

EXAMINING FUTURE WORKFORCE SKILLS IN MANUFACTURING  
INDUSTRY: PERCEPTION OF ELECTRICAL AND ELECTRONIC INDUSTRY  
AND PUBLIC HIGHER EDUCATION INSTITUTION

NOOR NAZIHAH BINTI MOHD. NOOR

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## DEDICATION

To my beloved husband,

*Mohd Harith Bin Jalil*

To my beloved *Ibu* and *Ayah*,

*Nor Azizah Binti Mat Zain & Mohd Noor Bin Othman*

To my beloved brothers and sisters,

*Mohd Noor Faiz*

*Norlinah*

*Noor Farrahin*

*Mohamad Nizam*

*Noor Amanina*

To my beloved niece and nephew

*Muhammad Noor Firash*

*Muhammad Noor Farish*

*Mia Nur Farissa*

*Nur Dhuha Sofea*

To my beloved mother-in-law and father-in-law

*Roshani Binti Awang*

*Jalil Bin Rusek*

To my beloved supervisor

*Dr. Shazaitul Azreen Binti Rodzalan*

Thank you for all your support. May Allah bless all your good deeds.

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In the name of Allah, The Most Gracious, The Most Merciful.

Praise to Allah S.W.T, Lord of universe who gives the blessing and strength to complete this research project. Peace and prayers be upon His Final Prophet and Messenger Muhammad, the ideal role model for human beings.

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## ABSTRACT

Malaysian youths need to be exposed to the real scenario of the future workforce in line with the soft skills and hard skills required in Industry 4.0. However, skills mismatch is a prolonged issue where the level and type of the existing skills do not meet the needs of the job market, thereby leading to unemployment among graduates. Hence, this study aims to identify the present and future workforce skills required by the manufacturing industry based on the public Higher Education Institution (HEI) and Electrical and Electronic (E&E) industry perspectives. In addition, this study attempts to identify the gap from both stakeholders' perspectives regarding future workforce skills. Using an explanatory mixed method, a total of 64 industry players from the E&E industry and academicians from public HEI participated in the first and second rounds of the survey. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) software, specifically independent sample t-tests. Significant differences were recorded in the mean score of the perception between industry players and academicians on soft skills and the hard skills required in the future workforce. Meanwhile, the interview revealed that both industry players and academicians agreed with the existence of a gap between soft skills and hard skills among graduates. These findings may assist the industry, public HEI, Malaysian youths (graduates) and policymakers to identify loopholes and take corrective and decisive steps in preparing future human capital with the right workforce skills. These findings anticipate that all stakeholders play a major role in providing future skills and preparing a skilled workforce for the future.

## ABSTRAK

Belia Malaysia perlu didedahkan dengan gambaran sebenar tenaga kerja masa hadapan yang memerlukan kemahiran insaniah dan kemahiran teknikal selaras dengan keperluan Industri 4.0. Walau bagaimanapun, ketidaksepadanan kemahiran adalah satu isu yang berpanjangan dimana tahap dan jenis kemahiran sedia ada tidak memenuhi keperluan pasaran kerja. Lebih memburukkan lagi, ia membawa kepada pengangguran dalam kalangan graduan. Oleh itu, kajian ini ingin mengenal pasti kemahiran tenaga kerja masa kini dan masa hadapan yang diperlukan oleh industri pembuatan berdasarkan perspektif Institusi Pengajian Tinggi Awam dan industri Elektrik dan Elektronik. Kajian ini juga ingin mengenal pasti sama ada terdapat jurang perspektif antara kedua-dua pihak berkepentingan mengenai kemahiran tenaga kerja masa hadapan. Kaedah campuran *explanatory* telah digunakan dalam kajian ini melibatkan 64 pemain industri dari industri Elektrik dan Elektronik dan ahli akademik dari Institusi Pengajian Tinggi Awam bagi tinjauan pusingan pertama dan tinjauan pusingan kedua. Sesi temu bual dengan enam pemain industri dan enam ahli akademik turut dijalankan. Perisian *Statistical Package for the Social Sciences* (SPSS) digunakan untuk menganalisis data menggunakan ujian-t sampel bebas. Dapatan kajian mendapati terdapat persepsi yang berbeza daripada pemain industri dan ahli akademik berkaitan kemahiran insaniah dan kemahiran teknikal. Hasil daripada data kualitatif menunjukkan pemain industri dan ahli akademik bersetuju bahawa terdapat jurang antara kemahiran insaniah dan kemahiran teknikal dalam kalangan graduan. Pengkaji berharap dapatan kajian ini dapat membantu industri, Institusi Pengajian Tinggi Awam, belia (graduan), dan penggubal dasar untuk mengenal pasti jurang dan mengambil tindakan sewajarnya dalam menyediakan modal insan masa hadapan yang mempunyai kemahiran tenaga kerja yang betul. Penemuan ini menjangkakan bahawa semua pihak berkepentingan memainkan peranan utama dalam menyediakan kemahiran masa hadapan serta menyediakan tenaga kerja mahir pada masa hadapan.

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## LIST OF ABBREVIATIONS

ICT	—	Information and Communication Technology
IT	—	Information Technology
RMK-12	—	Twelvth Malaysia Plan
MIDA	—	Malaysia Investment Development Authority
TN50	—	<i>Transformasi Nasional ke-50</i>
HEI	—	Higher Education Institution
E&E	—	Electrical and Electronic Industry
SLR	—	Systematic Literature Review
DP	—	Duplication
LC	—	Language Compatibility
NF	—	No Full-text
NR	—	Non-Related
CA	—	Casually Applied
PR	—	Partially Related
CR	—	Closely Related
PRISMA	—	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
Q-Q	—	Quantile-quantile

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Introduction**

Skills are important for the future workforce in order to be employed in the job market. Skills are recognized as indispensable and play a major role in the recruiting decisions process (Baird & Parayitam, 2019). Therefore, Higher Education Institutions (HEI) are responsible for producing graduates with the relevant skills as they are the future workforce source (Wong, Roslan, Siaw, Sulaiman & Ab Jalil, 2018). Employers are having high expectations regarding the skills possessed by the graduates when they are leaving their HEI (Baird & Parayitam, 2019), which is complicated by the arrival of Industry 4.0 impacting present skills through advanced technology. To some extent future jobs created will be different from the past due to automation and robots (Ahmad, Segaran & Md Sapry, 2020). The advancement of high technology in Industry 4.0 has encouraged the future workforce to obtain new skills (Mohd Kamaruzaman, Hamid, Mutalib & Rasul, 2020). Hence, in preparation for Malaysia to face the challenges of Industry 4.0, graduates need to be exposed to appropriate skills related to technological advancement. Additionally, Industry 4.0 is challenging for the global working environment as they have to be prepared to face the wave of the industry.

The present study focuses on three main points. Specifically, this study aims to (1) identify present and future skills in the manufacturing industry based on perceptions from the public HEI, (2) identify the present and future workforce skills

in the manufacturing industry related to the perceptions of the Electrical and Electronic (E&E) industry, and (3) investigate whether there are gaps between public HEI and the E&E industry regarding the future workforce skills.

This chapter begins by introducing the research background in Section 1.2, followed by the problem statement in Section 1.3. The problem then raises several questions listed in Section 1.4, which resulted in the research objectives in Section 1.5. The scope and significance of the study are explained in Sections 1.6 and 1.7, respectively. The research highlights some key terms in Section 1.8 and concluded in Section 1.9.

## **1.2 Research Background**

Apart from the service sector that contributes to a country's economy, the manufacturing industry is also important to the world at large. The manufacturing industry transforms the input into outputs in order to satisfy the customers and meet their demands (Lee, 2019). However, the manufacturing industry especially the manufacturing process has been impacted by the First Industrial Revolution down to the Fourth Industrial Revolution (Vaidya, Ambad, & Bhosle, 2018). The roles of modern economies are significantly influenced by advances in artificial intelligence, robotics and automation, material sciences, and nanotechnology (Younus, 2017). Additionally, the rapid changes in manufacturing technologies and applications in the manufacturing industry will also assist in increasing productivity (Vaidya et al., 2018).

The manufacturing industry and the Malaysian government will benefit immensely from understanding the main impact of Industry 4.0 given that the use of high technology will assist the manufacturing industry to maximise productivity (Lee, 2019). The manufacturing industry needs to elucidate the impact of the technology changes of Industry 4.0 while the government can support the implementation of Industry 4.0 (Lee, Tan & Sorooshian, 2019). One of the efforts of the Malaysian government is through the National Science, Technology, and Innovation Policy (DSTIN) 2021-2030. The goal of DSTIN is to transform Malaysia into a high-tech country in the next decade, which comprises the process of building human resources and nurturing skills and capacities as societal goals. These goals stemmed from the fact that a highly skilled workforce is needed to encourage the adaptation of advanced technology (MOSTI, 2021).

Malaysia is now gearing up towards a developed country in line with other developing countries characterised by a high quality of life, high income, and advanced technological infrastructure. One of the industries that contributed to the high-income level in Malaysia is the manufacturing industry (Lee, 2019). The manufacturing industry comprises eight sub-sector industries: the Electrical and Electronic (E&E) industry, food products, beverages and tobacco products and others as listed in Table 1.1. Nevertheless, this study focuses only on the E&E industry in Malaysia as the industry accounted for almost 590,000 employees in 2021, thereby making it the largest sub-industry of the manufacturing sector in terms of employment (MPC, 2021).

Table 1.1: Sub-sectors of Manufacturing Industry in Malaysia  
(DOSM, 2021)

Number	Sub-sectors
1.	Electrical and Electronic Products
2.	Food Products
3.	Beverages and Tobacco Products
4.	Textiles, Wearing Apparel and Leather Products
5.	Woods Products, Furniture, Paper Products and Printing
6.	Petroleum, Chemical, Rubber and Plastic Products
7.	Non-metallic Mineral Products, Basic Metal and Fabricated Metal Products
8.	Transport Equipment, Others Manufacturing and Repair

Malaysia's E&E industry can be categorised into four sub-sectors (Mohd Ali, 2016). The first category is consumer electronics, which includes products such as television with light-emitting diode (LED) technology, and digital systems (i.e. home theatre and audio; digital cameras). The second category is the electronic components which are related to products such as semiconductor devices, passive components, printed circuit boards and substrates. Meanwhile, the third category comprises industrial electronic products including those relating to multimedia and information technology, such as computer peripherals, computers, office equipment, and telecommunication products. Lastly, the fourth category is electrical products – such as solar-related items, lighting, and household appliances including washing machines, air conditioners, vacuum cleaners, and refrigerators. Nevertheless, this study included all four sub-sectors as one the stakeholders.

The wave of Industry 4.0 has an impact on the manufacturing industries in Malaysia by encouraging the acquisition of required skills that align with the changes

in Industry 4.0 changes. These changes attempt to transform the existing skills into future skills required in Industry 4.0. However, the manufacturing industries in Malaysia are still poorly aware of the changes in Industry 4.0 (Lee, 2019). One of the sub-industries affected by Industry 4.0 is the E&E industry – a sub-industry involved in the wave of technological advancement (Azmi, Kamin, Md Nasir, & Noordin, 2019b). The E&E industry is among Malaysia's 12 National Key Economic Areas (NKEA). Figure 1.1 depicts a fluctuation in the percentage of sales growth of the E&E industry in 2019 (DOSM, 2019b). Based on the statistics, the highest sales growth recorded was 6.7% in April 2019 as compared to the other months. The lowest sales growth was recorded in September 2019 with 1.3%. Moreover, employment in this sub-industry declined by 2.3% in 2016. One of the impacts is the replacement of unskilled workers with machines and automation (MPC, 2017).

