International Journal of
Technology and Systems
(IJTS)

THE ROLE AND OPPORTUNITIES OF INSURANCE IN ROBOTICS INDUSTRY

Dr. Ben Kajwang PhD

IPRJB
INTERNATIONAL PEER REVIEWED JOURNAL AND BOOK PUBLISHING

International Journal of Technology and Systems

ISSN 2518-881X (Online)

Vol.7, Issue 1, No.6, pp 89-100, 2022

www.iprjb.org

THE ROLE AND OPPORTUNITIES OF INSURANCE IN ROBOTICS INDUSTRY

Dr. Ben Kajwang PhD, ACII(UK), AIRM(UK), FIIU, FIIK, CPT, Chartered Insurer
Chief Executive Officer, College of Insurance, Nairobi, Kenya
Corresponding Author Email: bkajwang@coi.ac.ke

Abstract

Purpose: The study examined the role and opportunities of insurance in robotics industry.

Methodology: The research methodology used in this study was based on a critical literature review of available studies on insurance and robotics industry in different countries across the world. This research method was preferred since it is quite reliable, cost-saving and time-saving as compared to primary research methods. This study relied more on online journals, articles and published work from libraries since they provide easy access to secondary information/data.

Findings: Generally, the researcher noted that most of the studies failed to explain the role of insurance in the robotics industry but emphasized more on the opportunities of insurance in the robotics industry. The results revealed that the reviewed studies had conceptual and contextual gaps. This is because some studies discussed on a specific line of insurance firm or a different firm other than insurance but has adopted the digital innovations in the robotics industry. While other studies discussed more on the effects or impacts of application of RPA in the insurance firms which is a resultant outcome or benefit but failed to clearly outline the role and opportunities of insurance in the insurance industry.

Unique Contribution to Theory, Practice and Policy: This study will be of great importance to the management teams in the insurance industry by providing good insights on the available opportunities in the robotics industry that insurance firms can benefit from. On the other hand, policymakers in the insurance sector will be benefit from this study since it explains on the key role that policymakers and insurance regulatory authorities play in the adoption of RPA in the insurance firms. This will help them in implementing better policies that promote technological developments in the insurance sector. Further, the study will also be of academic value to the researchers and scholars by adding more insights to the knowledge base of insurance and robotics industry since its generally still scarce. The identified research gaps from the reviewed studies will also motivate the researchers and scholars to carry out more studies on insurance and robotics industry. Specially on the role of insurance in the robotics industry which stood out as the main research gap in this study

Keywords: *Role and Opportunities, Insurance, Robotics Industry*

International Journal of Technology and Systems

ISSN 2518-881X (Online)

Vol.7, Issue 1, No.6, pp 89-100, 2022

www.iprjb.org

INTRODUCTION

The global business environment has continued to rapidly grow and develop as a result of creative innovations and inventions in technology that continue to enhance efficiency in all business operations (Goel & Gupta, 2020). The new innovations and inventions in technology have also provided solutions to some of the challenges affecting businesses across the world. The use of robotics is one of the creative inventions that has provided fast operating solutions to large industries especially in the manufacturing sector that heavily depend on machines for production of goods (Tantawi, Sokolov & Tantawi, 2019). According to Leigh and Kraft (2018), robotics is the technology that deals with designing, construction, operation and use of robots in automation. Doyle Kent and Kopacek (2020) also simply defines robots as automatic machines that are programmed by a computer to increase productivity, reduce risks to human beings and improve product quality. A robot can also be defined as an autonomous machine capable of sensing its environment, carrying out complex computations to make decisions, and performing a series of actions at once (Eric, Geuna, Guerzoni & Nuccio, 2018).

The use of robots has had both positive and negative impacts on the social and business environment. The use of computers, laptops, tablets, phones and other communication gadgets that are built by robots has significantly improved communications across the world (Pagliarini & Lund, 2017). According to a report by the RoboHub online (2014), a significant impact of robots has also been felt in the fields of drones, prosthetics and exoskeletons, artificial assistants and self-driving cars. Thus, developed countries such as China have increased robot installations by employing over 154,000 industrial robots, followed by Japan employing over 55,200 industrial robots and US employing over 40,300 industrial robots. Goel and Gupta (2020) noted that US had increased its robot installations for the eighth consecutive year.

