DETERMINANTS OF THE FACTORS AFFECTING THE EMPLOYABILITY OF POLYTECHNIC ARCHITECTURE GRADUATES

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ABSTRACT: *Building information modeling (BIM) is a new approach to improving the construction industry towards Industrial Revolution 4.0 (IR 4.0). Yet, few studies have addressed how BIM employability skills have influenced the recruitment of new employees in the industry. Employment opportunities have increased following the rapid development of the construction sector. The industry, therefore, needs a skilled workforce to ensure successful BIM implementation, hence the growth of the industry. This study aims to determine the factors affecting the employability of architecture graduates from polytechnics. Using a quantitative approach, the study seeks to identify their level of BIM skills after completing their diplomas. The survey respondents comprised architecture graduates from Malaysian polytechnics. A simple random sampling method was used to select graduates from six Malaysian polytechnics that offer architecture courses. Online questionnaires were distributed to all the graduates from batch 2019 through Google Form. Descriptive and inferential statistics using regression analysis were performed to analyze the quantitative data. The findings indicate that the architecture graduates' level of BIM skills was moderate for technical skills and high for nontechnical skills. All the variables have a significant positive relationship, thus affecting their employability. The study, therefore, identifies ways to improve architecture graduates' skills and employability in the construction industry, particularly for BIM construction. The implication of the findings may help educators to enhance the skills and employability of architectural graduates according to employers' demands.*

Keywords: Building Information Modelling, Employability, Technical Skills, Nontechnical Skills, Architecture Graduates

1. INTRODUCTION

Towards becoming a developed country by 2020, Malaysia's construction industry is growing rapidly, with high demands for infrastructure and developments. The Malaysian construction sector has expanded with several development projects that present both challenges and opportunities. A new era of building information modelling (BIM) aims to enhance the industry's development according to the government's demand for better quality, cost-effectiveness, and time management in the execution of construction projects. BIM is increasingly recognized as a collaborative tool in the architectural, engineering, and construction (AEC) industry. BIM is also a digital tool for assisting the AEC industry in managing projects effectively, improving the planning process, and designing construction activities [1]. The tools can facilitate the AEC industry's increasing productivity and performance by saving time and costs, as well as solving issues that may arise on-site [2].

Accordingly, the Construction Industry Development Board (CIDB) with the Ministry of Works has taken the initiative to introduce the Construction Industry Transformation Program 2016–2020 (CITP) to enhance the growth of construction technology in Malaysia. The CITP 2016–2020 aims to advance the technology in the industry to meet the market demand in the construction industry[3]. Under the [4], the government has outlined three strategies to strengthen Malaysia's economic growth. One strategy is the priority of area B, which is to improve innovation and technology uptake. This strategy is in line with CIDB's key performance indicators (KPIs), which are to ensure that 70% of private and public building projects exceeding RM10 million implement BIM by January 2021. BIM Level 2 was introduced by Q4 2020 for all public building projects exceeding RM100 million (for construction projects JKR) [3]. Hence, BIM has become an essential tool in the construction industry, and the need for competent human resources is currently a priority for the construction players.

To meet the targets, the government has been focusing on generating employable graduates and hence, better human capital. One strategy in the Eleventh Malaysia Plan is to priorities the quality over the quantity of Technical and Vocational Education and Training (TVET) [4]. Polytechnics are one of the TVET programmers that produce TVET graduates under the Ministry of Higher Education (MoHE). Polytechnics are seen as institutions that produce semi-skilled workers who can cater to the industry's demands. Such efforts imply that the ministry has taken measures to ensure that the polytechnic institutions supply employees, particularly semi-skilled workers who can meet the construction industry's demands.

The present research aims to determine the factors that affect the employability of polytechnic architecture graduates in the construction sector involving BIM. The study can help identify the skills demanded from fresh graduates by employers in the construction industry. Furthermore, the study aims to identify the level of polytechnic architecture graduates in technical and nontechnical skills after completing their diploma programme. The findings can be used to facilitate academics and institutions in creating a benchmark to identify the level of skills in the BIM technical and nontechnical skills garnered by the students from their institutions.