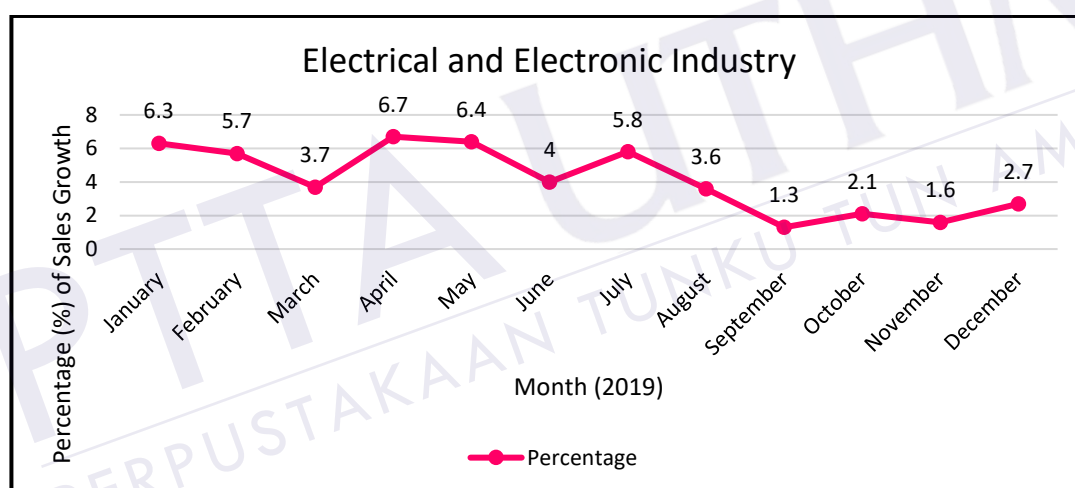


Figure 1.1: Sales Growth in the Electrical and Electronic Industry  
(DOSM, 2019b)

According to the annual report published by a variety of government agencies such as Malaysia Productivity Corporation (MPC), the Department of Statistics Malaysia (DOSM), and the Malaysian Investment Development Authority (MIDA), the E&E industry generates and contributes significantly to Malaysia's economic growth. This is due to the transition and development of the technology involved in the E&E products. In addition, the E&E industry is one of the major sub-sector industries which affects the productivity gap and a high percentage of the workforce. By 2020, the E&E industry reached 30% of the country's gross domestic profit (GDP) and provides over 40% of total employment (Jofree, 2021).

The manufacturing industries demand skills that must be aligned with the business need (Saleh, 2019). These skills act as a ticket for the future workforce in securing employment to get a promotion in their career. Employers required a future workforce to have multi-skills including soft skills and hard skills (Azmi et al., 2019a), whereby Higher Education Institution (HEI) is one of the stakeholders responsible to equip the future workforce with the necessary skills demanded by the industries. The features that could support the production of HEI holistic graduates with soft skills, hard skills, good morality and good ethics should be incorporated into the HEI curriculum designed by Malaysia's Ministry of Higher Education. One of the programmes included in the academic curriculum in HEI is the industrial training programme. Students can become potential future employers and equip themselves with real workplace skills and gain remarkable experience when they are sent to the industrial training programme (Azmi, Kamin, Noordin, & Md Nasir, 2019a). Hence, industrial training is mandatory for all students in Malaysia as specified by the country's Ministry of Higher Education.

In Industry 4.0, HEI is required to be able to produce quality and innovative generations and always learn to master the latest skills. Moreover, universities are increasingly required to prepare their students for future jobs that do not yet exist (Erdisna, Ganefri, Ridwan, Efendi, & Masril, 2020). According to Yaakob, Radzi and Sudan (2018), numerous parties such as the society and industries themselves have questioned the quality of education in Malaysia. This is due to the huge number of graduates being produced every year as Malaysia required a high-skilled and semi-skilled workforce to fill jobs in specific industries to support the country's development process (Che Rus, Yasin, Yunus, Rahim, & Ismail, 2015). The skills needed in the future include soft skills and hard skills (OECD, 2017; Deming, 2017; ILO, 2016). According to the Ministry of Higher Education (MOHE), hard skills comprise digital skills and technology skills while soft skills encompass teamwork skills, communication skills, moral and professional ethics, lifelong learning, critical-thinking and problem-solving skills, leadership skills and entrepreneurship skills.

In terms of employment, the HEI is one of the stakeholders responsible for producing a future workforce with the appropriate skills and good qualifications. The HEI are also increasingly required to prepare their students for future jobs that do not yet exist, such as automation (Erdisna, Ganefri, Ridwan, Efendi, & Masril, 2020). However, the lack of skills among the graduates leads numerous parties such as the

society and industries to question the quality of education in Malaysia in preparing a future skilful workforce (Yaakob, Radzi and Sudan 2018).

### 1.3 Problem Statement

The problem statement in this study could be viewed from three aspects. The first issue is related to skills mismatch, which is due to the supply-demand gaps between the fields of study, an imbalance between soft skills and hard skills, and mismatched theories and practices in education and training received by graduates (Ismail, 2012). The skills mismatch is also defined as the widening gap between soft skills and hard skills between Higher Education Institution (HEI) and industry expectations (Krishnasamy, 2020; The Star, 2020). An increase in unemployment rates among graduates might occur if this issue of skills mismatch is not addressed. Furthermore, the unemployment rate in Malaysia contributed by the public HEI is 13.3% which equals 13,906 graduates (MOHE, 2020). Besides, the skills mismatch is also highlighted by public HEI in Malaysia (Islam et al., 2015). One of the reasons is that graduates from public HEI are still unclear about the requirements of the industry (Ahmad et al., 2019). Graduates from public HEI lack the required soft skills and hard skills in comparison to those from private HEI. Hence, graduates from public HEI are less likely in getting job placement in the industry as the latter is more interested in recruiting those from private HEI (Buntat, 2019).

The second issue is lack of skills or skills deficiency, which is now a concern for many scholars (Ahmad et al., 2019; Ahmad, Segaran, & Md Sapry, 2020; Devi et al., 2020). In a study by Ismail (2012), the National Economic Action Council (NEAC) identified a lack of skills as one of the five factors contributing to the difficulties faced by graduates upon entering the job market. All employees in every industry will use digital tools and technologies during Industry 4.0 (Ismail & Razali, 2019), which requires new skills for the new jobs in Industry 4.0. The rapid changes in the working environment necessitate the future workforce to possess new skills and qualifications (Ahmad et al., 2019). Therefore, HEI needs to implement the skills required for present graduates to internalize the skills as a potential workforce in Industry 4.0.

Although several studies have focused on the aforementioned skills, there is a dearth of information in Malaysia with foresight and a framework for future workforce resulting from the impact of Industry 4.0. One of the reasons is jobs created in Industry



4.0 will be different from the past industrial revolution (Motyl et al., 2018). Hence, a certain set of skills for future work from the employers' and policymakers' perspectives need to be undertaken to prepare future highly-skilled workers. The majority of foresight studies on future workforce skills were designed to predict the overall required skills. For instance, a previous report on Future Work Skills 2020 listed 10 skills for the future workforce (Davies et al., 2011), comprising social intelligence, sense-making, novel and adaptive thinking, computational thinking, cross-cultural competency, new media literacy, cognitive load management design mindset, transdisciplinary, and virtual collaboration. Meanwhile, problem-solving, team-working and communication were identified as among the top three future-demand skills (Intelligence Unit, 2015). Soft skills such as communication, leadership, teamwork, problem-solving and self-organization (Deming, 2017) and digital skills comprising the ability to utilize office productivity software and search information were highlighted as the two major future work skills (Organization for Economic Co-operation and Development; OECD, 2017). In addition, the most critical skill is technical knowledge, whereas ASEAN countries have a low supply of workers with strategic thinking (International Labour Organisation, 2016).

Based on the discussion thus far, the present study has provided an overview and opportunity to investigate specific sets of future workforce skills that will be demanded by future employers, which will be impacted by technological change. More studies need to be conducted to elucidate the skills required in forthcoming years as per the perspectives of several stakeholders in the manufacturing industry and the skills to match the job offered. This research gap needs to be explored, especially in the HEI and manufacturing industries to synthesise the ideas and strategies to address the identified issues through good collaboration and roundtable discussion. As such, the study on the future workforce skills should support one of the 12<sup>th</sup> Malaysia Plan 2021-2025 (RMK-12), in improving labour market efficiency to accelerate economic growth. The findings will support the DSTIN's goal of transforming Malaysia into a progressive economy via technological and highly-skilled human capital. In addition, Ministry of Higher Education have published the book with the title Framing Malaysia Higher Education 4.0 Future Proof Talent written on 21<sup>st</sup> January 2022. This shown that government and policy makers itself strive towards education that in line with the wave of Industry 4.0.

## 1.4 Research Questions

The previous section has discussed the issues to be investigated in this study. Therefore, this study aims to address the following research questions:

- i. What are the present and future workforce skills required in the manufacturing industry based on public Higher Education Institution perspectives?
- ii. What are the present and future workforce skills required in the manufacturing industry based on Electrical and Electronic industry perspectives?
- iii. Are there any gaps between public HEI and the E&E industry in future workforce skills in the manufacturing industry?

## 1.5 Research Objectives

In answering the research questions from the preceding section, this study is designed to address the following three research objectives:

- i. To identify the present and future workforce skills required in the manufacturing industry based on public Higher Education Institution perspectives.
- ii. To identify the present and future workforce skills required in the manufacturing industry based on Electrical and Electronic industry perspectives.
- iii. To investigate any gaps between public HEI and the E&E industry on future workforce skills in the manufacturing industry.

## 1.6 Research Scope

The main focus of this study is to examine future workforce skills based on the perception of public Higher Education Institution (HEI) and the Electrical and Electronic (E&E) industry in Malaysia. The E&E industry was selected as a representative of the manufacturing industry, which contributes the most to Malaysia's economic earnings. Moreover, the industry needs to be further investigated to broaden



## REFERENCES

- Abdul Wahab, N., Muhammad, N., & Ismail, M. S. (2019). Student Disciplinary Management: Issue and Challenges in Malaysia. *International Social Sciences and Humanities Journal*, 2(20), 43-47.
- Abdullah, Z. (2018). Exploring University Branding: Employers' Expectation On University Graduates On Competency (Meneroka Penjenamaan Universiti: Jangkaan Majikan Terhadap Kecekapan Para Graduan Universiti). *Jurnal Personalia Pelajar*, 21(1), 95–104. Retrieved from [http://www.ukm.my/personalia/wp-content/uploads/2018/12/Artikel-11\\_Zulhamri\\_UPM\\_Final.pdf](http://www.ukm.my/personalia/wp-content/uploads/2018/12/Artikel-11_Zulhamri_UPM_Final.pdf)
- Adebakin, A. B., Ajadi, T. O., & Subair, S. T. (2015). Required and Possessed University Graduate Employability Skills: Perceptions of the Nigerian Employers. *World Journal of Education*, 5(2), 115–121.
- Adnan, A. A. Z., Yunus, N. K. Y., & Ghouri, A. M. (2019). Does Religiosity Matter in the Era of Industrial Revolution 4.0? *Asian Academy of Management Journal*, 24(2), 67–77.
- Afsar, B., & Umrani, W. A. (2019). Transformational Leadership and Innovative Work Behavior: The Role of Motivation to Learn, Task Complexity and Innovation Climate. *European Journal of Innovation Management*
- Ahmad, A. R., Segaran, Ng, K. S., Md Sapry, H. R., & Omar, S. S. (2019). Factors Influence The Students' Readiness on Industrial Revolution 4.0. *International Journal of Recent Technology and Engineering*, 8(2 Special Issue), 461–468.
- Ahmad, A. R., Segaran, P. A. P., & Md Sapry, H. R. (2020). Industry Revolution 4.0 and Job Creation for the University Students. *International Journal of Advanced Trends in Computer Science and Engineering*, 9(3), 2968–2971.
- Ahmad, A. R., Segaran, P. A. P., Soon, N. K., Sapry, H. R., & Sarah, S. (2019). Factors Influence The Students " Readiness on Industrial Revolution 4.0, *International Journal of Recent Technology and Engineering* (2), 461–468.
- Ahmad, M. F., Ali, M. H. M., & Sulaiman, Z. (2018). Employability Skill through Industrial Training: Employers' Perspective. *Journal of Social Science and Humanities*, 1(5), 1-5.

