THE IMPACT OF INDUSTRY 4.0 ON THE ACCOUNTING PROFESSION

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Abstract. This study aimed to discover the impact of Industry 4.0 on the accounting profession. It focused on 4 aspects, which are accounting information system, accounting process, the education and job opportunity of accountant. It adopted the survey method to collect data. This study found that Industry 4.0 would bring benefits to accounting firms and accountants. However, accountants need to learn more skills and knowledge to adapt to Industry 4.0 to enjoy the benefits and the new jobs created. Diffusion of innovation (DOI) theory and institutional theory were used in this study. From the findings, it is concluded that adopting the technologies of Industry 4.0 will bring numerous advantages to accounting firms. It also showed that the respondents were satisfied with the advantages of Industry 4.0. It is concluded that companies in the same industries will adopt the technologies because of external pressure from competitors. Industry 4.0 will improve the productivity and effectiveness of accounting companies. Industry 4.0 will also reduce fraud and error during the accounting process. The study revealed that the current knowledge of accounting students is not sufficient to adapt to Industry 4.0. The development of Industry 4.0 will provide new services to clients and create new job scope for accountants.
Keywords: *Industry 4.0, cloud computing, blockchain, artificial intelligence, job opportunity*

Introduction

Industrial Revolution 4.0 was introduced by the Germans in 2011. The objective of Industry 4.0 is to establish a highly flexible production model and digital products and services, and to achieve real-time interaction between humans, products, and equipment during the production process (Zhou et al., 2015). Its major component is the Cyber-Physical Systems (CPS), also known as networking of the physical world. CPS is a fusion of information, computing, communication, and control in virtual and physical world (Wang and Wang, 2016). The key technologies of Industry 4.0 include Big Data, the Internet of Things (IoT), Smart Factory, Cloud Computing, Real-time data processing, and Artificial Intelligence (AI) (Klinc and Turk, 2019). These new technologies will change the way information and data are used and make companies more efficient. It is expected that the existence of Industry 4.0 will become the strongest innovation driver in the coming decades, triggering the next wave of innovation (Wahyuni, 2020). Industry 4.0 is changing the business processes and business models applied to various industries. The implementation of Industry 4.0 aims to increase productivity, efficiency and operational efficiency in every value chain and production process (Wahyuni, 2020). According to PWC (2016), Industry 4.0 will have a significant impact on all areas of the industry, such as reducing costs, improving efficiency, and expanding profits. Therefore, Industry 4.0 will also affect the accounting sector, such as the accounting profession and accounting information system. Thus, the purpose of this study was to explore the impacts of Industry 4.0 on the accounting sector.

This study sought to explain the potential impacts and knowledge of Industry 4.0 in the context of the accounting sector. The need to understand the impacts has academic value. The findings and understanding gained through this study contribute to empirical evidence that proves there will be many changes in the accounting industry in the future. Therefore, employers, employees and graduates in the accounting industry need to be aware of how the industry may change. Analysing the impact of cloud computing and blockchain on the accounting information system and the impact of artificial intelligence on the accounting process may be crucial because it means that accountants and employees need to understand the new system and new process. The study also aimed to explore opportunities and challenges that Industry 4.0 brings to the accounting industry, especially in the development of education of the accounting profession. For instance, it is expected that Industry 4.0 will create new job opportunities in the accounting field such as blockchain accountant, cloud accounting specialist, historical accounting analyst and strategic accounting analyst. In addition, this study analysed the need for new accounting education to encourage accountants to learn new skills, which may be beneficial for future job opportunities. This is supported by findings of prior studies that found a gap exists between the skills and knowledge learned at university and those required by employers (Jackling and De Lange, 2009). Hence, accountants or graduates who lack the knowledge and skills will be at risk of losing their jobs or not being hired in the industry.

Literature review

Theoretical perspective

When adopting new technologies, many organisations consider the advantages of using the new technologies (To and Ngai, 2006). This is consistent with the concept of relative advantage in the Diffusion of Innovation (DOI) theory. Rogers (2003) defined the DOI theory as the degree to which innovation is considered better than its pioneers. When organisations realize that the benefits of adopting new technologies outweigh the associated risks, they are most likely to adopt the new technologies. Shih and Fang (2004) contended that compatibility is a technical feature that is conceptualised in the DOI theory and becomes the driving force of the decision to adopt new technologies. Thus, when the new technologies are deemed compatible with work applicable systems, the organisations may readily adopt the new technologies (Low et al., 2011). Institutional theory assumes that the external environment, actions and behaviours like law and regulation, values and norms, as well as culture and expectations have a significant impact on organisations. Companies are widely affected by changes in the external environment, and they must adapt to these changes to ensure sustainability. There are three types of institutional pressures, namely coercive pressure, mimetic pressure, and normative pressure. Coercive pressure is created by stakeholders such as the government, customers, and suppliers. Normative pressure comes from expectation, values, norms, and standards in the company culture. Normative pressure comes from suppliers, customers, and associations such as accounting bodies, media, and other social entities. For example, when accounting firms decide to adopt Industry 4.0 technology, it means that the firms will bring better quality services to their clients. Hence, it will influence the image, reputation, and competitive advantage of the accounting firms. Mimetic pressure arises when companies engage in competition seeking for superior performance. As an example, accounting firms may imitate other

firms that use the technology to gain benefit and success. Undoubtedly, Industry 4.0 will soon be a new trend and a new normal in every industry as many leading companies in the industry have adopted Industry 4.0 technology. Therefore, companies may adopt and use the technology because of the external isomorphic pressure from competitors, trading partners, customers, and governments.