2. LITERATURE REVIEW

Graduate employability refers to a person's ability to find and obtain employment upon graduation. Many institutions aim to produce graduates who can face the challenge of getting a job 6–12 months after graduating. Over the decade, researchers have discussed the employability concept and presented

various definitions of the term. Employability, in particular, has been defined variedly in previous studies.

Employability is presented as a graduate's ability to start working as a competent professional employee. The term is defined in one study as a set of skills, understandings, and personal attributes that increase the probability of students gaining employment and being successful in their careers, hence supporting the workplace, society, and economy [5]. Employability is also noted as having a range of skills, experience, comprehension, and personal characteristics that help people choose and build productive work supporting them [6]. These skills and knowledge will help graduates to utilize their skills and knowledge in their workplace. A productive labor market performance will benefit the community and the economic system.

Employability can also be described as having the skills, understanding, knowledge, and personal attributes for one can pursue and obtain employment. To meet the employers' demands, employees must have a competitive set of skills. Employability is the skills needed to develop the ability to obtain a job, fulfil future needs, and contribute effectively. Employability should allow a person secure a job to achieve a job, preserve the job, and get new employment if needed [7]. Individual skills, attitudes, and knowledge acquired from an institution can help graduates in job placement, maintain the placement, and secure new jobs within the industry.

2.1 Technical Skills

BIM technical skills are the individual skills related to BIM software, modelling, and software operation. The rapid digital revolution has increased the demand for workers who are equipped with both technical and nontechnical skills. Specific technical skills are needed for a particular job. A few BIM courses focus on technical BIM skills. Though the courses are confined to harnessing software skills, the students often will not be very effective in applying their knowledge to real-world challenges [8]. Some scholars argue that BIM and CAD should be taught by combining technological, management, and collaborative aspects in project delivery [9].

The industry desires graduates who are skilled in BIM software [10]. However, some scholars found that BIM concepts and knowledge are more important than software skills following technological evolvement [11]. Therefore, there is a need for a BIM curriculum to understand computer application concepts and the BIM process to ensure that graduates become knowledgeable. Most employers will not only evaluate graduates' technical ability but also expect the latter to have sound knowledge in BIM. The BIM curricula, therefore, may cater to the technical and nontechnical aspects to ensure that the graduates acquire BIM skills at the university level. One study suggests that employees acquire job-specific knowledge and the ability to successfully apply their knowledge in their work [12]. BIM skills were found to highly contribute to the success of an individual's career in the construction industry.

H1: Technical skills have a positive influence on graduate employability

2.2 Nontechnical Skills

Nontechnical skills are required to prepare students for job placement and are the most important in determining employees' job performance. The respondents in one study in the South Australian construction business highlighted the importance of soft skills such as teamwork, communication, leadership, and supporting management changes. From this standpoint the author concluded that BIM training and education resources should be devoted to developing technical skills and enhancing collaboration, communication, and management changes in the workplace [13].

Nontechnical skills are also known as soft or generic skills, personality traits, and interpersonal skills [14]. Most employers demand employees to have nontechnical skills related to BIM [15]. They believe that nontechnical skills are a must-have in an individual because technical skills can be enhanced through the working process. Another study also pointed to need for architecture graduates to have good soft skills in communication, presentation skills, and interpersonal skills [16]. Responsibility, a positive attitude, and teamwork are the three (3) most important qualities one must possess to serve the architecture industry.

H2: Nontechnical skills have a positive influence on graduate employability

3. METHODOLOGY

This research was carried out using a quantitative approach by means of an online Goggle Form-based questionnaire survey. A cross-sectional survey design method was used to collect data from the sample at a specific time. To represent the architecture graduates in this study, 169 respondents from six polytechnics in Malaysia were taken as the study sample.

