The Impact of Industry 4.0 Towards Accounting Profession and Graduate's Career Readiness: A Review of Literature

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ABSTRACT

Industry 4.0 creates a turning point to the businesses and professions across industries. A transformational change is set to take place in almost aspects in the businesses and professions. Accounting profession is not excluded and are not immune to the technological disruption caused by the recent industrial revolution. The adoption of smart technologies under the realm of Industry 4.0 are affecting the normal way of work performed by accountants. Hence a revision to the current roles of accountants is needed to accommodate the change in traditional practices, processes and methods of performing work in accounting field. This study aims to review the literature on the impact of Industry 4.0 towards the accounting profession and graduate readiness for Industry 4.0 employment and subsequently update the skills requirement of future accounting graduates. Skills mismatch and the skills relevant for long-term career fulfilment are among issues discussed in prior studies. The literature analysis allows the identification of appropriate solutions for higher education institutions to overcome these issues. The study is beneficial for higher academic institutions as they assimilate Industry 4.0 in their agenda to be able to produce graduates that are ready and competent for the industry.

Contribution/Originality: The paper's primary contribution is finding that the future work of accountant is highly affected by the technology introduced by Industry 4.0. This paper identifies major shift in the skill profiles of future accountant hence demanding the higher education institution to produce a highly qualified accounting graduates for Industry 4.0 labour market.

1. Introduction

The future of work is now. Immense technological change is now taking place in all aspects of life. The transition from the use of computer and automated machine from Industry 3.0 towards introduction of autonomous and smart system driven by data, combined with the Internet of things, Internet of System and cyber-physical system in Industry 4.0 (Maria et al., 2018; O'Connell et al., 2015; Tektüfekçi, 2019). The ascent of Industry 4.0 is the evolvement of technology in making human decision with minimum or even without human intervention due to digitisation of the business environment (Kruskopf et al., 2020). The fast-paced digital era in Industry 4.0 creates a significant threat to the labour market. Manual work is now being replaced by automated machines and systems. Pauceanu et al. (2020) believed that by the year 2025, more than half of today's job will disappear and replaced with advance technology and systems. Tasks normally handled by humans will be done through automation and Artificial Intelligence (AI). This will definitely cause a major disruption to the labour market (De Villiers, 2021). This is supported by Organisation for Economic Co-operation and Development (OECD) through its report in the OECD Employment Outlook 2019. A replacement to the knowledge-worker task is found to be at high risk of automation. It was found that 14% of jobs handled by humans will be replaced by automated machine and operation. Furthermore, almost 32% normal jobs face radical changes and transformations in this fast-paced digital era of Industry 4.0 (OECD, 2019).

As the nature of business changes with the development of information technology, current business operation practices will have to be readjusted to the new way of work. As a consequence, some professions will disappear and new professions which will requires high knowledge and technology proficiency will emerge (Kurt, 2019). Almost all professions in the business sector are affected by the changes in the technological environment including accounting profession (Stancheva-Todorova, 2019b; Surianti, 2020; Wadan et al., 2019). Accounting profession is exposed to the disruption through shift of technological processes and practices (Ghani & Muhammad, 2019; O'Connell et al., 2015; Omar & Hasbolah, 2018). The current and traditional accounting practices, procedures and method will no longer be relevant in the digitalized business environment. Accountants will have to embrace the automation of current accounting practices to be aligned with the agenda of Industry 4.0. Therefore, this paper aims to provide a better understanding on the impact of Industry 4.0 to accounting profession and accounting graduate readiness for Industry 4.0 employment. Identification of the right skill profiles and refining the current skillset might help accounting graduates to secure a job and sustain in the fast-changing industry age. Herein, a thorough literature review on the impact of Industry 4.0 on accounting profession and accounting graduates' readiness to partake Industry 4.0 is presented.