- Akor, T. S., Bin Subari, K., Binti Jambari, H., Bin Noordin, M. K., & Onyilo, I. R. (2019). Engineering and related programs' teaching methods in nigeria. *International Journal of Recent Technology and Engineering*, 8(2), 1279–1282.
- Akyazi, T., Goti, A., Oyarbide, A., Alberdi, E., & Bayon, F. (2020). A guide for the food industry to meet the future skills requirements emerging with industry 4.0. *Foods*, 9(4), 1–15
- Ali, M. F. M. (2016). The Influence of Technologies, Organizational Capabilities, and People on Organizational Performance in Electronic Manufacturing Industry.
- Al-Roubaie, A. (2019). Building capacity for digital development in the Arab world: The role of education. *International Journal of Engineering and Advanced Technology*, 8(5), 1530–1537.
- Altman, D., Burton, N., Cuthill, I., Festing, M., Hutton, J., & Playle, L. (2006). Why do a Pilot Study?
- Amiron, E., Latib, A. A., & Subari, K. (2019). Industry Revolution 4.0 Skills and Enablers in Technical and Vocational Education and Training Curriculum. *International Journal of Recent Technology and Engineering*, 8(1C2), 484–490.
- Amiruddin, M. H., Ngadiman, N., Abdul Kadir, R., & Saidy, S. (2016). Review of Soft Skills of TVET Trainees from the Malaysian Advanced Technology Training Center (ADTEC). *Journal of Technical Education and Training*, 8(1), 14–24.
- Anuar, A. R., Mansor, W. N. J. W., & Din, B. H. (2016). Skills Mismatch in Small-sized Enterprises in Malaysia. *International Journal of Economics and Financial Issues* 6(S7), 120–124.
- Anuar, A. R., Wan Mansor, W. N. J., & Din, B. H. (2016). Cabaran Meningkatkan Produktiviti Syarikat Berskala Kecil dan Sederhana di Malaysia: Kajian Mengenai Isu Kemahiran Buruh. *Geografia: Malaysian Journal of Society & Space*, 12(4), 26–33.
- Aqlan, F., & Nwokeji, J. C. (2018). Applying Product Manufacturing Techniques to Teach Data Analytics in Industrial Engineering: A Project Based Learning Experience. *IEEE*.
- Asada, H., Nixon, S. & Koen, V. (2017). Boosting productivity in Malaysia. Economics Department Working Papers No. 1370.
- Asonitou, S. (2015). Employability Skills in Higher Education and the Case of Greece. *Procedia – Social and Behavioral Sciences*, 175(2015), 283–290.

- Astuti, B., Lestari, R., & Bhakti, C. P. (2019). Student decision-making ability as a preparation for facing the industrial revolution 4.0. *International Journal of Scientific and Technology Research*, 8(10), 1200–1204.
- Azah Mansor, N., Abdullah, N., & Abd Rahman, H. (2020). Towards electronic learning features in education 4.0 environment: literature study. *Indonesian Journal of Electrical Engineering and Computer Science*, 19(1), 442.
- Azman, N., Sirat, M., Pang, V., Yew, M. L., Govindasamy, A. R., & Din, W. A. (2018). Promoting University – Industry Collaboration in Malaysia: Stakeholders' Perspectives on Expectations and Impediments. *Journal of Higher Education Policy and Management*, 0(0), 1–18.
- Azmi, A. N., Kamin, Y., & Noordin, M. K. (2018). Towards Industrial Revolution 4.0 : Employers' Expectations on Fresh Engineering Graduates, (December).
- Azmi, A. N., Kamin, Y., Md Nasir, A. N., & Noordin, M. K. (2019). The Engineering Undergraduates Industrial Training Programme in Malaysia: Issues and Resolutions. *International Journal of Engineering and Advanced Technology*, 8(5), 405–419.
- Azmi, A. N., Kamin, Y., Noordin, M. K., & Md Nasir, A. N. (2018). Towards Industrial Revolution 4.0: Employers' Expectations on Fresh Engineering Graduates. *International Journal of Engineering and Technology(UAE)*, 7(4), 267–272.
- Azmi, A. N., Kamin, Y., Noordin, M. K., & Nasir, A. N. M. (2019a). Effects of Industrial Training Programmes on Competencies of Engineering Graduates: A Preliminary Study. *Jurnal Kemanusiaan*, 17(1-S), 5-9.
- Azmi, I. A. G., Che Hashim, R., & Md Yusoff, Y. (2018). The employability skills of Malaysian university students. *International Journal of Modern Trends in Social Sciences*, 1(3), 1–14.
- Babbie, E. R. (2014). *The practice of social research* (13th ed). Belmont: Wadsworth, Cengage Learning.
- Bahrin, M. A. K., Othman, M. F., Azli, N. H. N., & Talib, M. F. (2016). Industry 4.0: A Review on Industrial Automation and Robotic. *Jurnal Teknologi*, 78: 6-13, 137-143.
- Baird, A.M. & Parayitam, S. (2019). Employers' ratings of importance of skills and competencies college graduates need to get hired: Evidence from the New England region of USA. *Education and Training*, 61(5), 622-634.
- Bassah, N. A. S. H. (2022). The Issues and Challenges of TVET in Malaysia: From the Perspective of Industry Experts. *The Online Journal for Technical and Vocational Education and Training in Asia*, 18, 1-15.

- Baygin, M., Yeti, H., Karakose, M., & Akin, E. (2016). An Effect Analysis of Industry 4.0 to Higher Education. 15th International Conference on Information Technology Based Higher Education and Training (ITHET); 1-4.
- Benešová, A., & Tupa, J., (2017). Requirements for Education and Qualification of People in Industry 4.0. *Procedia Manufacturing*, 11(2017), 2195–2202.
- Bernama. (2021). AG Report: TVET yet to achieve 11MP targets. Retrieved on May 22, 2022, from <https://www.nst.com.my/news/nation/2021/09/731611/ag-report-tvet-yet-achieve-11mp-targets>
- Bodrow, W. (2017). Impact of Industry 4.0 in Service Oriented Firm. *Advances in Manufacturing*, 5(4):1-7
- Bowman, K. (2010). Background paper for the AQF council on generic skills. Australia: Australian Qualifications Framework Council.
- Bradberry, T. (2019). 13 things mentally strong people won't do. Retrieved on May 22, 2022, from <https://www.linkedin.com/pulse/13-things-mentally-strong-people-wont-do-dr-travis-bradberry-1f>
- Buntat, Y. (2019). Industry Employers' Perspectives on IPTA Graduates in Malaysia. Retrieved from <https://www.utm.my/professors-council/2019/12/17/syarahan-perdana-98-prof-yahya/>
- Canetta, L., Barni, A., & Montini, E. (2018). Development of a Digitalization Maturity Model for the manufacturing sector. 2018 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), 1–7.
- Carter, D. (2017). Creativity in action – the information professional is poised to exploit the fourth industrial revolution : *The business information survey 2017*, 34(3), 122–137.
- Caruso, L. (2018). Digital innovation and the fourth industrial revolution : epochal social changes ? AI & SOCIETY.
- CEDEFOP. (2010). The Skill Matching Challenge: Analyzing Skill Mismatch and Policy Implications. Luxembourg: European Centre for the Development of Vocational Training, European Union.
- Chan, S. W., Ahmad, M. F., Zaman, I., & Woan, S. K. (2018). Employers' Perception on Important Employability Skills in the Manufacturing Industry. *International Journal of Engineering and Technology*, 7(2.29), 170–175.

- Chan, S. W., Ahmad, M. F., Zaman, I., & Woan, S. K. (2018). Employers' Perception on Important Employability Skills in the Manufacturing Industry. *International Journal of Engineering and Technology*, 7(2.29), 170–175.
- Che Rus, R., Yasin, R. M., Yunus, F. A. N., Rahim, M. B., & Ismail, I. M. (2015). Skilling for Job: A Grounded Theory of Vocational Training at Industrial Training Institutes of Malaysia. *Procedia - Social and Behavioral Sciences*, 204(November 2014), 198–205.
- Chen, H., Baptista Nunes, M., Ragsdell, G., & An, X. (2018). Extrinsic and Intrinsic Motivation for Experience Grounded Soft Skilld Sharing in Chinese Software Organizations. *Journal of Knowledge Management*, 22(2), 478–498.
- Chen, H., Baptista Nunes, M., Ragsdell, G., & An, X. (2018). Extrinsic and Intrinsic Motivation for Experience Grounded Soft Skills Sharing in Chinese Software Organizations. *Journal of Knowledge Management*, 22(2), 478-498.
- Chenoy, D., Ghosh, S. M., & Shukla, S. K. (2019). Skill development for accelerating the manufacturing sector : the role of “new-age” skills for “Make in India” *International Journal of Training Research*, 17(1), 112–130.
- Chhinzer, N., & Russo, A. M. (2018). An exploration of employer perceptions of graduate student employability. *Education + Training*. Vol 60, No. 1, pp: (104-120).
- Chin, S. T. S., & Md Yusoff, R. (2020). Mediating effects of soft skills to business performance: A study on a manufacturing organization. *Journal of Critical Reviews*, 7(16), 304–308.
- Choi, Y. (2018). Effects of Interdisciplinary Courses on Engineering Students' Competencies. TENCON 2018 - 2018 IEEE Region 10 Conference, (October), 793–797.
- Chromjakova, F. (2018). Digital literacy of employees in production process – Analyze of produc-tion stability and productivity in INDUSTRY 4.0 concept, 20014(November), 0–8.
- Cicek, K., Akyuz, E., & Celik, M. (2019). Future Skills Requirements Analysis in Maritime Industry. *Procedia Computer Science*, 158, 270–274.
- Ciolacu, M., & Beer, R. (2016). Adaptive User Interface for Higher Education based on web Technology, 300–303.
- Cohen, R. J. & Swerdlik, M. E. (2010). *Psychological testing and assessment: an introduction to test and measurement*. Mayfield Publishing Co.



