Examining the impact of Industry 5.0 on economic sustainability: A hybrid SEM-ANN approach

دراسة تأثير الثورة الصناعة 5.0 على االستدامة االقتصادية :نهج مختلط SEM-ANN

by

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ABSTRACT

While there is an existence of a significant amount of literature studieson industrial revolution there exist a scarce knowledge about examining the impact of Industry 5.0 on economic sustainability usinga hybrid SEM-ANN approach. The study aims at understanding the impact of industrial 5.0 on economic sustainability. A Quantitative analysis was done with data collected from over 363 participants. Twostage analytical techniques were applied in this work which involves the combination of ANN and with the PLS-SEM. First, PLS-SEM is used to enable understand the predictors and their significant influenceon the sustained use of industrial 5.0 revolution. The results show thatthere is a positive and non-significant relationship between predictorsand industrial 5.0 revolution on sustainability. The outcome of this study as provided valuable insight for those countries willing to adoptindustrial 5.0 revolution to understand its impact on economic sustainability.

ABSTRACT IN ARABIC

هذه الدراسة قبول شمولي في معظم الصناعات تعمل كثورة صناعية خامسة تعرف في الغالب باسم الصناعة 5.0 .يوفر نموذجا مفاهيميًا لفهم العوامل الحاسمة التي تؤثر أو تؤثر على قبوله والعوامل التي تدفع التأثير الملحوظ على الستدامة القتصادية بشكل أفضل الهدف الرئيسي من هذه الدراسةهو أن نكون قادرًا على الستفادة من إبداع الخبراء البشريين جنبًا إلى جنب مع ذكاء الكفاءة والآلت الأكثر دقة للتمكن من احداث ثوره

صناعة تتجه للستدامه و استخدام الموارد البشرية بافضل طريقه لزيادة النتاجية .في هذه الدراسة تم استخدام استبان بمشاركه ٣٦٣ مشارك .تم تحليل الردود باستخدام النهج لفهم مدى تاثير كل PLS-SEM يتم استخدام نهج . ANN و PLS-SEM المختلط المتبنيين و مدى تاثيرهم بلنسبه للثوره الصناعيه 5.0، النتائج تبين لنا مدى تاثيرهم على الثوره .النتائج توضح للمستهلكين المستعدين لتبني هذه التقنيه..

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1 CHAPTER ONE

1.1 Background information

Industry 5.0 has been regarded as the next industrial evolution, this is to leverage the creativity of human experts in collaboration with intelligence efficient and accurate machines (Liyanage et al, 2022). Different developing technologies and other applications have been used to assist industrial 5.0 in order to maximise production and deliver customised products in an efficient manner. In the past, humans and sometime with the help of animals have designed or manufactured vehicles, houses, clothes and weapons. There has been a massive gain in the economy as production capacity increase tremendously. This research project work is geared towards establishing the relationship between users and industrial 5.0 revolution. There has been a massive gain in the economy as most of production has increased. Industrial revolution has evolved with time the main objective being to maximise productivity and achieve mass production using the emerging technologies (Regenstein et al, 2022). Industry 5.0 is a paradigm change in production that intends to promote human connection and cooperation with modern technology (Lee et al., 2019). This new era stresses human-centered production methods that employ innovative technology to help people, promote creativity, and improve working conditions (Zhang et al., 2020). By blending the capabilities of Industry 4.0 with the human touch, industry 5.0 strives to build a more socially responsible, sustainable, and people-oriented manufacturing industry.

1.2 Research motivation

Industrial 5.0 is believed to move beyond the current industry 4.0 profit centered productivity and promote economic sustainability goals for instance: social environmental sustainability, resilience and human centricity (Nilashi et al ,2022).Industry has been the biggest contributor to every economy and provides jobs and prosperity across the globe. For the industry to continue bringing this prosperity, it had to adopt itself to continuity and that's why we have seen most industrial revolutions. Technological innovations complimented by industrial revolution is a typical feature of the life of a man which within many decades has brought about fundamental changes in human life (Anshari and Hamdan,2022). Major breakthrough in technology has marked the era of economic sustainability by giving rise to new waves of industrial developments. Since the middle of industrial revolution, there has been both the theoretical and empirical oriented a long run for economic analysis devoting increase attention to other nature of economic activities and more wave of technological changes. Most economics suggested that technological and economic changes do not just thrive by themselves but in an issue of related activities. Hence changes have been concentrated to acertain economic sector or industries. Which has so far become the leading industry for quitea period of economic sustainability and have wide effect on other sector of economy.

1.3 Problem statement

The evolvement of industrial revolution has taken several phases and many innovations affect human life towards economic sustainability. Researchers have never expounded the issue of economic sustainability effect on high predictions of high technology impacts in regards to industrial 5.0 revolutions. This study will utilize the use of UTAUT2 a theoretical framework proposed by Venkatesh et al () enable explain the people acceptance to technology and more specific the impact of industrial 5.0 on economic sustainability. Most model have not used all the variables for prediction into people's acceptance of industrial adoptions, hence Venkatesh has considered to synthesis more predictors into UTAUT2 so as to widen the theoretical relationships. The older model did not explore many issues and relied mostly on few concepts like culture and population, hence UTAUT2 relies on behaviors predictions. Previous model like UTAUT have always been used to describe users' technology adoption behavior in organizations while UTAUT2 will focus on individual perspective in technology adoptions. Very few academic studies have researched on industrial 5.0 adoption and its economic impact on economic sustainability through use of UTAUT2 model to enable determine factors influencing their acceptance.

1.4 Aim and objectives

1.4.1 Aim

To understand the drivers and barriers affecting industry 5.0 adoption among small and medium enterprises in the UAE and its impact on economic sustainability.

1.4.2 Specific objectives

- Develop a theoretical model by combining UTAUT 2 and TATT theory.
- Evaluate the developed model using the hybrid SEM-ANN approach.

1.5 Research questions

To achieve the above aim and objectives, the following research questions have been developed;

What is theoretical approach of UTAUT2 model in regards to industrial5.0 adoption on economic sustainability?

What are the predictions factors that influence the adoption of industrial 5.0?

1.6 Dissertation structure

1.6.1 Section 1

This section gives a brief introduction of wat industrial 5.0 revolution is. It has given the background information of this revolution, problem statement of this work, aim andobjective that the research work intends to achieve.

1.6.2 Section 2

This section gives an analysis of other research work who have done similar task in the field of industrial 5.0 revolution. Most of this research work was included in this phase hence making identify the gap which our research project is working on. Different stages of industrial revolutions have been highlighted in this section.

1.6.3 Section 3

This section deals with methods, procedures, tools and techniques that will be used to achieve the research specific objectives. Several procedures have been followed to enable achieve the stated objectives in an orderly way.

1.6.4 Section 4

It is in this section that results and validations are discussed. Each constraint is discussed and different hypothesis are measured which enabled us validate the result acquired.

1.6.5 Section 5

In this section, a presention and discussion of the project's findings and outcomes. The job has been completed successfully and is described briefly. At this stage, a concise overview of the outcomes and conclusions is presented, along with an indication of what was and was not accomplished and an indication of where more work is needed. At this stage, we have also highlighted the difficulties experienced, which will help future researchers set up a conducive atmosphere in which to succeed

2 CHAPTER TWO

2.1 Research background

In the year 1700s in Great Britain a revolution began which marked the end of people those who live in rural areas to make the things they needed by hand. It began more than two centuries before this date. Machines started emerging, and factories and banks were opened. People started creating machines which did the hard work and this become known as the *industrial revolution*, hence changing the history of the world forever. The start of this revolution in Great Britain was possible due to the fact that this nation had all the necessary factors. There was wealth and Men who wanted to risk their money. Availability of people was also another key factor (Hill,2018). In fact, this revolution was said to be the most profound revolution in all aspects of human history because it had a great impact on people lives. In the late 18th century and 19th century it brought into effect the ideas of the late Descartes, Galileo, Bacon and others. The advert of industrial revolution was promoted by various conditions like: advanced agricultural techniques and practises which brought about increased supply of food and raw materials, technological input and change in industrial organizations hence resulting in increase in production, profits and efficiency (Hsieh and Rossi-Hansberg,2019). Different stages of industrial revolution were undertaken which contributed to a vital capacity for economic development. The industrial revolution has undergone the following phases:

2.1.1 Industrial revolution 1.0: Mechanical production

According to James Watts (Šimurina and Tica,2006) they made further improvement to Newcomen steam power engine and hence started the point of industry revolution 1.0. Most economy which used fuel, made profitable the use of this steam engine especially in location were core was expensive.

2.1.2 Industry revolution 2.0: Mass production

A paradigm change was triggered by Henry ford's assembly which changed the history of the manufacturing process. A model known as T was the first automobile to be assembled in the line, which created less expensive cars and developed a high wage in the job market (Sihn,2016).

2.1.3 Industry revolution 3.0: Automated production

This is the period when they developed computer technology as an interface**.** During this era, the human power diminished, and even the speed of production increased considerablyby use of computer systems (Wolpaw et al,2008).

2.1.4 Industry revolution 4.0: Digital transformation

According to (Sihn et al,2016), industry 4.0 comprises of a huge network of advanced technology in the value chain. A new era of manufacturing processes is brought in by services, automation, internet of things, robotics, artificial intelligence and more other addictive manufacturing. The gap between virtual reality and the real world is getting blurred and cause a phenomenon called cyber-physical production systems. Cyber infrastructure is termed as the constant development of information systems and knowledgethat blend well with uncontrollable increase of all computer transmission, storage capacity as Alien put it (2019). Industrial 4.0 has been described as the high-tech strategy being promoted by the German government and implemented by the industries. It encompasses modern technology linked to the internet and making it more collaborative and flexible (Salima et al, 2018).

2.2 Technologies of industrial 4.0

Industry 4.0 has nine technological developments.

2.2.1 Cyber physical systems (CPS)

It is formed by advance logic and speed of development in communication. The manufactures systems of CPS have sensors that are installed in the whole physical aspect in order to connect physical things with virtual models. Business have found it easy to establish global networks which have enable join machinery, production facilities and warehousing systems of CPS in the future (Mosterman and Zander, 2016).

2.2.2 Internet of things

The new expression and combination of the present IoT and the manufacturing industry together with internet of service-initiated industry 4.0. IoT as brought about the advanced connectivity of services, data sharing, physical objects, systems and enabled object-object communication (He and Jin,2016).

2.2.3 Internet of services (IoS)

IoS has been playing as a service vendor that provide services thought the internet as per the type digitization services. They are available and on need basis by the subscriber as perthe business concept, available setup services and partners (Newman et al,2017).

2.2.4 Big data and analytics

Data analytics is useful for predictive manufacturing in industrial 4.0 which give an important direction for industrial technology that came as a result of rapid development of internet. The huge number of information produced and that is obtained daily which the traditional methods of processing and analysis are unable to cope with the big data analysis come in handy (Buxmann et al, 2009).

2.2.5 Autonomous robots

Robots nowadays have higher flexibility, easy to control in many fields and advanced functions. Under the guidance of handlers, future robots will interact and collaborate actively people under the guidance of handlers. They will be cheap and more complex so that they same standards like those currently used in other fields.

2.2.6 Addictive manufacturing (3D printing)

Industry 4.0 encouraged the advanced use of data technologies and smart production systems. Implementation of this technology for the purpose of integration plays an important role in the competiveness of the economy. New material is observed using 3D printing technology which has so far increased. In fact, the implementation of this industry depends entirely on 3D printing (Donato et al, 2017).

