EXAMINING THE READINESS OF THE NAMIBIA COLLEGE OF OPEN LEARNING IN ADOPTING AUTOMATION TECHNOLOGIES FOR IMPROVED SERVICE DELIVERY

A THESIS SUBMITTED IN PARTIAL FULFILMENT REQUIREMENTS

OF

THE REQUIREMENTS FOR

THE MASTER OF BUSINESS ADMINISTRATION MANAGEMENT STRATEGY DEGREE

OF

THE UNIVERSITY OF NAMIBIA

BY

NGEENDINA SEM-TANGI NTINDA

200116851

MAY 2022

SUPERVISOR: DR. ELISHA WOYO (UNAM)

Abstract

The 4th industrial revolution is upon all industries operating in different sectors of the economy. An organisation aiming to remain competitive by delivering improved service is left with no choice but to embrace the 4th industrial revolution. The highest demand by NAMCOL's customers for services such as student registration, materials and other services leads to customers spending time in long queues yearning for service delivery. The study examined the readiness of the Namibia College of Open Learning in adopting automation technology for improved service delivery. Automation is one the elements for the 4.0IR together with internet of things, cloud computing, artificial intelligence and cyber physical systems.

In order to address the following research objectives: examining NAMCOL's infrastructure in place for adaptation to the 4.0IR, analysing the employees' skills towards adaption of 4.0IR at NAMCOL, determining the implementation status of automation at NAMCOL and analysing the challenges experienced by NAMCOL in adopting automation; interviews were conducted. The whole population for the study was sampled using a census method. The responses were analysed using Qualitative Data Analysis software (QDA). The responses revealed mixed views towards the objectives.

The study revealed that NAMCOL has started to embrace the automation technology but have to improve its infrastructure. The study further concludes that not all employees are at the same level that is required for automation. Additionally, the implementation of automation is moving at a snail's pace. Lastly, the study revealed that there are numerous challenges affecting adoption of automation, such as lack of funds, skills gaps and insufficient infrastructure.

The study made the following recommendations: that NAMCOL solicits for more funds, establish an e-library, partners with international educational institutions, provides more training to its employees to fill up the skills gap and aligns the strategic plan to fin in with the 4.0IR.

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATION

4.0IR	Fourth Industrial Revolution

AI	Artificial Intelligence
CBLC	Computer Based Laboratory Centre
COL	Commonwealth of Learning
ICT	Information Communication Technology
IoT	Internet of Things
LMS	Learning Management system
M2M	Machine to Machine
ML	Machine Learning
MoE	Ministry of Education
MOOC	Massive Open Online Courses
NAMCOL	Namibia College of Open Leaning
ODeL	Open Distance e-Learning
ODL	Open Distance Learning
QDA	Qualitative Data Analysis
SE	Secondary Education
TP	Tertiary Programme
TVET	Technical Vocational Education Training

ACKNOWLEDGEMENTS

The completion of this study is owed to different institutions and individuals. Firstly, I give my thanks to the almighty God for the protection, wisdom, guidance and opportunity to enrol in this course. Secondary, I am indebted to appreciate my lovely wife Simsolia Namene Ntinda, my little one Paulina Rejoice Amwaama and the whole family for their unwavering support and most of all for my wife's understanding as well as for permitting me to spend time on this study.

Thirdly, special thanks to my supervisor Dr Elisha Woyo for his continuous professional support. I appreciate your guidance and insightful views as they made the completion of this study a good learning period. Fourthly, my words of gratitude go to Namibian College of Open Learning. I am thankful for the massive support you granted me financially and by any other means.

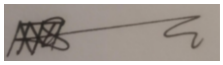
Lastly, my heartfelt gratitude to my colleagues, fellow students and friends for your support during this journey.

Dedication

I dedicate this study to my family for the everlasting love and support. The desire to inspire my nephews and nieces kept the fire burning, without such motivation from the littles ones, I could not have pushed this far.

DECLARATIONS

I, Ngeendina Sem-Tangi Ntinda, hereby declares that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.



_____ 06.02.2022

Signature Date

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

This chapter presents the background of the study, by discussing a brief overview of the Namibia College of Open Learning (NAMCOL) as well as concepts of the fourth industrial revolution and service delivery. The chapter further provides the statement of the problem, objectives of the study, significance of the study, and limitations and delimitations of the study.

1.2 BACKGROUND OF THE STUDY

NAMCOL is a leading Open Distance Learning state-owned institution in Namibia. It was established by an act of parliament (Act 1 of 1997). It aspires to contribute towards the educational levels of adults and out of school youth through programmes of open learning; by designing, developing and offering programmes to address the diverse educational needs of adults and out of school youths (NAMCOL, 2016). NAMCOL has grown over the years and expanded its products from secondary education to tertiary education. The institution has to fulfill its mandate by reaching out to many out of school adults and youth in education service delivery. In the quest to deliver on its mandate, the college has to adapt to changes in the market and industry.

Industrial progress has been at the core of the development of human society since the beginning of humankind (Schwad, 2015). In support, Tay, Lee, Hamid and Ahmad (2018) presented Industry 4.0 as a global change for each part of the company, through digitalisation, automation and the manufacturing processes. With advances in information and communication technologies, there is an increased uptake of robotic and other automation technologies due to innovation in sensors, devices, unmanned

air vehicles, information networks, optimisation and machine learning (Oztemel & Gursev, 2018).

Furthermore, manufacturing industries are adopting the Internet of things, allowing machines to communicate (M2M) mass data, robotics and automation, which they often use to improve decision-making (Oztemel & Gursev, 2018). Goh and Abudul - Wahab (2020) echoed the same sentiment: a technological optimistic future where objects will be connected to the internet and make intelligent collaborations with other objects anywhere, anytime. Moreover, businesses are increasingly adopting these technologies to enhance their competitiveness, and service delivery (Oztemel & Gursev, 2018).