In the human labour, robots have been highly considered so as to reduce risk of injury to humans when working in dangerous environments such as the industrial and manufacturing sectors. In addition, robots are more efficient and precise than humans hence implementing robots in the workplace can help eliminate most of the human errors (Goel & Gupta, 2020). On the other hand, businesses can save on time and cost effectiveness since robots can complete work that may take humans, months or week in one day and produce high quality products. High quality products lead to higher sales, increased demand among customers and more profits to the business (Iqbal, Khan & Khalid, 2017). Therefore, this means that businesses which have invested in the use of technology like robots are able to gain competitive advantage against their competitors.

According to Akkor and Ozyukse (2020), the most significant advantage of use of robots in the insurance sector is its potential to reduce workers' compensation payouts. They typically save workers from repetitive strain and other injuries by automating dangerous tasks. As a result, this helps to reduce the risk of a workers' compensation claims. A survey by InsurTech (2019) revealed that the cost of a workers' compensation claim was $ 41,003 on average between the year 2017

and 2018. Therefore, insurance organization can save on such labour costs by automating the high risk business tasks and this in turn also creates a safe environment for employees to work.

Further, many industries are investing in robots since they make the workplace safer to work at anytime (Mulumbi, 2021). However, in circumstances where the robots used are malfunctioning or improperly programmed they can quickly cause significant damage of property, critical injuries or even death to the human co-workers who work alongside these robots (Javaid, Haleem, Singh & Suman, 2021). Therefore, considering such risks caused by robots used in industries and in some homes, insurance companies have tapped into this opportunity by searching for the best insurance covers that can help reduce the risks posed by use of robots. Pradhananga, ElZomor and Santi Kasabdji (2021) indicated that some of the risks that affect the robotics industry include; property loss, cyber-attacks, product failure, human error and liability risks.

In the case of property loss, insurance companies provide property insurance that covers for damage to tangible properties such as high-end equipments, office equipments etc. To ensure that property insurance also provides compensation for any property damage caused by robots, insurance underwriters will have to keep up with the ever-changing innovations in robots and accommodate the growing needs (Bohnert, Fritzsche & Gregor, 2019). Under liability risks, the major concern has been on professional liability which occurs when a third-party company or individual claims that a robotic company has caused them financial loss or in case a product malfunctions. To cover for such risks, insurance companies have chipped in to provide errors & omissions insurance to cover the legal costs especially when faced with complex litigations (Bertolini et al., 2016).

The challenges of cyber-attacks has been a major concern in robotic companies since they heavily rely on technology in almost all its operations. The robots have become vulnerable as humans try to program the machines to suite their needs (Iqbal, Khan & Khalid, 2017). Moreover, cybercriminals have also managed to execute sophisticated multi-tiered attacks to infiltrate the company's network and leak out confidential information of companies. This has resulted to third-party lawsuits, fines and penalties from regulators (Christoforou et al., 2020). To cover for such risks and costs, insurance companies provide cyber insurance that protect robotic companies from third-party lawsuits relating to electric activities such as phishing scams. On the other hand, they protect against financial loss, reputation damage, covers for forensic investigation and data recovery (Javaid, Haleem, Singh & Suman, 2021).

According to Lamberton, Brigo and Hoy (2017), the new technological developments in robotic companies provide better opportunities for insurers to increase premiums on the various insurance claims. Increase in premiums results to increase in profits and significantly improves the performance of insurance companies. However, the main challenge that insurers have been experiencing is identifying what kind of technology makes a difference in terms of risk. In addition, underwriters without meaningful data on the technological developments encounter extra costs on premiums since they lack historical references (Akkor & Ozyukse, 2020). Thus, it is important that underwriters carry out thorough research and analysis on technological

developments and how best to categorize them depending on their risk level so as to allocate the right premium pricing and maximize on their profits (Bohnert, Fritzsche & Gregor, 2019).