Institutional theory emphasised that the institutional environment is essential for shaping organisational structure and actions (Scott, 2014). Institutional theory described organisational decision as not completely driven by efficiency goals but also by social and cultural factors and concerns about legitimacy. The theory claimed that companies in the same industry become more similar as a result of isomorphic pressure and legitimacy pressure (Oliveira and Martins, 2011). Khalifa and Davison (2006) suggested that institutional theory can test how institutional pressure affects individual adoption of technology.

Accounting information system

In recent years, cloud computing in the accounting field has developed rapidly. According to research conducted in 2017 on American and Canadian companies, the utilisation rate of cloud computing used by accounting companies had reached 51%, an increase of 27% since 2014 (Törnqvist and Forss, 2018). Zhang (2014) asserted that the traditional accounting information system is restricted by many factors, and among these factors are insufficient preparation of hardware facilities, lack of professionalism, high initial investment cost and complex maintenance process. This restricts the ability of some companies to develop their accounting information system and greatly weakens their competitiveness. Therefore, Zhang (2014) and Feng (2015), in line with the argument of DOI, believe that the combination of cloud computing and accounting information systems will improve traditional accounting information systems and promote the construction of corporate accounting information. Dimitriu and Matei (2015) and Christauskas and Miseviciene (2012) explained that companies do not need to install accounting software on every computer to apply cloud computing to accounting information systems because the data are not stored in the computer but in the cloud. This allows relevant parties to log in and access the information and data from any computer or site. In the past, the relevant parties need to go to the office to access the financial information of the company. Now, with cloud accounting, the relevant parties can easily access and share the financial information in real-time (Khanom, 2017; Dimitriu and Matei, 2014; Shkurti and Muça, 2014). Users are no longer limited to office computers because of the flexibility of the cloud, and this would certainly increase productivity.

Dimitriu and Matei (2015) found that cloud computing is cheaper than buying accounting software that needs to be installed on every computer, and such a set-up improves cost efficiency. Additionally, Zhang (2014) found that the use of cloud computing in accounting information systems can reduce maintenance costs. Since traditional accounting information system requires a large amount of hardware infrastructure, companies need to address security issues to facilitate the systems. Cloud computing can reduce the cost of technicians because it does not require IT staff to install or upgrade applications or maintain servers. In the past, if the desktop and hard drive files were deleted, or the user's laptop was stolen or malfunctioned, data would be lost. However, such a problem would not occur when cloud computing is used, as evidenced in the findings of prior studies. Even if the data stored in the cloud is lost, the

cloud provider usually has a backup that is easy to restore (Păcurari and Nechita, 2013) as the automatic backup of data is often performed as scheduled task (Dimitriu and Matei, 2015). The highest security standards are used to encrypt information, and the information is then stored securely because the application is in the cloud rather than on a specific device. This helps to protect the security of the data in the event of fires or other incidents that may put the sensitive and important information at risk (Khanom, 2017).

Several studies have discussed the concerns and risks of companies applying cloud computing for accounting information systems (Mohanty and Mishra, 2017; Dimitriu and Matei, 2015; Zhang, 2014). These studies argued that the cloud is too dependent on the Internet, and if the Internet connection is lost, the process will be interrupted. Furthermore, for relevant parties that could not access the Internet, access to the data and information would not be possible (Mohanty and Mishra, 2017). In addition, companies are also concerned about the possibility of hackers or competitors using viruses and spyware to illegally intercept and tamper with the data. Many studies have discussed blockchain-based accounting (Antoney and Augusthy, 2019; Dai and Vasarhelyi, 2017; Dai et al., 2017; Rechtman, 2017). A blockchain system is decentralised, which means that all parties involved (nodes) in a transaction have access to the blockchain, allowing them to read, verify, update, and publish new transaction in the block (Dai and Vasarhelyi, 2017). Blockchain may therefore provide a secure information system in the accounting field. Since the nodes are connected to each other, all verifications can be controlled, which makes manipulating information more difficult (Dai et al., 2017).

