Climate. *MIS Quarterly* 29(1):87-111 (2005)
- Bomel. (2001). Contract Research Report 387/2001 Improving Health and Safety in Construction: Phase 1: Data Collection, Review and Structuring, Health and Safety Executive, London.
- Brent, R.J. (2003). Cost Benefit Analysis and Health Care Evaluations, Edward Elgar, Cheltenham, UK.

- Brown, I.D. (1995). Accident Reporting and Analysis, Evaluation of Human work, J.R.Wilson and E.N Corlett. Eds. Taylor and Francis, London.
- Brown, J.D. (2001). Using Surveys in Language Programs. Cambridge: Cambridge University Press
- Building and Construction Industry. Victorian Current Acts. (2002). Business Dictionary. (2012). web: [www.business dictionary. Com /definition / organization.](http://www.businessdictionary.com/definition/organization)
- Business Times, Malaysia. (2014). 25 February 2014. Muhammad Ahmad Hamdan. Safety and Health in Construction Sector has Room to Improve. web: <http://www.nst.com.my/business>
- Cattell, R.B. (1973). Factor analysis. Westport, CT: Greenwoodress.
- Cattledge, G.H., Heindricks, S. and Stavenich, R. (1996). Fatal Occupational Fall in the U.S Construction Industry, 1980-1989. Journal of Accident Analysis and Prevention, Vol.28, No.5.
- Chan, A.P.C., Chueng, S.O., Lam, P.T.I., Yung., K.H.E. and Tam, C.M. (2001). Application of Delphi Method in Selected of Procurement Systems for Construction Projects; Journal of Construction Management and Economics, 19(3): 699-718
- Chan, K. C., Heng, L., Martin, S. (2012). The Use of Virtual Prototyping for Hazard Identification in the Early Design Stage; Construction Innovation; Vol. 12 No. 1, 2012.pp. 29-42
- Charehzehi, A. and Ahankoob, A. (2012). Enhancement of Safety Performance at Construction Site; International Journal of Advances in Engineering & Technology.IJAET ISSN: 2231-1963
- Charvolin, M., Dunchet, M. (2006). Conception des Lieux et Des Situations de Travail. Edition de l'IRNS ED950,pp. 1-149
- Chau, K.W., Ho, D.C.W., Leung, H.F., Wong, S.K., Cheung, A.K.C., Yau, Y., Lau, S.S.Y. and Wong,W.S. (2005). A sustainable framework of building quality assessment for achieving asustainable urban environment: paper presented at the 2005 World Sustainable Building Conference, Tokyo, 27-29 September.
- Chi, S., Zang, H., Han, S., Kwan, S. (2012). Systems Theory Analysing Safety Risks and Their Impacts on Injury Severity in the U.S. Construction Industry.

- Chin, W. W. (1998a). Issues and opinion on structural equation modelling. *MIS Quarterly*, 22(1), pp vii–xvi.
- Chin, W. W. (2010). How to Write Up and Report PLS Analyses. In V. Esposito Vinzi et al. (eds.) (Ed.), *Handbook of Partial Least Squares*, Berlin: Springer. doi: 10.1007/978-3-540-32827-8 29
- Chin, W. W., Marcolin, B. L. & Newsted, P. R. (1998). A Partial Least Square Latent Variable Modelling Approach for Measuring Interaction Effects: Result From a Monte Carlo Simulation Study and Voice Mail Emotion/ Adoption Study. Paper Presented at the 17th International Conference on Information Systems, Cleveland.
- Ching, W. C., Sau, S. L., Chen, C. L., Chih, H. F. (2010). Characteristic Analysis of Occupational Accidents at Small Construction Enterprises: *Safety Science* 48 (2010) 698–707
- Ching, W. C., Sou, S. L., Ying, M. C., Tsung, C. W., Chen, C. L. (2012). Applying Data Mining Techniques to Explore Factors Contributing to Occupational Injuries in Taiwan's Construction Industry: *Accident Analysis and Prevention* 48 (2012) 214– 222
- Ching, W. C., Chen, C. L., Sou, S. L. (2010). Use of Association Rules to Explore Cause–Effect Relationships in Occupational Accidents in the Taiwan Construction Industry: *Safety Science* 48, (2010) 436–444
- Chong, H. Y., Low, T. S. (2014). Accidents In Malaysia Construction Industry: Statistical Data and Court Cases: Universiti Tunku Abdul Rahman, Kuala Lumpur, Malaysia; *International Journal of Occupational Safety and Health (JOSE)* 2014, Vol. 20, No.3, 503-513.
- Collins English Dictionary - Complete & Unabridged 10th Edition. (2009)
- Construction Industry Master Plan (CIMP), Malaysia 2006-2015. Construction Industry Development Board, Malaysia (2007)
- Construction Industry of Development Board Malaysia. (2016). web: [https://www.cidb.gov. my/cidbv3/index.php?lang=en](https://www.cidb.gov.my/cidbv3/index.php?lang=en)
- Construction Industry of Development Board Malaysia. (2015). web: <https://www.cidb.gov. my/cidbv3/index.php?lang=en>
- Construction Industry of Development Board Malaysia. (2013). web: <https://www.cidb.gov. my/cidbv3/index.php?lang=en>