An online questionnaire served as the instrument of the study. The questionnaire consists of three sections: demographic profiles of respondents, BIM skills, and graduate employability. Section A seeks to determine the respondents' demographic backgrounds. Section B seeks to assess the graduates' BIM skills (technical skills and nontechnical skills), and Section C queries the graduates' employability after completing their diploma programme. The respondents were asked to score each item on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). After 12 months of completing their diploma programme, the respondents were asked to evaluate their employability.

IBM SPSS version 25.0 (Statistical Packages for Social Science) was used to analyze the data gathered from the survey. The data were analyzed by means of descriptive analysis to obtain the percentages and frequencies of the respondents' demographics and BIM skill levels. Regression analysis was performed to measure the correlation between employability skills and graduate employability.

4. FINDINGS

One hundred sixty-nine architecture graduates from six Malaysian polytechnics took part in the study. Table 1 shows the graduates' gender, race, polytechnic, and employment status.

Table (1) Respondents' demographic profiles

Measure	Gender	Frequency	Percent (%)
Gender	Male	85	50.3
	Female	84	49.7
Race	Malay	156	92.3
	Chinese	5	3.0
	Indian	4	2.4
	Siamese	3	1.8
	Indian Muslim	1	0.6
Polytechnic	Politeknik Ungku Omar (PUO)	36	21.3
	Politeknik Sultan Haji Ahmad Shah (POLISAS)	28	16.6
	Politeknik Sultan Abdul Halim Mu'adzam Shah (POLIMAS)	34	20.1
	Politeknik Port Dickson (PPD)	21	12.4
	Politeknik Merlimau Melaka (PMM)	30	17.8
	Politeknik Sultan Idris Shah (PSIS)	20	11.8
Employment Status	Full-time Job	77	45.6
	Contract Worker	68	40.2
	Further Study	20	11.8
	Has received a job offer	4	2.4
Total		169	100

Males (50.3 percent) and females (49.3 percent) were evenly distributed among the respondents. Most of the respondents (92.3 percent) were Malay, with the remainder being Chinese (3 percent), Indian (2.4 percent), Siamese (1.8 percent), and Indian Muslim (0.6 percent). About 20.1 percent of respondents were from POLIMAS, 21.3 percent from PUO, 16.6 percent from POLISAS, 17.8 percent from PMM, 12.4 percent from PPD, and 11.8 percent from PSIS. In terms of current job, over half of the respondents (45.6%) are permanent employees, while 40.2 percent are contract employees. About 11.8 percent are pursuing study, and 2.4 percent are newly employed.

Table (2) Reliability analysis

Constructs	Cronbach's Alpha
Technical skills	0.872
Nontechnical skills	0.861

Cronbach's alpha value was used to measure the reliability of the research instrument [17]. An alpha value in a range of 0.50–0.70 is considered reliable and a value of more than 0.70 is considered highly reliable. Table 2 shows that the level of reliability construct has a good value; the Cronbach's alpha (α) value for the technical skills is 0.872, and that for the nontechnical skills is 0.861. The result indicates that the questionnaire items are highly reliable and relevant to the research study.

Table (3) Level of technical skills and nontechnical skills

Items	Means	SD	Interpretation
Technical Skills	3.55	0.605	Moderate
Nontechnical Skills	3.65	0.591	High

Table 3 displays the architecture graduates' level of skills. Nontechnical skills received the highest mean score (M=3.65, SD=.591), followed by technical skills (M=3.55, SD=.605), thus indicating that most of the graduates thought their nontechnical skills to be better than their technical skills. They are generally employable within 6 to 12 months of completing their diploma degree, implying thus that they have a good level of career success.

Table (4) Pearson correlation between technical skills, nontechnical skills, and employability

Dimensions	Technical Skills	Nontechnical Skills	Employability
Technical Skills	1.000		
Nontechnical Skills	.702**	1.000	
Employability	.511**	.564**	1.000

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

A Pearson product-moment correlation coefficient was computed to assess the relationship between technical skills, nontechnical skills, and employability. A positive correlation was found between the variables (Table 4). The output shows a strong, positive correlation (r=0.702, n=169, p=0.000; p<0.000) between technical and nontechnical skills. Meanwhile, a moderate and positive significant correlation is noted between technical skills and employability (r= 0.511, n=169, p=0.000; p<0.000). There is also a moderate and positive significant relationship between nontechnical skills and employability (r=0.564, n=169, p=0.000; p<0.000).