Antoney and Augusthy (2019) explained that the blockchain-based accounting information system records and stores transactions in the blockchain ledger. This ledger will be shared among all relevant parties, and only authorised users can access this ledger. Fanning and Centers (2016) as well as Hong and Seo (2018) explained that all documents and data are placed in the blockchain system and such a move can prevent tampering from happening. Furthermore, after transforming all data and documents into digital documents, all relevant parties can access the information in real-time. The blockchain technology can approve the sending of invoices between the two parties and can also make payments. Dai et al. (2017) and Rechtman (2017) posited that by implementing the blockchain technology in the accounting information system, the risk of fraud can be reduced through secure and reliable database. Additionally, Tran and Phan (2019) found that the blockchain-based accounting information system can also help companies to reduce data input errors based on automatic accounting functions, thereby reducing the possibility of errors. Based on the arguments above, it is expected that Industry 4.0 will have an impact on the accounting information system. Therefore, it is hypothesised that:

H1: There is a significant relationship between Industry 4.0 and the accounting information system.

Accounting process

Due to the emergence of Industry 4.0, some studies have projected that the accounting process will be automated by technology or machines. Stancheva-Todorova (2019a) revealed that by using machine learning technology, the accounting process can be fully automated. In the traditional accounting model, accountants record and

calculate the data manually, and such a process easily increases the possibility of errors (Shi, 2019). However, the emergence of new technologies, namely AI and RPA can solve these problems. Kaya et al. (2019) maintained that RPA can be used in every step of the accounting process. RPA is highly process-driven and can perform rule-based automated tasks, allowing the software to collect data, trigger responses and initiate new actions. Stancheva-Todorova (2018) posited that the mundane and repetitive tasks usually completed by junior staff will be taken over by AI or RPA. Li and Zheng (2018) explained that in SMEs, the financial personnel will be responsible for both cash flow and bookkeeping. This may lead to confusion and human error, as well as financial fraud. By handing over these tedious and repetitive tasks to AI to complete, accountants will only need to review them. At the end of the period, the system will automatically generate a trial balance. This will improve accounting accuracy and reduce the possibility of fraud (Shi, 2019; Li and Zheng, 2018; Stancheva-Todorova, 2018). Wen (2020) proposed that AI has made a qualitative leap in accounting data. AI can provide higher quality information and help generate more transparent accounting information (Yoon, 2020), making the accounting process more realistic, reliable, and timely. However, Shi (2019) argued that accounting system with AI cannot completely solve the problem of fraud as the system is controlled by people.

Li and Zheng (2018) explained that in the traditional accounting model, accountants need to record and check all the procedures from posting journals and ledgers to forming statements. This process consumes a lot of manpower, material, and financial resources. This process is also prone to human error and distortion of accounting information. Furthermore, accountants need to manually record and calculate the accounting entry. For this reason, Shi (2019) emphasised that the use of AI technology will allow the system to automatically notify the accountants when there is an error in the accounting data, which thus avoids further extension of the errors, thereby improving accounting accuracy. Yoon (2020) also agreed that AI can improve the accuracy and efficiency of accounting task performance and processes and reduce operating costs and time. Zhang et al. (2020) stated that RPA can be used to imitate human behaviour such as sending emails, completing spreadsheets, and recording and keying in data. Kaya et al. (2019) further explained that RPA can handle the job of posting journal entry, adjustments, and account reconciliations. “Robot-accountant” is a combination of RPA with AI that will perform the steps in the accounting process (Li and Zheng, 2018). Supriadi et al. (2020) predicted that robotics will take over the fundamental tasks of an accountant such as recording and processing transaction as well as analysing financial report. This is supported by Kanellou and Spathis (2013) who argued that automation technologies will improve the quality of report and management analysis as well as make the collection and processing of data faster and easier.

AI is essential to the future of the accounting industry. Based on the DOI, it is conjectured that AI will provide professionals with the tools they need to improve productivity and work efficiency. Thus, it is hypothesised that:

H2: There is a significant relationship between Industry 4.0 and the accounting process.

The education of accountants

Prior studies have maintained that as a result of the emergence of Industry 4.0, today’s accountants must update their knowledge and skills. Wahyuni (2020) revealed

that accountants must be aware of the development of emerging technologies and strive to continue to improve their capabilities. It has been argued that for accountants to survive the era of Industry 4.0, they must have both the technical skills and the soft skills. Stancheva-Todorova (2019b) reasoned that the skills and knowledge of accountants in the future should be linked to blockchain technologies, data analytics, robotics, and AI. Badem and Kilinc (2019) also revealed that it is necessary for accountants to have specific technical knowledge to prepare technical infrastructure for obtaining accounting reports and for reading all data processing processes and applying them. Technical skills include data analysis and understanding of software and its functions (Kruskopf et al., 2019). However, accounting and auditing professionals tend to lack IT knowledge and technical skills, while the demand for these skills is more important than ever in the present time. Stancheva-Todorova (2020) and Kruskopf et al. (2019) explained that in addition to technical knowledge, accountants must also have critical thinking skills, communication skills, and leadership skills. Stancheva-Todorova (2020) explained that accountants need critical thinking skills to provide new insights for the business and for decision-making. Meanwhile, accountants need leadership skills because their involvement in company strategy management will increase in the Industry 4.0 era. McKinney et al. (2017) contended that accountants must have critical and sceptical thinking skills to use big data analysis critically. Additionally, Kruskopf et al. (2019) argued that accountants who are proficient in these skills will get better results when dealing with clients.