2. Methodology

Gheondea (2015) explained that the literature review process mainly comprises of two steps. The process will begin with a searching of the literature and followed by an analysis of the literature found. The literature search is expanded by using search method applied in the study of Sulong et al. (2021) where the searches are divided into general database search and focused search. For the general database search, the searches were conducted by using variety of database to find relevant studies. Prior studies related to Industry 4.0 and accounting profession from journal articles were retrieved from electronic databases; - ScienceDirect, Google Scholar, SAGE Journals ProQuest and ResearchGate, ranging from

year 2010 to 2021. The focused search retrieved articles through filtered search according to specific focus. The focused search focused on impact of Industry 4.0 on accounting, skills relevant to Industry 4.0 and accounting graduates' readiness for Industry 4.0 employment published in the year of 2010 to 2021. The final step is to analyze and categorize the literature based on main findings that are presented in the next section.

3. The Impact of Industry 4.0 Towards Accounting Profession and Graduate's Career Readiness

3.1. Industry 4.0 Reshaping the Accounting Profession

The impact of Industry 4.0 towards accounting are immense and certain. By the year 2025, accounting profession will evolve significantly due to the development in business, politics and technology especially the public's expectations towards the profession (Raporu, 2016). Islam (2017) had identified three major challenges faced by future accountants. The evolvement of smart technologies, globalization of financial reporting or disclosure standards as well as new and increased regulations are among the expected change that will change the way accountants perform (Islam, 2017). This will demand greater attention and adaptation from the accountants in meeting the stakeholders' expectation under Industry 4.0 transformation.

In accommodating the evolvement of Industry 4.0, the accounting profession will have to shift from current and traditional practices to an automated and systematic processes in most of accounting task. A technological and digital convergence is prominence. The application of AI in the accounting industry is an inevitable trend and this will bring a positive development and innovation to the industry (Luo et al., 2018). Industry 4.0 is capable in turning the conventional practices into a modernized and smart practices. Financial data will be organized and processed digitally by the system and the role of accountant is to evaluate the data produced by the system (Kruskopf et al., 2020). A detail list of gradual transformation of accounting tasks over the period is shown in Table 1.

Table 1: Gradual transformation of accounting task over the period

Accounting Task	Past Situation	Present Situation	Future Situation
Data Entry	Accountant	Operator/ Accountant	Artificial Intelligence
Bookkeeping	Accountant	Software	Software/ Artificial Intelligence
Compliance Work	Accountant/ Auditor	Software	Artificial Intelligence
Driving to Clients to Pick Up Documents	Accounts Staff	Electronic documents passed through email	Electronic documents passed through email
Preparing Bills, Giving Requisition	Accountant	Software- Billing Software, Purchase Requisition Software	Machine Learning
Preparing Ledger	Accountant	Spread Sheet	Software
Receipt Reconciliation	Accountants need to "balance the check book"	Software	Machine-readable data can then reconcile them

Personal Investigation in Auditing	Auditor	Use Software in Forensic Analysis	Artificial Intelligence
Preparing Documents and Tax Calculation	Accountant	Software	Machine Learning Algorithm
Preparing Financial Statements	Accountant	Accountants through help of ERP, SAP Software	XBLR (Automated Annual Reports)

Source: Akhter and Sultana (2018)

Industry 4.0 technological innovation adopted by the profession were explored in prior recent studies. Hoffman (2017), explained that the expansion of technology in accounting can be seen through modernized accounting and financial reporting. The financial reports are prepared by using new technological innovations recognized as XBLR-based structured digital financial reporting, knowledge-based systems, other application of Artificial Intelligence and blockchain-based distributed ledgers (Hoffman, 2017). According to Leitner-Hanetseder et al. (2021), the current accounting processes which are characterized as repetitive and routine tasks will be replaced by AI-based technologies and business intelligence (BI). Zheng (2019) explained that the use of financial robot will reduce the burden of accountants as the nature of work are normative, repetitive with innumerable data and information. The Robotic Process Automation is designed to automate few functions and works in accounting by replacing the traditional and basic financial work, hence improving the efficiency of financial management.