2.2.7 Cloud computing

It is a logic system that provides big space for storage in which enterprise or individuals can subscribe to get access to these resources. As the technology continue to improve its performance, data will continue to be stored in cloud storage system hence making production to be more data driven and reduce industrial limitations. More applications are being developed in cloud is gradually increasing (Dolen et al, 2017).

2.2.8 Simulation

Is a way of running a virtual or real process or any system in order to find out or guess the output of the said system. Simulations use real time data that represent the real world that include human, machines and products. Therefore, it is easy to optimise the machines settings in virtual environment before implementing it in the physical world. This will improve the quality and decrease machine setup time (Xu, 2012).

2.2.9 Industry revolution 5.0

This new paradigm has been seen to involve the emergence of artificial intelligence into people's lives which has made a significant penetration. There is a common cooperation which has enhanced several man's capacity and its return at the centre of universe. The convergence of this technologies provided the transformation from the fourth industrial revolution to the fifth. It has largely been concentrated on the interaction between machines and human.

2.3 The transformation of industrial 4.0 -5.0

The transition between industry 4.0-5.0 required mostly a great focus on human manufactures. The shift enabled bringing together both machines' domains and human hence enabling efficiency. Industrial Revolution 5.0 it is significantly implying that intelligence machines and robots work together with people. Advanced technologies like Internet of Things (IoT) and big data have enabled robots assist human work better and morequickly by utilizing these technologies. This added more human touch compared with IR 4.0 pillars of productivity and automation. Machines have come to be more intelligent and even more connected, industrial revolution 5.0 is aimed at combine the human cleverness and cognitive computing in collaboration processes (Skobelev and Borovik, 2017).

2.4 Opportunities and challenges of industrial 5.0

Industrial Revolution 5.0 is making convectional industries smarter by combining human intelligence and machines. The collaboration between human and machines will make them take on all the tasks like production and manufacturing. This revolution will give humanity accurate and a highly automated system with cognitive skills of a human brain like resemblance. The high technology industries in the future where interconnected system have converged into a single optimal unit thus benefitted from the combination of internet of things, cloud computing, big data analysis and deep learning. This single optimal unit are capable of managing information flow between cyber world and real and integrate computer resources into physical production processes. Every technology as its own advantage and disadvantages hence linking things with each other and people will have its own set of challenges (Taj and Zaman,2022).

2.5 Sustainable of industrial 5.0

The idea of industrial revolution and smart technology especially 4.0 was first developed by Karl Scwab (Schwab,2017) the president of the world economic forum. This made many scientists around the world to research more actively and develop it more towards a better strategy of economic digitalization. Indeed, the smart factory idea which was a newapproach to exploit the possibilities presented by new technological development in the context of industrialization were investigated by many scientists (Coumans,2018). The word of industrial 4.0 have been considered synonymous. However, this came with the negative social consequences like reduction in jobs. The solution to this problem lead to the development of industrial 5.0 as the scientific answer to this socio -economic challenges. It was promoted by Michael Rada (Rada,2017) to also ensure economic sustainability of the modern world.

2.6 Efficiency of industrial 5.0

According to (Liyanage et al, 2022), manufacturing efficiency will significantly increase and create versatility between humans and machines thus enabling interaction and monitor activities constantly. This interaction between humans and machines increase production at a rapid level. Industrial 5.0 provides a vision of many industries that are aiming beyond efficiency and productivity as their sole goals and reinforces the role and more contributions of industry to society according to European Union (Hoegel,2022).

2.7 Profits in industrial 5.0

Industrial 5.0 is not limited to industries but you find is applicability in various sectors and organizations. The application of this has been significantly wider than industrial 4.0 as spelled out by European commission. As time move from industrial 4.0 to industrial 5.0, high value jobs are being created than before due to freedom of design responsibility getting back to the people or workers (Wang,2022). The work force is becoming bigger with increase in the industrial 5.0 hence the same being replicated in the profit gains. Current, more production has been moved from mass production to a personalised output. Advances in the manufacturing industry and its more implementation in the industry as contributed in the increased productivity hence increase in profits.

2.8 Interaction within industrial 5.0

The economic factors in this new industrial revolution could bring about high-income disparities and other social problems. Many proposals have been raised in regards to this basic income programs that deal with the effects of automation (Mekkunnel,2019).

2.9 Similar things in industrial revolution

The industrial 5.0 has entails people working around robots and smart machines. It has similarity in industrial 4.0 in that they all use human labour hence making them work better and faster by leveraging advanced technologies like: big data and internet of things. It has created a personal human touch to industrial 4.0 pillars like efficiency and automation (Sezen,2019).

2.10 Economy in industrial 5.0

Industrial 5.0 economic values are defined by the refound and widened purposefulness which goes beyond producing goods and services for profit. This purpose constitutes three core elements: sustainability, resilience and human centricity (Miikkulainen et al,2019). In a globalised world, a profitable driven approach has become increasingly untenable, and a narrow focus on profit fails to make account correctly for societal and environmental cost and benefits. For this industry to thrive and become the provide for true prosperity, it should make definition for its true purpose to include environmental, social and societal considerations. This will include most responsible innovation which are aimed at increasing cost efficiency and maximising profits but also increased prosperity for all involved: workers, consumers, society, investors and the environment. In every economy, a human centric approach in industry 5.0 has put core human needs and interest at the very heart of the production process. There is more use of technology that has enabled adopt to the needs of the workers hence making sure the use of this technology as not impinged on workers fundamental rights like rights to privacy, human dignity and autonomy (Volpe et al, 2020). For industrial 5.0 to respect the planetary boundaries, sustainability needs to be there by developing a circular process that re-purpose, reuse and recycle natural resources., reduce environmental impact and waste. Sustainability is reducing energy consumption and greenhouse emissions that help avoid depletion and degradation of natural resources and ensure economic growth through ensuring the need of todays and future generations [Zafar et al, 2022]. Economic development will also make use of technologies like artificial intelligence and addictive manufacturing that play a large role by optimising resources efficiently and minimise waste.

Geopolitical shifts and natural crisis especially the covid -19 pandemic, gave highlights to the fragility of current approach to globalized production which has a great impact to the economy. Sufficient resilience strategic value chain, flexible business process and adaptable production capacity play a key role. Resilience has been referred to as the need to develop a high degree of robustness in industrial production which aim it better against disruptions and making sure it can provide and support critical infrastructure in times of crisis (Boin and McConnell, 2007).

The idea of sustainable development has developed over the centuries. People have tried to have an impact on natural environment and in order to enable them satisfy their own needs, by placing their self-interest over the common good. Hence, it can as well be stated that civilization has been making progress through successive phases of sustainable transformation for centuries making it often unknowingly towards sustainable development [Sarriegi et al, 2015].

Around the year 1000, an economic revolution swept over Europe(white,1964), bringing the so called the medieval era which came out with absolutely new solutions in economic development. The new technologies found their way into mining and led to invention of blast furnace hence making it possible to produce iron in large quantities. Mining in the 15thcentury become one of the economic drivers. Neoclassical economics and the 17th centuryconcept of homo economicus, either being rational in his or her choices it was particularly very important [Sarriegi et al,2015].

Industrial 5.0 mainly returned focus on human aspect of manufacturing. Machines and human have found ways to work together by improving quality and efficiency of production (demir,2021). The interaction between human and artificial intelligence is very paramount about in economic development in industrial 5.0. The fifths industrial revolution brought more revolution and benefits to the environment because of the development of systems that make use of renewable energy and minimise or eliminate waste hence improve economy. Cognitive technology become the driving force for the fifth industrial revolution by enabling the machines to perform task reserved for humans for instance image recognition and speech interpretations give good example. The interaction and collaborations between robots and human results in improvement of automotive capacity and hence great strides in economic milestone improvement [Szalavetz,2019].

The economy has been transformed on sustainable development by experiencing many changes in through transition from, automation of even relocation of entire industries. Earlier on it had led to job loss and economic hardships. Geopolitical situations, world economic transformations and policy on sustainable development have become the most determinants of failures or success of improvement of every living conditions. These factorshave the most growing influence of determining or shaping the modern business and other economic in most unpredictable conditions (Mousa,2017).

3 CHAPTER THREE

3.1 Hypothesis development and research model

The review of literature discusses relevant topics for the research, such as firm performance, technology adoption and many other relevant theories that will be used to develop the research's theoretical framework. Figure 1 depict the proposed framework from which hypothesis is derived. Several theories model do exist like: IDT, TRA, TATT, UTAUT etc. This study will utilise: The Unified Theory of Acceptance and Use of Technology (UTAUT2) is a widely used theoretical model that seeks to explain user acceptance of new technologies. In order to investigate the factors that influence adoption and use of technology related to Industry 5.0, this study utilized the Unified Theory of Acceptance andUse of Technology 2 (UTAUT2) model, as well as the Technology Acceptance Model (TATT) perceived threat construct in the context of Industry 5.0, these constructs can be used to examine the factors that influence the adoption and use of technologies related to AI, smart systems, robotics, and automation (Hwang et al, 2020). For example, employees maybe more likely to adopt and use a new AI-powered system if they believe that it will improvetheir job performance (performance expectancy), if they find it easy to use (effort expectancy), if they perceive that their colleagues and managers expect them to use it (socialinfluence), and if they have access to the necessary resources and support (facilitating conditions). To enhance the understanding of the adoption behaviour of Industry 5 technologies, it is important to consider the perceived threat construct from the TechnologyAcceptance Model (TATT) (Gbongli, 2022). Perceived threat refers to the degree to which anindividual feels that using a particular technology may have negative impacts on their job or performance. In the context of Industry 5, perceived threat could arise from concerns about job security or the potential replacement of human workers with automated systems.Incorporating perceived threat into the UTAUT2 model can provide a more comprehensiveunderstanding of the adoption behaviour of Industry 5 technologies. Previous studies have shown that perceived threat can significantly influence the adoption behaviour of new technologies (Choudhary et al, 2022). Therefore, addressing concerns related to perceived threatcan help to increase the adoption and usage of Industry 5 technologies. Moreover, by incorporating TATT constructs, researchers can examine the potential moderating effect of individual characteristics such as age, gender, and experience, on the adoption behaviour ofIndustry 5 technologies. For example, previous studies have found that individuals who areolder or have less experience with technology may have higher levels of perceived threat and lower levels of adoption (Venkatesh et al., 2003).

In conclusion, incorporating the perceived threat construct from TATT into the UTAUT2 model can provide a more comprehensive understanding of the adoption behaviour of industry 5 technologies (Tahir et al, 2022). By considering the impact of perceived threat, organizations can address employee concerns and improve the adoption process of industry 5 technologies. Additionally, examining the potential moderating effect of individual characteristics can help organizations tailor their adoption strategies to different groups of employees.

Most result are based on literature analysis of several articles and journals. This is done through questionnaires and analysis and help analyse the factor that influence the adoption of industrial 5.0 (Ndjambou et al,2016). Several theories have been established that provide different models of approach, but UTAUT2 play a significant role in industrial 5.0

revolution. There are several constructs that have been used as varying factor to demonstrate the intention of this various variables. Figure.1 illustrates this construct and show moderations and their interrelations. The UTAUT2 and TATT its objective is to unit disparate but those other related theories about adoption of industrial 5.0. It is a new unified model that was created to forecast technological acceptance and adoption by drawing theoretical and empirical between the conceptual parallels the other theories which have been described (Balasubramanian et al, 2016). It is also important to note that the moderators(such as gender, age, and experience) were removed In order to create a context-generic model that can directly analyse the relationships between its dimensions (Raman et al,2020), and the potential that moderators may not have an impact on technology usage across all contexts (Williams et al, 2019), this removal was necessary.