Jackling and De Lange (2009) reported that there is a gap between the skills and knowledge provided by university and the skills and knowledge required by employers. Jackling and De Lange (2009) also found that none of the existing undergraduate courses are able to provide broad-based general education and specialised professional education to meet the needs of employers of accounting graduates. Accounting firms are seeking accounting graduates with diversified skills and attributes to maintain a competitive advantage in the industry (Damerji, 2020). For this reason, Stancheva-Todorova (2019b) deemed that accounting programmes should be interdisciplinary with content of different departments taught to accounting students. Supriadi et al. (2020) emphasised that educational institutions must be able to develop courses related to Industry 4.0. Additionally, Törnqvist and Forss (2018) also mentioned that higher education needs to include technical courses in the syllabus to adapt to market changes. Ghani and Muhammad (2019) also suggested that professional institutions assist academia and university in providing courses related to accountants' future requirements for future accountants to remain competitive and relevant in the era of Industry 4.0 as accounting jobs may become increasingly dependent on the use of new technologies in line with the concept of mimetic pressure proposed by the institutional theory. Therefore, it can be hypothesised that:

H3: There is a significant relationship between Industry 4.0 and the education of accountants.

Job opportunities for accountants

Traditionally, accountants are responsible for input, processing of data transactions and integrating them into financial reports (Chen et al., 2012). However, past studies have shown that there is a significant association between Industry 4.0 and job opportunities of accountants (Adriana et al., 2020; Kruskopf et al., 2019; Chen et al.,

2012). Stancheva-Todorova (2019a) explained that due to the latest development in AI, Big Data, Robotics and their augmented applications, the accounting profession is gradually changing in terms of its role and the functions performed in organisations. White (2024) predicted that the era of globalisation will eliminate approximately 1 to 1.5 billion jobs between 2015 and 2025. This loss of work is due to the gradual development of technology which is slowly replacing humans (White, 2024; Adriana et al., 2020; Chen et al., 2012) especially in relation to non-cognitive tasks where technology has been seen to play a bigger role (Chen et al., 2012; Greenman, 2017; Bresnahan et al., 2002). Similarly, technology is also likely to replace humans in repetitive tasks as propounded by Rkein et al. (2020). In the accounting profession, these tasks are usually assigned to accounting assistants. However, with the advancement of technology, data entry can now be automated and many reports are automatically generated (Chen et al., 2012).

Ghani and Muhammad (2019) argued that even though automated operations will provide opportunities for reduced participation in certain tasks for accountants, they will need to focus more on big strategies such as resource efficiency. This is supported by Kruskopf et al. (2019) who contended that despite machines and technologies replacing some of the jobs of accountants, the use of technologies also requires accountants to focus more on specific tasks such as data analytics. Although the development of Industry 4.0 will cause many jobs to disappear, it will at the same time provide many new opportunities for fresh graduates and those already in employment who develop these new skills. For instance, AI technologies will enable accountants to focus more on valuable tasks such as decision-making, problem solving, strategy formulation and leadership (Yoon, 2020). The use of technologies will also create potential future jobs in the accounting field. Some of these were listed by Kruskopf et al. (2019) and they include blockchain accountant, cloud accounting specialist, historical accounting analyst and strategic accounting analyst. Wahyuni (2020) argued that the role of accountants has shifted from recording transactions to financial analysis. As explained by Rkein et al. (2020), accounting management can now spend less time monitoring cash flows or statements and focus more on management functions such as supervising employees and advising. This line of thought is supported by Greenman (2017) who maintained that cognitive tasks such as consulting cannot be replaced by technology, and accounting consultants will still be needed in the future where this type of cognitive tasks is usually performed by senior accountants and professionals.

Gulin et al. (2019) argued that as the accounting process becomes automated, the connection between accountants and clients will become closer as accountants will focus more on consulting services. AI and robotics are unable to interpret and analyse financial information; for this reason, accountants should enhance their skills and knowledge to focus on data analysis. Moudud Ul Huq (2014) contended that the development of technology is not to eliminate human wisdom, but to help accountants become better strategic consultants by providing key business insights. Liu and Vasarhelyi (2014) explained that big data enhances data measurement and comprehensive data, and in this respect, accountants should focus on decision making. Consequently, Shi (2019) deemed that some of the accounting work such as analysis, statistics and making accounting estimates will not be replaced by AI and robotics. Kruskopf et al. (2019) explained that in the Industry 4.0 era, the task of management accountants will be more precise and detailed. This is because computers or technology will be tasked with the job of collecting and gathering the data needed while

management accounts will need to take up the responsibility of analysing and preparing the massive amount of data. Additionally, as expectations increase according to mimetic pressure, Kruskopf et al. (2019) maintained that to be able to produce high-quality data, accountants need to act as service agents to transfer the knowledge analysed from the information to the system as this task cannot be performed or replaced by AI technology and robotics. Based on the argument presented, it is hypothesised that:

H4: There is a significant relationship between Industry 4.0 and job opportunity for accountants.

