Jurnal Kemanusiaan

Full Paper

INDUSTRY 4.0 CIVIL ENGINEER JOB SKILLS REQUIRED BY EMPLOYERS IN MALAYSIA

Nurfazwin Ab Rasid*, Nor Fadila Amin

Sekolah Pendidikan, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

*Corresponding author nurfazwin308@gmail.com

Received: 15 May 2018
Received in revised form: 14 December 2018
Accepted: 25 December 2018
Published : 30 April 2019

Abstract

We are in the commencment of Fourth Industrial Revolution that will transform the way of humans live and work style. Changes in the style of work in the 21st century happen to improve the country's economy. The changing nature of work and employment in the fourth industrial revolution force people to find the needs for well-developed skills for future job market. Rapid changes in the world of work require university providers to strengthen their role in producing highly skilled human capital to cater the industrial demands. Therefore, this study attempts to investigate civil engineering job skills and abilities that required for new generation civil engineers in Malaysia. This paper aimed to review the lists of skills needed by the employers for civil engineers in Malaysia. The findings presented for a necessary frameworks of job skills to civil engineering students to prepare their abilities for the future job demand.

Keywords: Job skills, Civil engineering graduates, Employers

■1.0 INTRODUCTION

In 21st century, the improvement achieved by humans far beyond the development that has been through thousands of years ago. In the fourth revolution, many experts see that the essential task of human beings will be replaced by robotic energy, millions of people lost their jobs especially in the manufacturing sector (Jumain, 2017). Professor Klaus Schwab the founder of World Economic Forum (WEF) founder and executive chairman, Schwab (2017), explains Industry 4.0 changes the nature of work and live.

The early twenty-first century has seen the emergence of hugely disrupted economies and business models, frequently encouraged by technological innovations (Tohmatsu, 2012; Christensen, 2013). Hence, all parties should be prepared with reskill so that the workers keep giving the contribution. Engineering graduates in Malaysia have good fundamental engineering knowledge (Mohd. Sam, Abu Bakar, & Kassim, 2004). Nevertheless, employers in Malaysia grumble on the graduate level in applying job are lack of generic skills (Kamsah, 2004). The World Economic Forum (WEF) outlined the importance of mastering the 4C's elements - Critical Thinking and Problem Solving, Communication, Collaboration and Creativity and Innovation at all levels of study, including in higher education (Roekel, 2014).

Engineering curricula have expanded in recent decades. In addition to science and technical engineering, they now include several non-technical competencies. The study by Hassan et al. (2007) indicates that there is a critical need for engineering programmes to refine in all areas, primarily in non-technical aspects of engineering education. Therefore, this paper is to review the job skills that employers need for civil engineers in Malaysia.

■2.0 METHODOLOGY

In identifying the job skills is to use search of information such journals as well as through an-internet search. A review of applicable literature was used to gather the data for this study. Review of applicable literature was used to accumulate data for this article. Applicable articles were determined or downloaded from on open access journals via well known search engines such as google, alta vista and yahoo at http://www.google.com.my; http://www.altavista.com and http: www.yahoo.com/ respectively. Whereas, subscribed journals were accessed via Universiti Teknologi Malaysia (UTM) library website at http://library.utm.my/. Relevant content information from journal articles, conference proceedings, discussion papers, textbooks, reports and policy documents have been read and analyzed to form part of this paper.

■3.0 RESEARCH FINDINGS

Review of more than 20 scientific papers, only 8 articles have been selected after using criteria that relevant to the study: the job skills that requires by employers in Malaysia. Based on the review, the list of job skills that employers need for civil engineers as shown in Table 1.