Statement of the Problem

As the adoption of robotics continues to increase in various industries across the world, the robotics industry has continued to expand and this has provided numerous opportunities that the insurance companies can navigate into. The production and maintenance of robots requires high capital investment by the robotic companies hence the need for insurance coverage in case of accidents or damages. In addition, there has also been new technological developments every now and then so as to improve the efficiency of robots in carrying out various operations. Insurance companies have tried to tap into this opportunity by analyzing the risks level for each technological development so as to know the correct premium pricing. However, it's still quite unclear what kind of coverage applies to robots because the insurance sector has not yet caught up with the technological advancement of robotics. Because of these uncertainty, organizations can under-purchase or over-purchase insurance or hesitate to use robotics. In addition, most insurers have also noted that insuring of robots can create complex coverage considerations, where the different uses and peculiarities of robots could place it into many insurance coverage areas (Devarajan, 2018). For instance, Niraula and Kautish (2019) indicated that insurers that have carried out adequate research on robots and its technological developments can offer robot-specific insurance to cover around 700 risk classes. This is both to the manufacturers of robots and the adopters of these robots. Therefore, there is need for insurers and underwriters to carry out more research on robots and the technological developments so as to clearly define the risk classes and identify the correct premium pricing.

Studies on the role and opportunities of insurance in the robotics industry are very scarce. Some of the studies that may guide this study include; Willcocks, Lacity and Craig (2017) study on Robotic process automation, strategic transformation lever for global business services, Christoforou et al (2020) study on the upcoming role for nursing and assistive robotics: Opportunities and challenges ahead and Bertolini et al (2016) study on risk management of robotic applications through insurance contracts. However, none of these studies have extensively discussed on the role of insurance in the robotic industry especially the robot-specific insurance that insurance can provide to the robotic industry and other adopters of robots. Therefore, the purpose of this study is to discuss the role of the insurance in the robotics industry and the available opportunities that it has tapped into and future opportunities that it can tap into to provide better insurance coverage to the robotics industry.

Theoretical Review

Diffusion of Innovation Theory

The Diffusion of Innovation theory was first developed by Everett Rogers in 1962 (García-Avilés, 2020). This theory tries to explain how, why and at what rate new ideas and technology spread

within a population or society. It describes how new scientific, technological, and other developments spread throughout communities and cultures before being widely accepted (Kee,

2017). According to Kreps (2017), Rogers explained five factors that influence the spread of a new idea or technology. They include; the innovation, adopters, communication channels, time and social system. He argues that an innovation relies heavily on social capital for it to self-sustain itself over a long period of time. The communication channels used and the social system which consist of a mix of rural-urban population, society's level of education and the extent of industrialization and development in certain area contributes to the widespread adoption of an innovation (Kee, 2017).

In addition, Hains and Hains (2020) also noted that adoption rates vary depending on the type of innovation and this is commonly influenced by the cost, accessibility, convenience, reliability and familiarity with the innovation. For instance, adoption of Information and Communication Technology (ICT) was faster as compared to the adoption of automobiles across many countries in the world. This is as result of the significant transformation it has caused in the business industry (Raynard, 2017).

Rogers further explained that adopters of innovation can be categorized into five groups including, innovators, early adopters, early majority, late majority and laggards (Benhabib, Perla & Tonetti, 2021). Innovators are risk-takers who are open to try new ideas while early adopters are those who are willing to try out new technologies and determine their value to the wider community. On the other hand, the early majority are a set of people who lead the way for the adoption of an innovation in the entire population while the late majority are the set of people within a population who imitate the early majority in incorporating new technologies into their daily operations. Lastly, the laggards are described as risk-averse individuals that are rigid to adoption of innovation (Dearing & Cox, 2018).

