Driving Digital Competency Model Towards IR 4.0 In Malaysia

N Khan¹, S Khan², B C Tan¹ and C H Loon³

¹Department of Marketing, Faculty of Management, Multimedia University, 63100 Cyberjaya, Malaysia
²Department of IT and Law, Faculty of Management, Multimedia University, 63100 Cyberjaya, Malaysia
³Faculty of Management, Multimedia University, 63100 Cyberjaya, Malaysia

nasreen.khan@mmu.edu.my, shereen.khan@mmu.edu.my, bctan@mmu.edu.my, hengloonec@yahoo.com

Abstract Today, fourth industrial revolution is causing tremendous uncertainty. These developments transform the way we live, and the way we work. The work environment change the job profiles and therefore requires employees with a wide range of competencies. Digital inclusion today depends largely more on competences than access to technologies. While there are challenges in getting high skilled jobs for the local workforce, the graduate unemployment rate in Malaysia was more than three times higher than national unemployment. The graduate unemployment has raised several queries on relevancy of education systems matching the industry skill needs. Industry has puzzled on skills measures to close the gap of digital skills required. Scholars and policymakers called for more research to discover the root causes of graduate unemployed. The first objective of the study is to investigate the digital skills that industry required and those unemployed graduates currently possess. Second objective is to develop the digital competency model that drives towards industry revolution 4.0. The outcome is to recommend the set of digital skills that graduates required to meet the industry expectations. This study also contributes to policy and practices as the provided competency model that can be applicable to industry 4.0 in the context of Malaysia.

Key words: Digital competency, IR 4.0, Unemployed Graduates, Malaysia

1. Introduction

Industry revolution (IR) 4.0 refers to a new phase of the Industrial Revolution that focuses heavily on interconnectivity, automation, machine learning, and real-time data. Industry 4.0 is not just about investing in new technologies and resources to boost the efficiency [1]. IR 4.0 had a broad influence on different aspects of human activities and affects every aspect of their lives. With rapid technological advances including artificial intelligence (AI), the Internet of Things (IoT), data-driven decision-making, virtual increased reality and robotics, it is apparent that potential workforce needs to be technologically capable. It is expected that robots will take over routine tasks like supervision, in whole or in part. For instance, IBM has built an expert framework based on AI that can replace junior lawyers. It is a daunting challenge to implement Industry 4.0 as it will be difficult to find new people with the digital skills needed to operate new systems and adapt them to future technologies.
Therefore, it is crucial importance to provide the future workforce with adequate education. Researchers expect that IR 4.0 would entail fundamental changes in major aspects of education on the basis of the trends such as content, delivery/pedagogy, and education structure/management. IR 4.0 requires improvements not only in technical education but also in general education. Graduates must be creative and entrepreneurial, and be able to manage uncertainty with cognitive versatility. Even more critical than ever is the need for improved communication and collaboration skills. To remain important in the era of rapid change, graduates need to develop self-learning skills [2].

Industry 4.0 implementation is highly dependent on the willingness of the workforce to apply and refine the use of new technology applicable to the working environment of Industry 4.0. The key concern is the development of human resources with the inculcation of abilities that will be able to perform in IR 4.0 [3]. Past literature showed that there have not yet been well established studies that documented on set of digital skills that required for IR 4.0. Hence, the aim of the research is to investigate the digital competency model towards IR 4.0 in Malaysia.

2. Research background
The world is now entering the digital economic era and Malaysia has to be prepared in order to be a true information-rich society. Malaysian businesses need to adjust to the rapid technological changes that impact the way companies work in order for Malaysia's digital economy to succeed. Companies must consider improvements in order to remain competitive. Malaysia Minister of Youth and Sports Khairy Jamaluddin said that “rapidly developing digital economy is increasing the demand for highly skilled technical workers, and digital business skills”. Regardless of challenges in getting high skilled jobs for the local workforce [4], Malaysia's graduates unemployment rate hit 10.7% in 2015, more than three times the national unemployment rate of 3.1% [5]. This is partly due to the mismatch between the programmes offered and market demand. Education institutions were currently not offering the right skills and this has caused Malaysian graduates to become less marketable.