Identification of smart technologies like cloud computing and blockchain technology in accounting will result in an immense change on the existing tasks and roles of the accountants. In Turkey, a cloud based electronic application known as e-Accounting Application were launched and regulated by the Revenue Administration of the Turkish Ministry of Treasury and Finance (Tektüfekçi, 2019). The most recent development from the application of e-Accounting Applications is the Electronic Financial Reporting Project where the audited financial reports were processed independently in a computerized environment and the results are used in the financial analyses. Within the scope of Industry 4.0, the e-Accounting Applications is capable of transforming the accounting processes into a cloud based electronic environment. The modernized accounting processes and procedures will influence accountants in completing accounting task differently.

A new way of workings for accountants will navigate a new direction for accountants under Industry 4.0. Adoption of smart digital and technological innovations will positively improve the effectiveness and efficiency of accountants' task. Repetitive and routine tasks like data processing will be performed completely by AI-based technology. Less involvement in manual activities will allow accountants to revisit their job function and focus more on other strategic and visionary tasks. As such, accountants will be able to shift their focus towards data analytics, judgmental and creative analysis and financial advisory activities (Akhter & Sultana, 2018). Accountants will engage more in managing activities and less on accounting matters (Jarosz et al., 2020) as to create value for the business by looking at the big-picture strategies (Ghani & Muhammad, 2019). As a result, accountants will take on bigger responsibilities in proposing and measuring critical business decisions which will bring business to another level (Wadan et al., 2019). Hence, a shift in an accountant's role is substantial.

The newly revamped accounting profession under Industry 4.0 will deal with real-time accounting which requires an up-to-date information and less reliance on periodic data. The analysis of data will no longer focus on historical data but towards big data produced by the system. Big data is characterized by the high volume of updated and unstructured data in a complex set of software (Damayanti, 2019). The ability to work with AI-based and Big Data technology will help accountants to utilize data produced by the system and generate meaningful information for users to use in decision making (Wahyuni, 2020). The accounting profession will not merely generate and report numbers but will expand towards interpreting the numbers for the creation of meaningful financial information in forming an ethical judgement and justified decision for users. Hence, this will lead to data quality improvement due to accuracy, higher detail and better timeliness. Creation of meaningful and improved data information will increase the service quality of an accountant indefinitely.

Nevertheless, the introduction of these technological innovations will not eliminate the role of accountants entirely. An accountant is needed in choosing the right and high-quality data to be processed by these smart technologies. Validity and reliability of the data used will be supervised by accountants (Surianti, 2020). The output generated from the data processed will be analyzed by accountant as only humans are capable of making professional judgement. Valuable decision making are derived from human knowledge and experience and this cannot be replaced by technology (Omar & Hasbolah, 2018). Furthermore, Rosi and Mahyuni (2021) suggested that accountant is the supervisor for the task performed by these advanced and smart technologies. They are responsible in monitoring and identifying the error made by the system. Suggesting a solution requires human intervention and judgement. Besides, Leitner-Hanetseder et al. (2021) and Losbichler and Lehner (2021) believed that human-machine collaboration is crucial in task that requires human involvement in making decision and judgement. The technologies and human exist as a co-actor working together in certain processes that is impossible to be conducted by technologies solely. For instant, forecasting process (Losbichler & Lehner, 2021), performance management and monitoring activity (Moll & Yigitbasioglu, 2019; Zheng, 2019) and other conventional processes. Therefore, a human-machine collaboration exists to accomplish certain accounting task. Accountant will have to deal and move together with the technology innovation in order to thrive in this digital era.

Without a doubt, the inclusion of technology in accountant's everyday work and task will bring to light the need for development of new knowledge and skills in the accounting sector (Rosi & Mahyuni, 2021; Wahyuni, 2020). Development of knowledge in accounting field should be aligned with development in Industry 4.0. Refinement to current accounting skills will help the accountant to survive in the fast-paced Industry 4.0 era. Provision of training and education might help the development of suitable skills and knowledge that suit the Industry 4.0 requirement. In fact, producing a qualified human capital and intellectual resources are the ascent of Industry 4.0 (Li, 2020). As the role and job scope of an accountant are changing, hence the right competencies and skills to fit the new roles must be in place as well. The future accountant will encounter bigger challenges as to fulfil the accountants' qualification under the Industry 4.0 (Stancheva-Todorova, 2019a). The accountants' skill profile will set to change and consequently affecting the education system in producing future accountants for the markets (Jarosz et al., 2020). The impact is undeniably consequential to the accounting graduates and the future labour market.