Materials and Methods

This study employed the quantitative research method. Quantitative research is a formal, systematic, and objective process in which numerical data are used to obtain information (Muijs, 2004). The use of quantitative research design would enable the classification, estimation, and quantification of the research data on the impact of Industry 4.0 on the accounting department into a graphical form, generating results that are more objective and reliable. This type of research design can help the researcher test the hypothesis of the research. In this study, survey research method was utilised where data were collected through the use of a questionnaire. A structured and closed-ended questionnaire was used in this study. A questionnaire is a set of formal questions used to obtain information from respondents (Hyman and Sierra, 2016). Hyman and Sierra (2016) explained that closed-ended questionnaire is more convenient for respondents to answer, and it is also easier for the researcher to perform the coding, entering and analysis of the data. In this study, a 5-point Likert scale was used to provide the pre-determined options as possible answers for the questionnaire items where the options ranged from 1 (not at all familiar) to 5 (extremely familiar). The questionnaire consisted of 6 sections and a total of 35 questions.

The data collection in this study involved primary data which were collected directly from the participants using an online survey. Blumberg et al. (2006) remarked that as primary data are close to the real situation, they are always the most authoritative information. In this study, the questionnaire was shared online via Google Form with the target population. The data were collected from respondents who have accounting background. The target population of this study was people with accounting major or accounting background as the study investigated how Industry 4.0 would affect the accounting industry. Non-probability purposive sampling method was used in this study. Fanning and Centers (2016) described non-probability purposive sampling as a sampling method that involves the researcher selecting the samples based on the researcher's opinion rather than random selection, and that not all population will have equal opportunity to participate in the research. According to Sekaran and Bougie (2016), purposive sampling involves obtaining information from specific target groups. In this study, the questionnaire was shared online rather than distributed to the respondents individually, and for this reason, not all people have an equal chance of answering this questionnaire. Additionally, the non-probability purposive sampling was used because the focus of this study was on people with accounting background. According to Ahmad et al. (2019), employers expect graduates to be equipped with the skills related to Industry 4.0 which are needed at the workplace. Thus, in Ahmad et al.'s paper, students were their targeted population as they sought to evaluate the extent of

readiness for Industry 4.0 among students. In this study, the targeted respondents were those in the accounting field including practising accountants and students pursuing accounting courses.

The instrument used in this study was adapted from past studies. The items for the first and second hypotheses were adapted from Shkurti and Muça (2014) and Wahyuni (2020) to evaluate the advantages of using Industry 4.0 technology. The items for the third hypothesis were adapted from Ahmad et al. (2019) and Ghani and Muhammad (2019) to measure the readiness of accounting personnel for Industry 4.0. The items for the fourth hypothesis were adapted from Törnqvist and Forss (2018) to assess the respondents' perception in terms of whether future job opportunities and job content will be changed by technology. The 5-point Likert scale was applied to all constructs.

Results and Discussion

Table 1 provides a detailed overview of the demographic data of the respondents. Based on *Table 1*, there are slightly more female respondents than male respondents at 89 and 84, respectively. Most respondents were from the 21 to 25 age group (50.3%). In terms of the highest level of education, most of the respondents reported having a bachelor's degree (75.7%). In contrast, in terms of professional certification, 78.6% of the respondents reported having an accounting degree. Most of the respondents were students (56.6%). In terms of accounting software experience, 49.1% of respondents were students, and for this reason, they reported having no experience of using such software. The remaining 50.9% of respondents have experience in using accounting software. *Table 2* shows the descriptive statistics for the constructs. It should be noted that *Table 2* only shows the top 3 highest mean values of each variable. It provides descriptive statistics on the minimum, maximum, mean and standard deviation.