According to Dube and Gumbo (2017) this theory is oftenly used by companies to promote the adoption of their products, where they focus on identifying the innovators and early adopters who are willing to try out the new ideas then they use them as the main audience to attract other customers. Therefore, this theory will be applicable to this study as we try to identify the role and opportunities that the insurance industry can benefit from the robotic industry. In this case, the insurance industry is considered as an early adopter to the robotics industry.

LITERATURE REVIEW

A study by Willcocks, Lacity and Craig (2017) investigated on the potential application of robotic process automation (RPA) into human resource function (HR) and global business service (GBS) operations in the London insurance market. The study noted that implementation of RPA in the HR functions will improve the business service provider Xchanging that is oftenly used in the back office operations of insurance companies in London. The findings of the study revealed that the use of RPA will help in automating most of the HR tasks that are repetitive such as employee onboarding process, employee data management, payroll management and applicant sourcing and

tracking. In addition, the results also indicated that implementation of RPA in HR functions and GBS operations will significantly increase productivity, efficiency and flexibility of employees in the insurance companies. It will also have a positive impact on the Return on Assets (ROA) and Return on Investment (ROI) in insurance companies.

A study by Bertolini (2016) sought to examine the risk management of robotic devices by insurance companies in France. The study targeted the risk managers in the insurance companies. The study also employed descriptive research designs to collect data from the risk managers. The findings of the study revealed that the main causes of accidents from robotic devices included; unexpected robot behavior, human errors and unexpected software problems. The study also found that accidents from robotic devices ranges from slight injuries to fatal injuries depending on the cause. To mitigate such problems, the study found that insurance companies provide occupational health and safety insurance covers to the users of robots. The study recommended that insurance companies should develop adequate legal frameworks and innovative risk management solutions to insure and protect robotic devices against accidents or damage.

Patil et al (2021) study sought to determine the impact of adoption of RPA in vehicle insurance fraud detection systems in the insurance sector in India. The study targeted the auto insurance companies in India and used questionnaires to collect data. The study also used the Linear Discriminant Analysis (LDA) to analyse the data collected. The results of the study revealed that the use of RPA in the insurance sector facilitates easy collection of policyholder's details, essential information from previous years' claims documents, therefore allowing the insurers to settle insurance claims seamlessly. In addition, RPA also helped in automation of most of the tasks carried out by the vehicle fraud detection systems so as to improve their accuracy to classify an insurance claim as fraud or legitimate. As a result, the time period used in the claiming and appealing processes reduced and this improved the efficiency of the entire process. The study recommended that the insurance sector should also consider integrating Machine Learning (ML) techniques besides the RPA when analyzing the insurance claims.

A study by Hallikainen, Bekkhus and Pan (2018) examined the impact of internal RPA capabilities on offering services to clients in OpusCapita service provider in Europe. The study discussed on the successful implementation of a strong internal RPA capability and how it extended its operations to providing RPA services to clients. The strong internal RPA has enabled the OpusCapita to provide essential invoicing solutions and advanced procurement services to large and medium sized companies in Europe. The findings of the study revealed that the use of RPA in procurement and supply-chain processes has increased the invoice automation level, the invoice volumes that employees can handle, invoice approval flows and better management of the Accounts Receivables and Account Payable accounts. Moreover, the internal RPA capabilities have had a significant impact on the ROI in OpusCapita company.

Another study by Kirchmer and Franz (2019) discussed the opportunities and challenges of applying RPA as process improvement approach. The study used the value-driven approach to identify the opportunities and try to address the challenges of adoption of RPA in business

processes. The results of the study revealed that the value-driven approach assisted in outlining the right sub-processes in a business that need to be automated, emphasized on the use of end-to-end processes so as to improve business processes and use of appropriate governance and hybrid workforce management to promote business sustainability. Therefore, the study concluded that value-driven RPA is subset of the process-led approach to managing digital transformation that uses business process management (BPM) to quickly and safely realize the full potential of digital initiatives.