- Creswell, J. W. and Miller, L. (2000). Determining Validity in Qualitative Inquiry; Theory into Practice, Vol. 39., pp. 124-130
- Creswell, J.W. (2007). Qualitative Inquiry and Research Design - Choosing among five Approaches. 2nd Edition. Sage Publications, California USA.
- Creswell, J.W. (2009). Educational Research .Pearson Education, United States.
- Creswell, J.W. (2012). Research Design: Qualitative, Quantitative, and Mixed Method Approaches. 3rd ed. California: Sage Publications.
- David, L.G. (2003). Construction Safety and Health. New Jersey: Prentice Hall.
- DeJoy, D.M. (1990). Towards a Comprehensive Human Factors Model of Workplace Accident Causation. *Prof. Safety*. 35(5).
- Department of Occupational Safety and Health Malaysia (DOSH). (2011a). Regulations. From http://www.dosh.gov.my/doshV2/index.php?option=com_phocadownload&view=category&id=6%3Aregulations-under-occupational-safety-and-health-act-1994-act-514&Itemid=99&lang=en
- Department of Occupational Safety and Health Malaysia (DOSH). (2011b). Summary of Accident Cases., from http://www.dosh.gov.my/doshV2/index.php?option=com_wrapper&view=wrapper&Itemid=142&lang=en
- Department of Occupational Safety and Health Malaysia. (2011). Occupational Safety and Health Act 1994 (Act 514)., from http://www.dosh.gov.my/doshV2/phocadownload/acts/akta_keselamatan.pdf
- Department of Occupational Safety and Health Malaysia. DOSH (2014). Ministry of Human Resource; DOSH Annual Report (2007-2013). Summary of Accident Cases., from http://www.dosh.gov.my/doshV2/index.php?option=com_wrapper&view=wrapper&Itemid=142&lang=en
- Department of Occupational Safety and Health Malaysia. DOSH (2016). Ministry of Human Resource; DOSH Annual Report (2007-2015). Summary of Accident Cases., from http://www.dosh.gov.my/doshV2/index.php?option=com_wrapper&view=wrapper&Itemid=142&lang=en
- Department of Occupational Safety and Health. (2001). Code of Practice for Safe Working in a Confined Space. Ministry of Human Resources Malaysia.
- Department Of Statistic Malaysia, Prime Minister's Department. Statistics, Construction, Labour Force Survey Report (2016) web: <https://www.statistics.gov.my/>

- Department Of Statistic Malaysia, Prime Minister's Department. Statistics, Construction, Labour Force Survey Report (2015) web: <https://www.statistics.gov.my/>
- Department Of Statistics Malaysia (2013). Quarterly Construction Statistics
- Developing A National Agenda. *Journal of Safety Research*, 41 (2010), 289–299.
- Devon, H. A, Block, M. E., Moyle-Wright, P., Ernst, D. M., Hayden, S. J., Lazzara, D. J., Savoy, S. M., et al. (2007). A psychometric toolbox for testing validity and reliability. *Journal of nursing scholarship : an official publication of Sigma Theta Tau International Honor Society of Nursing / Sigma Theta Tau*, 39(2), 155–64. doi:10.1111/j.1547-5069.2007.00161.x
- Dorsey, R. W. (1997). *Project Delivery Systems for Building Construction*. Associated General Constructors of America.
- Dumrak, J., Mostafa, S., Kamardeenm, I., Rameezdeen, R. (2013). Factors Associated with the Severity of Construction Accidents: The Case of South Australia. *Australasian Journal of Construction Economics and Building* ;13 (4) 32-49(2013)
- Economic Planning Unit, Malaysia Prime Minister's Department. (2016). web: [http : //www.epu.gov.my/ms](http://www.epu.gov.my/ms)
- Eddy, D. M., Hollingworth, W., Caro, J. J., Tsevat, J., McDonald, K. M., & Wong, J. B. (2012). Model transparency and validation: a report of the ISPOR-SMDM Modeling Good Research Practices Task Force--7. *Value in health : the journal of the International Society for Pharmacoeconomics and Outcomes Research*, 15(6), 843–50. doi:10.1016/j.jval.2012.04.012
- Edwin, S., Shamil, N. and Daniel, F. (1999). Factors Affecting Safety Performance On Construction Sites. *International Journal of Project Management* Vol. 17, No. 5, pp. 309±315, 1999 # 1999 Elsevier Science Ltd and IPMA. All rights reserved .,Printed in Great Britain: 0263-7863/99
- Edwin, S., Shamil, N. and Daniel, F. (1999). Factors Affecting Safety Performance On Construction Sites. *International Journal of Project Management* Vol. 17, No. 5, pp. 309±315, 1999 # 1999 Elsevier Science Ltd and IPMA. All rights reserved .,Printed in Great Britain: 0263-7863/99

- Ellias, I., Felix, H. and David, O. (2012). Cost-benefit Analysis for Accident Prevention in Construction Projects; *Journal of Construction Engineering And Management*, ASCE /August 2012/991
- Etymology Dictionary Online, (2010) Douglas Harper
- Factories and Machinery Act 1967 (act 139). FMA 1967., Malaysia
- Farlex Financial Dictionary. (2012) Farlex, Inc.
- Fellow, R and Liu, A. (2008). *Research Methods For Construction* (3rd Edition), Wiley-Blackwell,Utopia Press Pte.Ltd,Singapore, Blackwell, UK
- Ferrat, E.D., and Hughes, P. (2007). *Introduction in Health and Safety in Construction*, 2nd Ed.,Elsivier, Oxford, UK.
- Fewings, P. (2005). *Construction Project Management: an Integrated Approach*. London: Taylor and Francis
- Field, A. (2000). *Discovering Statistics using SPSS for Windows*. London – Thousand Oaks – New Delhi: Sage publications.
- Field, A. (2005). *Discovering Statistics Using SPSS: 2nd Edition*. Sage Publications, London, Thousand Oaks, New Delhi.
- Field, A. (2009). *Discovering Statistic Using SPSS: 3rd Edition*.SAGE Publications Asia-Pacific Pte Ltd.
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Errors. *Journal of Marketing Research*, 18, 39–50.
- Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach*. Boston: Pitman.
- Frijters, A. C. P. and Swuste, P. H. J. J. (2008). Safety Assessment in Design and Preparation Phase: *Journal Of Safety Science*, Vol. 46, pp.272-281.
- Ghaderi R. & Kasirossafar K. (2011). *Construction Safety in Design Process*, ASCE Conf. Proc. doi:10.1061/41168(399)54, AEI 2011: Building Integrated Solutions, Proceedings of the AEI 2011Conference.
- Ghani, M. K., Mohd, B. A., Alias S. K., Che Ibrahim, C. K. I., Abd. Hamid, E. Z., Abdul Rahim, A. H., Mohamad Kamat, K. A. & Mohd. Zain, M. Z. (2008). *Stategies in Reducing Hazards at Construction Sites*.Construction Research Institute of Malaysia (CREAM) –CIDB.137-148