Table 1. *Demographic profile of the respondents.*

Variables	Frequency (N)	Percentage (%)
Genders		
Female	89	51.4
Male	84	48.6
Age of respondents		
<20	18	10.4
21-25	87	50.3
26-30	46	26.6
31-35	18	10.4
36-40	3	1.7
41-45	1	6
Highest level of education		
PhD	3	1.7
Master	21	12.1
Bachelor degree	131	75.7
Diploma	10	5.8
Certificate	8	4.6
Professional certification		
Accounting degree	136	78,6
ACCA	21	12.1
MICPA	8	4.6
CPA Australia	5	2.9

CIMA	2	1.2
ICAEW	1	0.6
Occupation		
Student	98	56.6
Accountant/Finance exercutive	31	17.9
Auditor	22	12.7
Accounting consultant	14	8.1
Accounting/Finances academics	4	2.3
Chief accountant/Chief finance officer	3	1.7
Finance controller/Finance manager	1	0.6
Accounting software		
I am student	85	49.1
Biztory	28	16.2
SQL	21	12.1
MYOB	10	5.8
Intuit Quickbooks	7	4.0
QNE	5	2.9
AutoCount	4	2.3
Sage UBS	4	2.3
Million	3	1.7
Mr Accounting	3	1.7
Wave Accounting	3	1.7
Total	173	100

Table 2. *Descriptive statistics of the constructs.*

Descriptive statistics (Selected top 3 highest mean value)	Min	Max	Mean	Std. Deviation
Accounting information system				
The use of Cloud Computing and Blockchain in accounting information system allows relevant parties to access the information on any device with an internet connection.	2	5	4.62	0.604
The use of Cloud Computing and Blockchain in accounting information system allows relevant parties to obtain information in real time.	2	5	4.58	0.602
The adoption of Cloud Computing and Blockchain in accounting information system will enable it to have remote working capabilities.	1	5	4.49	0.744
The adoption of Cloud Computing and Blockchain in accounting information system will save cost.	2	5	4.24	0.738
Accounting process				
Artificial Intelligence (AI) technology and Robotics will perform some of the current accounting tasks such as keying data and posting journal entry.	2	5	4.50	0.720
The use of Artificial Intelligence (AI) technology and Robotics will increase the efficiency and effectiveness of work during the accounting process.	2	5	4.49	0.652
Automation of the accounting process can help accountants and auditors to gather information easily in real time.	2	5	4.49	0.759
Education of accountants				
Accountants in the Industry 4.0 era should develop technical skills such as understanding the capabilities of software and data analysis skills.	2	5	4.59	0.590
In the Industry 4.0 era, there is a gap between the skills and knowledge provided by university and the skills and knowledge required by employers.	2	5	4.55	0.677
Education inst. providers such as the university and accounting profession should provide courses related to the skills required by Industry 4.0.	1	5	4.53	0.728
Job opportunity for accountants				
Employers prefer hiring employees with technical and soft skills.	2	5	4.62	0.603
Expand the types of services that can be provided to clients.	2	5	4.61	0.634
Accountants will use both technical and soft skills to perform their accounting work.	2	5	4.54	0.727

The first objective (H1) of this study is to investigate whether Industry 4.0 will affect the accounting information system (dependent variable). The mean scores of the statements were all in the range of 3.95 to 4.62. It can be concluded that most of the respondents were “Very Satisfied” with the statements on accounting information

system variables. Statements 2.4, 2.3 and 2.7 were recorded as the statements recording the top 3 highest mean values at 4.62, 4.58 and 4.49, respectively. Statements 2.6 and 2.7 demonstrate that the respondents were satisfied and willing to adopt the technology of Industry 4.0. Statement 2.7 reported 100% satisfactory adoption level, while statement 2.6 reported 99.98% satisfactory adoption level by the respondents. The second objective (H2) of this study is to investigate whether Industry 4.0 will affect the accounting process. The mean scores of the statements were all in the range of 4.29 to 4.50. This is an indication that most of the respondents expressed "Extreme Likelihood" with the statements related to accounting process variables. Statements 3.1, 3.3 and 3.6 were recorded as the statements having the top 3 highest mean scores. The third objective (H3) of this study is to investigate whether Industry 4.0 will affect the education of accountants. The mean scores of the statements were all in the range of 4.18 to 4.59. This is an indication that most of the respondents were "Extremely Concerned" with the statements under the variables of Education of Accountants. Statements 4.1, 4.4 and 4.5 obtained the top 3 highest mean scores at 4.59, 4.55 and 4.53, respectively. The fourth objective (H4) of this study is to investigate the relationship between Industry 4.0 and job opportunity for accountants. The mean scores of the statements were all in the range of 4.18 to 4.62. This indicates that the majority of the respondents reported "Extreme Likelihood" to the statements under the variables of Job Opportunity for Accountants. Statements 5.5, 5.7 and 5.6 were recorded as the statements having the top 3 highest mean scores for this construct.

Table 3 presents the results of Pearson's correlation for each of the variables. When the p-value is less than 0.05, the correlation between the independent variable and dependent variables is significant (Schober et al., 2018). *Table 3* shows that all the correlation results are in the range of 0.507 to 0.649. Based on *Table 4*, it is illustrated that accounting information system obtained an R-value of 0.649, accounting process an R-value of 0.586, education of accountants an R-value of 0.507, and job opportunity of accountants an R-value of 0.569. In addition, *Table 4* shows that accounting information system, accounting process, education of accountants and job opportunity for accountants all obtained a p-value of 0.000. This indicates that moderate and positive relationships exist between the independent variable and the dependent variables.