The Ministry of Education’s Graduate Tracer Survey monitors the status of graduates of higher education institutions six months after they graduate. The statics showed that 24 per cent of graduates were still unemployed and Bachelor's graduates had the highest unemployment rate among graduates of all qualifications [6]. Graduate unemployment has posed a range of main policy concerns, such as quality improvement and relevancy of education programs to prepare for rapidly changing markets and improving knowledge asymmetry on business skills needs. Such findings raise further concerns for academics and policy makers, and more work is required to uncover the root causes of unemployed graduates [7]. Many explanations have been given for the lack of employability of local graduates. The central bank emphasized that while young people were the most vulnerable to these developments, they were also the last to be recruited and the first to be made redundant due to lack of experience, increased labor market knowledge asymmetry and poor communication skills [7]. There is a disparity between the training offered at universities and the skills needed by employers. Employers argued that the current university syllabus does not reflect current skills requirements. Employers pointed to the lack of effective communication skills of students as another significant hindrance [8].

The latest survey by Talent Corp Malaysia showed that weak soft skills are a hindrance for those seeking jobs. The lack of communication skills has been cited as the key field in which new students fall short, followed by innovative and critical thinking, analytical skills and problem-solving. Specifically, the issue of unemployment is directly linked to soft skills, life skills and mental well-being. Vice-Chancellor of the University of Malaya Prof Datuk Dr Mohd Amin Jalaludin emphasized that soft skills do not rely solely on one's English skills, but are strongly linked to attitudes,
experience, knowledge, and even their degree of articulation, assimilation and responsiveness. In addition, Parliamentarian and academic Dr. Ong Kian Ming says the fault lies with the education system, which "does not encourage critical thinking, presentation skills and communication strategies to flourish" [9].

Many predictions suggest that demand for digital skills is expected to increase in the future, with studies highlighting the urgent need for skills shortages in the digital economy to be addressed [10]. Nevertheless, there is no effective measures being introduced to monitor the individual learners to be digitally competent [11]. There are several challenges with the available measures: incompleteness and oversimplification, conceptual ambiguity and the use of self-reporting.

Regardless of Malaysia education system has introduced the digital learning environment, there is no established digital competency indicators and instruments that measure the current demand and supply for graduates’ digital competence in the context of Malaysia as the existing measurements were developed based on international standard [12]. Thus far, research on digital competency measurement that drive the graduate youth employment are urgently needed [13].

Due to the transition of the digital economy, the global workforce is projected to undergo a substantial change between work relations and purposes. Many industries across countries are already experiencing difficulties in hiring young students, and the situation is expected to worsen dramatically over the 2015-2020 timeframe [14]. Reducing the mismatch between the skills available and those required for the digital transformation of the economy has been a key priority over the last decade. The purpose of the objective is to develop the digital competency model towards IR 4.0 in Malaysia. The study addressed three key questions:

(i) What is the type of digital skills that industry required and those unemployed graduates currently possess?
(ii) What are the types of skills required by the industry for the graduates to be digitally competent?
(iii) Does the attitude play a role between digital competency and employability?

3. Literature review
Industry 4.0 is already being achieved in several major countries. Countries like the United States, China, Japan and even our neighbour, Singapore has already advanced to Industry 4.0 under names like “Smart Manufacturing”, “Made in China 2025”, “Industrial Value Chain Initiative”, and “Smart Nation Programme” respectively. Malaysia is steadily progressing towards Industry 4.0. The Malaysian Ministry of International Trade and Industry (MITI) has launched the National Policy on Industry 4.0 to help the country's companies and factories move forward. Ideally, this will allow local businesses to improve production, performance, quality and also to grow new skills and talent with people [15].

According to MITI, Malaysia is actually somewhere between Industry 2.0, which is the mass production of products, and Industry 3.0, Automation. It is a slow process that faces many challenges, such as the lack of knowledge and understanding of Industry 4.0 and the lack of standards and skills. It was reported that there is a shortage of qualified people in science, technology, engineering and mathematics (STEM) and a lack of emphasis on digital literacy and innovation, resulting in a workforce that is less adaptable to fast-moving technology [16].
Access to skilled labour is now a key factor that separates effective firms from failed ones. In the Fourth Industrial Revolution, skill gaps across all industries are poised to expand. In ever-shorter periods, rapid developments in artificial intelligence (AI), robotics and other new technologies are changing the very nature of the jobs that required the skills to do faster than ever before [17].