Table 1: The review on job skills that employers need for civil engineers in Malaysia

Author(s), Year	Technical skills	Project Management	Communication Skills	Creativity	Critical Thinking	Team Working	Leadership	Visualization Skills	Analytical Thinking	Problem Solving	Time Management Skills	Mathematical Skills	Decision Making
Tawfiq B. A. (2015)	/	/	/	/	/								
Alison D. (2018)	/	/	/		/		/						
Joanna Z. (2017)	/	/	/	/	/	/	/	/	/	/	/		
OHIO University (2017)	/	/	/				/			/		/	/
Jainudin, N. A., Francis, L., Tawie, R., & Matarul, J. (2015)			/		/	/	/				/		
National Academy of Engineering. (2004)		/	/	/			/		/				
Besterfield-Sacre, M., Ozaltin, N. O., Shartrand, A., Shuman, L. J., & Weilerstein, P. (2011)			/			/	/						
Entika, C. L., Mohammad, S., Jabor, M. K., & Osman, S. (2017)		/	/	/	/					/			/

Chart 1 below shows the percentage of the skills that required by the employers that found on this study. From the pie chart it is clear shows that the majorities of the employers mention that communication skill is the most required to be a civil engineer. The second is project management and leadership skill. Besides, minority of the employers mention visualization and mathematical skill is less required for civil engineer compare to others.

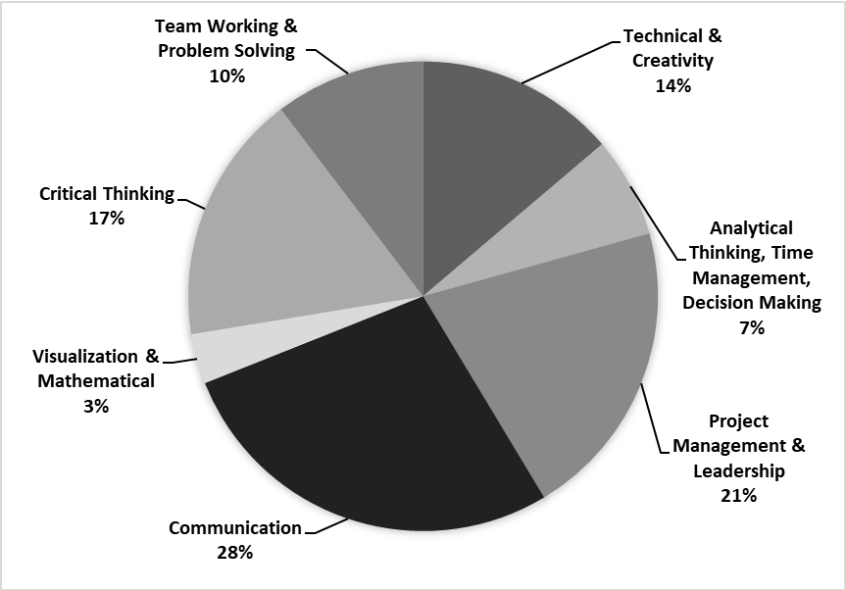

Chart 1: Percentage of civil engineer skill required by employer

Communication Skill

Based on the review, the communication skill is the most practically skill that mention by the employers in civil engineering field. The capability to communicate effectively is a highly required skill and the engineers need to be able to clearly communicate without ambiguity (Tawfiq, 2017; Alison, 2018; Joanna, 2017). Other than that, the communication skills are extremely important for civil engineers because they often manage teams of differ people (Alison, 2018). Moreover, another element of commucation skills is listening. Civil engineers should listen carefully to colleagues' or workers concerns and the needs of their clients (Alison, 2018). OHIO University has divided the communication skill into two which are written and oral likewise that define by Besterfiled-Sacre, Ozaltin, Shartrand, Shuman and Weilerstein. Frequently, civil engineers have always engaged with other vocations of various backgrounds like planners, architects, technicians and stakeholders so that they need to be able communicate along written reports (OHIO University, 2017; National Academy of Engineering, 2004).

Project Management Skill

Project management also the skill that needed as civil engineer. Usually the engineer will be sought for guidance and resolution when any problem happened. It is important that a civil engineer able to manage a diverse team of professionals and work effectively with client. Besides, a civil engineer needs to make sure they work within the budgets and time (Tawfiq, 2017; Alison, 2018). One of the main tasks of a civil engineer is to observe and assess the progress of work completed at a jobsite and ensure the workers are complying with the design documents, project plans, and other rules and regulations. Due to this responsibility they must be able to manage project information, arrange team members, and assign resources where necessary (OHIO University, 2017). According to National Academy of Engineering (2004), the management is also related to bussiness. Futhermore, with the expanding linkage between technlogy and the economic, there will be an increasing the chances of engineers to train their potential as leaders. Project management skill is required by civil engineers is to ensure they understand the pressure within the construction industry (Entika, Mohammad, Jabor, & Osman, 2017).