3.2. Skills Profile for Future Accountants

With the rise of smart technology in Industry 4.0, the capabilities of working with these technologies becomes the main concern of the employers in the market. Accounting practitioners believed that the automation of accounting processes will demand graduates who are capable of working under this new way of work. As most of accountant's work are being replaced by machines and devices, there is need for acquiring and developing technological skills among young graduates (Ghani & Muhammad, 2019). As reported by Raporu (2016) the spread of smart technologies, globalisation of business and profession, the change in regulation and governance as well as the change of public expectations towards business and accounting profession become the driver of change towards accounting profession by the year 2025. These factors set to change the current competencies and skills for future accountants. Consequently, Stancheva-Todorova (2019b) has outlined the knowledge and skills profile for future accountants in Industry 4.0 which encompasses knowledge and skills related to digital technologies, big data and data analytics, robotics and Artificial Intelligence, cyber security, tax implications as well as legal and regulatory requirements.

A revision to the accountant's skills emphasizing on solid technical skills and ethics supported by strong communication skills is a condition to work in Industry 4.0 sphere (Raporu, 2016). Khanh (2018), Purnamasari et al. (2019), Rhodes and Rhodes (2019) strongly believed that acquisition of knowledge and skills in IT is increasingly important as we move towards the digital age. Advantages are given to graduates who can work with IT tools. Moreover, the right combination of technical and soft skills relevant to Industry 4.0 is crucial to be instilled in young accounting graduates. Kruskopf et al. (2020) listed relevant technical and soft skills suitable for Industry 4.0 employment. The technical skills are recognized as analyzing, understanding and having sufficient knowledge on the function and capabilities of software and data security. These skills will enable young accountants to interact and work well with smart technologies. The soft skills consist of communication, conflict solving, leadership, risk management, creativity and strategic decision making, emotional intelligence, sales knowledge, adaptability and customer service orientation. These will help graduates to become experts as financial information providers that can create value to the organisation (Kruskopf et al., 2020).

Moreover, De Villiers (2010) had identified five essentials skills that are relevant in dealing with complex and constantly changing business environment. The skills are known as communication skill, leadership and teamwork skills, problem solving and thinking skills, ethical and moral values, and self-management skill. Another study conducted in search of the right skills that are compatible with Industry 4.0 employment was carried out by Tsiligiris and Bowyer (2021). The authors listed four important skills that will help accountants in facing technological disruption in accounting and business. The skills are related to ethics, business, digital and data, and soft skills. These are said to be the skills for success. Possession of these skills will help accountants to adapt to changes in their job function and role as an accountant. Mastering the non-financial skills like analytical skills, information technology skills as well as leadership skills (Surianti, 2020) will help future accountants to work well with technologies as well as to cope with great pressures from business and society. In fact, these skills are beneficial as the role of an accountant now move towards strategic and far-sighted vision that is aligned with Industry 4.0.

Apart from the aforementioned skills identified in previous studies, The World Economic Forum (2016) has outlined ten critical and vital skills for Industry 4.0. These skills would help accountants face the challenge of Future of Work for the year 2020. The recognized skills are complex problem solving, critical thinking, creative thinking, people management, coordinating with people, emotional intelligence, judgment and decision making, orientation towards service, negotiation ability, and cognitive flexibility (World Economic Forum, 2016). Undoubtedly, these skills are the accent of Industry 4.0 candidates' selections. Possession of these skills will be beneficial to the graduates as it will help them to thrive in the future workplace. It is crucial for accounting graduates to develop these skills and create a strong skills profile before embarking Industry 4.0 employment.