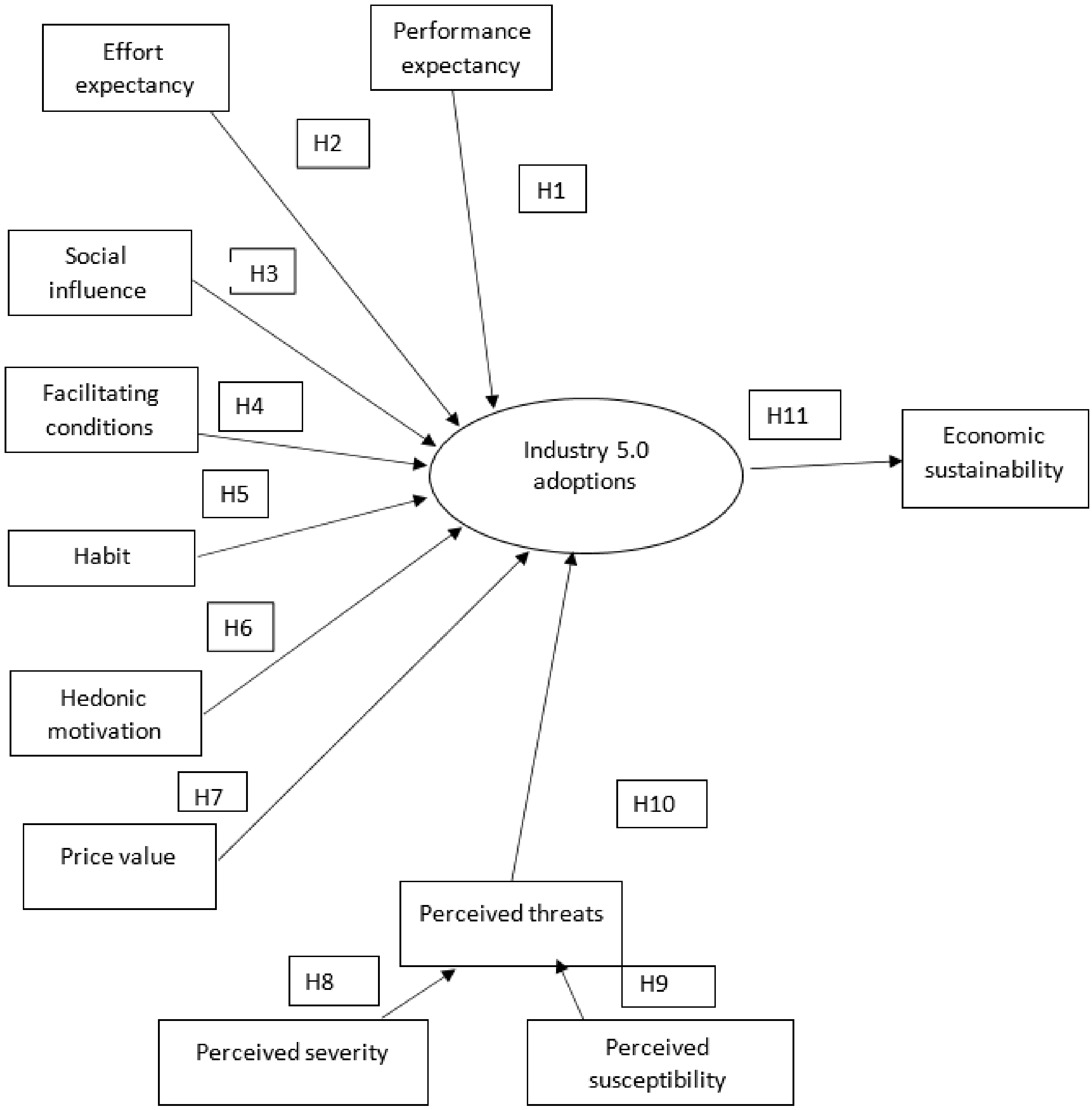

Fig1.Hypothesis model

3.1.1 Performance expectancy (PE)

According to Vankatesh et al,2003, performance expectancy is the degree on which individuals tend to believe that using the system will help her or him to attain gains in job performance. In industrial 5.0, In the context of Industry 5, this may include the ability to analyze large volumes of data quickly and accurately, optimize production processes, and enhance product quality. Employees who work with AI, smart systems, robotics, and automation need to believe that these technologies will enhance their performance and help them complete tasks more efficiently. For example, an engineer might believe that using AI-powered tools will allow them to design and prototype products more quickly. Organizations that implement such technologies aim to improve efficiency, productivity, and overall performance. Therefore, it is crucial to assess how individuals perceive the usefulness of these technologies, as it can impact their acceptance and adoption (Zhou and Wang, 2010). If individuals perceive that these technologies can help them in their job or task performance, they are more likely to use them. Conversely, if they believe that these technologies are not useful, they may resist their implementation. For example, employeesin a manufacturing company may perceive that a robotic arm can help them perform their tasks more efficiently, leading to increased productivity and fewer errors. In this case, employees are more likely to accept the technology and use it. However, if employees perceive that the robotic arm is not useful, they may resist its implementation, leading to a lower adoption rate (Mohammed,2019). Overall, performance expectancy is an essential construct to consider when implementing new technologies in an organization, particularlyin Industry 5. It is important to assess how individuals perceive the usefulness of these technologies to ensure successful adoption and implementation

H1: There is a positive and significant relationship between performance expectancy and the industrial 5.0 applications.

3.1.2 Effort expectancy (EE)

This refers to the degree to which an individual believes that using a particular technology will be easy to use. In the context of Industry 5, employees need to believe that the technologies they use are user-friendly and require minimal training. For example, an employee who needs to operate a robot on a manufacturing line should be able to use the robot without significant effort or training. Many people tend to avoid systems which are complex or use new technology and the one using high level of skills. The extend usage of technology make the effort of construct become non-significant (Jaiswal et al, 2016). For example, smart manufacturing systems require a high level of expertise and training, which can be a barrier to adoption. Therefore, by understanding effort expectancy, organizations can identify training needs and simplify user interfaces to improve technology adoption. According to UTAUT2, a user's perceived ease of use is influenced by various factors such as simplicity, clarity, ease of learning, and compatibility. For example, a user may perceivea technology as difficult to use if it requires too much time to learn, or if it is not compatible with their existing system. In a study by Zhou and Lu (2020), the researchers found that effort expectancy had a significant positive effect on the intention to use Industry 4.0 technologies in the manufacturing industry. Most studies have examined this construct and realised it is the greatest predictor of technology or revolution adoption (Ameen,2017).

H2: There is a positive and non-significant relationship between effort expectancy and the industrial 5.0 applications.

3.1.3 Social influence (SI)

According to Venkatesh et al, (2003), This refers to the degree to which an individual perceives that important others believe they should use a particular technology. In the context of Industry 5, employees need to feel that their peers and superiors believe that usingAI, smart systems, robotics, and automation is important and valuable. For example, if a company's leadership publicly supports the use of AI-powered tools, employees are more likely to adopt these technologies. Social influence can come from peers, supervisors, or even industry leaders. If influential others promote the use of a technology, employees maybe more willing to adopt it. For example, the adoption of robotic process automation in thefinance industry was driven by its successful use by industry leaders such as JP Morgan andDeutsche Bank. Therefore, understanding social influence can help organizations develop strategies to promote technology adoption and gain buy-in from employees. Research has shown that social influence plays a significant role in technology adoption and use. For example, a study by Venkatesh et al, (2003) found that social influence was a strong predictor of individuals' intention to use technology in the workplace. Another study by Kwon and Wen (2010) found that social influence had a significant impact on users' intention to use social networking sites. In the context of Industry 5.0, social influence can be particularly important, as it is a relatively new and rapidly evolving field that may be perceived as risky or uncertain by some individuals. If individuals perceive that their peersor colleagues are supportive of Industry 5.0 technologies, they may be more likely to adoptand use them. On the other hand, if individuals perceive that their social networks are not supportive, they may be hesitant to adopt and use Industry 5.0 technologies. The firms are expected by stakeholder to adopt to the new industrial 5.0 revolution. This includes the policy makers, customers, shareholders and competitors. Most studies have found it very important to explain the revolution adoption decisions (Esposito et al, 2004).

Overall, social influence is an important construct to consider when studying technology adoption and use, particularly in the context of Industry 5.0. Its impact on individuals' attitudes and behaviours should not be overlooked, and it can be a valuable tool in promoting the adoption of new and innovative technologies.

H3: There is a positive and significant relationship between social influence and the industrial 5.0 applications.

3.1.4 Facilitating conditions (FC)

According to Venkatesh et al, (2003), this construct refers to the degree to which individuals have access to the necessary resources to use a specific technology. In Industry 5, the use of complex technologies requires access to various resources such as hardware, software, and technical support. For example, the use of smart systems in logistics requires access to high-speed internet and reliable communication systems. Therefore, understanding facilitating conditions can help organizations identify potential barriers to adoption and develop strategies to provide employees with the necessary resources to effectively use technology solutions. In Industry 5.0, facilitating conditions are crucial for the effective use of advanced technologies and automation systems. For instance, a worker needs access to appropriate training and resources to operate a machine or a robot in a smart factory environment. Facilitating conditions are also related to the availability of technical support and adequate infrastructure that enables smooth and efficient operations in a smart factory setting.

Facilitating conditions play a vital role in the success of Industry 5.0 by reducing the barriers to technology adoption and increasing the likelihood of technology usage. This construct has been found to have a positive influence on intention to use and actual usage of technology (Venkatesh et al., 2003). Therefore, it is crucial to ensure that the necessary resources and support are available to facilitate the adoption and usage of advancedtechnologies in Industry 5.0. For example, a study conducted by Loonam and O'Kane (2014)found that facilitating conditions such as technical support and adequate infrastructure weresignificant factors in the successful implementation of advanced manufacturing technologies in the aerospace industry. Another study by Ahuja et al, (2016) demonstrated that facilitating conditions such as availability of technical support and resources played a critical role in the successful implementation of Industry 4.0 technologies in Indian manufacturing firms.

Overall, facilitating conditions are critical for the effective implementation and use of advanced technologies in Industry 5.0. Companies need to ensure that the necessary resources, training, technical support, and infrastructure are in place to facilitate theadoption and usage of these technologies.

H4: There is a positive and non-significant relationship between facilitating conditions and the industrial 5.0 applications.

3.1.5 Habit (HT)

According to Venkatesh and Thong,2012, habit is an extent to which people have been doing/performing behaviour automatically.