Devarajan (2018) conducted a study to analyze the effect of RPA application in the various industries in California, USA. The study noted that automation of the manual back office processes in insurance industries improved the business processing analytics and promoted a rapid customer growth. The use of RPA has provided solutions to most of the problems that insurance firms has experienced for a long period of time. This is by automating the extraction of data process from the database of customers which has significantly improved the claiming and appealing processes and underwriting processes. As a result, this has enabled insurers and underwriters to make fast and better decisions and has increased their competitive advantage over their competitors in the other financial institutions.

A study by Pillay and Njenga (2021) examined the insurance company opportunities for reducing expenses through digital innovation in South Africa. The study targeted all the insurance companies and used stratified random sampling technique to obtain a sample of 133 employees. The study used interview guides as the preferred data collection instruments. The study began by noting that insurance companies are among the companies that incur high overhead costs as a result of operational inefficiencies, which are often transferred to customers in form of premiums for insurance products. The findings of the study further revealed that most of the insurance companies were found to still rely on pre-digital methods to conduct most of their business operations. Therefore, the study recommended that insurance companies should adopt digital technologies, such as Artificial intelligence, Chatbot, Robotic Process Automation, Blockchain, and the Internet of Things into their business operations especially in underwriting claims, so as lower operational expenses and provide more affordable products and services to customers.

Another study by Modise (2019) sought to establish what are the factors that influence the success of employee reskilling in the implementation of automation, robotics and artificial intelligence in the insurance industry. The study conducted semi-structured interviews on 13 senior leaders within the selected insurance companies. The study also critically reviewed available studies that discuss on talent management and employee reskilling in the insurance sector. The findings of the study revealed that culture, structure of the organization, talent identification and management, psychological barriers and career management. The study suggested that implementation of automation, robotics and artificial intelligence provides the insurance with a better opportunity of creating efficient and required future skills and capabilities for the underwriters and insurers. The study also recommended that insurance companies should invest their resources to improve the

organizations' structure so as to accommodate the technological developments of robotics and artificial intelligence.

Mulumbi (2021) study investigated on the effects of digitalization on growth of life insurance firms in Kenya. The study targeted all the insurance companies listed in the Nairobi Securities Exchange. The study used the census sampling technique to obtain a sample size of 105 respondents. The analysis of the responses from insurers shows that the implementation of ICT on the insurance companies in Kenya is below the average. Additionally, it was discovered that while some facilities, such as SMS notification for premium transactions, policy and claim information, online premium payment and claim intimation, were implemented just above the average, others, such as online policy purchasing, viewing policy or claim information, and claim payments made directly to the claimant's bank account, were implemented below the average. The study noted that the insurance regulatory authority in Kenya had a significant influence on facilitating the digital transformation in insurance companies in Kenya. Therefore, the study recommended that should implement favorable legal policies to promote digital transformation. Moreover, insurance companies should adopt appropriate digital innovations such as use of robotics and artificial intelligence since they have a more significant impact on its essential operations.

RESEARCH METHODOLOGY

The research methodology used in this study was based on a critical literature review of available studies on insurance and robotics industry in different countries across the world. This research method was preferred since it is quite reliable, cost-saving and time-saving as compared to primary research methods. This study relied more on online journals, articles and published work from libraries since they provide easy access to secondary information/data.

RESULTS

The results of this study were categorized into various research gaps that the researcher identified from the literature review. The research gaps included; conceptual and contextual gaps.

Contextual and Conceptual Gaps

Generally, the researcher noted that most of the studies failed to explain the role of insurance in the robotics industry but emphasized more on the opportunities of insurance in the robotics industry. A study by Hallikainen, Bekkhus and Pan (2018) was found to have contextual gaps since it discussed on the RPA capabilities of the OpusCapita a service provider dealing with procurement and supply-chain services while the current study was on insurance companies. Other studies by Mulumbi (2021), Kirchmer and Franz (2019), Deverajan (2018), Patil et al (2021), Willcocks, Lacity and Craig (2017) and Bertolini (2016) had conceptual gaps. This is because studies by Mulumbi (2021) and Patil et al (2021) discussed on a specific type of insurance firm and studies by Kirchmer and Franz (2019), Deverajan (2018), Willcocks, Lacity and Craig (2017) and Bertolini (2016) discussed more on the effects or impacts of application of RPA in the insurance

firms which is a resultant outcome or benefit but failed to clearly outline the role and opportunities of insurance in the insurance industry.