Similarly, universities have also been adopting these technologies, especially for teaching and learning (Goh & Abdul – Wahab, 2020). Mogos, Lazarou, Dascalu and Trifan (2018) argues that universities need to adopt new educational systems to enhance learning using technology and the internet. This can be done through the integration of e-learning and automation. Lichtblau *et al.,* (2015) indicates that companies who want to remain competitive must assess where they stand in digital transformation by looking at strategy and organisation, smart factory, smart operations, smart products, data driven services and employees' skills.

The industry 4.0 revolution is a global thing and is happening simultaneously in different countries under different concepts. Lucato, Pacchini, Facchini & Mummolo (2019) indicated that the 4.0IR is happening under the following concepts or ideas in the following European contries countries: France with Nouvelle France Industrielle, Sweden with Produktion 2030, Italy with Fabbrica Intelligente, Belgium and Holland with Made Different, Spain with Industria Concectada 4.0, while Austria is using

Produktion der Zukunft. These show how developed countries are embracing the 4.0IR concepts. It is also inviting for developing countries to rise to the occasion and prepare for the 4.0IR. as it has greater benefit to industries and institutional growth. Despite the embracing of Industry 4.0, the readiness level of different institutions remains a challenge to prove, as different models have been developed to address and help the evaluation process.

The goal of industry 4.0 entails achieving a great level of operational effectiveness and productivity, as well as a high level of automation (Lucato, Pacchini, Facchini & Mummolo, 2019). It is in this regard that institutions are likely to strengthen automation technologies as a tool to improve their operations, service delivery and increase productivity. Additionally, Slusarczyk (2018) highlights that the preparedness or readiness of German and USA companies for the 4.0IR is at the same rate and the countries are ready for challenges posed by 4.0IR with an estimated 70% of the companies being ready.

The prospect of higher education to lead and transform teaching and learning in the era of education 4.0 depends on its readiness in adopting such technologies (Salom, 2019). Regarding the adoption of technologies, especially in a university or higher contexts, the focus has been on curriculum development and skills output into the 4.0 job market. There are limited studies that have focused on the readiness of Open Distance Learning institutions in Namibia. Therefore, the purpose of this study was to examine the readiness of NAMCOL in the adoption of automation technologies for improved service delivery.

1.3 STATEMENT OF THE PROBLEM

According to Urban *et al.*, (2018) universities must prepare a blue print that addresses the University Fourth Industrial Revolution 4.0 approach to address the present need and keep up to date realistic. Urban *et al.,* (2018) further emphasises that educational institutions must consider expertise on the skills, resources, strategies and finances for adoption of 4.0IR technologies. Institutions should develop strategies tailored to changes in the industry, based on their budget and capacity. NAMCOL annual report 2019 – 2020 (NAMCOL, 2020) reveals that, the college has twinned with other ODL institutions from developed economy settings such as the Commonwealth of learning (COL) and countries such as Canada. Hence, the need to adopt the new technology. The highest demand by NAMCOL's customers for services such as student registration, materials and other services leads to customers spending time in long queues and this poses a challenge to NAMCOL on meeting the demand (Nambadja, 2021, p. 3). This reflects the need for NAMCOL to improve on service delivery.

Though the adoption of technologies has been presented to be critical for service delivery in industries such as manufacturing, retail and hospitality (Oztemel & Gursev, 2018) very little has been examined in the context of ODL institutions. The purpose of this study was to examine the readiness of NAMCOL to adopting automation technologies for improved service delivery.

1.4 Research objectives

The main objective was to examine the readiness of NAMCOL to adopting automation technologies for improved service delivery during the Fourth Industrial Revolution. The following secondary objectives were pursued**:**

- To examine NAMCOL's infrastructure for adaptation to the 4.0IR
- To analyse the employees' skills towards adaptation to the 4.0IR at NAMCOL
- To determine the implementation status of automation at NAMCOL
- To analyse the challenges experienced by NAMCOL in adopting automation

1.5 SIGNIFICANCE OF THE STUDY

The results on this study have provided an insight into the readiness of the ODL institution (NAMCOL) for the 4.OIR and inform executives better for future planning. Additionally, the study has contributed literature on the readiness of adopting automation in ODL institutions for improved service delivery.

1.6 LIMITATION OF THE STUDY

The current COVID-19 has affected how the study was carried out. Not all the interviews were carried out using the face to face platform since some interviewees were in isolation. Hence, some Interviews were carried out using the zoom platform due to social distancing and other COVID-19 protocols. The other limitation of the study was the slow responsiveness by some of the participants and this almost affect the sample size. A permission letter to conduct research in the college from the director for NAMCOL helped to mitigate the above-mentioned limitation.

1.7 DELIMITATION OF THE STUDY

The study was restricted to NAMCOL Northern region and it only focused on the adoption of automation for the 4.0IR. NAMCOL Northern region was selected since it carries a large population of NAMCOL clients and it provides service to a bigger part of NAMCOL's customers. NAMCOL was chosen because it is the biggest supplier of ODL service in Namibia. The study was further restricted to use interviews as a method of collecting data due to the size of the population. The study was carried out within a period of one month.

1.8 SUMMARY

In summation, this chapter discussed the background of the study on readiness of NAMCOL for automation technology for improved service delivery. It further, presented the problem statement and laid out the research's objectives. Furthermore, the chapter outlined the significance of the study, limitation of the study and the study delimitation. The next chapter presents the reviewed literature on the readiness of NAMCOL for automation technology for improved service delivery.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, the researcher presented a review of national and international literature relevant to examining the readiness of NAMCOL in adopting automation technologies for improved service delivery. The chapter begins by defining the Fourth industrial revolution (4IR) readiness and outlines the adoption of automation. The chapter further review literature on automation technologies, in service industries including higher education. It moreover highlights the challenges in the adoption of automation. In the final analysis, the chapter presents the study's theoretical framework.