3.3. Accounting Graduate's Career Readiness for Employment under Industry 4.0

The ability of being employed requires the graduates to master and promote broader skills without sole reliance on technical knowledge of the discipline obtained from academic institutions (Yusof & Jamaluddin, 2017). Abdullah et al. (2020) explained that the career readiness of graduates depends on how well the graduates are utilizing the skills obtained at their respective university in securing a job. The notion of career readiness emphasizes on the ability of graduates to readily be part of the workforce and ensures the skills would help them stay relevant and sustain long in the job market (Spanjaard et al., 2018). With the right skills, graduates will have the ability to enter the job market, secure and strengthen their job position over their lifespan. Table 2 summarizes the graduate's readiness for employment in Industry 4.0. A mixed reactions were found in these studies as some of the students perceived that they are ready to be part of Industry 4.0 employment as others are still in the dark about the impact of Industry 4.0 towards their future. This brings a question to the field, is the future generation ready to embark on Industry 4.0 and be part of the workforce?

Table 2: Graduates readiness for employment in Industry 4.0.

Authors	Sample	Method	Finding
Teng et al. (2019)	Undergraduate students from two universities (China and Malaysia)	Questionnaire Survey	Malaysian university respondents highly believed that development of employment skills is well incorporated in the university curriculum compared to Chinese university respondents. They believed that their university had successfully equipped them with necessary employment skills which will help them to enter the job market and secure a job.
Purnamasari et al. (2019)	90 accounting students from Indonesia	Qualitative method which consists of interview and focus group discussion	The accounting students are still unprepared to enter Industry 4.0 job market due to lack of preparation provided by their academic institutions. Their concern toward digital era preparation mainly comes from the lack of understanding of how information technology and systems work, provision of

			facilities and infrastructure in their academic institutions which are insufficient to accommodate teaching and learning under the new digital age and lastly, the educators' capabilities in using technologies in delivering the learning materials in teaching and learning activities.
Rahmat et al. (2019)	190 undergraduate diploma and first-degree students from five Malaysian public universities.	Online survey questionnaire	The undergraduate students believed that they possessed the critical skills for employment under Industry 4.0. The five major skills identified are cognitive flexibility, critical thinking skill, negotiation skill, decision-making skill as well as service orientation skills. This indicates that, they are capable in meeting the employers' expectation if they have these critical skills.
Omar and Hasbolah (2018)	Undergraduate accounting students at University Selangor	Questionnaire Survey	Accounting students are generally aware about the Industry 4.0. They are motivated to be part of this Industrial 4.0 era and are willing to learn more about this era. Finally, students are aware that Industry 4.0 will affect their employment opportunity in the future job market.
Adnan et al. (2021)	ASEAN student leaders from five polytechnics located in Brunei, Indonesia and Malaysia.	Qualitative method which consists of interview and focus group discussion	ASEAN tertiary students are clueless about the required skills for Industry 4.0. Hence, this led to the low level of preparedness among the students and they are not ready to be part pf Industry 4.0 employment. The discouragement towards Industry 4.0 might be due to the fear of potential disruption caused by technological innovation brought by this era.
Pauceanu et al. (2020)	Public university students in the United Arab Emirates.	Questionnaire Survey	Students are still in the dark about the employability skills they should acquire under Industry 4.0. Students' perspective towards Industry 4.0 employability skills is not parallel with the future demand of job market in the UAE.

Over the years, critics and comments from employers in the industry regarding the graduates' competencies are everywhere. A noticeable gap on the skills expected by employers with skills possessed by graduates were found in most prior studies (Abbasi et al., 2018; Aryanti & Adhariani, 2020; Jackling & De Lange, 2009; Kavanagh & Drennan,

2008; Phan et al., 2020). Often, the expectation of employers was unattainable and the high number of skills mismatches subsequently affects future labour performance and efficiency. Young graduates who will be part of the labour market might not be able to sustain long if they are lacking the required skills demanded by employers. Heang et al. (2019) had identified early employment problems among young accounting graduates in Malaysia which dictates that they are not ready to be part of the industry. Among the problems identified are insufficient knowledge in technical area and lack of skills specifically in communication, time and stress management adaptation to a new work environment and handling of advanced and smart technology (Heang et al., 2019). These had become the reason of graduates' unpreparedness to be employed as they are not confident with their ability to work in the fast-changing working environment. Misperception of an accountant's role may also become the reason for skills mismatch (Ngoo et al., 2015). As the role of an accountant is set to change in the Industry 4.0 era, the current skills set developed among the accounting graduates is not up to par. Employers demand graduates who can perform more than what traditional accountants could do. Consequently, the skills discrepancy might affect the firm's performance where productivity and service delivered could be questioned (Ayodele et al., 2020) hence jeopardizing the firm's potential to expand or even survive in the competitive market. Employers are expecting graduates to be job-ready, add value to the business and society and expand globally.