- Cotet, G. B., Carutasu, N. L., & Chiscop, F. (2020). Industry 4.0 diagnosis from an imillennial educational perspective. *Education Sciences*, 10(1).
- Cropley, A. (2020). Creativity-focused Technology Education in the Age of Industry 4.0. *Creativity Research Journal*, 00(00), 1–8.
- D'Silva, V. (2020, February 2). More and More Graduates are Facing Unemployment in Malaysia. *New Straits Times*.
- Dacre Pool, L. & Sewell, P. (2007). The key to employability: Developing a practical model of grad-uate employability. *Education + Training*, 49(4), 277-289.
- Darbyshire, P. & McDonald, H. (2004). Choosing response scale label and length: Guidance for researchers and clients. *Australasian Journal of Market Research*, 12(2) 17-26.
- Darusalam, G., & Hussin, S. (2016). *Metodologi Penyelidikan Dalam Pendidikan: Amalan dan Analisis Kajian*. Edisi Kedua. Penerbit Universiti Malaya.
- Daulay, H., Akbar, M., & Ramly, M. (2019). Education and leadership training program in industrial revolution era 4.0 to improve employee creativity ministry of health of the republic of Indonesia. *International Journal of Engineering and Advanced Technology*, 8(5), 753–757.
- Davies, A., Fidler, D. & Gorbis, M. (2011). Future Work Skills 2020. Institute for the Future for the University of Phoenix Research Institute.
- Deloitte, L. (2016). Talent for Survival: Essential Skills for Humans Working in the Machine Age.
- Deming, D. J. (2017). The growing importance of social skills in the labor market. *National Bureau of Economic Research*. 1-37.
- Deming, D., & Kahn, L. B. (2018). Skill Requirements across Firms and Labor Markets: Evidence from Job Postings for Professionals. *Journal of Labor Economics*, 36(S1), 337-369.
- Devadason, E. S., Subramaniam, T. & Daniel, E. G. S. (2010). Final year undergraduates' perceptions of the integration of soft skills in the formal curriculum: a survey of Malaysian public universities. *Asia Pacific Education Review* 11(3), 321-348.
- Devi, M., Annamalai, M. A. R., & Veeramuthu, S. P. (2020). Literature Education and Industrial Revolution 4.0. *Universal Journal of Educational Research*, 8(3), 1027–1036.
- Dewi, D. P., Soekopitojo, S., Larasati, A., Kurniawan, M. F., & Hartanti, E. R. S. (2020). Developing instrument to measure student's capability for future work in industry 4.0

- at vocational education culinary program. *International Journal of Interactive Mobile Technologies*, 14(12), 110–121.
- Dhanpat, N., Buthelezi, Z. P., Joe, M. R., Maphela, T. V., & Shongwe, N. (2020). Industry 4.0: The Role of Human Resource Management. *SA Journal of Human Resource Management*, 18(0), 1–11.
- Dobrowolska, M., & Knop, L. (2020). Fit to work in the business models of the industry 4.0 age. *Sustainability (Switzerland)*, 12(12), 1–18.
- DOSM, Department of Statistic Malaysia (2014-2019). *Statistik Tenaga Buruh di Malaysia*.
- DOSM, Department of Statistic Malaysia (2019). *Department of Statistics Malaysia Press Release State Socioeconomic Report 2018*. Retrieved from [https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=449&bul\\_id=L25EUXQxbWdBaEV0WXU5aTFQWUpNdZ09&menu\\_id=TE5CRUZCbLh4ZTZMODZlbnk2aWRRQT09](https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=449&bul_id=L25EUXQxbWdBaEV0WXU5aTFQWUpNdZ09&menu_id=TE5CRUZCbLh4ZTZMODZlbnk2aWRRQT09)
- DOSM, Department of Statistic Malaysia (2019). *Manufacturing Statistics Malaysia, 2019*.
- Egcas, R. A. (2019). Contextualizing human skills education for legacy countries: The educators' perspective. *International Journal of Innovation, Creativity and Change*, 9(4), 60–75.
- Eichhorst, W. (2015). Do We Have to Be Afraid of the Future World of Work?. *IZA Policy Paper*, 102.
- Employment and Social Development Canada (2013). Explore careers by essential skills: Architectural Technologists and Technicians (NOC 2251). Retrieved on June 6, 2014 from [http://www.jobbank.gc.ca/es\\_searcheng.do?source=2&titleKeyword=architectural+technician&action=Search&noc=225](http://www.jobbank.gc.ca/es_searcheng.do?source=2&titleKeyword=architectural+technician&action=Search&noc=225)
- Erdisna, Ganefri, Ridwan, Efendi, R. E., & Masril, M. (2020). Effectiveness of Entrepreneur Digital Learning Model in the Industrial Revolution 4.0. *International Journal Of Scientific & Technology Research*, 9(03), 5611–5616. Retrieved from <http://www.ijstr.org/final-print/mar2020/Effectiveness-Of-Entrepreneur-Digital-Learning-Model-In-The-Industrial-Revolution-40.pdf>
- Erol, S., Jäger, A., Hold, P., Ott, K., & Sihn, W. (2016). Tangible Industry 4.0 : a scenario-based approach to learning for the future of production. *Procedia CIRP*, 54, 13–18.
- Fahimirad, M., Nair, P. K., Kotamjani, S. S., Mahdinezhad, M., & Feng, J. B. (2019). Integration and Development of Employability Skills into Malaysian Higher

- Education Context: Review of the Literature. *International Journal of Higher Education*, 8(6).
- Fantini, P., Pinzone, M., & Taisch, M. (2020). Placing the operator at the centre of Industry 4.0 design: Modelling and assessing human activities within cyber-physical systems. *Computers and Industrial Engineering*, 139(February 2018), 105058.
- Fitria, R. A., Rukun, K., Irfan, D., Dewi, M., Susanti, R., Sefriani, R., & Rasmita. (2019). New literacy oriented ict guidance module era of industrial revolution 4.0 in improving humanity literacy of students. *International Journal of Scientific and Technology Research*, 8(9), 1074–1078.
- Fitriana, M., Rasyid, Y., & Dewanti, R. (2020). The flipped english classroom in EFL context: A study of education 4.0. *International Journal of Advanced Science and Technology*, 29(5 Special Issue), 1503–1508.
- Flores, E., Xu, X., & Lu, Y. (2020). Human Capital 4.0: a workforce competence typology for Industry 4.0. *Journal of Manufacturing Technology Management*, 31(4), 687–703
- Fomunyam, K. G. (2020). The future of engineering education in South Africa. *International Journal of Engineering Research and Technology*, 13(4), 797–801.
- Fraenkel, J. R. & Wallen, E. N. (1996). *How to Design and Evaluate Research*. London: Sage Publications.
- Freddi, D. (2018). Digitalisation and employment in manufacturing companies. *AI & SOCIETY*, 33(3), 393–403.
- Garcia-Esteban, S., & Jahnke, S. (2020). Skills in European higher education mobility programmes: outlining a conceptual framework. *Higher Education, Skills and Work-Based Learning*, 10(3), 519–539.
- George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference*. 11.0 update (4th ed.). Boston: Allyn & Bacon.
- Ghani, E. K., & Muhammad, K. (2019). Industry 4.0: Employers' Expectations of Accounting Graduates and Its Implications on Teaching and Learning Practices. *International Journal of Education and Practice*, 7(1), 19–29.
- Ghazali, G. & Bennett, D. (2017). Employability for Music Graduates: Malaysian Educational Reform and the Focus on Generic Skills. *International Journal of Music Education*, 35(4), 588-600.
- Ghobakhloo, M. (2018). The Future of Manufacturing Industry: A Strategic Roadmap toward In-dustry 4.0. *Journal of Manufacturing Technology Management*, Vol. 29 Issue: 6, pp.910-936.



- Götz, M. (2019). The industry 4.0 induced agility and new skills in clusters. *Foresight and STI Governance*, 13(2), 72–83.
- Grzelczak, A., & Kosacka, M. (2017). Employees competences for industry 4.0 in poland—preliminary research results, (ICPR), 139–144.
- Grzelczak, A., & Kosacka, M. (2017). Perspectives Of Industry 4.0 Development In Poland – Pre-liminary Research Results, (ICPR), 133–138.
- Grzybowska, K., & Łupicka, A. (2017). Key Competencies for Industry 4.0. *Economics & Management Innovations (EMI)*, 1(1), 250–253.
- Guilland, A. (2018). Considerations for Solving the Skills Mismatch of Young Graduates and Requirements of Business World. *Proceedings of Inted2018 Conference*, 2252–2259.
- Ha, D. T., & Nuntaboot, K. (2020). New competencies required for nurses as compared to the national nursing competency standards in Vietnam. *Kontakt*, 22(2), 92–95.
- Haamann, T., & Basten, D. (2018). The Role of Information Technology in Bridging the Knowing-doing Gap: An Exploratory Case Study on Knowledge Application. *Journal of Knowledge Management*, 23(4), 705-741.
- Habanik, J., Grencikova, A., & Krajco, K. (2019). The Impact of New Technology on Sustainable Development. *Inzinerine Ekonomika - Engineering Economics*, 30(1), 41–49.
- Hadiyanto, Noferdiman, Syamsurizal, Muhaimin, & Krisantia, I. (2021). Students' Soft Skills, Hard Skills, and Competitiveness (SHC): A Suggested Model for Indonesian Higher Education Curriculum. *International Journal of Learning, Teaching and Educational Research*, 20(2), 218-234.
- Halim, F. (2018, May 3). Malaysia's Youth Unemployment Stays High Amid Skills Mismatch – MIDF. *The Edge Markets*.
- Hamid, A.R.A., Khazid, N.I.M., Yunus, R., Halim, H.A., & Razak, A.R.A (2018). The emerging of employment gap in the Malaysian construction industry. *Journal of Physics: Conf. Series* 1049 (2018) 012033.
- Hamzah, A., Nadarajah, K., Mat Noor, M., & Azlan, A. A. (2015). Students' Perception of the Programme Offered by the School of Biosciences and Biotechnology, Faculty of Science and Technology, UKM. *Jurnal Pendidikan Malaysia*, 40(2), 111–117.
- Hanapi, Z., Kamis, A., Tee, T. K., & Hanapi, M. H. (2016). Integrated employability skills gaps in Malaysia : An empirical study of Community College graduates, *Malaysian Journal of Society and Space*, 3(3), 145–153.