2.2 THE CONCEPT OF THE FOURTH INDUSTRIAL REVOLUTION, READINESS AND ADOPTION OF AUTOMATION

Concept 4.0 is not a new phenomenon. Singh and Mehra (2020) indicated that industry 4.0 was started in 2006 by the German Government to digitise the manufacturing sector to increase productivity. Hence the concept of industry 4.0 has been around for more than a decade and half now. However, the concept of industry 4.0 may seem to be new to some countries and organisations especially in developing countries (Pillay, Merkofer & Ori, 2016). Schwab (2018) highlights the four stages of the industrial revolution as illustrated below:

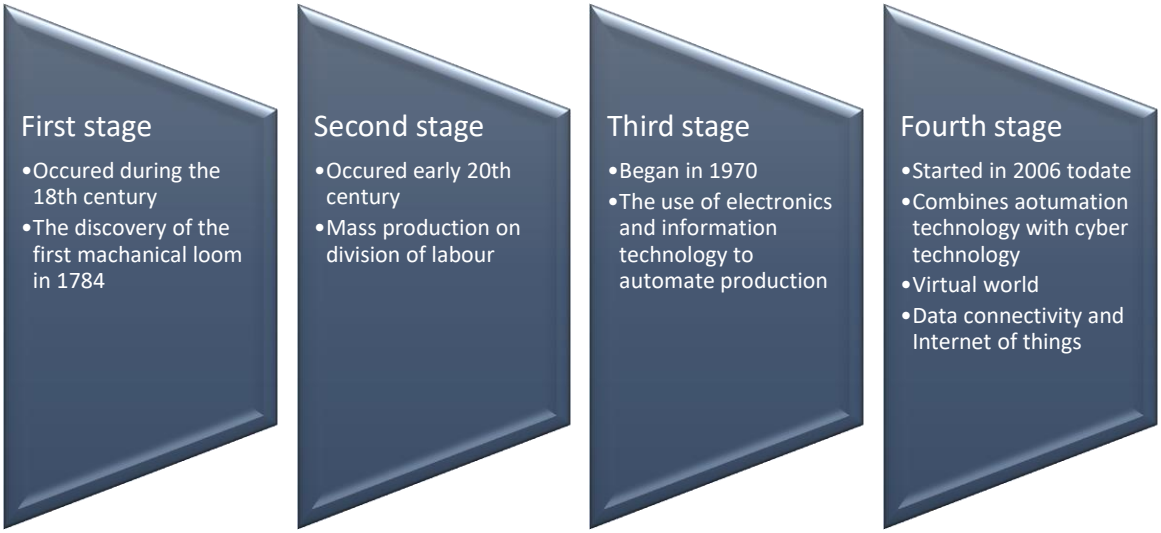


Figure 2.1: Four Stages of The Industrial Revolution

Source: Schwab (2018)

The industrial revolution 4.0 is a primary conception proclaimed by Professor Klaus Schwab. Today, the world has extended to the 4.0IR, which brought changes in various aspects of human life, including education (Nias, 2019). Professor Schwab conveyed that the 4.0 can fundamentally change how we live, work and relate to one another (Schwab, 2017). Schwwab (2017) the matter of the 4.0 IR has generated a significant influence on conscientiousness, and the education sector is no exception.

"The measurement of an educational institution's quality is not merely restricted to the great collaboration and engagement between lecturers and students in a cloud medium, but there could be more" (Mohamed, 2019:3). In support Dean and Gibbs (2015:12) pointed out "five (5) indicators of measuring quality within educational institutions are perfection, value for money, transformation, fitness for purpose and excellence".

Moreover, for better performance, industry and academia have continuously attempted to develop and re-develop self-assessment models that can evaluate the Industry 4.0

readiness of institutions (Hizan-Hanafiah, Soomro & Abdullah, 2020). The above-mentioned measuring indicators are not the only ones that can measure quality within education. Educational institutions can adopt different indicators that can fit their settings and can provide best reviews and picture for the institution.

Lase (2019:3) highlights that the world has entered the 4.0IR, categorised by growing connectivity, communication, progress of digital structures, artificial intelligence and virtual reality. Gradually convergent restrictions among individuals, technologies, information and communication expertise, undoubtedly influence several sectors, including education. Similarly, Onobrakpeya, Nana and Odu (2018) highlighted that different technological programmes do provide commercial benefits to institutions as automation of production processes. As different institutions compete with each other, for a competitive edge, they rely mostly on information technology.

NAMCOL, as one of the key players in the country's educational system, has embraced and taken cognition of the introduction of the 4IR to improve services to its customers by adding eLearning to its programme offering with production radio, video and web-based lessons. The tertiary modules hosted the Moodle Learning Management System (LMS) as a current knowledge acquisition and administration tool (NAMCOL, 2020). Although the NAMCOL LMS was piloted in 2014, and is fully implemented now; the concern of readiness is critical.

Al-Baadani and Abbas (2020) concludes that it is very challenging for every educational institution to have the learning process online fully for the first time. These challenges include limited internet access, difficulty in disseminating course content

and assessing learning outcomes and unfamiliarity with the platform used. NAMCOL director Herold Murangi in his report (2021) acknowledges that the institution recognises ICT as an important tool in enhancing access, strengthening operating systems, and improving the delivery systems. He highlighted that internet connectivity across different campuses is one of the major challenges affecting the full implementation of the 4.0IR operations at the institution.