***Table 3**. Pearson's correlation analysis.*

Correlations	Industry 4.0	Accounting information system	Accounting process	Education of accountants	Job opportunity of accountants
Industry 4.0	1				
Accounting information system	0.649**	1			
Accounting process	0.586**	0.716**	1		
Education of accountants	0.507**	0.507**	0.721**	1	
Job opportunity of accountants	0.569**	0.700**	0.723**	0.685**	1

*Note: ** correlation is significant at the 0.01 level (2-tailed).*

***Table 4**. Regression analysis.*

Regressions	Accounting information system (DV 1)	Accounting process (DV 2)	Education of accountants (DV 3)	Job opportunity of accountants (DV 4)
Industry 4.0 (Beta)	0.649	0.586	0.507	0.569
R square	0.421	0.343	0.257	0.324
Adjusted R square	0.417	0.339	0.253	0.320
Std. Error of the estimate	6.093	2.819	2.965	3.175

F-value	124.210	89.362	59.185	82.007
P-value	0.000**	0.000**	0.000**	0.000**
t-value	11.145	9.453	7.693	9.056

*Note: ** significant at the 0.05 level.*

Hypothesis 1: There is a significant relationship between Industry 4.0 and accounting information system

Table 4 shows that the R-value is 0.649, indicating that a positive and moderate correlation exists between Industry 4.0 and the accounting information system. Table 4 also shows that the R square is 0.421; this indicates that Industry 4.0 explains 42.1% of the variation in accounting information system. Moreover, a significant variance between Industry 4.0 and accounting information system was found as the significant value obtained was 0.000 ($p<0.05$) with t-value of 11.145. Therefore, the researchers can conclude that there is a relationship between Industry 4.0 and accounting information system; H1 is therefore supported in this study. The findings are consistent with the argument of Shkurti and Muça (2014) who asserted that cloud computing and other new revolutionary concepts have a broader impact on accounting information systems. In addition, Zhang (2014) and Dai and Vasarhelyi (2017) also found that the use of technology related to Industry 4.0 on accounting information system will improve the traditional accounting information system. According to the DOI theory, when a company realise that the benefits of adopting new technologies outweigh the associated risks, they are most likely to adopt the new technologies (Rogers, 2003). The company will adopt and use Industry 4.0 technology to gain benefit and success because of the mimetic pressure defined by the institutional theory.

Hypothesis 2: There is a significant relationship between Industry 4.0 and accounting process

Table 4 shows the R-value is 0.586, and this indicates a positive and moderate correlation between Industry 4.0 and accounting process. Furthermore, the R square is 0.343, indicating Industry 4.0 explains 34.3% of variation in accounting process. Moreover, there is a significant variance between Industry 4.0 and accounting process because the significant value is 0.000 ($p<0.05$) with a t-value of 9.453. Therefore, the researchers can conclude that H2 is supported in this study, and that there is a relationship between Industry 4.0 and accounting process. According to the institutional theory, coercive, normative, and mimetic pressures will encourage the adoption of Industry 4.0 technology. Thus, the result of this present study is consistent with those of prior studies. Fernandez and Aman (2018) maintained that the implementation of RPA technology will have a significant impact on the accounting process, whether it is from an individual perspective or an organisational perspective. Tran and Phan (2019) claimed that applying AI to accounting work can automate the tedious accounting process. Hence, it can be surmised that the adoption of Industry 4.0 technology will bring advantage to the company, employees, and their client.

Hypothesis 3: There is a significant relationship between Industry 4.0 and the education of accounting

Table 4 shows the R-value is 0.507, indicating that a positive and moderate correlation exists between Industry 4.0 and the education of accountants. Furthermore, the R square is 0.257, and this indicates that Industry 4.0 explains 25.7% of the

variation in the education of accountants. Moreover, there is a significant variance between Industry 4.0 and the education of accountants because the significant value is 0.000 ($p<0.05$) and the t-value is 7.693. Therefore, the researchers can conclude that H3 is supported in this study and that there is a relationship between Industry 4.0 and the education of accountants. The findings of this study are consistent with Wahyuni (2020) where the latter maintained that accountants must improve their knowledge and skills in line with the development of Industry 4.0. For accountants to survive in the Industry 4.0 era, they must have technical skills and soft skills. This is consistent with the institutional theory which propounds that students or employees will need to continue acquiring the skills and knowledge required because of mimetic pressure. Moreover, Jackling and De Lange (2009) reported that there is a gap between the skills and knowledge provided by universities and those required by employers. This shows that Industry 4.0 will affect the education of accountants and their existing knowledge is not enough for them to adapt to the changes taking place in the industry.