- Hanapi, Z., Mohd Shariff, M. S., Paijan, A., Mamat, A. B., & Abu Kassim, F. (2018). Indikator Kemahiran Employability dalam Kalangan Graduan Pendidikan. *Sains Humanika*, 10(3–3), 119–124.
- Handoko, B. L., Mulyawan, A. N., Samuel, J., Rianty, K. K., & Gunawan, S. (2019). Facing industry revolution 4.0 for millennial accountants. *International Journal of Innovative Technology and Exploring Engineering*, 9(1), 1037–1042.
- Hartanto, R., Purnomo, Nurhadi, D. (2020). Contributions of Mindset Entrepreneurial and Soft Skills toward Entrepreneurial Intentions of Vocational High School Students of Computer and Informatics Engineering Program. *2020 4th International Conference on Vocational Education and Training (ICOVET)*.
- Hartley, J. (2018). Ten Propositions about Public Leadership. *International Journal of Public Leadership*, 14(4), 202–217.
- Hasan, M. Z., Mallik, A., & Tsou, J. C. (2020). Learning method design for engineering students to be prepared for Industry 4.0: a Kaizen approach. *Higher Education, Skills and Work-Based Learning*.
- Hecklau, F., Galeitzke, M., Flachs, S., & Kohl, H. (2016). Holistic Approach for Human Resource Management in Industry 4.0. *Procedia CIRP*, 54, 1–6.
- Hermann, M., Pentek, T., & Otto, B. (2015). Design Principles for Industrie 4.0 Scenarios: A Literature Review.
- Hernandez-de-Menendez, M., Escobar Díaz, C. A., & Morales-Menendez, R. (2020). Engineering education for smart 4.0 technology: a review. *International Journal on Interactive Design and Manufacturing*, 14(3), 789–803.
- Hernandez-de-Menendez, M., Escobar Díaz, C., & Morales-Menendez, R. (2020). Technologies for the future of learning: state of the art. *International Journal on Interactive Design and Manufacturing*, 14(2), 683–695.
- Hidayah, K. F., Suparman, Hairun, Y., & Sari, D. P. (2020). Design of PBL-based differential calculus module to stimulate students' critical thinking skills. *Universal Journal of Educational Research*, 8(7), 2778–2793.
- Hidayat, M., & Yunus, U. (2019). The Entrepreneurship Learning in Industrial 4.0 Era (Case Study in Indonesian College). *Journal of Entrepreneurship Education*, 22(5), 0–15.
- Hidayat, T., Susilaningsih, E., & Cepi, K. (2018). The Effectiveness of Enrichment Test Instruments Design to Measure Students' Creative Thinking Skills and Problem-Solving. Thinking Skills and Creativity

- Hussin, H., Pang, Y. J., Rosly, R. N. R., & Omar, S. R. (2019). Integrated 21st Century Science, Technology, Engineering, Mathematics (STEM) Education through Robotics Project-Based Learning. *Humanities & social Sciences Reviews*, 7(2), 204–211.
- Ibrahim, M. Z. A., Rahman, M. N. A., & Yasin, R. M. (2017). Ketidaktepadan Kemahiran dan Kolaborasi Industri – Institusi PLTV di Malaysia: Satu Cadangan Penyelesaian. *SkillsMalaysia Journal*, 3(1), 17-22.
- Ilori, M. O., & Ajagunna, I. (2020). Re-imagining the future of education in the era of the fourth industrial revolution. *Worldwide Hospitality and Tourism Themes*, 12(1), 3–12.
- Institute For The Future (2020). Future Work Skills 2020 – Reports. Retrieved July 20, 2020, from <https://www.iftf.org/futureworkskills/>
- International Labour Office. 2016. Developing skills foresights, scenarios and forecasts: Guide to anticipating and matching skills and jobs volume 2. 1-216.
- International Labour Organization (2018). ASEAN in transformation: Perspectives of Enterprises and Students on Future Work. 1-98.
- Islam, R., Abdul Ghani, A. B., Kusuma, B., & Theseira, B. B. (2018). Education and Human Capital Effect on Malaysian Economic Growth. *International Journal of Economics and Financial Issues*, 6(4), 1722–1728.
- Islam, T. (2018). Skills Gap Assessment Between TVET Institutes and Industries of Bangladesh: Electronics Industries Perceptions. *Master Thesis*.
- Ismail, A. A., & Hassan, R. (2019). Technical Competencies in Digital Technology towards Industrial Revolution 4.0. *Journal of Technical Education and Training*, 11(3), 55–62.
- Ismail, A. A., & Hassan, R. (2019). Technical Competencies in Digital Technology. *Journal of Technical Education and Training*, 11(3).
- Ismail, M. H. (2012). Study on Employability of Graduates in Malaysia: A Survey of Employer Perspectives. *Prosiding PERKEM VII*, 2(2012), 906–913.
- Jaafar, S. N., Zakaria, N., & Rasheid, N. A. (2017). Career Choice and Employability Skills for Vocational College Students. *IOP Conf. Series: Journal of Physics: Conf. Series* 1049 (2018) 012050.
- Jaaffar, A. H., Ibrahim, H. I., Shah, K. A. M., & Zulkafli, A. H. (2016). Work-Integrated Learning and Graduate Employability Skills: The Employers' Perspective. *The Social Science*, 11(21), 5270-5274.

- Jafar, D. S. A., Saud, M. S., Hamid, M. Z. A., Suhairom, N., Hisham, M. H. M., & Zaid, Y. H. (2020). TVET teacher professional competency framework in industry 4.0 era. *Universal Journal of Educational Research*, 8(5), 1969–1979.
- Jagannathan, S., Ra, S., & Maclean, R. (2019). Dominant recent trends impacting on jobs and labor markets - An Overview. *International Journal of Training Research*, 17(sup1), 1–11.
- Jajuri, T., Hashim, S., Ali, M. N., & Abdullah, S. M. S. (2019). The Implementation of Science, Technology, Engineering and Mathematics (STEM) Activities and Its Effect on Student's Academic Resilience. *Asia Pacific Journal of Educators and Education*, 34(2019), 153-166.
- Jarche, H. (2018). Soft Skills are Human Skills. Retrieved from <https://jarche.com/2018/04/soft-skills-are-human-skills/>
- Jerman, A., Bertoneclj, A., Dominici, G., Pejić Bach, M., & Trnavčević, A. (2020). Conceptual Key Competency Model for Smart Factories in Production Processes. *Organizacija*, 53(1), 68–79.
- Jerman, A., Pejić Bach, M., & Aleksić, A. (2020). Transformation towards smart factory system: Examining new job profiles and competencies. *Systems Research and Behavioral Science*, 37(2), 388–402.
- Jima'ain, M. T. A., Hassan, F. N. A., Razak, K. A., Hehsan, A., & Junaidi, J. (2020). The emerging challenges of industrial revolution 4.0: A students' perspective. *International Journal of Advanced Science and Technology*, 29(6), 1215–1225.
- Jingyi, Q., Hua, L., Xiu, C., & Wen, F. (2020). Explore and practice of china's intelligent "new engineering" — based on the grounded theory. *International Journal of Information and Education Technology*, 10(8), 632–640.
- Jofree, A. F. M. (2021). *Faktor-faktor yang mempengaruhi ketidakcekan teknik industri pembuatan elektrik dan elektronik di Malaysia*. Universiti Tun Hussein Onn Malaysia. Phd Thesis.
- Jung, J. (2020). The fourth industrial revolution, knowledge production and higher education in South Korea. *Journal of Higher Education Policy and Management*, 42(2), 134–156.
- Kadir, J. M. A., Naghavi, N., Subramanian, G., & Abdul Halim, N. A. (2020). Unemployment Among Graduates – Is There a Mismatch. *International Journal of Asian Social Science*, 10(10), 583-592.

- Kamal, N., Ibrahim, M. F., & Huddin, A. B. (2019). Evaluation of Scratch programming mentoring program amongst primary school students. *International Journal of Innovation, Creativity and Change*, 9(6), 243–259.
- Kamaliah, S., Roslan, S., Bakar, A. R., & Ghiami, Z. (2018). The effect of supervised work experience on the acquisition of employability skills among Malaysian students. *Higher Education, Skills and Work-Based Learning*, 8(4), 354–364.
- Kamarudin, K. (2018, December 25). Revolusi Industri 4.0: Perlu Bersiap, Perubahan Pantas - Pensyarah. *Malaysiakini.Com*. Retrieved from <https://www.malaysiakini.com/news/457633>
- Kamaruzaman, F. M., Hamid, R., Mutalib, A. A., & Rasul, M. S. (2019). Conceptual Framework for the Development of 4IR Skills for Engineering Graduates. *Global Journal of Engineering Education*, 21(1), 54-61.
- Karre, H., Hammer, M., Kleindienst, M., & Ramsauer, C. (2017). Transition towards an Industry 4.0 State of the LeanLab at Graz University of Technology. *Procedia Manufacturing*, 9, 206–213.
- Kaur, S., Sirat, M. & Azman, N. (2008). The scenario of internationalisation and globalisation of higher education in Malaysia. In S. Kaur, M. Sirat & N. Azman (Eds.), *Globalisation and internationalisation of higher education in Malaysia* (pp. 3–21). Penang, Malaysia: Penerbit Universiti Sains Malaysia.
- Kementerian Pengajian Tinggi Malaysia (2006). *Modul pembangunan kemahiran insaniah (soft skills) untuk Institusi Pengajian Tinggi Malaysia*. Serdang: Penerbit Universiti Putra Malaysia
- Kenayathulla, H. B., Ahmad, N. A., & Idris, A. R. (2019). Gaps between competence and importance of employability skills: evidence from Malaysia. *Higher Education Evaluation and Development*, 13(2), 97–112
- Kergroach, S. (2017). Industry 4.0: New Challenges and Opportunities for the Labour Market. *Foresight and STI Governance*, 11(4), 6-8.
- Kinkel, S., Schemmann, B., & Lichtner, R. (2017). Critical Competencies for the Innovativeness of Value Creation Champions: Identifying Challenges and Work-integrated Solutions. *Procedia Manufacturing*, 9(0), 323–330.
- Kitchenham, B. (2004). Procedures for performing systematic reviews. Technical Report, Keele University, Staffs, pp. 1-26.
- Kothari, C. R. (2004). *Research Methodology: Methods & Techniques*. New Age International (P) Ltd



- Kowang, T. O., Bakry, M. F., Hee, O. C., Fei, G. C., Yew, L. K., Saadon, M. S. I., & Long, C. S. (2020). Industry 4.0 competencies among lecturers of higher learning institution in Malaysia. *International Journal of Evaluation and Research in Education*, 9(2), 303–310.
- Kusmin, K., & Ley, T. (2017). Towards a Data Driven Competency Management Platform for In-dustry 4.0.
- Laar, E. Van, Deursen, A. J. A. M. Van, Dijk, J. A. G. M. Van, & Haan, J. De. (2017). The relation between 21st-century skills and digital skills or literacy: A systematic literature review. *The Relation between 21st-Century Skills and Digital Skills or Literacy A Systematic Literature Review*.
- Lampropoulos, G., Siakas, K., & Anastasiadis, T. (2019). Internet of Things in the Context of Industry 4.0: An Overview. *International Journal of Entrepreneurial Knowledge*, 7(1), 4–19.
- Law, C.S. (2019). Malaysia Public Universities' Graduate Employability Policies : An Analysis of First Degree Graduates Unemployment and Underemployment Issues. *International Journal of Social Science and Humanities Research*. Vol. 6, Issue 4, pp: (480-489). 2018
- Lee, C. (2019). Manufacturing Performance and Services Inputs: Evidence from Malaysia. *Economics Working Paper*, (February), 1–24.
- Lee, W. Y., Tan, S. T., & Sorooshian, S. (2019). Impacts of Industry 4.0 on Malaysian Manufacturing Industries. *WSEAS Transactions on Business and Economics*, 16, 355-359.
- Lee, Y., Moon, G. G., & Kwon, Y. K. (2019). Implementing liberal arts education in the era of the Fourth Industrial Revolution: lessons and implications for Korea's higher education policy. *International Review of Public Administration*, 24(4), 282–294.
- Leedy, P. D., & Ormrod, J. E. (2010). *Practical research: Planning and design* (9th ed). New Jersey: Pearson Education
- Liao, Y., Deschamps, F., Loures, E.F.L. & Ramos, L.F.P. (2017). Past, present and future of Industry 4.0- a systematic literature review and research agenda proposal. *International Journal of Production Research*, 55(12), 3609-3629.
- Liao, Y., Loures, E.R., Deschamps, F., Brezinski, G. and Venancio, A. (2018). The impact of the fourth industrial revolution: a cross-country/region comparison. *Production*, 28, pp.1-18.