Table (5) Multiple linear regression coefficient

		B	*SE*	*Beta*	*t*	*p*
1	(Constant)	1.016	.291		3.494	.001
	Technical Skills	.264	.102	.228	2.585	.011
	Nontechnical Skills	.478	.105	.404	4.574	.000
	F-value			43.547		
	Sig.			.000		
	Adjusted R^2			.336		
	R^2			.344		

Note: R = 587; R^2 =.344; adjusted R^2 =.336; F (2, 166) = 43.55, p = 0.000 < 0.001

The overall multiple regression is statistically significant (R^2 =.34, F [2,166] = 43.55, p = 0.000<.001), and two variables (technical skills and nontechnical skills) accounted for 34% of the variance in employability. Technical skills (B =.264, β =.228, p =.011) and nontechnical skills (B=.478, β =.404, p =.000) have a statistically significant effect on employability, thus indicating that all the variables were important in the regression. The finding of this research model supports hypotheses H1 and H2, suggesting that both technical and nontechnical skills have had a significant impact on the architecture graduates' employability (Table 6).

Table (6) Hypotheses testing results

Hypothesis	Relationships	B	t-value	p	Decision
H1	TS→EMP	.264	2.585	.011	Supported
H2	NTS→EMP	.478	4.574	.000	Supported

5. DISCUSSION

Graduates' ability to be employed after graduation is critical to every institution, particularly a TVET institution. Their employability attests to the institution's ability to provide semi-skilled workers, as demanded by the industry. The current demands of BIM skills in the construction industry have created graduates who are skilled in technical and nontechnical skills related to BIM. These graduates have more advantages compared to those who are unskilled [18]. Therefore, graduates need to be skilled in technical and nontechnical aspects related to BIM to ensure their employability.

The architecture graduates' perceptions of their skills indicate that they have a high level of nontechnical skills compared to technical skills. This finding is in line with a previous study [19] which also found that most graduates have a high level of nontechnical skills. Such a discovery points to the need for the academia to enhance architecture graduates' skills level in the technical aspect of BIM.

Both technical and nontechnical skills were found to have a moderate impact on the graduates' employability. Improvements in these skills among the graduates were shown to increase their employability. Hence, the graduates must improve their level of skills to meet the market demands. Both skills play important roles in ensuring the graduates' employability in the BIM construction industry.

Findings from the multiple regression analysis support hypotheses H1 and H2, indicating that both technical skills and nontechnical skills significantly affect the graduates' employability. This finding offers strong evidence that having technical skills and nontechnical skills will increase a graduate's employability, particularly in the BIM construction industry. Students who want to ensure their employability upon graduation may increase their knowledge and polish their nontechnical skills. A previous study [20] also note that both technical and nontechnical skills affected the employability of graduates.

6. CONCLUSION

BIM skills have become vital for students' employability. Individuals who are equipped with various skills, knowledge, and the newest technology will have competitive advantages in terms of employability. The findings of the current study confirm that most architecture graduates from polytechnics are considered skilled. In particular, their skills are moderate for technical skills and high for nontechnical skills. These skills were found to increase their employability after graduation. These abilities, nonetheless, can be improved in the workplace.

Also implied from the findings are that most polytechnic architecture graduates have much potential as semi-skilled employees. They have a modest degree of career preparation abilities after graduation. However, the institutions and academics involved must take prudent steps to enhance the graduates' BIM technical skills to meet the industry's demands. Future studies may (i) identify the BIM skills demanded by employers from diploma-level architecture graduates and (ii) focus on the critical BIM skills from employers' point of view.

5. REFERENCES

[1] Suzila Mohd and Aryani Ahmad Latiffi, "Building information modeling (BIM) application in construction planning," *Challenges Innov. Integr. Collab. Constr. Eng.*, 2013.