- Ghazali, N., Yaman, S. K. (2014). Contractors' Compliance on Occupational Safety and Health (OSH) Policies in Malaysia's Construction Industry. Conference Paper. Research Gate; [https://www. Researchgate.net/publication/282940266](https://www.Researchgate.net/publication/282940266).
- Gillen, M. (2010). The NIOSH Construction Program: Research to Practice, Impact, and Developing A National Agenda. *Journal of Safety Research*, 41(2010), 289–299.
- Goh, A.T. and Ahmad, Y. (2011). Public Low-Cost Housing in Malaysia: Case Studies on low- cost flats in Kuala Lumpur. *Journal of Design and Built Environment*, Vol.8, 1-18.
- Gotz, O., Liehr-Gobbers, K., Krafft, M. (2010). Evaluation of Structural Equation Models
- Habing, B. (2003). Exploratory Factor Analysis. Website: <http://www.stat.sc.edu/~habing/courses/530EFA.pdf>
- Haenlein, M. & Kaplan, A. M. (2004). A Beginner's Guide to Partial Least Squares Analysis. *Understanding Statistics*, 3(4), 283–297.
- Hair, J. F., Anderson, R. E. (2013). *Multivariate Data Analysis*: Saddle River, NJ:Prentice Hall.
- Hair, J. F., Anderson, R., Tatham, R., Black, W. (1998). *Multivariate Data Analysis*, Prentice Hall, Upper Saddle River.
- Hair, J. F., Black, W. C., Babin, B. J. & Anderson, R. E. (2010). *Multivariate Data Analysis: 7 edition*.Upper Saddle River,NJ:Prentice Hall.
- Hair, J. F., Ringle C.M. and Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal of Marketing Theory and Practice*, 19(2), pp. 139–151.
- Hair, J. F., Ringle, C. M. & Sarstedt, M. (2011a). PLS-SEM: Indeed a Silver Bullet. *The Journal of Marketing Theory and Practice*, 19(2), pp.139–152.
- Hair. J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis: 7 edition*. Upper Saddle River, NJ: Prentice Hall.
- Hamid, A. A. R. (2008). Causes of Construction Accidents from DOSH Reports in Year 2000 to 2004; *Malaysian Journal of Civil Engineering* 20(2) : 242 - 259 (2008)
- Hamid, A. A. R., Majid, A. M. Z., Singh, B. (2008). *An Overview of Construction Accidents in Malaysia, Issues In Construction Industry*; Univision Press;

- Malaysian Book Publishers Associate (9101). Faculty Civil Engineering, UTM; ISBN 978-983-52-0568-2
- Hammer W. and Price, D. (2001). Occupational Safety Management and Engineering. 5th Ed., New Jersey: Prentice Hall
- Hashem M.A. and Tabtabai (2002); Analyzing Construction Site Accidents in Kuwait; Kuwait. J.Science Engineering 29(2)
- Haslam, R.A., Hide, S.A., Gibb, A.G.F., Gyi, D.E. Pavitt, T., Atkinson, S., Duff, A. R. (2005). Contributing Factors in Construction Accidents. Journal Of Applied Ergonomics, Vol.36.
- Health and Safety Executive [HSE]. (2001). Health and Safety Statistics 2000/2001. (Internal report reference E2033). Bootle, UK: Health and Safety Executive
- Heinrich, H. W., Petersen, D. and Ross, N. (1980). Industrial Accident Prevention. 5th Edition. New York: Mcgraw-Hill.
- Helen, L. and Steve, R. (2005). Occupational Health and Safety in Construction Project Management; ISBN 0-419-26210-5(hb:alk.paper):Spoon Press, New York
- Helen, L., Nick, B., Tracy, C. and Helen, C. (2008). The Model Client Framework: International Journal of Managing Projects in Business Vol. 2 No. 1, 2009 pp. 131-140
- Henseler, J. (2012). Why Generalised Structured Component Analysis Is Not Universally Preferable to Structural Equation Modelling. Journal of the Academic of Marketing Science, 40, 402 - 413
- Henseler, J., Ringle, C. M. & Sinkovics, R. R. (2009). The Use of Partial Least Squares Path Modeling in International Marketing: Advances in International marketing. 20(2009), 227-319.doi: 10.1108/S1474-7979(2009)0000020014
- Hilton, M. F. and Whiteford H. A. (2010). Associations Between Psychological Stress, Workplace
- Himadri, G., Partha, P. B. (2013). Measuring Construction Site Safety in Kolkata, India: International Journal of Scientific & Engineering Research, Volume 4, Issue 5, May-2013 2138,ISSN 2229-5518
- Hock, C., Ringle, C. M., Sarstedt, M. (2010). Management of Multi-purpose Stadiums: Importance and Performance Measurement of Service Interfaces. Services Tecnology and Management, Vol 14, No. 2/3, 188-206.

- HSE. (2001). Health and Safety Executive (HSE). The Accidents Reporting in Construction Industry, HMSO, London.
- HSE. (2009a). Health and Safety Executive (HSE). Construction Intelligence Report: Analysis of Construction Injury and Ill-health Intelligence. Retrieved March 1, 2011,
- HSE. (2012). Health and Safety Executive (HSE). The Analysis of Major Injuries in Construction, HMSO, London.
- Hughes, P and Ferret, E. (2008). Introduction to Health and Safety in Construction. 3rd Ed, Oxford; Elsevier Ltd.
- Hui, N. A (2014). Safety Culture in Malaysian Workplace: An Analysis of Occupational Accidents. School of Management, Universiti Sains Malaysia, Malaysia. Health and the Environment Journal, Vol. 5, No. 3, pp 32-43.
- Hulland, J. (1999). Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent Studies. Strategic Management Journal, 20, 195-204.
- Igbaria, M., Zinatelli, N., Cragg, P. & Cavaye. A. L. M. (1997). Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model. MIS Quarterly 21(3):279-305
- Jabatan Penerangan Malaysia. (2016). Web: <http://pmr.penerangan.gov.my/index.php/maklumat-kenegaraan/255-perspektif-wawasan-2020.html>
- Janicak, C. A. (1998). Fall-Related Deaths in The Construction Industry. Journal of Safety Research. Vol.29.No.1
- Jannadi, O. A. and Bu-Khamsin, M. S.(2002). Safety Factors Considered By Industrial Contractors in Saudi Arabia. Journal Of Building and Environment. Vol.37.No.5,pp.539-47
- Jarvis, C. B., MacKenzie, S. B. and Podsakoff, P. M. (2003). A Critical Review of Construct Indicators and measurement model misspccification in Marketing and Consumer Research. Journal of Consumer Research, 30(2), 199
- Jaselskis, E. J., Anderson, S. D. and Russell, J. S. (1996). Strategies for Achievement Excellence in Construction Safety Performance, Journal of Construction Engineering and Management, American Society of Civil Engineers (ASCE), pp 61-70.