- Lim, H-E. & Mustafa, M. M. (2013). Effectiveness of industrial training in improving students' ge-neric skills. *International Journal of Business and Society* 14(3), 368-375.
- Lisá, E., Hannelová, K., & Newman, D. (2019). Comparison between Employers' and Students' Expectations in Respect of Employability Skills of University Graduate. *International Journal of Work-Integrated Learning*, 20(1), 71–82.
- Lombardi, R. (2019). Knowledge Transfer and Organizational Performance and Business Process: Past, Present and Future Researches. *Business Process Management Journal*, 25(1), 2-9.
- Low, S. P., Gao, S., & Ng, E. W. L. (2019). Future-ready project and facility management graduates in Singapore for industry 4.0: Transforming mindsets and competencies. *Engineering, Construction and Architectural Management*.
- Luo, X. (2021). Quantitative Analysis on the Evaluation Indicators of Teaching Abilities of Physical Education Teachers in Colleges and Universities. *International Journal of Emerging Technologies in Learning*, 16(18), 143-155.
- Luque-Vega, L. F., Lopez-Neri, E., Santoyo, A., Ruíz-Duarte, J., & Farrera-Vázquez, N. (2019). Educational methodology based on active learning for mechatronics engineering students: Towards educational mechatronics. *Computacion y Sistemas*, 23(2), 325–333.
- Lusiyana, A., Festiyed, & Yulkifli. (2020). Measuring the physics students' data literacy skill in the era of industry 4.0 by using mirecal learning model. *International Journal of Scientific and Technology Research*, 9(1), 1203–1205.
- Lysaght, R. M., & Altschuld, J. M. (2000). Beyond initial certification: the assessment and maintenance of competence in professions. *Evaluation and Program Planning*, 23(1), 95–104.
- Maisiri, W., Darwish, H., & Van Dyk, L. (2019). An Investigation of Industry 4.0 Skills Requirements. *South African Journal of Industrial Engineering*, 30(3), 90–105.
- Majid, F. A. (2019). iCGPA, IR4.0 and graduate employability from the lens of the academics. *Asian Journal of University Education*, 15(3), 245–256.
- Malasamy, G. V., Nadarajah, D., & Mehmood, S. A. (2018). Effects of Knowledge Acquisition, Information Capability and Relationship Quality on Product Innovation Flexibility among Manufacturing Firms in Malaysia. *International Journal of Engineering & Technology*, 7(2.34), 29–33.

- Malaysia's National Foresight Magazine (2017). Future of Work 2<sup>nd</sup> Edition MyForesight Magazine. Retrieved September 28, 2020, from [https://www.myforesight.my/wp-content/uploads/2017/12/myForesight%202017-2%20\(Web\).pdf](https://www.myforesight.my/wp-content/uploads/2017/12/myForesight%202017-2%20(Web).pdf)
- Malaysian Qualification Agency (2017). Malaysian Qualification Framework 2<sup>nd</sup> Edition. Retrieved September 28, 2020, from <https://www.mqa.gov.my/pv4/document/mqf/2019/Oct/updated%20MQF%20Ed%202%2024102019.pdf>
- Manocha, T., & Sharma, V. (2020). Study on the readiness among youth towards industry 4.0. *International Journal of Advanced Science and Technology*, 29(3), 6324–6333.
- Marnewick, A. L., & Marnewick, C. (2020). The Ability of Project Managers to Implement Industry 4.0-Related Projects. *IEEE Access*, 8.
- Marnewick, C., & Marnewick, A. L. (2020). The Demands of Industry 4.0 on Project Teams. *IEEE Transactions on Engineering Management*, 67(3), 941–949.
- Marouani, Mohamed A. & Nilsson, Björn, 2016. "The labor market effects of skill-biased technological change in Malaysia," *Economic Modelling*, Elsevier, 57(C), 55-75.
- McGarry, O. (2020). The Benefits of Soft Skills Training for your Workforce. Retrieved from <https://www.learnupon.com/blog/soft-skills-training/>
- Mcmurray, S., Dutton, M., McQuiad, R. W. (2016). Employer Demands from Business Graduates. *Education and Training* 58(1), 112-132. DOI: 10.1108/ET-02-2014-0017
- Mesquita, A., Oliveira, A., Sequeira, A., Oliveira, L., Silva, P. (2020). The Workforce of the Future – Projects and Initiatives to Overcome the Challenges Enacted by the Digital Transformation. *Advances in Tourism, Technology and Smart Systems*.
- Messer, D. (2018). Work placements at 14-15 years and employability skills. *Education and Training*, 60(1), 16–26.
- Mian, S. H., Salah, B., Ameen, W., Moiduddin, K., & Alkhalefah, H. (2020). Adapting universities for sustainability education in industry 4.0: Channel of challenges and opportunities. *Sustainability (Switzerland)*, 12(15).
- Ministry of Education Malaysia (2015). Malaysian Education Blueprint 2015-2025 (Higher Education). Retrieved September 28, 2020, from <https://www.moe.gov.my/menumedia/media-cetak/penerbitan/pppm-2015-2025-pt/1384-4-executive-summary-pppm-2015-2025/file>
- MITI, Ministry of International Trade and Industry (2018). *MITI Report 2018. Report*.
- Mohd Ali, M. F. (2016). *The Influence of Technologies, Organizational Capabilities, and People on Organizational Performance in Electronic Manufacturing Industry*.



- Retrieved from [http://eprints.usm.my/32206/1/MOHAMED\\_FADZIL\\_MOHD\\_ALI\\_24\(NN\).pdf](http://eprints.usm.my/32206/1/MOHAMED_FADZIL_MOHD_ALI_24(NN).pdf)
- Mohd Kamaruzaman, F., Hamid, R., Mutalib, A. A., & Rasul, M. S. (2019). Comparison of engineering skills with IR 4.0 skills. *International Journal of Online and Biomedical Engineering*, 15(10), 15–28.
- Mohd Kamaruzaman, F., Hamid, R., Mutalib, A. A., & Rasul, M. S. (2019). Conceptual Framework for the Development of 4IR Skills for Engineering Graduates. *Global Journal of Engineering Education*, 21(1), 54-61.
- MOHE, Ministry of Higher Education (2012). *The National Graduates Employability Blueprint 2012-2017*. Serdang, Selangor. Universiti Putra Malaysia Press.
- MOHE, Ministry of Higher Education (2019). *Statistik Pendidikan Tinggi 2019: Kementerian Pengajian Tinggi. Kementerian Pengajian Tinggi Malaysia*.
- MOHE. (2006). *Development of Soft Skills for Institutions of Higher Learning*. Serdang, Selangor: Universiti Putra Malaysia Press.
- MOHE. (2012). *The National Graduate Employability Blueprint 2012-2017*. Serdang, Selangor: Universiti Putra Malaysia Press.
- MOHE. (2015). *Malaysian Education Blueprint 2015-2025 (Higher Education)*. Putrajaya: Ministry of Higher Education.
- Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMAP) 2015 statement. *Systematic reviews*, 4(1), 1-9.
- Motyl, B., Baronio, G., Uberti, S., Speranza, D., & Filippi, S. (2017). How will Change the Future Engineers' Skills in the Industry 4.0 Framework? A Questionnaire Survey. *Procedia Manufacturing*, 11(June), 1501–1509.
- Mourtzis, D. (2018). Development of skills and competences in manufacturing towards Education 4.0: A teaching factory approach. In 2018 International Conference on the Industry 4.0 mod-el for Advanced Manufacturing. AMP 2018. *Lecture Notes in Mechanical Engineering*, Springer, Cham, pp. 194-210.
- Muktiarni, M., Widiaty, I., Abdullah, A. G., Ana, A., & Yulia, C. (2019). Digitalisation trend in education during industry 4.0, *Journal of Physics: Conference Series*, 0–6.
- Musa, Z. (2020, October 19). Tough Time for Fresh Graduates. *The Star*.
- Mustafa, Z. (2019). Importance of Academia-Industry Linkages. *New Straits Times*. Retrieved from <https://www.nst.com.my/education/2019/01/453582/importance-academia-industry-linkages>

- Mustapha, R., & Darusalam, G. (2018). *Aplikasi Kaedah Fuzzy Delphi Dalam Penyelidikan Sains Sosial*. Penerbit Universiti Malaya.
- Myers, J.H. (1999). *Measuring customer satisfaction: Hot buttons & other measurement issues*, Chicago, USA: AMA.
- Nadarajah, J. (2021). Measuring the Gap in Employability Skills among Malaysian Graduates. *International Journal of Modern Trends in Social Sciences*, 4(15), 81-87.
- Ngoc, T. T. B., & Binh, D. T. (2019). Vietnam's electronics industry: The rise and problems of further development. *Humanities and Social Sciences Reviews*, 7(4), 1–12.
- Noah, J. B. & Abdul Aziz, A. (2020). A Systematic Review on Soft Skills Development among University Graduates. *EDUCATUM Journal of Social Sciences*, 6(1), 53-68.
- Onyilo, I. R., Arsat, M., Latif, A. A., & Akor, T. S. (2020). Green automobile technology competencies in Nigeria and the fourth industrial revolution. *Journal of Critical Reviews*, 7(7), 865–869.
- Organisation for Economic Co-operation and Development (OECD). 2017. Future of Work and Skills. Paper presented at the 2<sup>nd</sup> Meeting of the G20 Employment Working Group. Hamburg, Germany. 1-24.
- Osmin, S. S (2017). Employer's Perception on IT Graduates Employability: A Case Study Politeknik Ungku Omar. *International Journal of Networks and Systems*, 6(1), 1-6.
- Othman, H., Daud, K. A. M., Ewon, U., Salleh, B. M., Omar, N. H., Baser, J. A., Ismail, M. E., & Sulaiman, A. (2017). Engineering Students : Enhancing Employability Skills through PBL. *IOP Conference Series: Materials Science and Engineering* 203 012024.
- Ovinova, L. N., & Shraiber, E. G. (2019). Pedagogical model to train specialists for Industry 4.0 at University. *Perspektivy Nauki i Obrazovania*, 40(4), 448–461.
- Padil, S. (2017). Kerangka Kemahiran Employability Senibina Graduan Politeknik. Universiti Tun Hussein Onn Malaysia: Ph.D. Thesis. 2
- Parahoo K. (1997) *Nursing research: principles, process and issues*. Basingstoke: Macmillan.
- Paschou, T., Rapaccini, M., Adrodegari, F., & Saccani, N. (2018). Competences in Digital Servitization: A New Framework. *Proceedings of the Summer School Francesco Turco, 2018*(September), 381–387.
- Patacsil, F. F., & Tablatin, C. L. S. (2017). Exploring the Importance of Soft and Hard Skills as Perceived by IT Internship Students and Industry: A Gap Analysis. *Journal of Technology and Science Education*, 7(3), 347-368.

