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Graduate Employability Skills Needed in theEra of Industrial Revolution 4.0: Perspectivefrom Industrial Practitioner

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Abstract--- Industrial Revolution 4.0 was a turning point in the growth and reform of the industry that playeda major role in improving the country's economy. This refers to the changes that took place in the mechanical industry in the past. In ensuring that technology is used to its utmost capabilities, the labor market sets the conditions for graduates to enter their desired fields of employment. These conditions are called employability skills. The purpose of this study is to identify problems that are occurring in the industry,focusing on the topic of engineering graduates and their employability skills. This is a qualitative study using the interview method. The researcher collected data from 4 respondents who played an important role in the engineering industry. This study uses elements of employability skills from previous studies. In this study, research found that the importance of marketability skills can provide an advantage to the engineering industry to increase production and service value to meet consumer needs. Among the marketability skills emphasized by the respondents are time management, flexibility in completing tasks, the use of new technology, and the desire to acquire new knowledge.

Keywords--- Employability Skills, Industrial Revolution

I.Introduction

Technological change in the industrial sector is no stranger to researchers studying the Industrial Revolution 4.0 era. These technological changes have prompted employers to follow the currents of modernization to improve the quality of production for the purposes of meeting customer satisfaction, whichis the main source of industrial economy. Industrial Revolution 4.0 is a phenomenon that occurs from the effects of using modern technology, such as Augmented Reality, big data analytics, the Internet of Things (IoT), and the creation of numerous and fast prototypes. The increasing use of technology in the industrialsector has provided employment opportunities in the engineering field for the construction and managementof machines to facilitate the production of products. The transformation that took place during Industrial Revolution 4.0 also led to holistic changes in production, management, and management systems. This enabled companies and industries to reduce budgets and expenses[15]. The changes that took place in the era of the Fourth Industrial Revolution opened up many job opportunities to accommodate the increase in manpower in the engineering sector.

However, the workforce requires skills that can help the industry. In addition, the writings of Nelson andPhelps [6]

stated that investments made in education are important in producing knowledge workers. This proves that the development of a graduate's quality is crucial in ensuring that the labor market continues to be satisfied by preparing graduates with marketable skills. Based on the views of previous researchers, human capital development is highly important and is the core of any economy. The importance of human capital development can be attributed to the development of the labor market towards Industrial Revolution 4.0, which emphasizes on the skills inherent in graduates. As such, the rate of development is much faster than it was in the past. Industrial Revolution 4.0 has brought about a powerful global revolution that has taken place in almost every country, transforming every industrial sector, especially engineering.

However, data from the Department of National Statistics[14] expects the number of unemployed graduates in 2019 to be 170.3 thousand people: an increase of 5.5 percent (2018: 161.3 thousand people). University graduates categorized as actively unemployed accounted for 74.8 percent (127.4 thousand people) of total unemployed graduates. More than half of the actively unemployed graduates, 51.6 percent (65.7 thousand people), are unemployed for less than three months, while 29.5 percent (37.5 thousand people) are unemployed within three months and for less than six months. 10.9 percent (13.9 thousand people) of them are unemployed within six months and for less than a year while the final 8.1 percent (10.3 thousand people) are unemployed for more than a year. That said, in order to control the environmental changes taking place in the era of Industrial Revolution 4.0, highly knowledgeable and skilled human resources are essential to counteract this. Achieving this would meet the demands for industry-leading skills and tackle unemployment problems[9]. According to Ismail[4], the issue of unemployment is due to the mismatch of possessed skills against the skills that employers need.

Unemployment can stem from various factors, such as graduates still being in the job-seeking process, or being unable to enter employment due to failure in the interview process as a result of not mastering employability skills. Yusof et al[5] also stated that most graduates leaving institutions of higher education are not able to meet the needs of employers in terms of soft skills and workability. This illustrates that soft skills are one of the main factors associated with graduate employability. Most researchers agree on this opinion. The current labor market is highly competitive, and coupled with the dumping of graduates each year, the statistics for in-employment decreases. By mastering soft skills, graduates have advantages and added value that will aid in securing a job.

- The objectives of this study are:
- To investigate the importance of employability skills in the engineering industry.
- To describe the employability skills needed in the engineering industry.

II. Literature Review

The industrial process underwent four phases which described the Industrial Revolution. Each phase presents its specialty in making beneficial changes to economic structure. In recent years, rapid technological advancements in the world of digitalization have led to changes in industrial business processes. According to Salleh et al.[12], the use of information and communication technology has had a significant impact on the world of work, which in turn can positively impact human capital development.