This construct refers to the degree to which individuals have developed a pattern of behaviour related to using a specific technology. In Industry 5, habit can influence the adoption and use of technology solutions. If employees are accustomed to using specific tools and processes, they may be resistant to change. For example, moving from a paper-based to a digital record-keeping system may be met with resistance from employees who are used to working with paper. Therefore, understanding habits can help organizations develop effective change management strategies to encourage adoption and usage of new technology solutions. In the context of Industry 5.0, individuals who have a habit of using technology may be more likely to adopt and use new technologies related to AI, smart systems, robotics, and automation. For example, employees who are used to using smartphones, laptops, and other digital devices may be more receptive to using new technologies in their work, such as AI-powered chatbots for customer service or automation software for streamlining business processes. Habit can be a powerful predictor of behaviour, as it involves deeply ingrained patterns of behaviour that are often resistant to change. In the context of our study, habit can be an important factor in determining whether individuals will adopt Industry 5 technologies and processes on a regular basis. Habit can influence a person's behaviour in a number of ways. For example, if an individual has developed a habit of using a certain type of software or technology, they may be more likely to continue using it even if newer or more advanced technologies become available. In addition, habits can be difficult to break, and individuals may continue to use outdated or inefficient technologies simply because they are familiar and comfortable with them. Given the importance of habit in influencing behaviour, it is important to understand how it relates to the adoption of Industry 5 technologies. Researchers have found that habit can be a significant predictor of adoption behaviour, with individuals who have developed strong habits around using technology more likely to adopt new technologies in the future (Yakovleva et al, 2018).

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H5: There is a positive and significant relationship between habit and the industrial 5.0 applications.

3.1.6 Hedonic motivation (HM)

Venkatesh and Thong, 2012 Hedonic motivation is another important factor that has been studied in relation to the adoption and use of new technologies in Industry 5.0. Hedonic motivation refers to the pleasure and enjoyment that individuals experience when using a particular technology. This factor has been found to be particularly important for technologies that are considered to be entertaining or enjoyable, such as virtual reality or gaming applications. There are almost six dimension of hedonic motivation that have enabled firms adopt to industrial 5.0 (Arnold and Reynolds, 2003). Social, ratification, idea, role, adventure, value, pleasure, escapism and arousal (Ruyter et al,2004). Research has shown that hedonic motivation can have a significant impact on an individual's intention to use a particular technology (Kowatsch et al., 2019). In the context of Industry 5.0, this factor can be particularly relevant for technologies that aim to improve the user experience or provide new forms of entertainment or engagement. For example, augmented reality tools can be used to enhance the user experience by providing immersive and interactive visualizations of manufacturing processes.

Furthermore, hedonic motivation can also be leveraged as a means of encouraging user engagement and adoption of new technologies. By incorporating gamification elements into a technology, such as points, badges, or leader boards, users can be motivated to engage with the technology and explore its various features and capabilities (Deterding et al., 2011).This can be particularly relevant for Industry 5.0 technologies, as gamification can be usedto incentivize workers to adopt new manufacturing processes or technologies and improve overall productivity. According to Curran and Meuter, (2007), the expected outcome for instance pleasure and efficiency from use of internet banking are the main reasons which motivate the customers intention to accept internet banking. Walker and Jonson (2006) had it that the customers intention to accept internet banking depend on the customers view about the capability to use or operate such technology. This means industrial 5.0 revolutionwill be mostly adopted by those who are technological enthusiast and will trust its adoption.

In summary, hedonic motivation is an important factor to consider in the development and adoption of new Industry 5.0 technologies.

By understanding and leveraging this factor, organizations can improve user engagement and adoption of new technologies, ultimately leading to increased productivity and competitiveness.

H6: There is a positive and significant relationship between hedonic motivation and the industrial 5.0 applications.

3.1.7 Price value (PV)

According Venkatesh and Thong, (2012) Price Value is another important factor that is addressed in the UTaut2 model. It refers to the extent to which a user perceives that using the new technology will be worth the cost. This means that the perceived benefits of using the technology should outweigh the perceived cost or effort required to adopt it. In Industry 5, the adoption of new technologies can involve significant costs such as investment in hardware and software, training, and maintenance. Therefore, understanding price value can help organizations assess the return on investment of technology solutions and make informed decisions regarding their adoption and use.

Price Value can be viewed as a trade-off between the benefits and the costs associated with using a new technology. If the perceived benefits are high, users are more likely to be willing to pay a higher price to use the technology. On the other hand, if the perceived benefits are low, users may not be willing to pay a high price for the technology. Price Value is important because it can affect the intention to use the technology and, ultimately, its adoption.

For example, in the context of Industry 5.0, if a new technology is perceived as having high benefits, such as increased productivity, cost savings, and better quality, users may be willing to pay a higher price for the technology. However, if the technology is perceived ashaving low benefits, such as limited impact on productivity and cost savings, users may notbe willing to pay a high price for it. It can help researchers and practitioners understand thefactors that influence users' willingness to pay for and adopt new technologies, which is important for the successful implementation of Industry 5.0 (Østergaard,2018).

H7: There is a positive and significant relationship between price value and the industrial 5.0 applications.

3.1.8 Perceived severity (PSEV)

According to (Liang and Xue, 2009), Perceived severity is one of the key constructs in the TATT model that can affect the adoption of new technologies in the organizational context. Perceived severity refers to the extent to which individuals perceive the potential harm that can arise from not adopting the new technology. In the context of Industry 5.0, the perceived severity can be related to the potential negative impacts on productivity, efficiency, and competitiveness if an organization fails to adopt the advanced technologies. For instance, organizations that do not invest in the latest robotics and automation systems may fall behind in terms of production efficiency and quality control, resulting in a loss of market share to their competitors.

Moreover, perceived severity can also be linked to the perceived risk associated with the new technology. Organizations may perceive the adoption of Industry 5.0 technologies as risky due to concerns related to data security, privacy, and ethical considerations. However, the perceived severity of not adopting these technologies may outweigh the perceived risks, leading organizations to invest in them despite the potential risks. Perceived severity is an important factor to consider when implementing new technologies in the workplace. Employees must be aware of the potential risks and hazards associated with the technology and perceive them as severe enough to take action to prevent them. For example, employees may not use a new technology if they perceive it as potentially dangerous to their health and safety. Therefore, it is important for organizations to ensure that employees are adequately trained and informed about the potential risks associated with the new technology and how to mitigate them.

Several studies have found perceived severity to be a significant predictor of employees' behavioral intentions towards using new technologies in the workplace (Raza et al., 2016). Therefore, it is essential for organizations to identify and address employees' perceived severity concerns to ensure the successful adoption and integration of Industry 5.0 technologies.

H8: There is a positive and significant relationship between perceived severity and perceived threats.

3.1.9 Perceived susceptibility (PS)

Perceived susceptibility is the degree to which a person believes he or she will be affected by a particular technology or innovation. Perceived susceptibility is an important consideration in the context of Industry 5.0, the latest iteration of the industrial revolution that aims to combine the benefits of automation and digitalization with human creativity and innovation (Liu, 2022). The use of artificial intelligence (AI) and machine learning (ML)in manufacturing processes is one example of how perceived susceptibility might relate to Industry 5.0. Some employees may view these technologies as a threat to their employment and fear being replaced by automation. However, if businesses can demonstrate that AI and ML can improve their job performance and make their work easier, they may be more likely to accept and adopt these technologies Shao et al, (2020). Numerous benefits accrue from considering perceived susceptibility in the context of Industry 5.0. Companies can design more effective training programs, communication strategies, and change management plans if they comprehend how workers perceive the potential effects of new technologies on their jobs, Kang et al, (2020). This can help reduce resistance to change and increase workplace productivity and creativity.

H9: There is a positive and significant relationship between perceived susceptibility and perceived threats.

3.1.10 Perceived Threats (PT)

According to Liang and Xue, (2009), Perceived threats are a key concept in acceptance theory, which seeks to explain why individuals may or may not adopt a particular technology or innovation. According to Davis (1989), perceived threats refer to the potentialnegative consequences that individuals associate with a new technology or innovation, andthese can include both tangible and intangible factors such as economic costs, loss of control, and concerns about privacy or security. In the context of Industry 5.0, perceived threats may include the fear of job displacement, concerns about privacy and security, and skepticism about the reliability and accuracy of new technologies.

To overcome these perceived threats and encourage adoption of Industry 5.0 technologies, organizations need to communicate effectively with stakeholders and address their concerns. Venkatesh et al. (2003) suggests that clear communication about the potential benefits and risks of a new technology is crucial for gaining user acceptance, and organizations implementing Industry 5.0 technologies should emphasize the potential benefits for workers and the economy, as well as their commitment to protecting privacy and security. Parida et al, (2020) argue that Industry 5.0 can mitigate social challenges by combining human and machine capabilities, and that organizations should involve workersin the development and implementation of new technologies to address concerns about jobdisplacement. In addition to communication and involvement, organizations can also use other strategies to address perceived threats. Shrouf et al. (2014) suggest that energy management can be a key area for mitigating environmental and economic concerns associated with Industry 4.0, the predecessor to Industry 5.0. Similarly, Haider and Sagheer(2019) propose that Industry 5.0 can address social challenges through innovation in areas such as education and training, which can help workers adapt to new technologies and remain competitive in the job market. In conclusion, perceived threats are an important component of acceptance theory and a key consideration for organizations implementing Industry 5.0 technologies. By addressing these threats through effective communication, involvement, and other strategies, organizations can facilitate successful adoption and helpto realize the potential benefits of Industry 5.0.

H10: There is a negative and significant relationship between perceived threats and the industrial 5.0 applications.

3.1.11 Industry 5.0 adoption

The adoption of Industry 5.0 is crucial for achieving economic sustainability is a critical component of Industry 5.0, which seeks to balance economic growth with environmental and social considerations. In this context, economic sustainability can refer to the ability of organizations to maintain financial viability while also achieving environmental and social goals. This can involve developing new business models, products, and services that are more resource-efficient and socially responsible, as well as optimizing processes and supply chains to minimize waste and emissions. To achieve economic sustainability in Industry 5.0, organizations can use a variety of strategies. For example, Parida et al, (2020) suggest that Industry 5.0 can be used to create "smart factories" that are more efficient and sustainable through the use of advanced technologies such as the Internet of Things (IoT) and artificial intelligence (AI). Similarly, Haider and Sagheer (2019) propose that Industry 5.0 can be used to develop new products and services that are more environmentally and socially responsible, such as energy-efficient appliances and sustainable transportation solutions. In addition to technological innovation, organizations can also promote economic sustainability through sustainable supply chain management. For example, Kaur and Singh(2020) suggest that supply chain sustainability can be achieved through collaboration amongsupply chain partners, adoption of sustainable practices such as waste reduction and energyefficiency, and adoption of sustainable procurement practices such as sourcing from suppliers with strong environmental and social performance. Moreover, there are economicbenefits associated with sustainability in Industry 5.0. For example, sustainable supply chainmanagement practices can reduce costs and increase efficiency (Kaur and Singh, 2020). Additionally, sustainable products and services can appeal to environmentally and sociallyconscious consumers, leading to increased demand and profitability (Haider and Sagheer, 2019).

In conclusion, economic sustainability is a critical consideration for Industry 5.0, and organizations can promote sustainability through technological innovation, supply chain management, and sustainable business practices. By balancing economic growth with environmental and social responsibility, organizations can achieve long-term financial viability and contribute to a more sustainable future.

H11: There is a positive and significant relationship between industry 5.0 adoption and economic sustainability.

4 CHAPTER FOUR

4.1 Overview

This section deals with methods, procedures, tools and techniques that will be used to achieve the

Methods, processes, instruments, and approaches utilized for research specific objectives. Several procedures have been followed to enable achieve the stated objectives in an orderly way.

4.2 Quantitative analysis

The research project work is based on quantitative methodology which one is most suited to accomplish the desired goals. It's the best and most efficient option available. The data source includes questionnaires.