- Pedersen, M. R., Nalpantidis, L., Andersen, R. S., Schou, C., Bøgh, S., Krüger, V., & Madsen, O. (2015). Robot Skills for Manufacturing: From Concept to Industrial Deployment.
- Perini, S., Luglietti, R., Margoudi, M., Oliveira, M., & Taisch, M. (2017). Training Advanced Skills for Sustainable Manufacturing : A Digital Serious Game. *Procedia Manufacturing*, 11(2017), 1536–1543.
- Pfeiffer, S. (2017). The Vision of “Industrie 4.0” in the Making – a Case of Future Told, Tamed, and Traded.
- Piatkowski, M. J. (2020). Expectations and challenges in the labour market in the context of industrial revolution 4.0. the agglomeration method-based analysis for Poland and Other EU Member States. *Sustainability (Switzerland)*, 12(13).
- Piñol, T. C., Porta, S. A., Arévalo, M. C. R., & Minguella-Canela, J. (2017). Study of the training needs of industrial companies in the Barcelona Area and proposal of Training Courses and Methodologies to enhance further competitiveness. *Procedia Manufacturing*, 13, 1426–1431.
- Pinzone, M., Fantini, P., Perini, S., Garavaglia, S., Taisch, M., & Miragliotta, G. (2017). Jobs and Skills in Industry 4.0: An Exploratory Research, 282–288.
- Pita, C., Eleftheriou, M., Fernánde-Borra´s, J., Goncalves, S., Mente, E., Santos, M. B., Seixas, S. & Pierce, G. J. (2014). Generic skills needs for graduate employment in the aquaculture, fisheries and related sectors in Europe. *Aquaculture International*, 1-20.
- Popkova, E. G., & Zmiyak, K. V. (2019). Priorities of training of digital personnel for industry 4.0: social competencies vs technical competencies. *On the Horizon*, 27(3–4), 138–144.
- Precision Consultancy (2006). Employability skills: from framework to practice: an introductory guide for trainers and assessors. DEST: Canberra. Retrieved on November 6, 2013 dari <http://www.voced.edu.au/content/ngv52958>
- Preston, C. C. & Colman, A. M. (2000). Optimal Number of Response Categories in Rating Scales: Reliability, Validity, Discriminating Power, and Respondent Preferences. *Acta Psychologica*, 104(2000), 1-15.
- Puriwat, W., & Tripopsakul, S. (2020). Preparing for industry 4.0-will youths have enough essential skills?: An evidence from Thailand. *International Journal of Instruction*, 13(3), 89–104.
- Puteh-Behak, F., & Ismail, I. R. (2018). Multiliteracies project approach: Dated or a worthy learning tool? *GEMA Online Journal of Language Studies*, 18(2), 312–334.

- Putra, L. I. A., & Suparman. (2020). Design of student worksheet according to PBL learning model to improve problem-solving skills. *International Journal of Scientific and Technology Research*, 9(3), 4967–4973.
- Qizi, K. N. U. (2020). Soft Skills Development in Higher Education. *Universal Journal of Educational Research*, 8(5), 1916–1925. <https://doi.org/10.13189/ujer.2020.080528>
- Ra, S., Shrestha, U., Khatiwada, S., Seung, W. Y., & Kwon, K. (2019). The Rise of Technology and Impact on Skills. *International Journal of Training Research*, 17(1), 26–40.
- Rahmat, N., Ayub, A. R., & Buntat, Y. (2016). Employability Skills Constructs as Job Performance Predictors for Malaysian Polytechnic Graduates: A Qualitative Study. *Malaysian Journal of Society and Space*, 12(3), 154-167.
- Rahmat, N., Ayub, A. R., & Buntat, Y. (2016). Employability skills constructs as job performance predictors for Malaysian polytechnic graduates : A qualitative study. *Malaysian Journal of Society and Space*, 12(3), 154-167.
- Ramhari, V. (2018). Factors contributing to productivity in the South African Electronic Manufac-turing Industry.
- Ramirez-mendoza, R. A., Morales-menendez, R., Iqbal, H., & Parra-saldivar, R. (2018). Engineering Education 4.0 -, 1273–1282.
- Ramlee, M. (2017). Skills Training and Vocational Education In Malaysia. In: Education in the Asia-Pacific Region: Issues, Concerns and Prospects, 3, 137-153. Singapore: Springer Nature.
- Rasaki, E. O., & Abioye, A. (2018). Human, Conceptual and Technical Skills as Determinants of Preservation Management in University Libraries in Southern Nigeria. *Global Knowledge, Memory and Communication*, 67(1/2), 34–51.
- Rasiah, R., Turner, J. J., & Ho, Y. F. (2019). The impact of emotional intelligence on work performance: Perceptions and reflections from academics in malaysian higher educationobitat endiaest que. *Contemporary Economics*, 13(3), 269–282.
- Rasul, M. S., Abd Rauf, R. A., Mansor, A. N. & Puvanasvaran, A. P. (2018). Employability skills assessment tool development [versi elektronik]. *International Education Studies*, 5(5), 43 - 56.
- Rhee, H., Han, J., Lee, M., & Choi, Y. W. (2020). Effects of interdisciplinary courses on future engineers' competency. *Higher Education, Skills and Work-Based Learning*, 10(3), 467–479.

- Richert, A., Shehadeh, M., Plumanns, L., Schuster, K., & Jeschke, S. (2016). Educating Engineers for Industry 4.0: Virtual Worlds and Human-Robot-Teams Empirical Studies towards a new educational age, (April), 142–149.
- Ritter, B. A., Small, E. E., Mortimer, J. W., & Doll, J. L. (2017). Designing Management Curriculum for Workplace Readiness: Developing Students' Soft Skills. *Journal of Management Education*, 1-24.
- Ritter, B. A., Small, E. E., Mortimer, J. W., & Doll, J. L. (2018). Designing Management Curriculum for Workplace Readiness: Developing Students' Soft Skills. *Journal of Management Education*, 42(1), 80–103.
- Rivera, F. M. La, Hermosilla, P., Delgadillo, J., & Echeverría, D. (2020). The sustainable development goals (SDGs) as a basis for innovation skills for engineers in the industry 4.0 context. *Sustainability (Switzerland)*, 12(16).
- Roblek, V., Meško, M., & Krapež, A. A. (2016). Complex View of Industry 4.0, *SAGE Open*, 6 (June), 1–11.
- Rodzalan, S. A. (2016). The influence of individual and organisational factors on university students' generic skills. Universiti Teknologi Malaysia: Ph.D. Thesis.
- Román-Graván, P., Hervás-Gómez, C., Martín-Padilla, A. H., & Fernández-Márquez, E. (2020). Perceptions about the use of educational robotics in the initial training of future teachers: A study on STEAM sustainability among female teachers. *Sustainability (Switzerland)*, 12(10).
- Rony, Z. T., Lubis, F. M., Santoso, B., & Rizkyta, A. (2020). The relevance of political skills for leaders and managers in the industrial revolution 4.0: A case study of the Indonesian private television industry. *International Journal of Innovation, Creativity and Change*, 12(1), 447–465.
- Rotatori, D., Lee, E. J., & Sleeva, S. (2020). The evolution of the workforce during the fourth industrial revolution. *Human Resource Development International*, 00(00), 1–12.
- Rowley, J., Munday, J., & Polly, P. (2018). Preparing Future Career Ready Professionals: A Portfolio Process to Develop Critical Thinking Using Digital Learning and Teaching. *Springer International Publishing*, 702-707.
- Rumsey, A., Morehouse, J. B., & Densmore, C. (2019). Evaluating Manufacturing Workforce Development Initiatives in Georgia. *Procedia Manufacturing*, 34(2019), 1030–1042.



- Rüßmann, M., Lorenz, M., Gerbert, P., Waldnder, M., Justus, J., Engel, P., & Harnisch, M. (2015). Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries. *Boston Consulting*, (April).
- Sakuneka, T. (2019). Industry 4.0 competencies for a control systems engineer. 2019 IEEE Tech-nology & Engineering Management Conference (TEMSCON), 1–6.
- Salah, B., Abidi, M. H., Mian, S. H., Krid, M., Alkhalefah, H., & Abdo, A. (2019). Virtual reality-based engineering education to enhance manufacturing sustainability in industry 4.0. *Sustainability (Switzerland)*, 11(5), 1–19. <https://doi.org/10.3390/su11051477>
- Salampessy, Y. M., & Suparman. (2020). Design of probability module based on PBL learning model to improve critical thinking skills. *International Journal of Scientific and Technology Research*, 9(3), 5695–5700.
- Saleh, H. (2019). Employer Satisfaction with Engineering Graduates Employability : A Study among Manufacturing Employers in Malaysia. *International Journal of Scientific & Technology Research*, 8(9), 813–817.
- Saleh, M., Baker, S. & Al Barghuthi, N. (2017). Innovation in Education via Problem Based Learning from Complexity to Simplicity. 2017 International Conference on New Trends in Com-puting Sciences Higher Colleges of Technology Sharjah , United Arab Emirates Ministry of Finance Abu Dhabi , United Arab Emirates Higher Colleges of Technology Sharjah , United Arab Emirates.
- Salleh, K. M., Sulaiman, N. L., Mohamad, M. M., & Lai, C. S. (2017). Assessing Soft Skills Components in Science and Technology Programs within Malaysian Technical Universities. *Songklanakarin Journal Of Science And Technology*, Prince Of Songkla University, 5, 399.
- Salleh, K.M., Sulaiman, N.L., & Talib, K.N. (2010). Globalization's Impact on Soft Skills Demand in the Malaysian Workforce and Organizations: What makes graduates employable?
- Sari, W. K., & Wilujeng, I. (2019). The effectiveness of Problem Based Learning - physics module with authentic assessment for enhancing senior high school students' physics problem solving ability and critical thinking ability.
- Schallock, B., Rybski, C., Jochem, R., & Kohl, H. (2018). Learning Factory for Industry 4.0 to Provide Future Skills beyond Technical Training. *Procedia Manufacturing*, 23(2017), 27–32.

- Schez-Sobrinho, S., Vallejo, D., Glez-Morcillo, C., Redondo, M., & Castro-Schez, J. J. (2020). RoboTIC: A serious game based on augmented reality for learning programming. *Multimedia Tools and Applications*, 79(45–46), 34079–34099.
- Schumacher, A., Erol, S., & Sihn, W. (2016). A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises. *Procedia CIRP*, 52, 161–166.
- Schwab, K. (2016). *The Fourth Industrial Revolution*, by Klaus Schwab.
- Selamat, A., Alias, R. A., Hikmi, S. N., Puteh, M., & Tapsir, S. H. (2017). Higher Education 4.0: Current Status and Readiness in Meeting the Fourth Industrial Revolution Challenges. Ministry of Higher Education Malaysia, (August), 23–24.
- Setia, S., & Ekowati, D. (2020). Fresh evidence on technology leadership and technology transformation at schools in five different continents: Moderating role of supply chain. *International Journal of Supply Chain Management*, 9(4), 387–397.
- Shin, W. S., Lee, Y. S., & Dahlgaard, J. J. (2019). A pattern-based decision framework in the era of Industry 4.0. *Total Quality Management and Business Excellence*, 30(sup1), S158–S181.
- Shvetsova, O. A. & Kuzmina, A. D. (2018). Development of Engineering Personnel in the Era of the Fourth Industrial Revolution, 45–48.
- Siddoo, V., Sawattawee, J., Janchai, W., & Thinnukool, O. (2019). An exploratory study of digital workforce competency in Thailand. *Heliyon*, 5(5), e01723.
- Silva, H. C., & Lima, F. (2017). Technology, employment and skills : A look into job duration Technology, employment and skills : A look into job duration. *Research Policy*, 46(8), 1519–1530.
- Silverman, D. (2002). *Why Interview*. London, UK: Sage Publication
- Singh, D., & Tilak, G. (2020). Implementation of education model 4.0: Developing industry 4.0 skills in graduates engineers for improving employability skills. *Humanities and Social Sciences Reviews*, 8(2), 601–613.
- Singh, G. K. G., & Singh, S. K. G. (2008). Malaysian Graduates' Employability Skills. *Unitar E-Journal*, 4(1), 15-45.
- Singh, H., & Gera, M. (2015). Developing Generic Skills in Higher Education. *Indian Journal of Applied Research*, 5(6):824-826.
- Škrinjarić, B., & Domadenik, P. (2019). Examining the role of key competences in firm performance. *International Journal of Manpower*, 41(4), 391–416.