Xing and Marwala (2019:2) point out that "the 4th industrial revolution digitises and vertically integrates processes across the entire organisation. It also vertically integrates all internal processes from suppliers to customers". 4.0IR is a wide-ranging instrument towards the effectiveness of the institutions of the 21st century and can thus influence all the works and activities within an organisation. These are expectations and ideal settings for the educational sector and educational institutions in the industry 4.0 era. However, Ally and Wark (2020) in a commonwealth paper on sustainable development and education in the Fourth Industrial revolution revealed that the educational sector in many countries has not kept up with advances in the 4.0IR despite societies moving through different eras of the 4.0IR and that the educational sector is still in 2.0IR. Benesova *et al.,* (2018) echoed the same sentiment that after the introduction of 4.0IR, Education 4.0 was introduced, but the educational sector falls to the back of the pack and is some revolutions behind. Hence, it is worth assessing or investigating the readiness level of educational institutions continuously to bring them on par with other sectors. Educational institutions could also consider copying or adapting to what other institutions in different sectors are implementing.

2.2 AUTOMATION TECHNOLOGIES

Palanivel and Joseph (2020:1) explained that education is one of the most demanding sectors to automate, and effective education has to do with more than just transferring information from teachers to students. Current education calls for social interaction and an adaptation to the individual students' learning needs and capabilities. It should be noted that meaningful human interactions are vital in education and are almost difficult to automate. In support, Kenson (2018) highlights that automating tasks in education may require artificial intelligence (AI) and Machine Learning (ML) technology. Additionally, automation in education may include grading and providing students with feedback on assessments.

Automation in education can be discussed parallel to Smart Education. Joseph and Palanivel (2020) highlights that automation encompasses various technologies ranging from continuous delivery and integration tools to hybrid cloud management to machine vision tools deployed in autonomous vehicles. A growing number of massive open online courses (MOOCs) are available without limitation as students' registrations have increased from 18 million to 35 million (Dintoe, 2018). The adoption of automation in educational institutions must be on technologies that are applicable for them, such as automated feedback on assessment, online courses, support systems (administration) training and monitoring.

Doepker (2019) predicts in the World Economic Forum "The Future of Jobs" report that worldwide, 75 million jobs will be displaced by automation by 2022. However, during this period, there will be another 133 million new jobs added to the global economy. Nevertheless, due to lack of skilled human resources and absence of requisite qualifications, many of these posts will remain vacant. This may be rightly

called the skills gap, which has been a problem for a decade. This problem will not be resolved until the universities and departments of higher education find possible measures. The type of curriculum in place at university could be a pointer on the readiness for automation technology.

According to Palanivel and Joseph (2020) the rapid adoption of smartphones for educational purposes and the availability of high-speed Internet are the prime factors boosting smart education. Moreover, the implementation of e-Learning would increase the overall smart education or education 4.0. which is a cost-efficient and more convenient way of learning as it provides training and tutorials from experts, improved courses and certification programs. Automation in education, comes in different means and all have to be embraced.

2.3 INFRASTRUCTURE NEEDED FOR AUTOMATION

Physical infrastructure and IT systems are fundamental to the operation and attainment of educational growth. A study carried out by Salmon (2019) found that inadequate technical infrastructure support and the burden of cost to the content developer and end-user are the main obstacles that need to be overcome in Malaysia. Mohamed *et al.* (2019) in their study revealed that living with big data management, advanced technology and digitised systems, the only way for an educational system to succeed in 4.0 IR is to strategically utilise the Internet of things (IoT). However, to keep up with the technological advances, the educational sector needs to have technological readiness in developing organisations based on IR 4.0. This includes the acquisitions of modern infrastructure and handling them to ensure that they are utilised properly to enhance excellence in service delivery.

Mogoş, Bodea, Dascălu, Safonkina, Lazarou, Trifan and Nemoianu (2018) further highlight the lack of knowledge and expertise in using ICT tools and adapting them to the educational activities' requirements. They indicated that some of the tools might be too complex or hard to use for some teachers or students. They also indicated a lack of adequate ICT tools, which can cause resistance to change and unwillingness to fully implement IR 4.0 among the educational staff. In the same vein, Manda and Dhaou (2019) identified that infrastructure challenges in developing countries were threatened by social trials and technological and organisational challenges.

In a study by Liu and Zhou (2016) they found challenges in China surrounding the introduction of new technologies such as analytics, development of networks and smart devices. Poor ICT infrastructure in developing countries is thus one of the major challenges likely to confront governments in their bid to implement industry 4.0.

2.4 EMPLOYEE SKILLS NEEDED FOR AUTOMATION TECHNOLOGIES

Ally and Walk (2020) conclude that the changes in the 4.0IR have impacted the entire structures and well being of human life, including the way they work, do business, and interact within the global world. "Digitalisation, the Internet of Things, Big Data are common tools in the era of 4.0IR, which have been applied in all sectors including the educational system". For the people to operate fully within the 4.0IR world, they must be digitally literate. If there is no digital literacy, the implementation of automation technologies will just be a dream and not a reality.

Additionally, Manda and Dhaou (2019:9) expressed that the skills challenge in South Africa results from a complexity of socio-economic and socio-historic factors. The 4th industrial revolution requires a highly skilled workforce which unfortunately South Africa has been struggling to produce. Digital literacy is more of a human resource

function than a technical function in institutions. Moreover, Farsi and Zio (2019) stressed that human resources play a major role in the realisation of industry 4.0 as skills possessed by employees are major assets to an organisation.

Mogoş, Bodea, Dascălu, Safonkina,Lazarou, Trifan and Nemoianu (2018) support that higher learning institutions must have the knowledge and skills in virtual and augmented reality, automation, machine learning, robotics and model-based design. In order to provide new sets of skills, institutions of higher learning have to provide educational patterns that make it possible to combine technology, principles of modern industry, but at the same time it must be rooted in communication, be personalised, collaborative and relevant to society needs. In support, the expectation is for human resources or employees to possess the required skills and fit in with the changes. However, not all employees would need to have or be updated with the required automation skills as automation will not cover the whole industry or operations. Some jobs will take remain not to be automated due to their nature and types of operations.

Ally and Walk (2020) Highlighted that the changes in the economy and progression in technology that led to the evolution in the education system impact numerous parties and should be assessed to improve understanding and encourage competent application in the educational system. Hence, the need to investigate the readiness of NAMCOL for automated technologies for quality service delivery.