- Jeffrey, S. O. (2007). Using Theories to Prevent Accidents. Acquired from <http://www.safetycouncil.com/pdf/534Oakley.pdf> on 9th May 2007.
- Jimmie W.H. (1997). Construction Safety; Prentice-Hall, Inc., Simon & Schuster/AViacom Company, Upper Saddle River, New Jersey 07468
- Jonathan Zemeckis. (2014). Being a Construction Workers; the Good, the Bad and the Ugly; The New Frontier in Building & Construction.
- Kamal, I.S.M., Ahmad, I.N., Ma'arof, M.I.N. (2013). Review on Accidents Related to Human Factors at Construction Site; Advanced Engineering Forum Vol. 10 (2013) pp 154-159
- Kartam, N. A. and Bouz, R.G. (1996). Fatalities and Injuries in the Kuwaiti Construction Industry. Journal of Accidents Analysis and Prevention, Vol.30. No.6.
- Keng, T. C., Razak, N. B. (2014). Case Studies on The Safety Management at Construction Site; Department Of Quantity Surveying, Kulliyah of Architecture & Environment Design, International Islamic University, Malaysia; Journal of Sustainability Science and Management; Volume 9 number 2, December 2014: 90-108: ISSN: 1823-8556 @ Penerbit UMT
- Khairolden, M. G., Zuhairi, A. H., Maria Zura, M. Z., Ahmad, H. A. R. (2008). Safety in Malaysian Construction: The Challenges and Initiatives. Feature., IEM; Jurutera Journal, p.p 16-19
- Kitchenham, B. and Pfleeger, S. L. (2002). Principles of Survey Research: part 5: Populations and Samples. ACM SIGSOFT Software Engineering, 27(5), 17-20.
- Kline, R. B. (2010). Principles and Practice of Structural Equation Modelling. (3rd ed.), The Guilford Press, New York.
- Koehn, E. E., Kothari, R. K. and Pan, C. S. (1995). Safety in Developing Countries: Professional and Bureaucratic Problems, Journal of Construction Engineering and Management, September, pp 261- 265.
- Kotani, K., Tateda, C., Horii, K. (2007). Computer Task Based- Evaluation Technique for Measuring Everyday Risk-Taking Behaviour: Second International Conference on Usability and Internationaliation, pp. 22-27
- Kumar, R. (2005). Research Methodology: A Step-By-Step Guide for Beginners. 2nd Edition. Sage Publication, London, UK

- Kuang, L. C., Hassan, H., Zainuddin, N. M. (2010). Towards Zero Accidents in Construction Projects: Promoting HIRARC as an Effective Tool to Reduce Accidents. Department of Technology Management, FMETM, University Malaysia Pahang, Malaysia: 3rd International Graduate Conference on Engineering, Science and Humanities (IGCESH), School of Graduate Studies, Universiti Teknologi Malaysia, 2-4 november, 2010
- Laitenant, H. and Rouhomaki, I. (1996). The Effect Of Feedback and Goal Setting on Safety Performance at Two Construction Sites. *Journal of Safety Science*. Vol.24. No.1.
- Lancaster, G. A., Dodd, S. & Williamson, P. R. (2004). Design and Analysis of Pilot Studies: Recommendations for Good Practice. *Journal of Evaluation in Clinical Practice*,10(92),307-12.doi:10.1111/j.2002.384.doc.x
- Latiffi, A. A. (2012). Performance Measurement For Construction Business: PhD Thesis. Loughborough University, UK
- Lawrence F. Bennet. (2003). The Management of Construction: A project Life Cycle Approach, University of Alaska, Fairbanks.
- Lawrence J. M., Alistair G. F. G., Roger Haslam and Martyn Pendlebury. (2003). The Development of An Accident Causal Model for Off-Site Production in Construction; 19th Annual ARCOM Conference Construction 3-5 September 2003, University of Brighton.
- Lee, C. K., Hasahudin, H. and Nurhaizan, M. Z. (2010). Towards Zero Accidents in Construction Projects: Promoting HIRACS As An Effective Tool To Reduce Accidents, 3rd International Graduate Conference on Engineering, Science and Humanities (IGCESH), UTM
- Lewis, W., Agarwal, R. & Sambamurthy, V. (2003). Sources of Influence on Beliefs about Information Technology Use: An Empirical Study of Knowledge Workers. *MIS Quarterly*. Vol. 27, Number 4, 657-678
- Li, R. Y. M. (2006). Effectiveness of Various Construction Safety Measures in Hong Kong; BSc Thesis, Real Estate and Construction, The university of Hong Kong, Hong Kong
- Li, R. Y. M. and Poon, S. W (2010). Why Do Accidents Happen? A Critical Review on the Evolution of the Construction Accident Causation Models; CIB Congress, 10-14 May 2010, Manchester; ISBN:978-3-642-35045-0