Leadership Skill

Based on the review, leadership skill is necessary for civil engineer after communication and project management skill. They need to effectively lead and manage each team and ensure the projects are completely success (Alison, 2018; Joanna, 2017; Besterfield-Sacre et al., 2011). Civil engineers are responsible for the performance of the project. Therefore, this is important that civil engineers have significant leadership skills (Alison, 2018; Joanna, 2017; OHIO University, 2017; National Academy of Engineering, 2004). Moreover, civil engineer needs to comprehend the fundamental of leadership and afford to implement them in develop standard as their career advance (National Academy of Engineering, 2004).

Critical Thinking Skill

Civil engineers frequently face challenging problems and need to come out with competent solutions immediately. So that, the critical thinking skills is required for civil engineer. They need to evaluate the advantages and disadvantages of all the possible solutions, and they need to be firm to choose the best decisions (Tawfiq, 2015; Alison, 2018). They must have ability to think quikly but accurately in order to apply general rules to specific problems and solve them (Joanna, 2017).

Technical Skill

Civil engineer also required hard skill, particularly technical skill. They need to be skilled in design techniques and working with map reading, drawings, models, as well as related engineering software (Tawfiq, 2015; Alison, 2018). A civil engineer should be able to foresee any possible future problems and find solutions for them (Tawfiq, 2015; Joanna, 2017). Basically, the foundation for any career in engineering, mainly in civil engineering is a comprehension and implement knowledge of science. Students who choose their career in civil engineering today have the advantage, because the formal practice they receive in undergraduate and graduate education helps them lay the foundation for their technical practice (OHIO University, 2017).

Creativity Skill

From the review, Tawfiq (2015), state that the creativity skill is required for civil engineer. Engineers should be able to innovate and improve on solutions. In addition, to develop and implement new projects, a civil engineer must have an ability to be creative is an essential skill (Joanna, 2017). According to National Academy of Engineering (2004), creativity (innovation, invention, thinking outside the box, art) is a necessary quality for engineering.

Problem Solving Skill

Problem solving is used on daily basis in the construction industry. Civil engineers need to deal with unexpected problem with a good solution (Joanna, 2017). Analytical skills are very important. Throughout the different level of a project, engineers will face the number of

variables that will influence the progress of a project (OHIO University, 2017). So that, the employers required to civil engineers to have the problem-solving skills. Futhermore, it is important to solve the problem instead of running away from it. In general, engineer's job is to help evaluate a problem and to solve it. They should take an opportnity to build their problem-solving skills before becomes a civil engineer (Entika, Mohammad, Jabor, & Osman, 2017).

■4.0 CONCLUSION

Futher on hard skills and formal qualifications, employers are frequently concerned about the work-related practical skills or competences that current employees or prospective new employ was afforded to use in order to perform diverse job tasks successfully (Bessen, 2014). Employers nowadays place an attention and give emphasis to employability skills in future engineers which caused an outstanding grow in unemployment among engineering graduates in Malaysia (Zaharim, Yusoff, & Omar, 2009).

There is a most required skills on civil engineering career need to be considered. The review is to conclude civil engineer jobs skills that most employers needed. The findings presented for a necessary frameworks of industry 4.0 job skills to civil engineering students to prepare their abilities for the future job demand. Therefore, students able to compete job demand in this industry 4.0 revolution.

Other than that, this framework helps universities in redesign and develop curriculum for civil engineering students to face work challenges in industry 4.0. This study also advantageousl to civil engineer fresh graduates, employees and employers as their guidance. The results of the review could be used for future research. Future research could identify the civil engineer job skills required by employers in others country. They could make a comparison of the job skills needed by employer in different countries.

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***Dedication:**
We would like to thank School of Graduate Studies (SPS), UTM for assissting this study financially through Zamalah Scholarship.