In South Africa, poor broadband penetration was one of the barriers hindering transformation to the alleged smart society driven by digital connectivity, advanced technology, skills, knowledge, and innovation to institute economic and social development (Manda & Backhouse, 2016:10). They further alluded that “Despite a

failing primary education system, South Africa has arguably one of the best higher education systems in Africa. South Africa, however, continues to face a shortage of skills critical in the 4th industrial revolution due to inefficiencies in the post-schooling education and training system".

2.6 READINESS AND PREPAREDNESS STATUS

Readiness is characterised as a perception, purpose, attitude, and action in the degree to which change is needed and the capacity of the company to achieve it (Shah, Irani, & Sharif, 2017). During the change process, preparation is a state of mind that represents a desire or receptivity to improve one's thoughts. Adam & Widarman (2020:3) evaluated that "Before developing a positive state of mind towards organisational change, employee needs to be able to visualise the organisation's current situation and environment by comparing past and anticipated future perspectives".

Additionally, (Schwab, 2018) has concerns that organisations might be unable to adapt; governments could fail to employ and regulate new technologies to capture their benefits. This has clearly point out the need for examining readiness issues continuously for better performance and quality service delivery and to have a competitive edge over those not carrying readiness activities. Is also important to note that, human resource readiness is a strategic activity in an organisation to prepare for inevitable changes in the industry.

Mohamed *et al.* (2020) pointed out that with the speed of innovation and 4.0IR, the education sector needs to prepare the important ground work to ensure readiness and success in adapting to the 4.0IR. Moreover, (Teichler, 2018) echoed that the whole support system including human support, need to be transformed and readied to engage

4.0IR. Hizam-Hanafiah, Soomro, Abdullah (2020) described Industry 4.0 readiness as the degree to which organisations can take advantage of Industry 4.0 technologies and be digital prepared for 4.0IR.

Lase (2019) in his study, further alluded that Organisation or institution cannot escape these changes, subsequently it is essential to prepare sufficient human resources to be ready to adapt and be able to compete on a global scale. Improving the quality of human resources through education and in-service training is a way to balance the development and preparation for IR 4.0. Educational institutions being a service rendering institution as its main product rely most on its human resources to provide its product in the market.

Akdil, Ustundag and Cevikcan (2018) indicated that after the adoption of Industry 4.0, most organisational strategies will be revised, including a change in vision, mission, values, goals and key performance indicators. Affirming this, Urban *et al.*, (2018) emphasised that universities must prepare a blue print that addresses the University Industry Revolution 4.0 approach to address the present need and keep up to date realistic. Therefore, organisations need to be ready for the change in strategic plan or review the organisation strategic plan in order to accommodate changes brought about by Industry 4.0.

Moreover, Lichtblau *et al.*, (2015) developed a six-dimension model to assess the industry readiness for 4.0 focusing on organisational strategies, smart factory, smart operation, smart products, data-driven services and employees. These dimensions and models can be adopted to fit the NAMCOL situation in evaluating the readiness level. Therefore, it can help institutions to avoid to be caught off guard by changes in industry. Changes can be in technology or any other factors of the economy. Readiness

is important for business continuity and avoid business being outperformed by its competitors or failing to deliver quality service to clients. NAMCOL can use reviewed models to evaluate its readiness for the changes brought about by industry 4.0 such as automation technology and other industry 4.0.

2.5 CHALLENGES IN ADOPTING AUTOMATION

Notwithstanding the rewards of the 4.0IR, there are many challenges towards full implementation such as funding, pedagogical knowledge, lack of resources, student readiness and digital literacy. Next the section looks at the challenges in a bit more detail:

2.5.1 Funding for 4.0 IR automation

Funding plays a major role in any institution. Darling-Hammond, Flook, Cook-Harvey, Barron and Osher (2019) pointed out that despite integrating distance and e-learning clearly having advantages in the education system, some higher educational institutes have been facing challenges in implementation due to financial constraints. Moreover, Palvia, Aeron, Gupta, Mahapatra Parida, Rosener & Sindhi (2018) reported that the financial challenges in the online education arena are being experienced worldwide. The Economist Intelligence Unit (2018) alluded that lack of finance is mainly experienced in developing counties, in which Namibia is part of. In Namibia, the Ministry of Education budget cater for higher institution, including NAMCOL as a state owned enterprises; the Ministry of Education budget cut has affected the operation of the organisation (Ministry of Education, 2020). Ahmab et al (2019:40) highlighted that financial readiness is vital towards the effective implementation of 4.0 IR, but there is lack of funds. They reported lack of funds in Nigeria, Germany and

America. They reported that “the Indian education sector emphasised the concept of community engagement through the utilisation of online courses and employment of partnership models to tackle financial challenges”.

Mogoş, Bodea, Dascălu, Safonkina,Lazarou, Trifan and Nemoianu (2018) expressed that one of the essential pillar in the adopting technologies is the financial difficulties for both private and public educational institution. Having a limited budget, the management of higher institutions can try to become more efficient in having a high level of the student’s satisfaction, a better retention rates, a good rate regarding the employability after they graduate, a good feedback from the employer’s point of view, to follow the market demands and trends and also tries to create interesting educational courses and activities for the future students.

In agreement, “Without appropriate and adequate financial funding students who come from financially challenged households in South Africa might never be able to achieve academic success, change the negative cycle of poverty or contribute towards changing the race and gender profile of South African academe” (Manda & Dhaou, 2019:9). Funding or investments by government into public institutions to carry out their strategic plans is known as a main challenge hindering the implementation of automation technologies as part of industry 4.0.