In this age of advanced technology, the world of work requires graduates to be proficient in the fields of study, namely technical skills, and employability[5] [9]. Employability skills enhance career development by developing skills that are relevant to the workplace. The concept of employability is now being interpreted by looking at individual and industrial needs[1].

According to a study by the Gao et. al (2008), engineering is a field that conducts research to acquire skills and knowledge based on engineering science[10]. Engineering plays a vital role in production and the production of workers and makes use of the Mathematics and Science system. This system is used as the basis of design to make products safe, environmentally-friendly, and efficient.

During Industrial Revolution 4.0, the demand for education and skills needed in the labor market changed. As stated by Yusof et al.[7], globalization demands changes in areas of expertise. Thus, knowledge that universities offer should align with market demand. As such, it has been our interest to ensure that employability skills being instructed to graduates meet the challenges and demands of Industrial Revolution 4.0, which emphasizes the need for ICT skills in the industrial sector.

Yusof and Jamaluddin[16] state that the elements of employability skills are divided into 3 aspects, namely education programs, generic skills, and an individual's ability to meet the demands of the labor market in order to obtain their desired career. This element involves the development of a graduate in improving their quality of work or maintaining existing employment. Employability skills are related to factors that influence the development of the labor market, individuals, and industries, as described by Yusof & Jamaluddin[7].

However, some of the studies that were reviewed also divide employability skills into 2 subsets; technical skills and non-technical skills[12] [13] [17]. Technical skills consist of skills learned by graduates during their studies, such as the use

of tools, machines, and their craftsmanship[15]

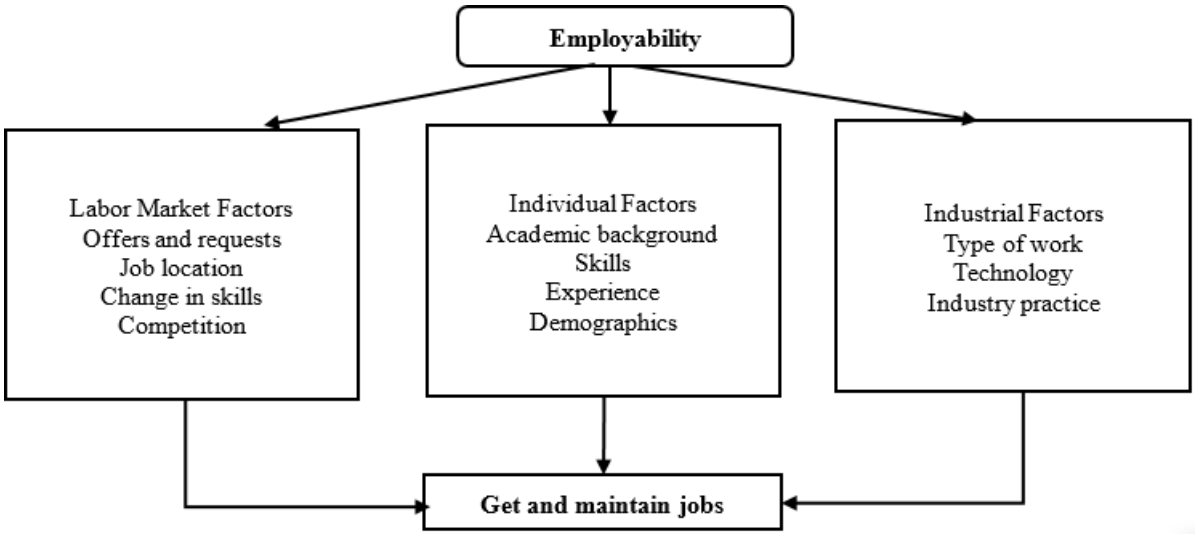

Fig. 1: Relationships between Labor Market, Individual, and Industry Factors Affecting Employability[7].

Fig. 1 demonstrates three employability factors, the first of which are the individual factors that comprise the academic background, skills, experience, and demographics of the graduate. Here, work experience, involving skills and academic qualifications, is seen as one aspect the labor market considers. Secondly, the labor market factors in supply, job location, and skill change. This is especially concerning for workers because of difficulties they face in sectors that are not favorable to them. The third and final factor involves the industry influencing the types of jobs available, industry practices, and technologies.