4.2.1 Primary data collection

The collection of primary data was conducted to supplement the previously stated background research. Questionnaires were largely used to collect data from those who have adopted or are planning to adopt industrial 5.0 due to their potential to save time and suitability to the current environment. It aids in identifying the available gaps and the optimal approach for achieving project objectives. A link to a Google form questionnaire was sent to people who work in organizations related to the topic infields mentioned in the questionnaire, through face-to-face interactions during exhibitions or conferences with people who contribute to the same field, and through emails with technical employees of companies related to, 363 responses were gathered. This is considered sufficient for analysis as it reaches suggested minimum threshold (Chong et al, 2017). The structure of the questionnaire followed the structure below:

Part A: Questions related to personal information. This question block includes three (3) questions that relate to the above-mentioned factor. It is mapped to know which are the categories of users and their academic level make them get involved in industrial 5.0.

Part B: Questions related to industrial 5.0 use. The questionnaire block involves two (2) questions that help in understanding the above-mentioned item. It mapped out to understand who often users

Part C: Questions related to conceptual model factors. This question block was included in PLS-SEM analysis and contained a total of 32 closed question measured by using a 5point Likert scale, where 1= strongly disagree, 5= strongly agree.

The question was made obligatory to enable avoid missing any data. A sample questionnaire is found at the appendices.

A questionnaire survey was distributed to enabled collect data from both medium and large industrial companies. The selection of this firms was important because of its capability to enable in different production level.

4.2.2 Respondents

The respondent demographic characteristics is summarised in table1. Each person was considered to be a key informant by having relevant knowledge and experience to be able to address the survey questions about industrial 5.0 revolution.

4.2.3 Data analysis

To better improve ability to investigate, develop and justify experimental findings, statistical analysis is most relied by researchers. The advancement of computer technologies has enabled an increase in prolification due to its application of statistical techniques (Hair et al,2017). The analytical practices used in this work have been explained in this section. Similar techniques followed in these studies have been employed in this research work (Kalinic et al,2021) for the confirmation of research model and examining of proposed research hypotheses. Two stage analytical techniques have been utilized in this work which involves the sequence of ANN and with the PLS-SEM. First, PLS-SEM is to be used to enable understand the predictors and their significant influence on the sustained use of industrial 5.0 revolution. The massive quantity of involved indicators and rather than confirmation). PLS-SEM is a robust against distribution that is non normal, it cannot examine the non-linear relationship between constructs. Combining the ANN approach with PLS-SEM address this, for the ranking of the normalised importance of the significant variables (Lee et al,2020), to identify the importance of the predictors (Kalini et al,2021). he ANN method can make better predictions than the usual regression method. techniques (Lee et al, 2020). The PLS-SEM analysis serve to enable test the hypotheses H1to H11 of this research work. The main aspect of this research is to use indicators to explore exactly which benefits can play a role in the development and increase of employee satisfactions and hence increase employee loyalty. Analysis and results of this research is of practical significance for both level of management in industrial 5.0 revolution and adoption.

4.3 Research instruments

The items captured in hypothesis section were adapted to enable ensure construct reliability of the research work project and enable meet the set objectives. The participants were engaged on adopted items in a five-point scale that ranges from “1= strongly disagree” to “5= strongly agree” and open-ended questions (Krosnick, 2018). This provided participants or responded with few options to choose from and always avoid a situation of discouragement. The five-point scale has been convenient and easier to use in making choices. The method of survey used was subjected to several checks and if need arise amendments were made based on the feedback received from the 363 respondents. The items of performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation and price value were adopted from (Al-Emran et al, 2022). The questionnaire tool was subjected to content and face validity examinations and modifications were made founded on the received response from the respondents. The itemsof each factor are presented in table 2. The item of performance expectancy was measured in terms of extent to and impact of industrial 5.0 revolution: helps in increasing top management in general and decision making: these indicators measure the extent to which industrialization revolve. Perceived susceptibility in terms of the possibility of making decision in future or to some point. Perceived severity was exposed to the measure using several other indicators (Cheyanne et al, 2022).

Table 1: Questionnaire

constructs	items	
Performance Expectancy (PE) (Venkatesh et al., 2003)	PE1	I find industry 5.0 useful in my daily life.
	PE2	Using industry 5.0 helps me accomplish tasks more quickly.
	PE3	Using industry 5.0 increases my productivity.
Effort Expectancy (EE) (Venkatesh et al., 2003)	EE1	Learning how to use industry 5.0 is easy for me.
	EE2	My interaction with industry 5.0 is clear and understandable.
	EE3	I find industry 5.0 easy to use.
	EE4	It is easy for me to become skilful at using industry 5.0.
Social Influence (SI) (Venkatesh et al., 2003)	SI1	People who are important to me think that I should useindustry 5.0.
	SI2	People who influence my behavior think that I should useindustry 5.0.
	SI3	People who influence my behavior think that I should useindustry 5.0."
Habit (HT) (Venkatesh et al., 2003)	HT1	The use of industry 5.0 has become a habit for me.
	HT2	I am addicted to using industry 5.0.
	HT3	The usage of industry 5.0 is a must.
Facilitating Conditions (FC) (Venkatesh et al., 2003)	FC1	I have the necessary resources to use industry 5.0.
	FC2	I have the necessary knowledge to use industry 5.0.
	FC3	Industry 5.0 technologies are compatible with othertechnologies I use.
	FC4	I can get help from others when I have difficulties usingindustry 5.0.
Hedonic Motivation (HM) (Venkatesh et al., 2003)	HM1	Using industry 5.0 is fun.
	HM2	Using industry 5.0 is enjoyable.
	HM3	Using industry 5.0 is very entertaining.
Price Value (PV) (Venkatesh et al., 2003)	PV1	Industry 5.0 technologies are reasonably priced.
	PV2	Industry 5.0 technologies are a good value for the money.
	PV3	At the current price, Industry 5.0 technologies provide agood value.
Perceived Severity (PSEV) (Liang, H. and Xue, Y., 2009)	PSEV1	I believe that industry 5.0 technologies are vulnerable to security incidents.

	PSEV2	I believe that the productivity of industry 5.0 technologies isthreatened by security incidents.
	PSEV3	I believe that the profitability of industry 5.0 technologies isthreatened by data protection incidents.
	PSEV4	I believe that industry 5.0 technologies can be used formaking a secure working environment.
Perceived Susceptibility (PS)(Liang, H. and Xue, Y., 2009)	PS1	Industry 5.0 is likely to make bad decisions in the future.
	PS2	The chances of Industry 5.0 making bad decisions are great.
	PS3	Industry 5.0 may make bad decisions at some point.
Perceived Threats (PT) (Liang, H. and Xue, Y., 2009)	PT1	My fear of exposure to Industry 5.0's risks is high.
	PT2	The extent of my worry about Industry 5.0's risks is low.
	PT3	The extent of my anxiety about potential loss due to Industry5.0's risks is high.
	PT4	The extent of my worry about Industry 5.0's risks due tomisuse is high.

Industry 5.0 Adoption (IA) **(**Edinbarough et al, ,2022).	IA1	Adopting Industry 5.0 allows employees to be flexible andcollaborative.
	IA2	Adopting Industry 5.0 enables employees to interpret datacompetently.
	IA3	Adopting Industry 5.0 increases resource efficiency.
	IA4	Adopting Industry 5.0 enhances production flexibility.
Economic Sustainability (ES) **(** Wang et all,2022**)**	ES1	Using industry 5.0 decreases the cost of energy consumption.
	ES2	Using industry 5.0 reduces the cost of purchasing materials.
	ES3	Using industry 5.0 offers better products/ services tocustomers.
	ES4	Using industry 5.0 increases financial returns.

5 CHAPTER FIVE

5.1 Descriptive analysis

Table 1 summary of the respondents' characteristics reveals that 190 of the 363 respondents were males. Regarding age, 168 of the respondents were between the ages of 29 and 35, while 124 were between the ages of 23 and 28. About (125) respondents to the study hold bachelor's degrees, (16) diplomas/advanced diplomas, (186) master's degrees, and (36) doctorates. The majority of respondents (188) reported using industry 5.0 between 11 and 20 times per week.

Table 2: Demographic information

characteristics	values	frequency
gender	male	190
	female	173
age	18-22	1
	23-28	124
	29-35	168
	>35	70
qualification	bachelor	125
	diploma/advanced diploma	16
	master's degree	186
	Ph.D. degree	36
trends	robotization	84
	Big Data Analytics	221
	Virtualization	145
	Machine learning	166
	Internet of Things	193
	Smart Systems	91
frequency	<5 times	39
	5-10 times	103
	11-20 times	188
	>20 times	33

5.2 Measurement model assessment

Before examining the structural model hypotheses, the study evaluated the measurement model by examining its convergent validity, discriminant validity, and internal consistency reliability (Hair et al., 2016). The constructions' reliability was assessed utilizing composite reliability (CR) and Cronbach's alpha (CA). According to Table 3, CA values ranged from 0.699 to 0.948, and CR values ranged from 0.733 to 0.801. Both CA and CR scores surpassed the 0.70 threshold except for EE3 which can be ignored due to it being close to the threshold (Ramayah et al., 2018), showing a high level of reliability among the metrics.

For convergent validity, factor loadings and extracted average variance were evaluated (AVE). This study's convergent validity can be demonstrated in Table 3 as the factor loadings were greater than 0.708%, except for 1 item which has a score 0.699 and the AVE values were greater than 0.50. (Hair et al., 2016). The evaluation of discriminant validity was conducted using the fornell-larcker criterion at a cutoff value of 0.7. Table 4 displays the values of the bonds connecting the constructs, and not any of these values exceed the crucial value of 0.7. In addition, the VIF values of all constructs weren't as big as suggested limit of 3.3, indicating that there is no multicollinearity problem between the predictor constructs. These findings suggest that the discriminant validity has been confirmed. In conclusion, this study attained convergent and discriminant validity as well as internal consistency reliability.

5.3 Structural model

After validating the measurement model, the next phase is to evaluate the structural model by looking at the predictive capabilities of the model and the inter-construct linkages. This will be done once the measurement model has been validated (Hair et al., 2017). In light of this, the evaluation of the structural model was carried out by computing the coefficient of determination (R2), path coefficients, and the accompanying t-values using the bootstrap resampling approach (5,000 re-samples). Table 5 offers substantial evidence for every one of the hypotheses that were offered. Results from the path coefficient between the items. effort expectancy (β = 0.157, t 5 1.718) hedonic motivation (β = 0.136, t = 2.087) performance expectancy (β = 0.317, t = 4.493) perceived threat (β = 0.144, t = 2.012) , price value(β = 0.159, t = 3.067) and social influence (β = 0.169, t = 2.385)all showed positive correlation with industry 5.0 adoption. facilitating conditions (β = -0.002, t = 0.02) and habit (β = -0.121, t = 2.435) showed negative correlation with industry 5.0 adoption. Perceived susceptibility (β = 0.453, t = 7.654) and perceived severity (β = 0.422, t = 7.305) displayed good relations with perceived threats, industry 5.0 (β = 0.74, t = 17.98) have a positive correlation with economic sustainability. according to Table 5 According to prior research, the path coefficient is statistically significant if the confidence interval contains no zero values (Hair et al., 2012, 2016).