2.5.2 Pedagogical Knowledge

The Namibian education system supports the construction of knowledge through student centred paradigm. The 4.0IR will require students to construct knowledge through online pedagogy. Kentnor (2019) in his study conducted in United State of America concluded that online pedagogy is one of the challenges hindering the full

implementation of automation and other online learning platforms. In the same vein, Sherina, Shahnaz and Maznah, (2019) indicated that the inclusiveness due to students' uniqueness in learning style and preferences is a challenge that needs to be faced by the lectures and tutors and it must be acknowledge and taken into consideration when designing content to be delivered through technological means.

Amadi and Ememe (2013) reported that some countries were not ready to implement 4.0IR due to staff and students' poor ICT knowledge. Ahmad et al (2019:41) supported that "living in the 21st century where learning can be done through digitised devices and cloud medium, the education sector must transform its pedagogical approaches as well as modify the content of curricula to meet industrial needs". They further state that in IR 4.0 era, designing an online course should be flexible at an intellectual level to yield new learning plans for empirical students' knowledge leading to advanced employability.

Farsi and Zio (2019) highlight that human resistance to change, education and training as well as the human machine interaction are the main challenges to 4.0IR implementation from the human resources point of view. Human role in implementation process and realisation of 4.0IR is crucial since more soficicated devicers are used and need to be control by human being. Morever, the human role in industry 4.0 context, the need for smart labours, operators and supervisors (Long, Nicoletti & Padovano, 2017)

2.5.3 Lack of resources for adopting automation technologies

A study on personal competency readiness in facing industry 4.0 model carried out in Indonesia by Sari *et al.*, (2020) revealed that the main challenges in facing the industrial era 4.0 is how the to prepare human resources to be able to be involved in

this change in digitalisation and automation industry. Human resources cannot be left out when discussing other resources needed in the readiness for automation. Additionally, a study on challenges experienced by students studying through ODL at Higher Education Institutions in Namibia carried out by Ilonga, Ashipala and Tomas (2020) highlighted that student face challenges in accessing the technology, the Internet and getting connected. These are infrastructural issues faced by both service providers and clients.

Lack of training, facilities and infrastructure, students' readiness in them of physical and psychological also hinder the successful outcome of ODL (Munezero *et al.*, 2016). Barretoa, Amarala, & Pereiraa (2017) stressed that in an Industry Internet of Things (IIoT) context the logistics challenges might require something like: high need for transparency (supply chain visibility); integrity control (right products, at the right time, place, quantity, condition and at the right cost) of the supply chain; dynamic 'configurability' of supply networks, specially by re-examining service-level agreements with upstream and contracted suppliers; supply network design, towards achieving lean, agile, resilient and green supply chains. Despite that these challenges were identified from studies carried out in different fields other than education sector, they could also be similar in the education sector.

Nias (2019) outline that although the teaching profession does not have a significant influence with the 4.0 industrial revolution, teachers must continue to improve themselves so they can produce better quality human resources. Mirroring this to NAMCOL as an educational institution with teachers delivering service, the need for ongoing skills upgrade is a must to the institution and its employees. In other veins, NAMCOL does not only employ teachers but it have other administrative and operation's staff members in theirs system.

2.5.4 Students' readiness for Automation technologies

Ilonga, Ashipala and Tomas (2020) called for well-articulated plans and actions to address the challenges faced by students in the distance e-learning mode that include automation feedback on assessment and basic skills to access and navigate through the e-learning platform. The same sentiment was shared by Xing on his study based on Massive open online courses as he highlighted that Massive open online courses, or MOOCs, is a form of education that provides stand-alone instruction online and student are finding it difficult to navigate through on their own (Xing, 2015). The moment students are ready for automation, MOOCs threaten different universities in distinct ways such as costs of physical resources and production constraint. The students and lecturers and administration staff transferred the mode of service delivery from use of modest technology to the full implementation of 4.0IR. NAMCOL is not an exception to the said scenario.

2.6 DIGITAL LITERACY FOR AUTOMATION

Teng *et al.* (2019) suggest that industrial revolution 4.0 requires technical knowhow combined with soft skills and social adaptability focusing more on communication, personality development, leadership, team work, innovativeness, problem solving and critical thinking ability. Adam and Widarman (2020) stressed that in recent years, many organisations are in the process to adopt Industry 4.0 to enhance the efficiency and effectiveness of the organisation's production. However, the organisation tend to reduce the number of employees with the adoption of Industry 4.0. Unskilled and semiskilled worker are the most affected. Automations technologies can replace human abilities should employees fail to upgrade their skills to the skills required in the industry.

Xing and Marwala (2019) argued that one perceptive lens of today's life is based on intelligent technology powered by artificial intelligence. For the nation to generate professionals that fulfil the demands of the workplace, the first necessity is to prepare the human resources (Alakrash & Razak, 2020). Moreover, the continuous transformation will demand a high degree of adaptability on individuals to continue learning throughout their working lives; the educational and training system must cater effectively to this demand (The economist intelligence, 2018:15). The above-mentioned points to the necessity of employees' skills to continuously develop in order for it to be at a level expected by the industrial changes and adaption.

Sari *et al.* (2020) highlighted eight (8) variables that positively and significantly affect the readiness of industrial human resources 4.0, namely; sense-making, social intelligence, novel and adaptive thinking, cross-cultural communication, computational thinking, transdisciplinary, cognitive load management and virtual collaboration. The focus is on digital literacy and virtual collaboration. Ilonga, Ashipala & Tomas (2020) recommended that both lecturers and ODL programme administrators should undergo refresher training on distance education annually to ensure they are aware and can address the challenges faced by their students. In their study, Benesova *et al.* (2018) highlighted that employees' skills and qualifications are essential for the readiness of 4.0IR because controlling or maintenance will only require highly qualified employees. Moreover, (Sari *et al.*,2020) stated that human resource is substantial for in accompanying the process of change that will come about.