CONCLUSIONS AND RECOMMENDATIONS

The study concluded that the role of the insurance sector in the robotics industry is to carryout adequate research on robots and technological developments so as to determine the best robot-specific insurance that can be offered to both the manufacturers and users of robots. This is essentially important since it will help to mitigate the risks that are associated with the production and use of robots or application of RPA. From the review of previous studies, this study also concluded that some of the opportunities in the robotics industry that insurance firms can tap into include; use of RPA in improving vehicle insurance fraud detection systems, reducing expenses, in employee reskilling and in automating the extraction of data process from the database of customers which can significantly improve the claiming and appealing processes and underwriting processes.

This study will be of great importance to the management teams in the insurance industry by providing good insights on the available opportunities in the robotics industry that insurance firms can benefit from. On the other hand, policymakers in the insurance sector will be benefit from this study since it explains on the key role that policymakers and insurance regulatory authorities play in the adoption of RPA in the insurance firms. This will help them in implementing better policies that promote technological developments in the insurance sector. Further, the study will also be of academic value to the researchers and scholars by adding more insights to the knowledge base of insurance and robotics industry since its generally still scarce. The identified research gaps from the reviewed studies will also motivate the researchers and scholars to carryout more studies on insurance and robotics industry. Specially on the role of insurance in the robotics industry which stood out as the main research gap in this study.

REFERENCES

Akkor, D. G., & Ozyukse, S. (2020). The effects of new technologies on the insurance sector: a proposition for underwriting qualifications for the future. *Eurasian Journal of Business and Management*, *8*(1), 36-50.

Benhabib, J., Perla, J., & Tonetti, C. (2021). Reconciling models of diffusion and innovation: A theory of the productivity distribution and technology frontier. *Econometrica*, *89*(5), 2261-2301.

Bertolini, A. (2016). Insurance and risk management for robotic devices: Identifying the problems. *Global Jurist*, *16*(3), 291-314.

Bertolini, A., Salvini, P., Pagliai, T., Morachioli, A., Acerbi, G., Cavallo, F., ... & Dario, P. (2016). On robots and insurance. *International Journal of Social Robotics*, *8*(3), 381-391.

Bohnert, A., Fritzsche, A., & Gregor, S. (2019). Digital agendas in the insurance industry: the importance of comprehensive approaches. *The Geneva Papers on Risk and Insurance-Issues and Practice*, *44*(1), 1-19.

Christoforou, E. G., Avgousti, S., Ramdani, N., Novales, C., & Panayides, A. S. (2020). The upcoming role for nursing and assistive robotics: Opportunities and challenges ahead. *Frontiers in Digital Health*, *2*, 585656.

Dearing, J. W., & Cox, J. G. (2018). Diffusion of innovations theory, principles, and practice. *Health affairs*, *37*(2), 183-190.

Devarajan, Y. (2018). A study of robotic process automation use cases today for tomorrow's business. *International Journal of Computer Techniques*, *5*(6), 12-18.

Doyle Kent, M., & Kopacek, P. (2020, September). Do we need synchronization of the human and robotics to make industry 5.0 a success story?. In *The International Symposium for Production Research* (pp. 302-311). Springer, Cham.

Dube, C., & Gumbo, V. (2017). Diffusion of innovation and the technology adoption curve: Where are we? The Zimbabwean experience. *Business and Management Studies*, *3*(3), 34-52.

Eric, E., Geuna, A., Guerzoni, M., & Nuccio, M. (2018). Mapping the evolution of the robotics industry: A cross country comparison.

García-Avilés, J. A. (2020). Diffusion of innovation. *The international Encyclopedia of media psychology*, 1-8.