Hypothesis 4: There is a significant relationship between Industry 4.0 and job opportunity for accountants

Table 4 shows that the R-value computed is 0.569, indicating that a positive and moderate correlation exists between Industry 4.0 and job opportunity for accountants. Furthermore, the R square is 0.324, indicating that Industry 4.0 explains 32.4% of the variation in job opportunity for accountants. In addition, there is a significant variance between Industry 4.0 and job opportunity for accountants as the significant value obtained is 0.000 ($p<0.05$) with a t-value of 9.056. Therefore, the researchers can conclude that H4 is supported in this study. The findings show that there is a relationship between Industry 4.0 and job opportunity for accountants. The findings of this study are also consistent with Wahyuni (2020) and Törnqvist and Forss (2018) who conclude that Industry 4.0 will change the working methods and practices of accountants. According to Rkein et al. (2020) and Chen et al. (2012), repetitive tasks are most likely to be replaced by technology, and many reports can be automatically generated by technology. Therefore, such a situation will greatly reduce accountants' employment opportunities and change their job content. However, based on the discussion of Hypothesis 3, accounting students and employees will need to continue to acquire skills and knowledge to remain relevant and to prepare for the emergence of Industry 4.0 in response to various pressures defined by the institutional theory. Such a move is necessary for them to increase their job opportunities and chance of being hired in the industry.

Conclusion

From the theoretical perspective, this study has made three main contributions. First, the diffusion of innovation (DOI) theory has been used in this study to analyse the impact of Industry 4.0 on the accounting sector. Based on the results obtained, the hypotheses established for this study have all been accepted and the relationship between the independent variable and dependent variables has been acknowledged and ascertained. Based on the findings, it is concluded that the impact of Industry 4.0 will bring many advantages to the accounting organisation and lead to positive adoption of Industry 4.0 technologies. In addition, the institutional theory has also been used in this study. Influences such as coercive, normative, and mimetic pressures were found to

encourage the adaption and adoption of Industry 4.0 by companies, students, and employees. Prior studies showed that Big Four accounting firms have started to adopt the Industry 4.0 technology. The findings of the present study also showed that the respondents expressed satisfaction with the advantages of Industry 4.0. This suggests that companies in the same industry will adopt and use the technology out of mimetic pressure from competitors. In addition, normative pressures will ensure that customers and organisations will operate in the external environment in a socially compliant manner, thus encouraging the adoption of Industry 4.0. It can be concluded based on the findings that the use of Industry 4.0 technology will bring quality services to clients of accounting firms. With the adoption of Industry 4.0, accounting companies can improve their corporate image, reputation, and competitive advantage. However, the findings also highlight the need for accounting employees and graduates to improve their skills and knowledge to adapt well to Industry 4.0. Moreover, due to mimetic pressure, employees and graduates need to continue to acquire skills and knowledge required in order to be more competitive and to improve their chances of being hired in the industry.

From the practical perspective, the study found several impacts of Industry 4.0 on the accounting profession. The use of Industry 4.0 on accounting information systems and accounting process will bring a lot of benefits to the companies, employers, employees, and clients. The impact of Industry 4.0 will improve the productivity and effectiveness of accounting firms. The development of Industry 4.0 will help firms to reduce fraud and error during the accounting process. This will also lead to good quality services being provided by the firms to their clients. Moreover, the impact of Industry 4.0 will enable employees to work remotely. This is especially relevant during the time of Covid-19 where employees have to change from working under the face-to-face work model to working from home. It is apparent that Industry 4.0 technologies allow employees the freedom of not having to return to office to work and to connect remotely with clients all over the world via the Internet. Industry 4.0 also makes it possible for relevant parties to obtain and share information through cloud computing. This will greatly improve the efficiency of accounting companies. The technologies touched upon in this study have now become a basic trend that cannot be delayed or avoided. The transition is expected to accelerate, especially after the occurrence of the Covid-19 pandemic. Therefore, it is necessary to understand and think about how the technologies should be applied, and for creative areas to be developed in terms of where these technologies can be applied. The study also found that Industry 4.0 will affect the current education of accounting students. The study found that the current skills and knowledge of accountants are not sufficient for them to adapt to Industry 4.0. The current practices and teaching of accountancy courses in higher education institutions are also insufficient to prepare future accountants for the demands of the job market or the industry. These findings are of practical significance for institutions of higher learning in reformulating future syllabus of accounting programmes. In addition, the study also found that job opportunities for accountants may be reduced with the introduction of Industry 4.0, and in this respect, the researchers believe that reformulating the accounting programmes is essential to help increase and create job opportunities for accountants. Such a move will also provide new services to accounting clients. The impact of Industry 4.0 can provide universities, accounting students and accountants with insights on how to learn about and adopt the technologies of Industry

4.0. By learning and adopting the technologies of Industry 4.0, accounting students and accountants will gain competitive advantage in academia and the accounting industry

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Conflict of interest

The authors confirm that there is no conflict of interest involve with any parties in this research study.

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