- Soboleva, E. V., & Karavaev, N. L. (2020). Preparing engineers of the future: The development of environmental thinking as a universal competency in teaching robotics. *European Journal of Contemporary Education*, 9(1), 160–176.
- Sohimi, N. E., Affandi, H. M., Rasul, M. S., Yasin, R. M., Nordin, N., & Adam, S. (2019). Malaysian Industrial Collaborations for Skills Development in 4<sup>th</sup> Industrial Revolution. *Journal of Technical Education and Training*, 11(3), 63–72.
- Sopa, A., Asbari, M., Purwanto, A., Santoso, P. B., Mustofa, Hutagalung, D., Maesaroh, S., Ramdan, M., & Primahendra, R. (2020). Hard Skills versus Soft Skills: Which are More Important for Indonesian Employees Innovation Capability. *International Journal of Control and Automation*, 13(2), 156-175.
- Sousa, M. J., & Rocha, A. (2019). Strategic Knowledge Management in the Digital Age. *Journal of Business Research*, 94, 223-226.
- Spottl, G. (2016). TVET Plays Crucial Role in “Industry 4.0.”
- Stacho, Z., Stachová, K., Papula, J., Papulová, Z., & Kohnová, L. (2019). Effective communication in organisations increases their competitiveness. *Polish Journal of Management Studies*, 19(1), 391–403.
- Stock, T., & Seliger, G. (2016). Opportunities of Sustainable Manufacturing in Industry 4.0. *Procedia CIRP*, 40(2016), 536–541.
- Stojanova, H., Lietavcova, B., & Raguž, I. V. (2019). The dependence of unemployment of the senior workforce upon explanatory variables in the European Union in the context of Industry 4.0. *Social Sciences*, 8(1).
- Suastra, I. W., Ristiati, N. P., Adnyana, P. P. B., & Kanca, N. (2019). The effectiveness of Problem Based Learning - physics module with authentic assessment for enhancing senior high school students’ physics problem solving ability and critical thinking ability. *Journal of Physics: Conference Series*.
- Subbiah, K. Kannan, S., Koiyu, R. & Monama, L. (2017). Undergraduate students perception on industrial training. *International Journal of Business and Management Invention* 6(7), 72-76.
- Subramonian, H. (2008). Competencies Gap between Education and Employability Stakes. *Team Journal of Hospitality & Tourism*, 5(1), 45-60.
- Sudira, P., & Juwanto, R. E. (2019). Design training kits CPI for vocational learning in industry 4.0. *International Journal of Recent Technology and Engineering*, 8(3), 6293–6302.

- Sutherland, K., & Ho, S. (2017). Undergraduate Perceptions of Social Media Proficiency and Graduate Employability – A Pilot Study.
- Tan, A. Y. T., Chew, E., & Kalavally, V. (2017). The Expectations Gap for Engineering Field in Malaysia in the 21st Century. *On the Horizon*, 25(2), 131–138.
- Tan, O. K., Bakry, M. F., Ong, C. H., Goh, C. F., Lim, K. Y., Saadon, M. S. I., & Choi, S. L. (2020). Industry 4.0 Competencies among Lecturers of Higher Learning Institution in Malaysia. *International Journal of Evaluation and Research in Education*, 9(2), 303–310.
- Teles dos Santos, M., Vianna, A. S., & Le Roux, G. A. C. (2018). Programming skills in the industry 4.0: are chemical engineering students able to face new problems? *Education for Chemical Engineers*, 22, 69–76.
- Tella, A. (2020). Repackaging LIS professionals and libraries for the fourth industrial revolution. *Library Hi Tech News*, 37(8), 1–6.
- Teng, W., Ma, C., Pahlevansharif, S., Turner, J. J., Pahlevansharif, S., & Turner, J. J. (2019). Graduate readiness for the employment market of the 4th industrial revolution. The development of soft employability skills.
- Terkowsky, C., Frye, S., & May, D. (2019). Online engineering education for manufacturing technology: Is a remote experiment a suitable tool to teach competences for “Working 4.0”? *European Journal of Education*, 54(4), 577–590.
- Tetep, & Suparman, A. (2019). Students’ digital media literacy: Effects on social character. *International Journal of Recent Technology and Engineering*, 8(2 Special Issue 9), 394–399.
- The Economic Planning Unit. (2006). *Ninth Malaysia Plan 2006-2010*. Putrajaya: The Economic Planning Unit.
- Thi, M. N. V., & Hoang, H. (2020). Exploring the antecedents of English speaking performance: An empirical study on students in Vietnam. *Universal Journal of Educational Research*, 8(5), 2108–2116.
- Thirunavukarasu, G., Chandrasekaran, S., Betageri, V. S., & Long, J. (2020). Assessing learners’ perceptions of graduate employability. *Sustainability (Switzerland)*, 12(2), 1–17
- Tickle, & Louise (2013, February 28). Employability Initiative Winner: Edinburgh College of Art. *The Guardian*.

- Triyono, M. B., Trianingsih, L., & Nurhadi, D. (2018). Students' Employability Skills for Construction Drawing Engineering in Indonesia. *World Transactions on Engineering and Technology Education*, 16(1), 29-35.
- Tsirkas, K., Chytiri, A., & Bouranta, N. (2020). The Gap in Soft Skills Perceptions: A dyadic Analysis. *Education + Training*, 62(4), 357-377.
- Vagias, W. M. (2006). Likert-Type Scale Response Anchors. *Clemson International Institute for Tourism & Research Development*.
- Vaidya, R. W., Prasad, K., & Mangipudi, M. R. (2020). Mental and emotional competencies of leader's dealing with disruptive business environment - A conceptual review. *International Journal of Management*, 11(5), 366–375.
- Velciu, M., & Grecu, L. (2017). The Job and Talent Mismatch as New Challenges. *Proceedings of the 11<sup>th</sup> International Management Conference*.
- Veljković, S. M., Nešić, A., Dudić, B., Gregus, M., Delić, M., & Meško, M. (2020). Emotional intelligence of engineering students as basis for more successful learning process for industry 4.0. *Mathematics*, 8(8), 1–9.
- Venter, A. A. J., Herbst, T. H. H., & Iwu, C. G. (2019). What will it take to make a successful administrative professional in the fourth industrial revolution? *SA Journal of Human Resource Management*, 17(2005), 1–14.
- Vila, C., Ugarte, D., Ríos, J., & Abellán, J. V (2017). Project-based collaborative engineering learning to develop Industry 4.0 skills within a PLM framework. *Procedia Manufacturing*, 13, 1269–1276.
- Vu Anh, T. L., & Le Quoc, T. (2019). Development orientation for higher education training programme of mechanical engineering in industrial revolution 4.0: A perspective in Vietnam. *Journal of Mechanical Engineering Research and Developments*, 42(1), 71–73
- Wagiran, Pardjono, & Sofyan, H. (2020). What industry needs of vocational school graduate competence in the era of industrial revolution 4.0. *International Journal of Advanced Science and Technology*, 29(5), 2459–2470.
- Wagiran, Pardjono, Suyanto, W., Sofyan, H., Soenarto, S., & Yudiantoko, A. (2019). Competencies of future vocational teachers: Perspective of in-service teachers and educational experts. *Cakrawala Pendidikan*, 38(2), 388–400.
- Wang, B., & Ha-brookshire, J. E. (2018). Exploration of Digital Competency Requirements within the Fashion Supply Chain with an Anticipation of Industry 4.0. *International Journal of Fashion Design, Technology and Education*, 0(0), 1–10.

- WEF, World Economic Forum (2017). *Digital Transformation Initiative Mining and Metals Industry*. Retrieved from <http://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/wef-dti-mining-and-metals-white-paper.pdf>
- Welman, C., Kruger, F. & Mitchell, B. (2005). *Research Methodology*. Cape Town: Oxford University Press.
- Wikle, T. A. & Fagin, T. D. (2015). Hard and soft skills in preparing GIS professionals: Comparing perceptions of employers and educators. *Transactions in GIS* 19(5), 641-652.
- Winterton, J., & Turner, J. J. (2019). Preparing graduates for work readiness: an overview and agenda. *Education and Training*, 61(5), 536–551
- Wittink, D.R. & Bayer, L.R. (1994). The measurement imperative. *Marketing Research: A Magazine of Management and Applications*, 6(4) 14-22
- Wong, S. P., Roslan, S., Siaw, Y., Sulaiman, T., & Jalil, H. A. (2018). The Employability of Undergraduate Students in a Malaysian Higher Educational Institution. *Educational Leader (Pemimpin Pendidikan)*, 6(2018), 165-182.
- World Economic Forum (2017). *Digital Transformation Initiative Mining and Metals Industry*. Retrieved from <http://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/wef-dti-mining-and-metals-white-paper.pdf>
- World Economic Forum (2018). The Future of Jobs – Reports - World Economic Forum. Retrieved July 15, 2020, from [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf)
- World Economic Forum (2019). ASEAN Youth, Technology, Skills and the Future of Work. Retrieved September 28, 2019, from <https://www.weforum.org/reports/asean-youth-technology-skills-and-the-future-of-work>
- World Economic Forum. (2016). The Future of Jobs - Reports - World Economic Forum. Retrieved March 16, 2019, from <http://reports.weforum.org/future-of-jobs2016/future-workforce-strategy>
- Yaakob, H., Radzi, N. F., & Sudan, R. A. (2018). Employers' Perception on Malaysian Polytechnic Graduates Employability Skills. *First International Multidisciplinary Academic Conference 2018*, (October), 1–8.

- Yee, T. N., Kui, M. T., & Wei, F. P. (2015). Bridging the Gap of Perceived Skills between Employers and Accounting Graduates in Malaysia. *American Journal of Economics* 2015, 5(2), 98–104.
- Yusof, H. S. M., Munap, R. Said, N. S. M., Ali, S. R. O. & Mat, K. A. (2017). Employers Perspectives on Graduates Employability Skills: Soft Skills. *Journal of Basic and Applied Scientific Research* 7(6), 16-19
- Yusof, Y., Alwi, N. S. A. M., Roddin, R., & Awang, H. (2018). Penerapan Kemahiran Employabil-ity Dalam Pengajaran Dan Pembelajaran Di Kolej Komuniti Di Negeri Johor.
- Zeidan, S., & Bishnoi, M. M. (2020). An effective framework for bridging the gap between industry and academia. *International Journal on Emerging Technologies*, 11(3), 454–461.
- Zhong, R. Y., Xu, X., Klotz, E., & Newman, S. T. (2017). Intelligent Manufacturing in the Context of Industry 4.0: A Review. 616-630



## VITA

The author was born in June 2, 1996, in Johor, Malaysia. She went to SMK Taman Johor Jaya 2, Johor Bahru, Johor, Malaysia for her secondary school. She pursued her degree at the Universiti Tun Hussein Onn Malaysia, Malaysia and graduated with Bachelor of Technology Management with Honours in 2019. She then enrolled at Universiti Tun Hussein Onn Malaysia, Malaysia, in 2019, where she was awarded the Master of Science in Technology Management in 2023. She currently working as Executive Officer in Human Resource and Admin Department in manufacturing industry.



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PERPUSTAKAAN TUNKU TUN AMINAH