The R2 values for endogenous constructs were computed in order to measure the amount of variance explained by the dependent variables. This metric refers to the structural model's ability to predict future event outcomes. According to previous research (Cohen, 1988; Hair et al., 2016), R2 values are deemed insignificant if they fall between 0.02 and 0.12, moderate if they fall between 0.13 and 0.25, and significant if they are at or above 0.26. According to the results of this study, in descending order, the R2 values of the endogenous constructs were 0.548 for the economic sustainability construct, 0.594 for the industry 5.0 adoption, and 0.644 for the perceived threats.

Table 3: Reliability and convergent validity results

constructs	indicators	loading	CA	CR	AVE
Performance Expectancy (PE)	PE1	0.773	0.771	0.776	0.57
	PE2	0.851			
	PE3	0.781			
Effort Expectancy (EE)	EE1	0.798	0.748	0.754	0.59
	EE2	0.780			
	EE3	0.699			
	EE4	0.799			
Social Influence (SI)	SI1	0.848	0.799	0.8	0.593
	SI2	0.760			
	SI3	0.809			
Habit (HT)	HT1	0.948	0.728	0.737	0.605
	HT2	0.805			
	HT3	0.916			
Facilitating Conditions (FC)	FC1	0.792	0.904	0.8	0.623
	FC2	0.768			
	FC3	0.767			
	FC4	0.831			
Hedonic Motivation (HM)	HM1	0.776	0.798	0.801	0.624
	HM2	0.792			
	HM3	0.843			
Price Value (PV)	PV1	0.739	0.723	0.733	0.636
	PV2	0.795			
	PV3	0.855			
Perceived Severity (PSEV)	PSEV1	0.716	0.728	0.738	0.644
	PSEV2	0.806			
	PSEV3	0.871			
	PSEV4	0.708			
Perceived Susceptibility (PS)	PS1	0.832	0.78	0.798	0.647

	PS2	0.854			
	PS3	0.725			
Perceived Threats (PT)	PT1	0.789	0.768	0.769	0.649
	PT2	0.755			
	PT3	0.792			
	PT4	0.735			
Industry 5.0 Adoption (IA)	IA1	0.823	0.716	0.742	0.65
	IA2	0.729			
	IA3	0.788			
	IA4	0.813			
Economic Sustainability (ES)	ES1	0.738	0.731	0.74	0.795
	ES2	0.757			
	ES3	0.804			
	ES4	0.718			

Table 4: Fornell-larcker criterion results

	EE	ES	FC	HM	HT	IA	PE	PS	PSEV	PT	PV	SI
EE	0.77											
ES	0.668	0.755										
FC	0.709	0.658	0.79									
HM	0.69	0.655	0.66	0.804								
HT	0.103	0.048	0.176	0.133	0.892							
IA	0.636	0.74	0.61	0.615	0.079	0.789						
PE	0.645	0.683	0.667	0.631	0.166	0.656	0.802					
PS	0.279	0.21	0.28	0.316	0.603	0.247	0.167	0.806				
PSEV	0.287	0.204	0.321	0.309	0.702	0.318	0.267	0.679	0.778			
PT	0.255	0.258	0.3	0.295	0.655	0.3	0.239	0.74	0.73	0.768		
PV	0.389	0.403	0.422	0.331	0.344	0.45	0.322	0.397	0.45	0.458	0.798	
SI	0.612	0.632	0.728	0.607	0.206	0.617	0.588	0.277	0.315	0.315	0.498	0.806

Notes: EE "economic expectancy", ES"economics sustainability", FC "facilitating conditions", HM" hendonic motivation", HT "habit",IA"industry 5.0 adoption",PE "performance expectancy",PE"performance expectancy", PS" perceived suscepility" PSEV"perceived severity", PT" perceived threat", PV" price value", SI"social influence"

Table 5: Hypothesis testing results

structural path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics	P values	empirical evidence
EE -> IA	0.157	0.162	0.092	1.718	0.086	Rejected
FC -> IA	-0.002	0.002	0.082	0.022	0.983	Rejected
HM -> IA	0.136	0.135	0.065	2.087	0.037	Accepted
HT -> IA	-0.191	-0.164	0.079	2.435	0.015	Accepted
IA -> ES	0.740	0.739	0.041	17.98	0	Accepted
PE -> IA	0.317	0.301	0.071	4.493	0	Accepted
PS -> PT	0.453	0.452	0.059	7.654	0	Accepted
PSEV -> PT	0.422	0.425	0.058	7.305	0	Accepted
PT -> IA	0.144	0.122	0.072	2.013	0.044	Accepted
PV -> IA	0.159	0.159	0.052	3.067	0.002	Accepted
SI -> IA	0.169	0.175	0.071	2.385	0.017	Accepted

5.4 Artificial neural network results

Since PLS-SEM is only be used for to investigate linear models, there is a propensity to occasionally generalise the intricacies while choosing the sustained usage of mobile payment contactless technologies. This necessitates the use of an ANN technique that can identify both linear and non-linear correlations. Additionally, ANN approaches expect no type of distribution predictions. These strategies perform improved forecasts and frequentlybetter than the standard regression methods (Alkawsi et al., 2021). Yet if the “black-box” operating mode of ANN is examined, it would not be suited to test the ideas about what causes what. Hence, this concern was attended by first assessing the casual associations using PLS-SEM prior to using the extracted significant components as the ANN inputs to prevent model over-fitting.

The established research model of this study has three endogenous constructs.Consequently, the research model was split into two ANN models, as seen in Figures 1 and 2. The two

models were investigated with the ANN multilayer perceptron network using SPSS 26. The construction of ANN models contains only one hidden layer, which is utilized
to create the total number of neurons in the hidden layer (Alkawsi et al., 2021). The first model was, the number of created hidden neurons was 4, whereas 2 hidden neurons were formed for the second model, as represented in Figures 2, correspondingly. The concern of model overfitting was solved by utilizing a ten-fold cross-validation strategy. In that case, the data was separated into a 90:10 ratio for training and testing purposes, respectively. This approach was also utilized to establish the relative value of the predictors (Khayer et al., 2020).

The ANN model has hidden and output layers that have utilised the sigmoid function as the activation function (Kalini´c et al., 2021). Figure 4 depicts that the first model has six significant exogenous constructs: PE, SI, HT, HM, PV and PT. These six variables aided as input layers, while the endogenous variable (industry 5.0 adoption) served as the end product layer. In the second model, as shown in Figure 5, the exogenous variables PSEV AMD PS served as input layers, and the endogenous variable PT served as the output layer.

The root mean square of error (RMSE) is used to figure out how well the two ANN models can predict from the 10 networks is determined (Kalini´c et al., 2021). Table 6 shows that the RMSE values for model 1 are in the range of 0.095 to 0.106 for training and from 0.064 to 0.110 for testing. Training RMSE values for model 2 vary from 0.065 to 0.081, whereas testing values range from 0.062 to 0.087.

Inferring from the trivial variations in the RMSE values and the calculated standard deviation for both datasets (0.005995964,
0.003231109 for the training dataset in the two models, respectively) and (0.013269309 and 0.010876182 for the testing dataset in the two models, respectively), the implementation of ANN resulted in models with greater precision. This demonstrates that ANN models may

dependably create predictor-output linkages and can provide improved prediction performance by quickly fitting the data.

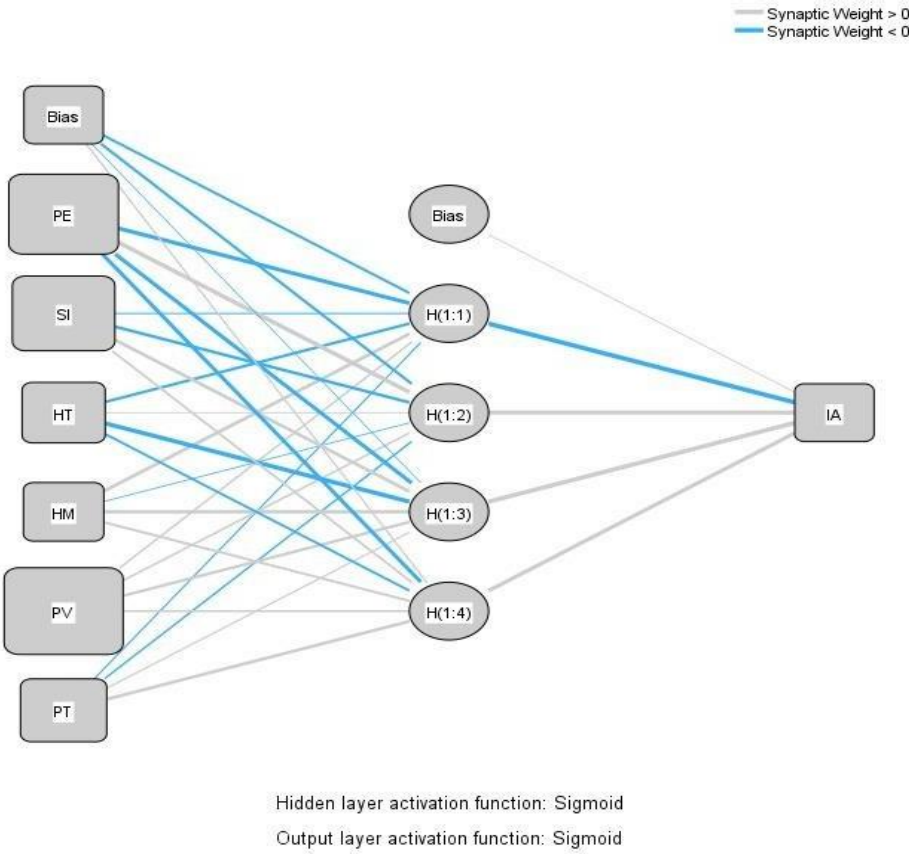

Figure 1 ANN model 1

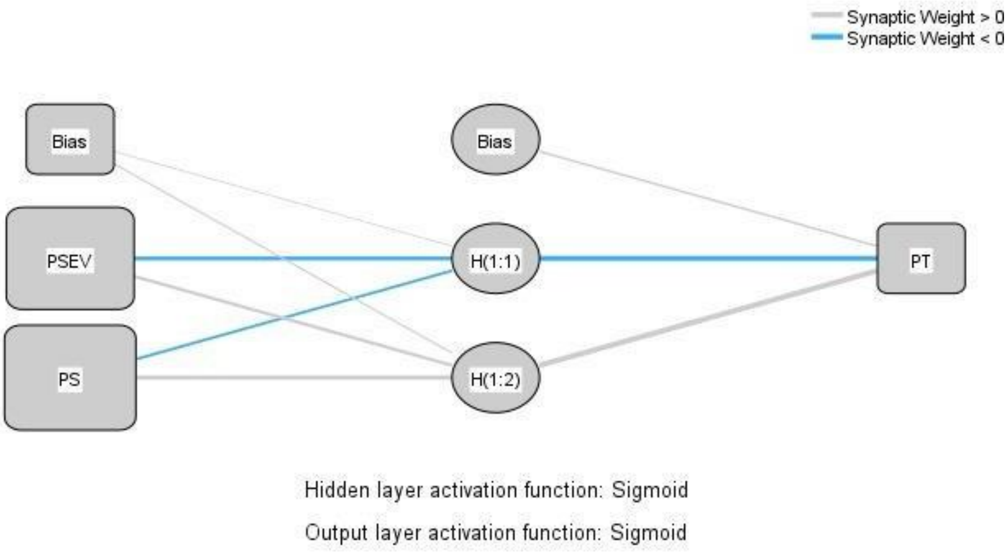

Figure 2 ANN model 1

Table 6: RMSE values of ANN models

	Model 1		model 2	
Network	RMSE (Training)	RMSE (Testing)	RMSE (Training)	RMSE (Testing)
1	0.095	0.110	0.065	0.087
2	0.102	0.088	0.081	0.075
3	0.098	0.082	0.066	0.085
4	0.097	0.088	0.069	0.062
5	0.106	0.075	0.077	0.053
6	0.096	0.097	0.083	0.077
7	0.097	0.075	0.071	0.074
8	0.099	0.064	0.074	0.066
9	0.100	0.078	0.078	0.083
10	0.099	0.075	0.073	0.072
Mean	0.099	0.083	0.074	0.073
Standard deviation	0.003231109	0.013269309	0.005995964	0.010876182

5.5 Sensitivity analysis

Using sensitivity analysis, the contribution of each predictor to the continuous adoption of contactless mobile payment technology was determined. This was accomplished by calculating the normalized importance as a percentage by dividing the relative importance of each input by the optimum relative importance (Qasem et al., 2020). According to Table 7's sensitivity analysis results, PE (0.9667) is the most important input linked with industry 5.0 adoption followed by HE and PV with relative weights of (0.876) and (0.6529), respectively. However, the PT and HT have the least impact on the sustained adoption of industry 5.0 tecnology.