III. Research Methodology

A. Research Design

In this research, Qualitative Research Design was used in order to obtain useful data from respondents. Qualitative research design is a primarily exploratory research that allowed the researcher to gain an understanding of implied reasons, opinions, or problems. It also provided the researcher with insights thathelped to develop ideas or hypotheses for potential quantitative research. The interviews were conductedin a semi-structured format, whereby the interview template was only partially utilized. This decision was taken because the questions posed by the researcher were designed for open-ended answers.

B. Population and Research Sample

In qualitative studies, sample size cannot be determined from the beginning of the study as it is in quantitative studies. Sample selection and data analysis continue to a point where no new information is available, or the information obtained is in conflict with previously acquired information. This is known as asaturation point.

This research studied a study of a small, 4-person sample, comprising people in the industry from operations and management divisions. A small sample was selected due to the saturation of the answer the respondents provided the researcher.

Table I: Respondents' Job Position

Respondent	**Job Position and Experience**
A	Assistant Engineer (Tunnel Department)
B	Supply Chain Management
C	Lead Mechanical Engineer
D	Facility Executive

The selected respondents used a random sampling method from the respondents that could be reached by the researcher. This involves respondents who are able to give answers to research questions and meetthe objectives of the study based on their experiences and skills.

C. Research Instrument

In this study, the researcher used a qualitative method of generating data to obtain raw data results fromthe conducted research. This study also used the interview method. This interview and its protocol was designed with regards to the research questions. The checklist was divided into 4 sections: introduction, transition, key question, and closing. The protocol was created to facilitate the researcher asking the respondents questions and to avoid having to ask the respondents further follow-up questions. The researcher used phone to record the answers the respondents provided, while making brief notes on the respondents' descriptions.

This preliminary research interview references the Employability Skills Model that the researcher refined,consisting of communication, interpersonal, problem learning and decision making, ICT, and lifelong learning. The interview questions were drafted from questions that arose from studying previous employability models.

D. Research Analysis

Data collected through qualitative interviews were analyzed by interpreting transcripts. The researcher made qualitative and descriptive data interpretations. This range of processes allowed the researcher to extrapolate some form of explanation or understanding of the problems from the collected qualitative data utilizing an interpretative philosophy.

IV. Data Analysis

A. Critical Analysis

5 questions were asked to obtain sets of data that proved that employability skills derived from previousstudies were what the industry demanded. The topics for the questions were communication, interpersonal, problem learning and decision making, ICT, and lifelong learning.

The interview analysis conducted on these 4 respondents found that respondents provided answers to transition questions before proceeding to the key question.

Table II: Interview Analysis

Question	Respondent	Answer	Critical Analysis
From your own views, can you describe the importance of Industrial Revolution 4.0 in the engineering industry?	A	*"... But then, since the industry is going towards Industrial Revolution 4.0, they are trying to make everything electrical, automated and not by human operators. In terms of machine learning, they are using artificial intelligence and fully eliminating human operators."*	The importance of Industrial Revolution 4.0 in the Engineering Industry is to improve worker capability in manufacturing and producing good products by using automated machines and decreasing workload on human beings. To ensure the process of producing products and services to consumers, graduates must be able to provide the engineering industry with the necessary skills. Employability skills are also able to create challenging competition among employees in improving the company's quality of production. Respondents also stated that, in the era of Industrial Revolution 4.0, machines are being controlled by AI (Artificial Intelligence). This shows that, by using AI- controlled machines, we can fully eliminate human operators. This change can lead the industry into something new and advanced.
	B	*"Particularly in manufacturing, to have a healthy job market, we need a competitive industry, and if your industry is not competitive enough to remain relevant to the technologies we have out there globally, you're going to lose out..."*	

	C	*"The industrial revolution is a way to help the industry improve their employability and production…" "… Industrial revolution also helps to innovate the good values inside the company into something new and advanced."*	
	D	*"Revolution inside the industry regarding their production and manufacturing in order to maintain or improve the product and service quality…"*	
What are the employability skills a graduate should have in order to face Industrial Revolution 4.0?	A	*"Willing to learn. Everyone should be capable of learning at their own pace…"*	Employability skills suggested by the interviewees to face IR4.0 are: 1. Willingness to learn, Flexibility, 3. Adapt new and different knowledge, 4. Communication, and ICT skills Willingness to learn is one of the attributes graduates are suggested to acquire to face the Industrial Revolution 4.0 era, wherein technology in the industry is more advanced. Flexibility, and adapting to new and different knowledge can be used to increase productivity and servicesin the workplace. Communication skills in industry are also required for employees to communicate among colleagues and machines.
	B	*"… Flexible in the kinds of knowledge you can absorb, and trying to relate it to the broader picture…"* *"… The flexibility to adapt to different knowledge is what will keep you competitive and help you stay relevant."*	
	C	*"Willing to learn something. A lot of new workers start to hate their jobs before they evenstart…"*	
	D	*"Communication and ICT skills, if I must say.*	

		Because for me,	
		that is the true meaning of Industrial Revolution 4.0."	