2.7 THE STRATEGIES TO OVERCOME THE CHALLENGES OF 4.0 IR

Manda and Dhaou (2019:10) highlighted that the 4th industrial revolution requires developing countries like South Africa to rise to the challenges brought by their socio-historic, socio-economic and economic contexts. Developing countries need to develop models or strategies that are responsive and relevant to their context instead of blindly adopting so-called “exemplary models” that have worked in contexts that are different to the developing country adopting them. There is also a greater need to develop strategies that bring social benefits instead of focusing primarily on economic prospects brought by the 4th industrial revolution. Strategies should also look into innovative ways to address socio-economic challenges such as potential job losses, widening wage gaps, and skills redundancy. In demonstrating the benefits of the 4th industrial revolution, the government should also explain how social innovations in industry 4.0 can address some of society’s challenges and improve citizens' quality of life and social well-being. Similarly, institutions operating within the country's economic sector should develop strategies within the scope of the established strategies of dealing with IR 4.0 in the country.

Financial readiness is very important to succeed in IR 4.0 as it influences efforts towards a well-functioning higher education system (Ahmad *et al.*2010). In agreement with the notion, allocation of finances as budgetary issue requires strategic planning and evaluation of investments before the spending is done. ODL institutions could develop strategies to see how they can benefit through the implementation of automated technologies. In other views, the whole support systems including human support, need to be transformed and readied to engage IR 4.0. This aligns with the 4.0IR landscape and safeguards the workforce employability for future generations

(Ahmad *et al.*2010). Strategies on how to readied the human resources are needed in institutions to prepare for changes. Strategies could include the human resource policy, recruitment and continuous development of employees in the organisation.

2.8 THE THEORETICAL FRAMEWORK

The study is framed Industrie 4.0 by Litchblau *et al.* (2015:21) readiness models developed for the Impuls-Stiftung, for Mechanical Engineering, Plant Engineering and Information Technology in Frankfurt, Germany as an analytical tool. The model identifies six (6) dimensions "strategy and organisation, smart factory, smart operations, smart products, data-driven services and employees". These are also applicable to the education sectors since they analyse readiness comprehensively. Palanivel and Joseph (2020) supports that educational institutions are similar to other businesses organisation, thus "education is ripe for automation". The model was used as theoretical lenses to understand the research questions and as analytical tools to interpret and analyse the collected data.

Institutions can use the models to evaluate and assess their level of readiness. In the same vein, Henning, Wahlster and Helnig (2019) stress that multiple dimensions can also be filtered based on complexity and the output to use for dimension, levels such as either ready or not ready. Contrary, Litchblau *et al.* (2015:21) industry 4.0 model is appropriate for this study since it furthers the dimensions into the five levels of readiness: Outsider, beginner, intermediate, experiment, expert, and top performer.

The researcher can locate the position of NAMCOL as an ODL in preparing for the full implementation of 4.0 and Automation in achieving the mission and vision of the institution. The researcher opted to frame only four dimensions of the six, and five levels as lenses of analysis namely, employees, strategies, smart factory and smart

operations. The model thus enabled the researcher to examine NAMCOL level of readiness in adopting automation technologies for improved service delivery.

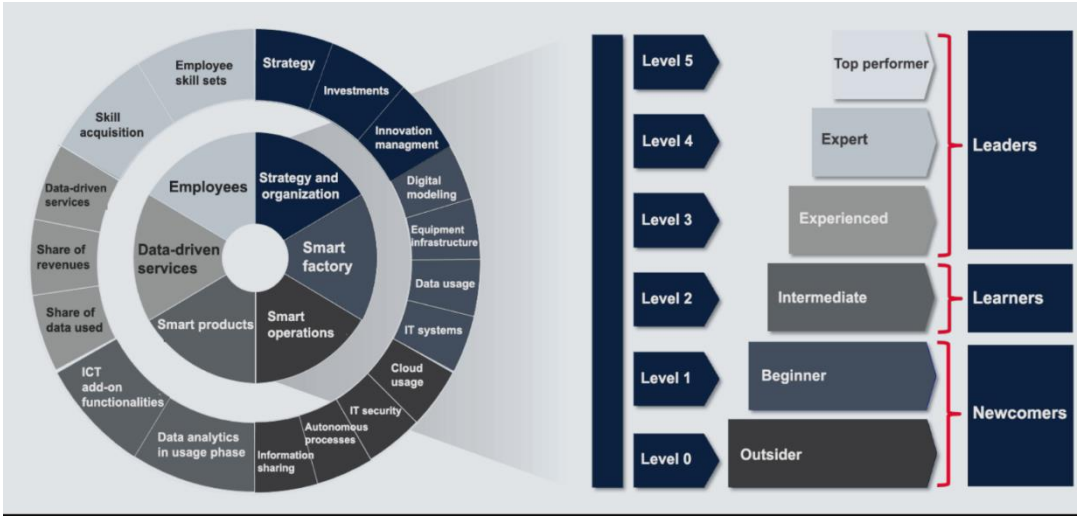


Figure 2.1 Industry 4.0 Model

2.8.1 Employees

Employees at NAMCOL refer to the organisation's contracted, employed and prospect personnel as per the model. The focus was on how these employees acquired the needed skills for adopting automation technologies. It also focused on the already existing set of skills that the prospective employees possessor must possess for them to be appointed in the organisation. This part of the model was significant to the study since it helped to investigate the digital literacy needed for automated technologies in the quest for quality service delivery and estabilish the level of NAMCOL; whether it was positioned at newcomer, learners or leaders in the implementation level.

2.8.2 Strategies and organisation

Organisations operate as per their strategic plans and the focus of this is on the strategies in place that safe guard the implementation of automation technology. This

part of the model also includes the investment activities that the organisation is making to implement the strategies on automation technologies (Litchblau *et al.,* 2015). The study is modelled on this as the researcher examined the implementation status of automation technologies as per set strategies if there are any at NAMCOL

2.8.3 Smart factory

Smart factory focuses on the infrastructure needed or used in carrying out automated technology or any other industry 4.0 activities. It also includes in the IT systems in place to enable the execution of activities in the organisations as it embraces the industry 4.0 (Litchblau *et al.,* 2015). This element was used to frame the questions used in the research tool for the correct data collection process. The data were collected with the focus on the elements of the model and this provided guide on automated technologies. This model set is best examining the level of readiness in terms of infrastructure and IT system at NAMCOL.