Table 7: Sensitivity analysis for model 1

Neural Networks	performance expectancy	social influence	Habit	hedonic motivation	price value	perceivedthreat
1	0.204	0.183	0.127	0.119	0.231	0.136
2	0.225	0.214	0.08	0.215	0.161	0.106
3	0.245	0.147	0.13	0.182	0.197	0.98
4	0.367	0.184	0.115	0.134	0.114	0.87
5	0.321	0.162	0.104	0.115	0.205	0.94
6	0.212	0.106	0.24	0.27	0.236	0.152
7	0.375	0.137	0.104	0.092	0.222	0.69
8	0.379	0.960	0.131	0.123	0.136	0.134
9	0.356	0.870	0.127	0.136	0.222	0.71
10	0.280	0.151	0.098	0.196	0.172	0.103
Mean importance	0.2964	0.3114	0.1256	0.1582	0.1896	0.4821
Normalized importance (%)	96.67	51.44	34.9	87.65	65.29	36.56
Ranking	1	4	6	2	3	5

Table 8: Sensitivity analysis for model 2

Neural Networks	perceived severity	perceived susceptibility
1	0.489	0.511
2	0.399	0.601
3	0.405	0.595
4	0.410	0.590
5	0.443	0.557
6	0.437	0.583
7	0.501	0.499
8	0.365	0.635
9	0.488	0.512
10	0.358	0.642
Mean importance	0.4295	0.5725
Normalized importance (%)	76.54	99.96
Ranking	2	1

5.6 Discussion

According to the ten (10) proposed determinant of industrial 5.0 revolution, the research study identified that they all have a significant influence in its revolution. Performance expectancy and effort expectancy have a positive influence in the industrial 5.0 revolution and this align to the findings of Khatibi, et al (2019). This implies that, technological conditions have a great impact on how these revolutions are shaped. There is need for a great technological integration and infrastructure development, since most countries stated exporting technology to those who are behind industrial 5.0 economic revolution. This revolution as increased collaboration between smart systems and humans as pointed out by the determinant factors. According to Draghici,(2019) industrial 5.0 revolution is more scalable and people concern than other previous one by having more technology at its disposal. It has also solved the issues of removing human workers from different processes and made application of machines and technology. Industrial 5.0 as transformed economic sustainability among production efficiency and production risk and work place safety. The study has shown that technology resources, teamwork and external support significantly influence industry 5.0 adoption in order to reap economic sustainability. The study has provided valuable recommendations for practitioners, that there is need to focus on developing more technology infrastructure, flexibility and collaborative and from capability and trustworthy team capable of implementing digital transformation and enable make nation sustainable. Through the analysis provided more future research directions can also be identified and predictions done on how industry 5.0 will impact the manufacturing landscape in future. Countries need to simultaneously acquire new technologies capabilities to enable increase their control over populations that is based on pervasive surveillance systems and having and ability to influence digital infrastructure.

5.6.1 Performance expectancy on industry 5.0 adoption

The research shows how Performance Expectancy helped bring about the Industrial 5.0 transformation. As defined by (Venkatesh et al. 2003), "Performance Expectancy" describes an employee's confidence in a system's ability to improve their productivity on the job.

Other variables have had a significant effect in addition to Performance Expectancy. For instance, anticipating of future technologies has been a motivating factor in the field of technological expectation (Ghalandari,2012). Industrial output is expected to increase as a result of the optimistic anticipation that forthcoming innovations would provide even more benefits (Schwab, 2016). The advancement of the Industrial 5.0 revolution may be traced back to this optimistic outlook, which encourages investment in technical innovation.

That new technology, procedures, and systems will boost productivity in the workplace and in industry is a central tenet of the Industrial 5.0 revolution.Understanding that improved technology interfaces and the use of artificial intelligence may simplify processes, minimize human error, and raise productivity is central to the relationship between Performance Expectancy and the Industrial 5.0 revolution (Chui et al., 2018). As a consequence, there has been a change in perspective, with both employees and managers in industrial settings becoming confident in these technologies' ability to boost productivity.

5.6.2 Effort expectancy on industry 5.0 adoption

Another crucial factor that has played a major influence in Industrial 5.0's spread is the concept of effort expectancy. The term "user friendliness," as defined by (Venkatesh et al.2003), refers to how little work is necessary to use a piece of modern technology. Workers are more inclined to accept technology that they feel will complement their job efforts without needing considerable training or exertion in the setting of Industrial 5.0.

The advancements in artificial intelligence, machine learning, and cyber-physical systems that characterize the so-called "Industrial 5.0" revolution are all geared at improving the efficiency and effectiveness of manufacturing operations by extending the capabilities of humans. Workers' perception of these technologies as instruments that improve job performance without incurring substantial extra effort or needing extensive training periods is crucial for their widespread adoption.

The perceived ease of use of a technology is just as essential as the technology's real utility in deciding its adoption, as shown by the idea of Effort Expectancy (Davis, 1989). Employees may be resistant to adopting new technology, even though it may improve their work lives, if they perceive that it is too complicated or too time-consuming to learn and use.(Prassida and Asfari 2022) corroborate this idea by noting that employees are more likely to adopt technology that need little to no extra training or effort on their part.

This is why, in the age of Industrial 5.0, it is essential for new technologies to include user-friendly designs and straightforward interfaces. Companies and developers of new technologies are spending a lot of time and money making their products intuitive and simple to use (Nielsen, 2012).

In addition, the importance of training and support systems in decreasing the perceived effort involved in adopting new technology cannot be emphasized. (Compeau and Higgins1995) found that employees were more receptive to new technologies when they were provided with thorough training programs and excellent technical assistance.

Finally, in the context of the Industrial 5.0 revolution, Effort Expectancy is a critical factor in technology adoption. Companies may increase the likelihood that their employees will embrace new technologies that increase productivity and efficiency by making such technologies intuitive and simple to use.

5.6.3 Social influence on industry 5.0 adoption

Adoption of the Industrial 5.0 revolution may be attributed in large part to social influence. Social influence, as defined by (Venkatesh and Davis 2000), is the extent to which a person believes that influential individuals think they should adopt a new system. It focuses on how peer pressure might influence how people embrace new technologies. Colleagues, superiors, industry trends, and even regulatory authorities are all possible social influences in the context of Industrial 5.0. In an industrial setting, these larger societal issues typically play a role in determining whether or not new technology will be adopted.

An employee may feel obligated to accept and utilize new technology if they believe their superiors and peers also see the value in doing so (Fishbein & Ajzen, 1975). This fits with the findings of the Theory of Reasoned Action, which posits that people's actions are shaped by their expectations of how others would react.

Market tendencies have an outsized impact on contemporary culture. In order to stay competitive, some organizations may feel compelled to embrace new technology when their industry peers do so. This is consistent with (Rogers's 2003) theory of the diffusion of innovations, which describes how an idea or product spreads across a population or social system over time.

5.6.4 Facilitating conditions on industry 5.0 adoption

Companies that have been adapting to technology developments and have a competent workforce are more likely to participate in the Industrial 5.0 revolution. This is because these businesses already possess a number of the enabling circumstances essential for technological innovation to flourish, including a tech-savvy staff and a solid foundation for future technological growth.

One of the most important enabling conditions is the presence of sufficient resources. Physical resources for implementing and maintaining these technologies are also included in this category (Zhou, Lu, & Wang, 2010). Organizations more prepared for the Industrial 5.0 transformation have the financial means to purchase the newest technologies, acquire the appropriate equipment, and recruit or educate personnel to handle these technologies.

The availability of a competent labor force is also critical to creating favorable circumstances. Artificial intelligence, machine learning, and cyber-physical systems are just some of the cutting-edge technology that will need to be handled by a trained workforce in order for Industrial 5.0 to be a reality. Therefore, businesses that employ people with strong technical skills are in a better position to embrace and reap the benefits of the Industrial 5.0 revolution (Bessen, 2019).

Adoption of Industrial 5.0 is influenced in part by the availability of technical assistance. When transitioning to new technologies, having access to trustworthy technical assistance may help minimize disruptions and speed up problem resolution (Venkatesh & Bala, 2008).
Finally, the culture and leadership of a company may serve as enabling circumstances. Successfully adapting to Industrial 5.0 requires an organization to have a culture of innovation and to have leaders that advocate for the adoption of new technologies (Büchi, Just, & Latzer, 2020).

5.6.5 Habit on industry 5.0 adoption

According to this theory, individuals are more likely to accept new technologies and procedures if they are consistent with their present routines and the ones they are already familiar with.
Workers who are already comfortable using technology into their daily tasks may be more receptive to the new technologies being introduced as part of the Industrial 5.0 revolution. They may be more likely to accept a new technology because of their familiarity with it (Venkatesh et al., 2012).
People are more inclined to embrace new technology if they believe that doing so would be a natural extension of their current routine at work. For instance, if a machine operator is used to seeing production metrics on a physical dashboard, they may be more inclined to accept a digital dashboard if it displays this data in a manner consistent with their previous experience (Wood and Neal, 2007).
In conclusion, habits, coupled with privacy and security concerns, play a major role in determining how widely the Industrial 5.0 revolution will be adopted. Therefore, it may be important to understand these characteristics and build technologies that correspond with current behaviors and handle privacy and security concerns in order to encourage the

widespread use of Industrial 5.0 technologies.

5.6.6 Hedonic motivation on industry 5.0 adoption

The enjoyment one receives from making use of a technological device is what is meant by "hedonic motivation." In the context of Industrial 5.0 (Venkatesh et al. 2012), this indicates that "technological enthusiasts" are more inclined to accept the advancements linked with this revolution.

Personalized, human-centered manufacturing and the incorporation of cutting-edge technologies like AI, ML, and cyber-physical systems are hallmarks of the fifth industrial revolution, often known as Industrial 5.0. Adopting such cutting-edge technology may be inherently motivating for people who love interacting with new technologies and finding enjoyment in exploring their potential.