B. Closing of Interview

The interview analysis conducted on these 4 respondents found that respondents provided answers andsuggestions to closing questions that offered a better understanding of the topics.

Table III: Interview Analysis for Closing

Question	**Respondent**	**Answer**	**Critical Analysis**
Are there any other employability skills that are suitable for engineering graduates to learn?	A	*"Time management is one of the important aspects that we should see."*	Employability skills that are suitable for engineering graduates to learn: Time management Business and knowledge of economics Mechanicalskills
	B	*"Number one: time management. That is the most important thing when you're working. Number two, business and economics."*	
	C	*"Time management and mechanical skills…"*	
	D	*"… You need to be more business minded, and also time management…"*	

Are there any additional information or opinions regarding employability skills in the engineering industry that you would like to share?	A	*"Employability skills are needed in industry in order for the industry to gain benefits. So, these skills must be something that graduates can show to prove that they can help the industry gain those benefits."*	Employability skills comprise the soft skills and aspects that the labor market seek from graduates. This is because if graduates are able to show their capability in managing everything independently, workload will
	B	*"Your soft skills will take you very far. Your ability to build relationships, your ability to communicate at every level, your ability to apply your interpersonal skills; those are the things that will take you thefurthest in your career."*	decrease and productivity inside the industry will increase. In IR4.0, learning new skills and information will help graduates take their capability and employability to the next level. This helps graduates to compete in orderto increase their chances at securing jobs.
	C	*"Employability skills are one of the aspects thatwe need to see in graduates. Improving their employability skills means they increase their chances at getting jobs."*	
	D	*"Learn from elders and also combine it with new technology. But, don't just depend on elderly advice, because IR4.0is what we call a stepping stone to a new generation."*	

V. Conclusion and Suggestion

This study finds that the definition and concept of graduate employability is explained in many different contexts by several leading scholars in their respective fields. In general, the employability of graduates can be understood as a graduate's ability to master important employability skills[1].

In conclusion, there are a few notes to keep in mind to ensure that every graduate has the employability skills to secure a job. Through the conducted research, the most important aspects to consider are a willingness to learn, flexibility, adapting to new and different knowledge, communicative ability, and ICT skills, where one of the element was reported as a dominant in the previous research which was communication skills[12]. Some interviewees suggested that time management, alongside business and knowledge on economics, are elements that should be added to the list. This is due to the importance of time management in completing tasks and business mindsets causing the era of Industrial Revolution 4.0 to become more competitive. Time management is also one of the personal attributes graduates should possess to be of good value[16]. Yusof and Jamaluddin[16] categorized the 3 aspects as stated in the literature review. This aspects can be used to divide the employability skills answered by interviewee in order to meet the demands in labor market. Clarke[2] also states that employability covers multiple proactive, self-management attitudes, and actions career management among individuals as efforts to secure desired careers.

In this study, it is also shown that the importance of Industrial Revolution 4.0 in the engineering industry is to increase the workers' production ability and to produce good products with the use of automated machines, thus reducing the workload on humans. Due to the needs of manpower, employability skills are needed in 2 subsets, technical and non-technical skills[12]. This demonstrates that, by using machines operated by AI (Artificial Intelligence), we can eliminate human workload. These changes can develop the industry into something new and advanced. Furthermore, employability skills are defined as soft skills and aspects that the labor market seeks in employable graduates. This demand is because if graduates successfully demonstrate their ability to manage everything independently, workload is reduced and productivity in the industry will increase.

However, the finding of this research suggested that employability skills stated by the respondents and literature review from past research are similar.

Table IV: Comparison between Respondents and Literature Review in Term of Employability Skills

Respondents	**Literature Review**
Mechanical Skills ICT Business and Economics Knowledge	Technical and Non-Technical Skills [12] [17]
Communication Time Management	Generic Skills[7]
Adaptability Flexibility Willing to Learn	Individuals Skills[16]

In IR4.0, learning new skills and information will help graduates improve their capabilities and bring their employability to the higher levels. This helps graduates stand a better chance at competing, thus increasing their odds of securing a job. The researcher expects this study to continue, focusing on employability skills that can be integrated with Industrial Revolution 4.0. This can help graduates prepare for the sizable wave of change that comes with the IR4.0 era.

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