- Li, X. and Wang, R. (2007). Survey Research on Relationships among Service Failure, Service Recovery and Customer Satisfaction, International Conference on Management Science and Engineering, Harbin, China, 1121-1123.
- Lin, K. M. (2011). E-Learning Continuance Intention: Moderating Effects of User e-Learning Experience. *Computers & Education*, 56(2),
- Lingard, H. and Rowlinson, S. (1997). Behavior-Based Safety Management in Hong Kong's Construction Industry. *Journal of Safety Research*. Vol.28. No.4.
- Lucko, G. & Rojas, E. M. (2010). Research Validation : Challenges and Opportunities in the Construction Domain; *Journal of Construction Engineering and Management*, 136 (1), 127-135
- MacCallum, R. C., Widaman, K. F., Zhang, S. & Hong, S. (1999). Sample Size in Factor Analysis. *Psychological Methods*, 4, 84-99.
- Majid, A. M. Z., Hamid, A. A. R., Singh, B. (2008). Causes of Accidents at Construction Sites: *Malaysian Journal of Civil Engineering* 20(2) : 242 - 259
- Malaysia Investment Development Authority (MIDA). (2016). <http://www.mida.gov.my/env3/>
- Malaysian Institute of Architect (PAM) (2015). 26 August 2015. Construction Industry to Grow 10.5% in 2015. <http://www.buildingshows.com/market-insights/malaysia/malaysian-institute-of-architects-says-construction-industry-to-grow-10-5-in-2015/801798372>
- Manu, P., Ankrah, N., David, P., Suresh, S. (2010). An Approach for Determining the Extent of Contribution of Construction Project features to Accident Causation. *Safety Science*, 48(p):p.687-692
- Martis, M. S. (2006). Validation of Simulation Based Models: A Theoretical Outlook, *The Electronic Journal of Research Business Methods*, 4(1), 39-46.
- Masayuki, N. S. (2006). Current Activities for Improvement of Construction Occupational Health and Safety in Japan, 4th Quarter Master Builders Association Malaysia, 88-95
- Master Builders Association Malaysia (2012). [http://www.mbam.org.my/mbam/Annual Safety Conference 2012](http://www.mbam.org.my/mbam/Annual%20Safety%20Conference%202012); Malaysia Master Builders Association (MBAM), June 2012) Patrick Manu, Nii Ankrah, David Proverbs, Subashini Suresh

- McGraw-Hill Concise of Engineering. (2014). 2002 by The McGraw-Hill Companies, Inc. Merriam-webster_definitions.
- Memon, K. & Rahman, A. I. (2012). Users' Perceptions of Various Aspects of Malaysian Internet Financial Reporting. *The Journal of Organizational Management Studies*, 2012, 1-14, doi: 10.5171/2012.852558.
- Mike, B., Brian, K. and Paul, L. (1996). *The Handbook of Health and Safety at Work*. London:Kogan Page.
- Mohd, K. G., Zuhairi, A. H., Maria, Z. M. Zain., Ahmad, H. A. R. (2008). Safety in Malaysian Construction: The Challenges and Initiatives Feature., IEM; *Jurutera Journal*, p.p 16-19
- Molla, A. and Licker, P. S. (2005). eCommerce Adoption in Developing Countries: A Model and Instrument. *Information & Management*, 42(6), 877–899. doi:10.1016/j.im.2004.09.002
- Monsingh, K.S., Haupt, T. (2007). *Construction Accident Causation: An Exploratory Analysis*; Cape Peninsula University of Technology
- Morse, J. M. (2003). Principles of Mixed Methods and Multimethod Research Design. in Tashakkori, A. and Teddlie, C. (eds.) *Handbook of Mixed Methods in Social & Behavioral Research*. Thousand Oaks, California: Sage Publications.
- Muhwezi, L., Chamuriho, L. M. & Lema, N. M. (2012). An Investigation into Materials Wastes on Building Construction Projects in Kampala-Uganda. *Scholarly Journal of Engineering Research*, 1(1), pp. 11–18.
- Myers, D. (2013). *Construction Economics: A new approach* (3rd ed.). New York: Routledge.
- Nagapan, S. (2014). *Structural Modelling of Cause and Effect Factors of Construction Waste Generation In Malaysian Construction Industry*; PhD Thesis. Universiti Tun Hussein Onn Malaysia, Johor, Malaysia.
- Naoum, S. G. (1998). *Dissertation Research and Writing for Construction Student*. Oxford; Butterworth-Heinemann.
- National Institute Occupational Safety and Health (NIOSH). (2016). Ministry Of Human Resources Malaysia; <http://www.niosh.com.my/v3i/index.php/en/>
- Nden, T., Avre, G. K., Oladipo, T. O., Edom, A., Samuel, P. O., Ananso, G. N. (2014). *Causes and Effects of Accidents on Construction Sites (A Case Study*

of Some Selected Construction Firms in Abuja F.C.T Nigeria). IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 11, Issue 5 Ver. I (Sep- Oct. 2014), PP 66-72 www.iosrjournals.org.

Negara, B. (2014). Economic and Financial Data for Malaysia: Bank Negara Malaysia.

News Straits Times (NSTP). (2017). Chuan Bee Kim. 16 May 2017. 80 per cent of Accidents at Malaysia Construction Sites go Unreported: NIOSH . web: <http://www.nst.com.my>

News Straits Times (NSTP). (2017). Teoh Pei Ying. 14 May 2017. Three Injured When Under-Construction Building Collapse at jalan Kia Peng. web: <http://www.nst.com.my>

News Straits Times (NSTP). (2015). Nuradzimah Daim. 28 October 2015. 518 Foreign Workers Deaths at Construction Site Since 2006. web: <http://www.nst.com.my>

News Straits Times (NSTP). (2015). Zarina Zakariah and Nuradzimah Daim. 11 September 2015. Transforming the Construction Sector. web: <http://www.nst.com.my>

News Straits Times (NSTP). (2014). 21 February 2014. Work Ministry to Seek Industry Players Feedback in Improving Construction Sectors Ecosystem. web: <http://www.nst.com.my>

News Straits Times (NSTP). (2014). 02 February 2014. Senior General Manager, Corporate and Business Sector, CIDB. There is a Room to Improve Safety in the Construction Sectors. web: <http://www.nst.com.my/business>

News Straits Times (NSTP). (2012). 02 May 2012. CIDB Act Amended to Increase Construction Site Safety. web: <http://www.nst.com.my>

News Straits Times (NSTP). (2013). 09 June 2013. Did Building Firms Do Enough for Safety. web: <http://www.nst.com.my>

News Straits Times (NSTP). (2013). 19 march 2013. Too Few Safety officers at Construction Sites. web: <http://www.nst.com.my>

News Straits Times (NSTP). (2013). 25 July 2013. Construction Site Accidents in Last 5 Years. web: <http://www.nst.com.my>