3.4. The Role of University

Higher education institutions as human labour provider plays a significant role in creating supply that matches current demand and situations in the labour market (Engel, 2019). It is the responsibilities of the university to train the next generation to be the next leaders and highly competent workforce for the market (Li, 2020). As one of the key components in the education supply chain, universities are capable in influencing the direction of the labour market entirely. Li (2020) believed that higher education institutions are committed in meeting the expectations and demands of the job market. This can be seen through development of educational programs that are relevant to current markets, innovation towards curriculum design, changes in delivery method and many others strategies used in providing competent graduates for Industry 4.0 workforce. Nevertheless, the incompatibility of graduates produced by universities with the market expectations had become a concerning issue over the years. Often, the blame is directed to the education system that fails to provide qualified candidates for the job market (Jackling & De Lange, 2009). Employers and accounting students' dissatisfaction towards skills development provided by their universities were shown in the study of Al Mallak et al. (2020), Bunney and Therry (2010), Hadiyanto and Suratno (2015), Heang et al. (2019), Kavanagh and Drennan (2008) and Kirstein (2016). Less emphasis on technical knowledge but more on soft skills development, changing the structure and content of the syllabus, as well as updating the learning delivery method to keep abreast with Industry 4.0 are among the transformation suggested by these studies.

Undeniably, the quality of accounting graduates will significantly be affected if no changes are made in the education systems. A revision of education systems should be the main agenda of higher education institutions (Bunney & Therry, 2010). Altarawneh (2016) suggested that, in order to develop well-rounded candidates, the emphasis in teaching and learning should be comprehensive and not limited to theoretical aspect. The learning of soft skills should be given greater attention as these skills will enhance the employability of graduates. Improvement in education programs is needed to allow

development of employability skills that is vital for Industry 4.0 employment. In addition, Lawson et al. (2014) suggested that to ensure the relevancy of accounting graduates for long term career demands, the accounting education should focus on integration of the competencies in the curriculum and application of these competencies while creating value to the organizations. Besides that, in order to produce qualified graduates for Industry 4.0 job market, embedding technologies in existing programs and syllabus to be technology and forward looking could be one of the solutions (Kruskopf et al., 2020). The usage of technological tools in accounting courses and programs will help graduates to be familiar with the future technologies and comfortable in handling and working with technology. Hence, the arrival of online distance learning might create a meaningful learning experience and can be a great platform to inculcate learning and adaptation of technology among young graduates.

4. Conclusion and Recommendation

Assimilation and adaptation towards Industry 4.0 working environment requires candidates that are ready and well-suited with the Industry 4.0 job market. For the business to move and expand globally in fast-paced environment, a strong support from the accounting profession is highly important. Accountants have to move together with the business as expert financial information provider and knowledge worker who can create value for the business. Employers demand well-trained candidates from academic institutions. The revision towards current skill sets is highly recommended to ensure relevancy of the profession in Industry 4.0. Redefining skills which are in tune with the characteristic of Industry 4.0 enables future accounting graduates to be accepted by the labour market. Development of skill profiles for future accountants should become the main agenda for the higher academic institutions under this new era. Nevertheless, the change in the teaching and learning method might affect the development of the skills for Industry 4.0 employment. Movement towards Industry 4.0 has created a new vision for higher education institutions to move towards Education 4.0. Online and distance learning should be the ascent of Education 4.0. Future research should look at the effectiveness of the new way of learning in enhancing career readiness among accounting graduates while developing the critical skills for Industry 4.0 employment.

Conflict of Interests

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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