[2] Y. Y. Al-Ashmori *et al.*, "BIM benefits and its influence on the BIM implementation in Malaysia," *Ain Shams Eng. J.*, vol. 11, no. 4, pp. 1013–1019, 2020.

[3] CIDB, "Construction Industry Transformation Programme 2016-2020 - Midterm review for enhancement," 2019.

[4] Eleventh Malaysia Plan, "Mid-term Review of the Eleventh Malaysia Plan 2016-2020," 2018.

[5] M. Yorke and P. Knight, "Evidence-informed pedagogy and the enhancement of student employability," *Teach. High. Educ.*, vol. 12, no. 2, pp. 157–170, Apr. 2007.

[6] L. Dacre Pool and P. Sewell, "The key to employability: Developing a practical model of graduate employability," *Educ. + Train.*, vol. 49, no. 4, pp. 277–289, Jun. 2007.

[7] R. Kumari, S. Kumar, and V. K. Sharma, "Fuzzified expert system for employability assessment," *Procedia Comput. Sci.*, vol. 62, no. SCSE, pp. 99–106, 2015.

[8] J. Molavi and B. Shapoorian, "Implementing an interactive program of BIM applications for graduating students," in *ICSDEC 2012*, 2012, no. October, pp. 1009–1016.

[9] L. Wang and F. Leite, "Process-oriented approach of teaching building information modeling in construction management," *J. Prof. Issues Eng. Educ. Pract.*, vol. 140, no. 4, p. 04014004, Oct. 2014.

[10] W. Wu and R. R. A. A. Issa, "Key issues in workforce planning and adaptation strategies for BIM implementation in construction industry," in *Construction Research Congress 2014*, 2014, no. 2008, pp. 847–856.

[11] Hamid Abdirad and Carrie S. Dossick, "BIM curriculum design in architecture, engineering, and construction education: A systematic review," *J. Inf. Technol. Constr.*, vol. 21, pp. 250–271, 2016.

[12] I. Sarfraz, D. Rajendran, and C. Hewege, "An exploration of global employability skills: A systematic research review," *Int. J. Work Organ. Emot.*, vol. 9, no. 1, p. 63, 2018.

[13] J. C.. Gardner, M. R. Hosseini, R. Rameezdeen, and N. Chileshe, "Building information modelling (BIM) education in South Australia: Industry needs," in *Proceedings of the 2014 (5th) International Conference on Engineering, Project, and Production*

Management, 2014, no. November, pp. 293–302.

[14] R. Sacks and E. Pikas, "Building information modeling education for construction engineering and management. I: Industry requirements, state of the art, and gap analysis," *J. Constr. Eng. Manag.*, vol. 139, no. 11, p. 04013016, Nov. 2013.

[15] J. A. I. Raiola, "Employability skills in BIM for construction managers : Recommendaations for education," in *ASEE Annual Conference and Exposition, Conference Proceedings*, 2016, p. 15.

[16] Rohani Salleh, Md Anwar Md Yusoff, and Mumtaz Ali Memon, "Attributes of graduate architects: An industry perspective," *Soc. Sci.*, vol. 11, no. 5, pp. 551–556, 2016.

[17] J. C. Nunnally, "Phychometric theory," *Psychom. theory*, p. 640, 1978.

[18] Hasan Saleh and Hendrik Lamsali, "Engineering skills : Employer satisfaction among Malaysian graduate engineer," *Int. J. Electr. Eng. Appl. Sci.*, vol. 2, no. 2, pp. 63–68, 2019.

[19] Hashamuddin Yaakob, N. F. Radzi, and R. Ahmad Sudan, "Employers' perception on Malaysian Polytechnic graduates employability skills," *First Int. Multidiscip. Acad. Conf. 2018*, no. October, pp. 1–8, 2018.

[20] Md Moazzem Hossain, Manzurul Alam, Mohammed Alamgir, and Amirus Salat, "Factors affecting business graduates' employability–empirical evidence using partial least squares (PLS)," *Educ. + Train.*, vol. 62, no. 3, pp. 292–310, Feb. 2020.

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