- News Straits Times (NSTP). (2013). 27 June 2013. Panel to Identify Work Practices to Reduce Construction Accidents. web: <http://www.nst.com.my>
- Nicholas, C., Emmanuel, D. (2012). Benefits and Barriers of Construction Health and Safety management (HSM); *Journal Of Engineering, Design and Technology*, Vol.10 N0.2, (2012) pp.276-298.
- Occupational And Environmental Safety & Health Operational Procedure. (2009). WRHA., Manitoba.
- Occupational Safety and Health Act (OSHA) 1994 (Act 514), Malaysia
- Ofori, G. (1992). The Environment: The Fourth Construction Project Objective?, *Construction Management & Economics*, 10 (5), 369-395.
- Oke, A. E., Ogunsami, D. R., Ogunlana, S. (2012). Establishing A Common Ground for the Use of Structural Equation Modelling for Construction Related Research Studies. *Australasian Journal of Construction Economics and Building*, 12 (3) 89-94.
- Paton, N. (2008). Senior Managers Fail to Show Competence in Health and Safety: *Occupational and Health*, 60(3),6.
- Patton, M., Q. (2002). *Qualitative Research and Evaluation Methods*. 3rd Edition. Sage Publications, USA.
- Peihua, Z., Helen, L., Nick, B., Ron, W., Brian, K. (2011). Application of Q-methodology in Studying Construction Stakeholders: Perceptions of OSH Risks – An Introduction to the Preliminary Stage”, *School of Property, Construction and Project Management, RMIT University, Australia*.
- Pejman, G. P. S., Hamid, A., Mir, H. M. J., Kiyanoosh, G. R. (2013). Application of Domino Theory to Justify and Prevent Accident Occurance in Construction Sites; *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*;p-ISSN: 2320-334X, Volume 6, Issue 2, Performance in the Tourism Sector. *Service Business*, 5(4), pp. 411–428.
- Petersen, D. (1976). *Safety Supervision*. New York : American Management Associations.
- Phoya, S. (2012). *Health and Safety Risk Management in Building Construction Sites in Tanzania: The Practice of Risk Assessment, Communication and Control*; Chalmers University of Technology, Gothenburg, Sweden.

- Pinto, A., Nunes, I. L., Ribeiro, R. A. (2010). Qualitative Model for Risk Assessment in Construction Industry: A Fuzzy Logic Approach. *International Federation for Information Processing*, pp. 105-111
- Pipitsupaphol, T. and Watanabe, T. (2000). Identification of Root Causes of Labor Accidents in the Thai Construction Industry. *Proceeding of the 4th Asia Pacific Structural Engineering and Construction Conference IASPEC 2000* 13-15 September 2000 Kuala Lumpur, pp193-202.
- Plouffe, C.R., Hulland, J.S., Vandenbosch, M. (2001). Research Report: Richness Versus Parsimony in Modeling Technology Adoption Decisions—Understanding Merchant Adoption of a Smart Card-Based Payment System. *Information Systems Research*. 12(2), 208–222
- Priyadarshani, K., Karunasena, G., Jayasuriya, S. (2013). Construction Safety Assessment Framework for Developing Countries: A Case Study of Sri Lanka (2013); *Journal of Construction in Developing Countries*, 18(1), 33–51
- Project Management Research. Newtown Square: Project Management Institute Inc.
- Rahman, A. I, Memon, A. H, Ahmad. T. A (2013). Examining Factor Effecting Budget Overrun of Construction Projects Undertaken Through Management Procurement Method Using PLS-SEM Approach; *Procedia Social and Behavioral Science Journal* 107 (2013) 120-128, University Malaysia Kelantan, Malaysia. Published by Elsevier Ltd
- Rahman, A. R., & Hassan, K. H. (2008). Regulating High-Risk Activities in Construction Industry in Malaysia: The Need for Legal Protection; *Jurnal Undang-Undang Dan Masyarakat; UKM* (2008)pp.246-258
- Ramayah, T., Lee, J. W. C. & In, J. B. C. (2011). Network Collaboration And Performance in the Tourism Sector. *Service Business*, 5(4), 411–428. doi:10.1007/s11628-011-0120-z
- Ramayah, T., Yan, L. C. & Sulaiman, M. (2005). SME e-Readlines in Malaysia: Implications for Planning and Implementation. *Sasin Journal of Management*, 11(1).103-120.
- Ramli, A. (2014). Development and Validation of a Safety and Health Performance Model for Low Cost Housing; PhD Thesis. Universiti Tun Hussein Onn Malaysia, Johor, Malaysia.

- Ramli, A., Akasah, Z. A., Asan, A. (2015). Development of Building Safety and Health Performance Framework for Building Management in Malaysia. 2nd International Conference On Construction and Building Engineering”,2015 (ICONBUILD2015). ICONBUILD2015 Conference Handbook,pp.62,11th-13th August, Padang, West Sumatera, Indonesia.
- Ramli, A., Akasah, Z. A., Mohd, A. (2012). A Preliminary Study On Building Design Factors Contributing To Building Safety And Health Performance Of Apartment Buildings In Malaysia; Paper presented at International Conference on Culture, Society, Technology and Urban Development in Nusantara, Universiti Pembangunan Panca Budi, Medan, 11-13 October (pp. 1-20), Medan, Indonesia.
- Ramli, A., Akasah, Z. A., Mohd, A. (2012); A Review of Building Factors Contributing to Building Safety Performance; Paper presented at 2012 International Conference on Innovation and Technology for Sustainable Built Environment. UiTM Perak, 16-17 April (pp. 437-443), Perak
- Ramli, A., Akasah, Z. A., Mohd, I. M. M. (2013). Safety and Health Factors Influencing Performance of Malaysia Low Cost Housing: Structural Equation Modeling (SEM) Approach, International Conference on Innovation, Management and Technology Research, Malaysia, 22 – 23 September, 2013, Procedia - Social and Behavioral Sciences 00 (2013) 000–000
- Ramli, A., Akasah, Z. A., Asan, A. (2015). Development of Building Safety and Health Performance Framework for Building Management in Malaysia”. 2nd International Conference On Construction and Building Engineering”, (ICONBUILD2015). Conference Handbook,pp.62, August 2015, Padang, West Sumatera, Indonesia.
- Rampal, K. G., Jemoin, M. N. (2006). Developing Regulations for Occupational Exposures to Health Hazards in Malaysia. Regul. Toxicol. Pharmacol. 46, 131–135.
- Rancangan Malaysia ke Sepuluh 2011 – 2015. (2010). Unit Perancangan Ekonomi, Jabatan Perdana Menteri, Putrajaya.
- Ridley, J. (1986). Safety at work, 2nd Edition. London: Butterworth Ltd.
- Rietveld, T. & Van H, R. (1993). Statistical Techniques for the Study of Language and Language Behaviour. Berlin – New York: Mouton de Gruyter.