According to the World Economic Forum report, there are ten skills that required for the Fourth Industrial Revolution. These are complex problem solving, critical thinking, creativity, people management, coordinating, emotional intelligence, judgement and decision-making, service orientation, negotiation and cognitive flexibility [18].

Digital competence – Digital Competence is a collection of expertise, skills, attitudes that are needed when using ICT and digital media to accomplish the tasks; solve problems; communicate; manage information; create; collaborate; and share content; and develop knowledge effectively, efficiently, correctly, objectively, creatively, independently, ethically, flexibly, reflectively, for work, learning, society [19]. The concept of digital competence has been increasingly occupying a strong position in developing countries’ policy documents, actions, and initiatives, since the turning of the new millennium.

Nevertheless, as [20] and [21] have reported, there is still no common, research-based acceptance and validation of the concepts. This lack of theoretical justification results to overlook the full range of skills and focus only on some inadequate skills. Due to lack of research and digital competence is policy-related, so far, most researchers refer to policy papers, such as papers by OECD, EU or UNESCO.

Given the increased use of fast-changing digital technologies in the workplace, people now need to continue developing and refreshing their skills and knowledge in order to keep up with constant innovations and new developments in the digital world [21]. Digital skills are varying according to the context and technology changes. Thus, depending on it, different authority/groups has categorised digital skills. According to past research, there are two different types of skills are needed to be digitally competent: digital skills and digital navigation skills [22]. Digital skills are the technological skills required to use emerging technology, whereas emerging navigation skills are a broader range of skills needed to succeed in the digital world. Those involve identifying information, prioritizing information, and determining the accuracy and reliability of information.

The Canadian research "Defining Critical Digital Skills in the Canadian Workplace" describes digital skills as a multi-faceted term that includes four skill clusters: (1) Digital Information Processing Skills; (2) Digital Technical Skills; (3) Transversal Skills; and (4) Foundational Skills (Chinien and Boutin, 2011). According to the Future Digital Skills needs, there are three types of digital skills such as digital entry-level skills, digital intermediate skills and advanced digital skills. The UK Digital Skills Workforce defines digital skills as the skills required to communicate with emerging technology, emphasizing such skills as 'essential life' [23]. Conversely, the OECD's adult learning study mentions 'problem solving in technology-rich settings' as one of the requisite skills and digital skills as 'the capability to use technology to resolve problems and perform complex tasks' [24]. The Framework for the Creation and Understanding of Digital Competence in Europe recommends a structure for digital competence for all people. The dimensions of digital competence are: content-creation, communication, information, security and problem-solving. Digital competence is a multi-modal and multifaceted concept that is continually changing with the development of digital media [25].
Reflecting previous research guidelines, the European Commission recently strengthened the criteria for digital competence and introduced 5 sets of digital competencies such as: Information and Data Literacy, Digital Content Creation, Communication and Collaboration, Security and Problem Solving [26]. Basically, technological skills are a core component of digital competence [27]. In its broader context, digital competence can be understood as a multi-faceted term. Thus, digital competence is a concept that describes technology-related skills and, more broadly, the ability to function in a digital world. Technology-related skills are summed up by technology, ICT and digital skills and the understanding of digital technologies. More generic life skills in the digital world consist of a combination of learning skills, leadership skills, entrepreneurship skills, organizational skills, social and communication skills and, finally, awareness of ethics, security and culture [28].

**Digital competency and employability** - Skills and qualifications have a good association with jobs and there is ample evidence that skills and qualifications affect service and pay. Employability is defined as a labor market linked to technical experience and skills [29]. This is more important to shifts in the economy as people with these transferable skills migrate through various job situations. Digitally equipped citizens benefit from high employment and other life benefits [30]. Specifically, the development of digital skills is an educational challenge, but it affects all, and the government and other welfare services are equally responsible for filling this vacuum. No conclusive research is done to confirm the appropriate digital skills that suit to particular context. According to the organization for economic cooperation and development, lack of digital skills is likely to have a detrimental effect on people’s employability and quality of life [31].