Individuals actively seek out media and technologies that meet their wants and desires, according to the Uses and Gratifications Theory (Katz, Blumler, & Gurevitch, 1973), lending credence to the role of Hedonic Motivation in technology adoption. Even in a business setting, a technology's popularity may be influenced by how much its users like working with it. As various studies (Hassenzahl, 2004; Van der Heijden, 2004) have shown,hedonic motivation may be a strong driver of technological adoption, this makes sense.

Hedonic Motivation may be more or less influential in the context of technology adoption depending on individual qualities as technical self-efficacy, risk inclination, and openness to experience.(Agarwal and Prasad ,1998) and (Venkatesh and Bala, 2008) found that people who are open to new experiences and have a high level of technological self-efficacy(the belief that one can perform tasks using technology) are more likely to adopt new technologies.

5.6.7 Price value on industry 5.0 adoption

When thinking about implementing the new technologies of the Industrial 5.0 revolution, the notion of Price Value is crucial. Price Value is the consumer's mental trade-off between the perceived advantages of the apps and the monetary cost of utilizing them, as described by (Venkatesh et al. ,2003) in the Unified Theory of Acceptance and Use of Technology (UTAUT). This suggests that the likelihood of adoption of new technology increases when the perceived advantages exceed the costs.

The cost of investing in new technologies is often weighed against the possible advantages, such as higher productivity, efficiency, and product quality, in the context of Industrial 5.0. Organizations are more inclined to embrace new technology if they believe the benefits will more than compensate for the initial investment and recurring maintenance fees.

Artificial intelligence, machine learning, and cyber-physical systems are all examples of Industrial 5.0 technologies that may help businesses save money in the long term by improving their operational efficiency, cutting down on waste, and making more informed decisions. The initial investment in such technologies, however, may be substantial due to the time and money needed to teach employees to make the most of them (Brynjolfsson & McAfee, 2014).

The Economic Theory of Innovation (Schumpeter, 1934) provides support for the idea of Price Value by positing that businesses are more willing to embrace innovations when they anticipate financial gains from doing so. Many research on technology adoption have revealed that the perceived economic benefit is a strong predictor of adoption (Tornatzky &

Klein, 1982; Rogers, 2003), and our conclusion is consistent with those findings.

5.6.8 Perceived severity on industry 5.0 adoption

In this context, "Perceived Severity" may allude to the unfavorable outcomes that a company may experience if it does not employ Industrial 5.0 technology. The loss of a competitive edge, inefficient operations, dissatisfied customers, or dwindling profits are all possibilities. Businesses may be more eager to invest in Industrial 5.0 solutions if they believe the ramifications would be severe (Kim & Kankanhalli, 2009).

Financial investment, employee training, and time are only some of the resources needed to implement new technologies like those linked with the Industrial 5.0 revolution. However, the expenditures and labor connected with the change might be justified if the perceived severity of not embracing these technologies is great enough. This idea is consistent with the basic economic theory of cost-benefit analysis, which states that an action should be conducted only if the benefits justify the costs (Boardman et al., 2018).

Several variables may affect how severe an issue is seen by an organization, including its external environment, its strategic objectives, its industry, and the experiences of other businesses that have adopted comparable technology (Tornatzky & Fleischer, 1990). For instance, the perceived severity of not adopting Industrial 5.0 technology may be greater in highly competitive environments than in less competitive areas.

5.6.9 Perceived susceptibility on industry 5.0 adoption

If a company does not adopt the new technology and processes connected with the Industrial 5.0 revolution, they may fear falling behind the competition, losing market share, lowering profits, or becoming obsolete. The potential of such unfavourable results may encourage businesses to embrace the Industrial 5.0's related technologies and ideas (Chau & Tam, 1997).

This idea is consistent with the Prospect Theory (Kahneman & Tversky, 1979), which proposes that the perception of possible losses might impact decision-making, especially in uncertain situations. The risk here is in ignoring the technologies key to the forthcoming Industrial 5.0 renaissance.

The pace of technological development in an industry, the organization's history with adopting new technologies, and the experiences of other companies in the field are all elements that might affect the perception of vulnerability (Chatterjee, Grewal, & Sambamurthy, 2002). For instance, a company's perceived vulnerability to bad consequences from not embracing new technologies may be larger if it is in an area where technology advances fast.

5.6.10 Economic sustainability on industry 5.0 adoption

Economic sustainability the approach of economic sustainability presupposes some basic of what to be sustained more it is specific and detailed on the description of what to be preserved, it is harder to as a result of guaranteed danger of overspecification. Support the path coefficients. This makes it statistically significant.

Industrial 5.0 as brought innovation and mostly the acceleration of the development of industrial technologies in attractiveness of employments processes in fully automated production, especially for young people in search purpose and sustainability. To build more sustainable technologies workplaces through digitization. The key element of economic sustainability in industrial 5.0 is the environmentalization friendly technologies, friendly products and the use of best practise of environmental management.

The use of artificial intelligence (AI) and machine learning (ML) in manufacturing processes is one example of how perceived susceptibility might relate to Industry 5.0. Someemployees may view these technologies as a threat to their employment and fear being replaced by automation. However, if businesses can demonstrate that AI and ML can improve their job performance and make their work easier, they may be more likely to accept and adopt these technologies.

The adoption of Industry 5.0 is crucial for achieving economic sustainability is a critical component of Industry 5.0, which seeks to balance economic growth with environmental and social considerations. In this context, economic sustainability can refer to the ability of organizations to maintain financial viability while also achieving environmental and social goals. This can involve developing new business models, products, and services that are more resource-efficient and socially responsible, as well as optimizing processes and supply chains to minimize waste and emissions.

6 CHAPTER SIX

6.1 Key findings

This research work was based on achieving the objectives and stated research questions. The research questions wanted to understand the impact of industrial 5.0 revolutions. The choice of identified constraints: Performance expectancy, effort expectancy, social influence, facilitating conditions, Habit, Hedonic motivation, Price value, Perceived severity, Perceived susceptibility and economic sustainability enabled understand and meet the research objectives. The result obtained from the filled questionnaires showed that respondent reached the highest at 80%. The level of performance expectancy, effort expectancy and facilitating conditions associated with industrial 5.0 revolution was at the highest. With issue of performance expectancy, most of the people are yet to benefit fully with increase in industrial 5.0 revolution. In addition, from the point of respondent, the level of infrastructure that should assists in development of industrial 5.0 should be increased. This perception has brought about a high level of adoption. Effort expectancy has been equitable to the concept of what to be used by ta participants i.e. what exactly people feel about technology that is easy to use. The adoption may vary across the culture and behaviour differently around the globe. The analysis from survey questionnaire from 363 participants (received response) found that effort expectancy influences the behaviour intention to use technology. So, it is considerable factor for industrial 5.0 revolution and people will adopt it if they feel technology involved is easy to use. Considering the importance of social influence, the participants demonstrated their support for industrial 5.0 revolution and shared their experience with other for more motivations to enable much adoption. The research work also found hedonic motivation as being an important tool that enabled adoption of this revolution through various interaction. To enabled people, adopt to this revolution, there is also a need to be concerned about the information being received to be correct and accurate. The set policies and procedure need to be followed to enable proper dissemination of this information and interaction.

This research work confirmed that Price value had a positive relationship with participants. It was hypothesized that price value affects industrial 5.0 revolution participants and their use. Low cost or sensible interaction affect the intention to use or adopt industrial 5.0. Better rating is linked to greater willingness to accept this revolution.

6.2 Theoretical contributions

Our research study has offered several contributions that have provided understanding of industrial 5.0 revolution. First, this study as looked on the literature review of various research and found that the mentioned determine contribute to industrial revolution in various capacities. Its finding has confirmed that determinant factors like performance expectancy and effort expectancy play an essential role in shaping the impact of industrial 5.0 revolution. The research work has identified that although effort expectancy, social influence and hedonic motivation are highly rated globally, and facilitation conditions, habit and perceived threats are different in many countries. Other than determinant factors, personal issues may affect the revolution of industrial 5.0 among workers. This research has shed light on unexplored area of study which issues associated sustainable use of industrial 5.0 revolution. This has added a significant value to both theories in general and technologies in specific.

Second, the unified theory of acceptance and use of technology was integrated and enabled better understanding of determinants of industrial 5.0 revolution as it has been determinants by empirical findings in this study. It is also good the research work has pinpointed out that, the determinant factors contribute much on shaping industrial revolution provided that the information disseminated to the user is accurate and effective.

Although, mostly effort expectancy, hedonic motivation and social influence have been identified that their level is low and different among others.

Finally, the study has shed light on an explored areas of industrial revolution on which other researcher can make a great contribution.

6.3 Practical implications

The finding of this research work has offered valuable implications hence enabling developers to make concrete decision and successfully promote industrial 5.0 revolution. First, the determinant factors make it intense in the first initial stage of adoption, and to be able to encourage more people to embrace industrial 5.0 revolution through performance expectancy. The research study found that hedonic motivation is a very crucial drive in first initial of industrial revolution. The industries should make sure that enabling technologies and infrastructure are in good place and proper ways of improving skills to be adopted which avoid user complications

Second, there is also a substantial implication in most management as should adopt to digital culture in their industries as necessary. Industrial 5.0 as also contributed to economic sustainability. The finding also showed a significant relationship between Habit and industrial 5.0 revolution. It was seen to be a driver of behaviour and most people adopt to changes which align to this behaviour. The privacy and security elements can make individual also consider using a certain technology associated with industrial revolution which they believe can be more secure.

Third, most user are very keen to check on the ways determinant factors affect their influence of the choice of industrial 5.0 revolution and there is need to develop a compressive information sharing that can create impact on economic sustainability. To achieve economic sustainability in Industry 5.0, organizations need to use a variety of strategies. This can involve developing new business models, products, and services that are more resource-efficient and socially responsible, as well as optimizing processes and supply chains to minimize waste and emissions.

Fourth, the industrial 5.0 revolution represents some exclusive limitations and responses for instance high price in manufacturing policies, legalization in all exclusive policies to enable preclude any thought full problems within the society perspective, digital technology and business at large.

6.4 Limitations and future work

This research work has some limitations which have provide a suggestion for future study. The sample of research work was limited to 200 participants in a specific geographical location. More work can be expanded to involve other geographical locations because industrial 5.0 revolution its spreading worldwide. The measurement and structural models brought about the influential determinants of industrial 5.0. The study also focused on the theoretical construct rather than practical skill by the participant which opened opportunities for future researchers.

Second, this study was limited to management level especially in the private sector as most of them did participate in the questionnaires send through the emails. It will be worthwhile if this work can be extended to those in public sector and other countries.

Third, our research used quantitative method of analysis that is based on survey data to examine participants responds and their perception on industrial 5.0 revolution. Future works can use qualitative analysis approach to enable develop a richer understanding on how and why all the people attitudes and intentions are influenced.

Fourth, this research work used PLS-SEM to understand the hypothesis based on each predictor and their independent effect on an outcome, the variable examined may contain complex or configurations for multiple conditions. Therefore, future research could be done to examine this configuration of multiple conditions, and develop a complementary understanding of configurations pathways to the adoption of industrial 5.0 revolutions.

6.5 Conclusion

This work introduced a survey-based understanding of people perception towards industrial 5.0 revolution. It was noted that, it is a hypothesis that has been designed to enable harmonise the employed circumstances and efficiency of machines and humans in consistent manner, authorized by a diversity of evolving technologies that support industrial

This revolution is expected to increase customer satisfaction, people usage and manufacturing production. A number of limitations have been presented in section above that need to be handled to better realise the concept of industry 5.0.

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