- Ringen, K., Englund, A., Welch, J. L. and Seegal, J. L. (1995). Why Construction is Different, *Occupational Medicine : State Of the Art Reviews*, 10,2,255-259
- Robson, A. (2002). *Real World Research*. 2nd Edition. Blackwell, UK
- Rosli Ahmad. (2008). *Best Practices in Safety Management for Conventional Civil Construction Industry in Malaysia; Master Thesis of Science Construction Management*. Malaysia: Universiti Teknologi Malaysia.
- Rowlinson, S.(2004). *The Need For Accident Reporting System : Legal Versus Company Needs*. In : Rowlinson,S. *Construction Safety Management System*. London : Spon Press.
- Rummel, R. J. (1970). *Applied factor analysis*. Evanston, IL:Northwestern University Press.
- Safe, S. (2000). *The Facts About Construction Injuries*, (Online): <http://www.sitesafe.org.nz/facts.html>.
- Sakaran, U. and Bougie, R. (2009). *Research Methods for Business*. 5th Edition, A John Wiley and Sons, Ltd, Publication.
- Saleh, B., Hamid, I., Nasser, H. and Maimoonah, H. (1994). *Occupational Safety and Health Act 1994*, Central Law Book Corporation Sdn Bhd Malaysia.
- Salleh, A.A., Muhammed, A. H., Abdullah, M. N. (2014). PLS-SEM: Assessment of Critical Success Factors for Energy Management Towards Sustainable Management ; Faculty of Geoinformation and Real Estate, UTM, Malaysia; *Journal Teknologi*, 72:1 (2015) 1-6/www.journalteknologi.utm.my/eISSN 2180-3722.
- Salleh, N.A., Nordin, M. N., Rashid, A. A. K. (2012). *The Language Problem Issue among Foreign Workers in the Malaysian Construction Industry; International Journal of Business and Social Science Vol.3 No. 11;*
- Samuel, L., Sarfo, M. (2010). *Health and Safety on Construction Sites in Ghana : COBRA Held at Dauphine Université, Paris, 2-3 September 2010;ISBN 978-1-84219-619-9*
- Sarah, N., Ezekiel, C., Rod, G., Subashini, S. (2015). *The Dynamism Of Stakeholders : Power in Construction Projects*, ResearchGate, discussions, stats, and author profiles for this publication at: <http://www.researchgate.net/publication/266890076>.

- Sariah, A. K. (2014). Senior General Manager.,Corporate and Business Sector CIDB).,Business Times, Malaysia : <http://www.nst.com.my/business/>(February 02,2014)
- Sarstedt, M. and Ringle, C. M. (2010). Treating Unobserved Heterogeneity in PLS Path Modeling: A Comparison Of FIMIX-PLS with Different Data Analysis Strategies. *Journal of Applied Statistics*, Vol. 37, No. 8, 1299–1318.
- Saunders, M. R., Lewis, P. and Thornhill, A. (2007). *Research Method for Business Students*. 4th Edition, Prentice Hall, London, UK
- Sekaran, U. (2003). *Research Methods for Business A Skill Building Approach* (4th Edition), USA: John Wiley & Sons, Inc.
- Sekaran, U. and Bougie R. (2010). *Research Methods For Business: A Skill Building Approach*.5th Edition, Wiley, London.
- Seyyed, S. H. and Targhabeh, Z. (2012). Major Theories of Construction Accident Causation Models: A Literature Review. *International Journal of Advances in Engineering & Technology*, Sept 2012. IJAET ISSN: 2231-1963
- Shanteau, J. (1995). Expert judgement and Financial Decision Maling. *Risky Business: Risk Behavior and Risk Management*, Bo Green (Ed), Stockholm University.
- Singh, R. (2009). Does My Structural Model Represent the Real Phenomenon?: A Review of the Appropriate Use of Structural Modelling (SEM) Model Fit Indices. *The Marketing Review*, 9(3), 199-212
- Slevin, D. P., Cleland, D. I. and Pinto, J. K. (2012). *Project Stakeholders* (eds.) The Frontiers.
- Social Security Organisation. (2000). *Annual Report for 2000*, Kuala Lumpur.
- Social Security Organization of Malaysia Malaysia. (Perkeso). (2013). <http://www.perkeso.gov.my>
- Spangenberg, S. (2010). *Large Construction Projects and Injury Prevention: Doctotal Dissertation*, Faculty of Engineering, Science & Medicine, Aalborg University, Denmark
- Standard Industrial Classification 2000. (2014). Department Of Statistics Malaysia (MSIC)
- Stevens, J.P. (1992). *Applied Multivariate Statistics for the Social Sciences* (2nd edition) Hillsdale, NJ: Erlbaum.