**Digital competency and attitude** – A variety of factors have an effect on users’ access to digital content, some of which are due to trust in one’s capability to learn, concern about learning, and lack of confidence in learning [32]. Past research identified two major barriers to the development of digital expertise. These are stress and lack of self-assurance [33]. However, overconfidence in one's digital capabilities can also be a hindrance to developing new digital skills. Although numbers of research have identified the possibility of learner characters, there is no conclusive research that clearly highlight the barriers that affect individuals to be digitally competent [34].

**4. Conceptual Framework**
Lack of competences to use digital technologies has become a barrier to social integration and individual progress. The digital society has long been measured in terms of access to digital technologies. However, digital inclusion today depends largely more on competences than on access to and use of technologies. Most graduates nowadays have either low or no digital skills. As a result, graduates are unemployed as they are unable to meet the needs of the industry. Although previous research has highlighted that digital competency help to boost employability, there is no establish studies that confirm how digital competency improve employability. Based on previous research on type of possible skills that required to be digitally competent, below framework with hypothesis are developed.

H1: Digital competency has positive relationship with employability in Malaysia
H2: Attitude mediate the relationship between digital competency and employability in Malaysia
Research methodology

The approach includes a systematic literature review using a broad variety of references to provide a summary of the current debate on the demand for and availability of digital skills and skills gaps. The research unit of the study consists of those Malaysian graduates currently employed in the financial sector, the healthcare sector, the sales sector and the big data industry, as these four sectors have high demand for individuals with digital skills. The first phase involved a cognitive one-on-one interview with industry experts and graduates’ employees to define a set of specific skills needed by industry and currently possessed by graduates. The second phase included a focus group of selected academic

![Figure 1: Framework to Developing Digital Competency Model towards Industry 4.0](image)
experts, business experts and graduate staff to determine the specific skills needed to be digitally competent graduates. The survey instruments covering a range of potential digital abilities were explored with the focus group methodology. Finally, standardized questionnaires were circulated to the respondents belong to four industries.

Survey data were analyzed using the Social Sciences Statistical Kit (SPSS) and the Moment Structures Analysis (AMOS) statistical tools. Finally, the Competence Model as a Solution for Unemployed Graduates in Malaysia was confirmed through the Exploratory and Confirmatory Factor Analysis (EFA and CFA).

6. Conclusion
Malaysia government is scheduled to introduce the Digital Economy Masterplan in October 2020 and integrate Fourth Industrial Revolution (IR 4.0) with the digital economy as it has become more relevant and urgent to coordinate these efforts after Covid-19. In order to achieve the objectives of Malaysia’s national digital strategy, to build a digital workforce capable of meeting national and foreign economic needs, universities should be responsible for training graduates. But until now, education agencies have not been fully aware of the needs of the industries that will hire them.

A main concern that has been raised is that companies and employers will only advocate for progress in digital education if they reduce costs or increase revenues. Government is also considered to be part of the causes as it lacks awareness of the business models used by companies. In fact, firms and employers do not have enough knowledge on the skills shortage to tackle it.

Many industries in which professional yet aged workers leave without their expertise being absorbed or retained by younger employees. Reducing the disparity between the skills available and those needed for the digital transformation of the economy has been a key priority. There is no established digital competency indicators and instruments that measure the current demand and supply for graduates’ digital competency in the context of Malaysia as the existing measurements were developed based on international standard. Investigation on digital competency measurement that drive the graduate youth employment are urgently needed.

Government, businesses, employer and higher education institutions must work together hand in hand to promote the digital competency. Awareness needs to be created from policy makers about what’s going on in the digital world and the high speed of digital education development around the globe. Education technologies must support and help to overcome loss of knowledge and experience. The ultimate goal of learning and teaching should be the acquisition of adaptive rather than routine competence. There is ample evidence that when young people have an understanding of what they can learn from digital education and are also closely directed by experienced teachers with the aid of high-quality digital content technologies, they will certainly become digitally competent workforce.

Hence, this research propose a digital competency model that drive towards Industry 4.0. This study provides important insights into further exploratory and empirical studies in this particular field of research.

7. Recommendation
This study suggests that the government introduce reforms to ensure that digital skills are incorporated in education and training, allowing individuals to engage completely in the new digital economy. Study further indicates that employers must provide training to keep workers digital skills up-to-date and build strategies to optimise the digital skills of their workforce.