Goel, R., & Gupta, P. (2020). Robotics and industry 4.0. In *A Roadmap to Industry 4.0: Smart Production, Sharp Business and Sustainable Development* (pp. 157-169). Springer, Cham.

Hains, B. J., & Hains, K. D. (2020). Community reaction towards social innovation: A discussion of Rogers' Diffusion of Innovations theory in consideration of community emotional response. *J. Int. Agric. Ext. Educ*, *27*, 34-46.

Hallikainen, P., Bekkhus, R., & Pan, S. L. (2018). How OpusCapita Used Internal RPA Capabilities to Offer Services to Clients. *MIS Quarterly Executive*, *17*(1).

Iqbal, J., Khan, Z. H., & Khalid, A. (2017). Prospects of robotics in food industry. *Food Science and Technology*, *37*, 159-165.

Javaid, M., Haleem, A., Singh, R. P., & Suman, R. (2021). Substantial capabilities of robotics in enhancing industry 4.0 implementation. *Cognitive Robotics*, *1*, 58-75.

Kee, K. F. (2017). Adoption and diffusion. *The international encyclopedia of organizational communication*, *1*, 41-54.

Kirchmer, M., & Franz, P. (2019, July). Value-driven robotic process automation (RPA). In *International Symposium on Business Modeling and Software Design* (pp. 31-46). Springer, Cham.

Kreps, G. L. (2017). Diffusion theory in integrative approaches. In *Oxford Research Encyclopedia of Communication*.

Lamberton, C., Brigo, D., & Hoy, D. (2017). Impact of Robotics, RPA and AI on the insurance industry: challenges and opportunities. *Journal of Financial Perspectives*, *4*(1).

Leigh, N. G., & Kraft, B. R. (2018). Emerging robotic regions in the United States: insights for regional economic evolution. *Regional Studies*, *52*(6), 804-815.

Modise, T. (2019). *Employee reskilling in the South-African short-term insurance industry with the implementation of automation, robotics and artificial intelligence* (Doctoral dissertation, University of Pretoria).

Mulumbi, A. (2021). *Effects of digitalization on growth of life insurance firms listed in the Nairobi Securities Exchange in Kenya* (Doctoral dissertation, Strathmore University).

Niraula, P., & Kautish, S. (2019). Study of The Digital Transformation Adoption in The Insurance Sector of Nepal. *LBEF Research Journal of Science, Technology and Management*, *1*(1), 43-60.

Pagliarini, L., & Lund, H. H. (2017). The future of Robotics Technology. *J. Robotics Netw. Artif. Life*, *3*(4), 270-273.

Patil, N. S., Kamanavalli, S., Hiregoudar, S., Jadhav, S., Kanakraddi, S., & Hiremath, N. D. (2021, June). Vehicle Insurance Fraud Detection System Using Robotic Process Automation and Machine Learning. In *2021 International Conference on Intelligent Technologies (CONIT)* (pp. 1-5). IEEE.

Pillay, C. P., & Njenga, J. K. (2021). Opportunities for Reducing Expenses through Digital Innovation: The Case of an Insurance Company. *The African Journal of Information Systems*, *13*(1), 5.

Pradhananga, P., ElZomor, M., & Santi Kasabdji, G. (2021). Identifying the challenges to adopting robotics in the US construction industry. *Journal of Construction Engineering and Management*, *147*(5), 05021003.

Raynard, M. (2017). Understanding academic e-books through the diffusion of innovations theory as a basis for developing effective marketing and educational strategies. *The Journal of Academic Librarianship*, *43*(1), 82-86.

Tantawi, K. H., Sokolov, A., & Tantawi, O. (2019, December). Advances in industrial robotics: From industry 3.0 automation to industry 4.0 collaboration. In *2019 4th Technology Innovation Management and Engineering Science International Conference (TIMES-iCON)* (pp. 1-4). IEEE.

Willcocks, L., Lacity, M., & Craig, A. (2017). Robotic process automation: strategic transformation lever for global business services?. *Journal of Information Technology Teaching Cases*, *7*(1), 17-28.