- Sulaiman, K. (2008). A study of building Procurement Process as a Potential Tool to Enhance Safety Practice in the Construction Industry, Thesis (Ph.D), School of built environment, University of Salford, Salford, U.K
- Suraji, A. A., Duff, R., Stephen, J. P. (2001). Development of Causal Model of Construction Accident Causation., Journal of Construction Engineering and Management July/August 2001 / 337 ., J. Constr. Eng. Manage. 2001.127 :337-344.
- Talib, A. L. S. (2012). Management Practices and Osh Implementation In Smes in Malaysia
- Tam, C. M., Zeng, S. X. and Deng, Z. M. (2004). Identifying Elements of Poor Construction Safety Management in China. Journal of Safety Science. No.1.
- Tan. C. K. and Nadeera. A. B. (2014). Case Studies On The Safety Management At Construction Site; Journal of Sustainability Science and Management; Volume 9, Number 2, December 2014:90-1-8, ISSN: 1823-8556. Penerbit UMT
- Targhabe, Z. J and Hosseinian, S. S. (2012). Designing For Construction Workers' Safety., International Journal of Advances in Engineering & Technology, Sept 2012., IJAET ISSN: 2231-1963
- Tariq S. A. and John G. E. (2000). Identifying Root Causes Of Construction Accidents; Journal Of Construction Engineering And Management / January/February 2000
- Aksorn, T. and Hadikusumo B.H.W. (2007). The Unsafe Acts and the Decision-to-Err Factors of Thai Construction Workers; Journal of Construction in Developing Countries, Vol. 12, No. 1
- The American Heritage. Dictionary of the English Language, Fourth Edition copyright 2000 by Houghton Mifflin Company.(2009). Published by Houghton Mifflin Company
- The MalayMailonline (2017). 14 Mac 2017. 57 Workers Escape Unhurt After Klang's Centro Mall plaster Ceiling Collapse. web: <http://www.themalaymailonline.com/malaysia>
- The MalayMailonline (2017). 21 February 2017. Bangladeshi Worker Killed by Collaped Building Structure. web: <http://www.themalaymailonline.com/malaysia>

- The MalayMailonline (2016). 17 May 2016. Call for Stricter Scaffold Safety in Malaysia After Collapse Injures Six. web: <http://www.themalaymailonline.com/malaysia>
- The Stars News, Malaysia. (2015). web: <http://www.thestar.com.my/>
- The SunDailyonline (2016). 22 October 2016. 733,000 Affordable Homes Under Construction: Noh Omar. web: <http://www.daily-sun.com/>
- The SunDailyonline (2016). 23 May 2016. CIDB, DOSH Team up to Reduce Construction Fatalities. web: <http://www.daily-sun.com/>
- UK Standard Industrial Classification of Economic Activities 2007. SIC (2007). Divisions 41 – 43
- Ulang, M. N. (2012). Communication of Construction Health and Safety Information in Design; Civil and Environmental Research www.iiste.org ISSN 2222-1719 (Paper) Vol 2, No.5
- Urbach, N. and Ahlemann, F. (2010). Structural Equation Modelling in Information Systems Research Using Partial Least Squares, *Journal of Information Technology; Theory and Application*, 11(2), pp.5-40
- Using the Partial Least Squares (PLS) (2010). *Approach Handbook of Partial Least Squares*, Springer Handbooks of Computational Statistics, Berlin Heidelberg.
- Vanderstoep, S. W. and Johnston, D. D. (2009). *Research Methods for Everyday Life*. John Wiley & Sons, United States of America.
- Velicer, W. F. and Fava, J. L. (1998). Effects of Variable and Subject Sampling on Factor Pattern Recovery. *Psychological Methods*, 3, 231-251.
- Victorian Current Acts., *Building And Construction Industry Security Of Payment Act 2002 - Sect 5., Definitions*
- Vinzi, E. V., Chin, W.W., Henseler, J. and Wang, H. (2010). *Handbook of Partial Least Squares: Concepts, Method and Application*, Springer.
- Wan, M. A. (2013). A Comparison of Partial Least Square Structural Equation Modeling (PLS-SEM) and Covariance Based Structural Equation Modeling (CB-SEM) for Confirmatory Factor Analysis; *International Journal of Engineering Science and Innovative Technology (IJESIT)*, Volume 2, Issues 5, September 2013, pp.198-205.

- Wang, W., Liu, J., and Chou, S. (2006). Simulation Based Safety Evaluation Model Integrated with Network Schedule. *Journal Of Automation in Construction*, Vol.15(3),app.34341-354
- Winch, G. and Bonke, S. (2002). Project Stakeholder Mapping: Analysing the Interests of Project Stakeholders. In: D P Slevin, D I Cleland and J K Pinto (eds.) *The Frontiers of Project Management Research*. Newtown Square : Project Management Institute Inc.
- Wong, P. S. P., Cheung, S. O. (2005). Structural Equation Model of Trust and Partnering Success, *ASCE, Journal of Management in Engineering*, 21(2)70-80.
- WordNet 3.0. (2014). Farlex Clipart Collection. 2003-2012 Princeton University, Farlex Inc
- Yaghmaie, F. (2003). Content validity and its estimation, *Journal of Medical Education*. 3, 25–27.
- Yang, J. B., & Peng, S. C. (2008). Development of a Customer Satisfaction Evaluation Model for Construction Project Management. *Building and Environment*, 43(4), pp. 458-468.
- Yong, Y. C. & Mustaffa, N. E. (2011). Clients, Consultants and Contractors' Perception of Critical Success Factors for Construction Projects in Malaysia. *Proceedings of the 27th Annual Association of Researchers in Construction Management Conference*, England.
- Yranheikki, E. and Savolainen, H. (2000). Occupational Safety and Health in Finland. *Journal Of Safety Research*. Vol.31. No.4.
- Yuan, K., Wu, R., Bentler, P.P. (2010). Ridge Structural Equation Modelling with Correlation matrices for Ordinal and Continuous Data. *British Journal of Mathematic and Statistical Psychology*, 64, 107-133
- Yusuf, L., Akhmad S., Yulianto S. N., Rosmariani, A. (2011). The Nature of Fall Accidents in Construction Projects : A Case of Indonesia; *International Journal of Civil & Environmental Engineering IJCEE-IJENS* Vol: 11 No: 05
- Zainun, N. Y., Ghazali, M. F., Rawan, M. N. (2015). Key Parameters for Medium Cost Housing Demand in Malaysia. Department of Built and Construction (UTHM); Department of Construction Management (USM). Eprints.uthm.edu.my

- Zainun, N. Y., Roslan, N., Memon, A. H. (2014). Assessing Low-Cost Housing Demand in Melaka.: PLS-SEM Approach. *Advanced Materials Research*. Vols. 838-841 (2014) pp 3156-3162. Online at www.scientific.net
- Zakaria, N. H., Mansor, N., Abdullah, Z. (2012). Workplace Accident in Malaysia: Most Common Causes and Solutions; *Business and Management Review* Vol. 2(5) pp. 75 – 88 ISSN: 2047 – 0398



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