7
Education and training providers also have to ensure that education courses fulfil the need for digital skills in the broader economy. Most importantly, the education sector must work closely with the industry to ensure that the digital skills produced match current trends, such as the creation of evaluation metrics that better define employability skills that students possess before they complete a senior year. Education providers need to raise students' understanding of the importance and efficiency of group work. If the schools were to follow this, students would be more appreciative of the attempts made to improve the use of this teaching technique. In addition, these organisations need to provide funding for staff development programmes in order to facilitate successful teaching and greater efforts to incorporate computer technology into business. Last but not least, society as a whole plays a significant role in making meaningful and oriented digital knowledge accessible.

8. Future research

As ICT spreads through our communities, affecting more and more parts of our lives, digital competency has become important for every person. Digital skills drive economic development and are essential to maintaining global competitiveness and efficiency. They are required across the population in order to allow social inclusion and access to digital public and private services. Many companies are struggling to recruit workers with the right skills to harness technological innovations, and parts of society are losing out on the advantages of the digital economy.

Recognizing the critical role of digital competence in today’s society, this research proposes ten metrics to assess digital competence towards industry 4.0. The model built in this research is to define indicators to assess digital competencies that enhance employability in the context of Malaysia. Future studies will step beyond the current study to explore other measures of digital competence that affect employability among young graduates in Malaysia.

References

[1] Rojko, A. (2017). Industry 4.0 concept: background and overview. Retrieved from https://doi.org/10.3991/ijim.v11i5.7072
[2] Abdul Haseeb, A.S. MD. (2018). High education in the era of IR 4.0. Retrieved from https://www.nst.com.my/education/2018/01/323591/higher-education-era-ir-40
[3] Ahmad, D. I. (4 November, 2016). Is It The Dawn of Industrial Revolution 4.0 in Malaysia. Retrieved 16 April, 2018, from MIGHT myforesight: http://www.myforesight.my/2016/11/04/is-it-the-dawn-of-industrial-revolution-4-0-in-malaysia/
[4] Nixon, S. Asada, H., and Koen, V. 2017, “Fostering inclusive growth in Malaysia.” OECD economics department working papers, No. 1371, Paris: organization for economic cooperation and development.
[5] Mohd Ibrahim, D.H and Mahyuddin, M.Z. (2016). Youth unemployment in Malaysia: developments and policy considerations. Retrieved from https://www.bnm.gov.my/files/publication/ar/en/2016/ep04_003_box.pdf.
[6] Mui, R. (2018). Degrees of underemployment: fresh grads stuck in a bind. Retrieved from https://sweetspot.straitstimes.com/education/degrees-of-underemployment-fresh-grads-stuck-in-a-bind/
[7] MOHE report (2017). Employability in Malaysia selected works. Retrieved from http://mycc.my/document/files/PDF%20Dokumen/Employability%20in%20Malaysia%20Selected%20Works.pdf
[8] Sani, R. (2018). Demand for soft skills in the workplace. Retrieved from https://www.nst.com.my/education/2019/02/461884/demand-soft-skills-workplace.
[9] Kong, L. (2017). Malaysia: education policies need to start thinking about robots taking our jobs away. Retrieved from https://www.studyinternational.com/news/automation-malaysia/
[10] World Economic Forum (2018). The Future of jobs report. Retrieved from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.
[11] Antoninis, M. (2019). Digital literacy skills: from a framework to a measure. Retrieved from http://uis.unesco.org/en/blog/digital-literacy-skills-framework-measure.
[12] Shamila M. S, Wan Aida W Y, Husain H, Shuhaida M. S. and Azma Asnawishah A. H (2019),” Malaysian research students encounter with information seeking process for academic purposes”, Journal of e-learning and higher education, Vol. 2019 (2019), Article ID 822970, DOI: 10.5171/2019. 822970
[13] Grundke, R., et al. (2018). “Which skills for the digital era? Returns to skills analysis”, OECD Science, Technology and Industry Working Papers, No. 2018/09, OECD Publishing, Paris, https://doi.org/10.1787/9a9479b5-en
[14] World Economic Forum (2016). The future of jobs report: employment, skills and workforce strategy for the fourth industrial revolution. Retrieved from http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf
[15] Comparehero.my (2018). Meaning of industry 4.0: its challenges in Malaysia. Retrieved from https://www.comparehero.my/technology/articles/what-is-industry-4
[16] Lee, R. (2020). Cover story: IR4.0 in Malaysia: The challenges. Retrieved from https://www.theedgemarkets.com/article/cover-story-ir40-malaysia-challenges
[17] Milano, M. (2019). The digital skills gap is widening fast. Here’s how to bridge it. Retrieved from https://www.weforum.org/agenda/2019/03/the-digital-skills-gap-is-widening-fast-heres-how-to-bridge-it/
[18] Gray, A. (2016). The 10 skills you need to thrive in the Fourth Industrial Revolution. Retrieved from https://www.weforum.org/agenda/2016/01/the-10-skills-you-need-to-thrive-in-the-fourth-industrial-revolution/
[19] Ferrari, A. (2012). Digital competence in practice: An analysis of frameworks. Retrieved from https://www.researchgate.net/profile/Yves_Punie/publication/256460731_Lecture_Notes_in_Computer_Science/links/55a676dc08ae92aac77f28bd/Lecture-Notes-in-Computer-Science.pdf
[20] Alexander J. A. M. van Deursen, Alex van der Zeeuw, Pia de Boer, Giedo Jansen & Thomas van Rompay (2019). Digital inequalities in the internet of Things: differences in attitudes, material access, skills, and usage. Information, communication & society, DOI: 10.1080/1369118X.2019.1646777.
[21] van Laar, E., van Deursen, A.J.A.M., van Dijk, J.A.G.M., de Haan, J.Hide (2020). Measuring the levels of 21st-century digital skills among professionals working within the creative industries: A performance-based approach. https://doi.org/10.1016/j.poetic.2020.101434
[22] Grand-Clement, S. (2017). Digital learning- education and skills in the digital age. Retrieved from https://www.rand.org/content/dam/rand/pubs/conf_proceedings/CF300/CF369/RAND_CF369.pdf
[23] UKDS (2015). Digital Skills for Tomorrow’s World. UK digital skills task force. Retrieved from : http://www.ukdigitalskills.com/.
[24] OECD (2015). OECD Digital economy outlook 2015. OECD. Published July 15. Retrieved from http://www.oecildlibrary.org/science-and-technology/oecd-digital-economy-outlook-2015_9789264232440-en.
[25] Ferrari, A. (2013). Digcomp: A framework for developing and understanding digital competence in Europe. Institute for prospective technological studies. Published august. Retrieved from http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6359.
[26] Vuorikari, R. (2016). DigComp 2.0: The Digital competence framework for citizens. Update phase 1: the conceptual reference model. DOI: 10.2791/11517

[27] Punie Y., Brecko, B., and Ferrari, A. (2014). DIGCOMP: a Framework for developing and understanding digital competence in Europe. Retrieved from https://www.researchgate.net/publication/282860020_DIGCOMP_a_Framework_for_Developing_and_Understanding_Digital_Competence_in_Europe

[28] van Laar, E., Van Deursen, A.J.A.M., Van Dijk, J.A.G.M and Haan, J.d. (2019). Twenty-first century digital skills for the creative industries workforce: Perspectives from industry experts. DOI: 10.5210/fm.v24i1.9476

[29] Tseng, K. (1972). Self-perception and employability. Journal of counseling psychology, vol. 19, no 4, pp. 24-17.

[30] Pirzada, K and Khan, F.N. (2013). Measuring relationship between digital skills and employability. European journal of business and Management. Vol.5, No.24. ISSN 2222-1905

[31] Petropoulos, G. (2018). The impact of artificial intelligence on employment. Retrieved from https://www.bruegel.org/wp-content/uploads/2018/07/Impact-of-AI-Petropoulos.pdf

[32] Park, Y., & Chen, J. (2007). Acceptance and adoption of the innovative use of smartphone. Industrial Management and Data Systems, 107(9), 1349-1365.

[33] Rosenthal, R. L. (2010). Older computer-literate women: Their motivations, obstacles, and paths to success. Educational Gerontology, 34(7), 610-626.

[34] Hinrichsen, J and Coombs, A. (2013). The five resources of critical digital literacy: a framework for curriculum integration. Research in Learning Technology. Retrieved from https://journal.alt.ac.uk/index.php/rlt/article/view/1433