2.8.4 Smart operations

The smart operation focuses on autonomous process and information sharing. The main focus of the study was on automation (Litchblau *et al.,* (2015); hence this part of the model was vital for the study in order to establish the autonomous process in place at NAMCOL and the readiness for the institutions for automation process.

The study was framed based on this model and dimensions as a bench mark on the readiness of Namibian College of Open Learning in adopting automation technologies for improved service delivery. The dimensions and levels are the determinate for the level of readiness of NAMCOL as an ODeL for the adopting service delivery.

2.8.5 Element of theory used for the study

Despite that, the Industrie 4.0 model has six (6) main core elements, the researcher only used four elements in collecting data. The model helped the researcher in formulating and creating a focus for interview questions. The following elements were used as the main or the basis of data collection in the research: employees' readiness, strategies and organisation, smart factories focusing on equipment infrastructure and IT system, smart factories with the focus on automation technologies. The for selected elements influence the interview questions as they became focus point of the literature.

2.9 CHAPTER SUMMARY

In this Chapter, the researcher reviewed different literature considered important to the study. The reviewed literature revealed that most of the studies focused on readiness in other sectors of the economy and a few have focused on the educational sector. Those studies that focused on the educational sector are mainly on Education 4.0 which focuses on the content offered by the educational sector and not on how it is offered. In the final analysis, more studies need to be carried out on ODeL as most studies are on the face to face learning mode. Literature was reviewed in a thematic system following the headings such as; concepts and issues, automation technology, infrastructure, digital literacy, readiness, challenges and possible recommendation to address challenges posing a threat to the adoption of automated technology.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter presents the methodology used. It further covers the research design employed in the study. The chapter also discusses the population and the sampling method used as well as the sample size for the study. Furthermore, it also discusses the research instruments and procedures employed in collecting data for the study. Finally, it explains the research ethics used in conducting the study.

3.2 RESEARCH DESIGN

Kumar (2011) referred to a research design as a procedural plan that the researcher adopts to answer research questions objectively, accurately, economically and validly. The study used a case study design, whereby an interpretive approach through a qualitative paradigm was used to frame the study and understanding a phenomenon rather than explaining a phenomenon. Johnson and Christensen (2017) refers to case study research as a form of qualitative research that focuses on giving a detailed account of one or more cases and can address exploratory and descriptive research questions. This research used NAMCOL Northern region as the case study. The research topic and objectives are qualitative in nature, therefore qualitative interpretive data was collected through interviews.

The qualitative paradigm enabled the researcher to interact with the participants and provide more insightful interpretations and examination on the readiness of NAMCOL to adopt Automation Technology for service delivery. Johnson and Christensen (2017) refers to Qualitative research as an attempt to discover, explore, and describe a given

setting, events, situations or set of meanings. While Cresswel (2005) views qualitative research as a process involving emerging questions and procedures, data typically collected in the participants' setting, data analysis inductively building from particulars to general themes and researcher interpretations of the meaning of data. The researcher was interested in describing and exploring phenomena generating ideas and understanding participants' subjective perspective, and obtaining particularistic findings about NAMCOL northern region employees.

3.3 POPULATION

Creswel (2005) views population as the term that sets the parameter on the study units and refers to individuals in the universe who have specific characteristics and identifying the individuals in it. Moreover, Strydom (2011) refers to a population as the totality of persons, events, organisational units, case records or other sampling units with which the research problem is concerned.

The target population included fourteen (14) NAMCOL employees at the Northern Region in Ongwediva. The population comprised of employees serving in different departments in NAMCOL Northern Region such us: Technical Vocation Education Training (TVET) one (1) Secondary Education (SE) Six (6) Tertiary Programmes (TP) two (2) Administration three (3) Learner Support and Information Technology two (2) as well as Computer Based Laboratory Centres (CBLC).

3.4 SAMPLING

Smith and Albaum (2010) refers to the census sampling method as way of surveying all members of the population. Johnson and Christensen (2017) stated that when a researcher studies every individual in a population, one is conducting a census and not a survey. The researcher opted for census sampling method because the population

size was small and it was good to include all the members of the population in the study. The sample size was fourteen (14) NAMCOL Northern Region employees. In a similar situation a study conducted by Pep (2015) in Nigeria on an oil industry speed freaking covered the whole population of fifty (50) employees on the plant. Smith and Albaum (2010) further stated that the practicality of deciding the sampling method entirely relies on the population size. The whole population was studied, not just a subset of the population, hence no sample was drawn.

3.5 RESEARCH INSTRUMENT

A semi structured Interview guide was used to collect data. Greeff (2011) highlights that researchers use semi-structured interviews to obtain a thorough representation of a participant's perceptions and accounts of a certain topic and accords the researcher and participants more flexibility. The interview guide was developed using a comprehensive review of literature. De Vos, Strydom, Fouche and Delport (2011) refer to an interview guide as an interview schedule and highlighted that the researcher must have a set of predetermined questions that might be used as an appropriate instrument to engage the participants in the chosen terrain as this would help in foreseeing difficulties that might be encountered and content covered. A total of fourteen (14) NAMCOL employees based in the Northern Region were interviewed to provide an insight on the study.

3.6 RESEARCH PROCEDURE

Ethical clearance and approval were obtained from the University of Namibia to conduct the research. Additionally, the researcher sought for permission from the Director of NAMCOL to carry out the research within the institution. The researcher sent out an email with a blank schedule to target participants so that they could fill in

the appropriate time for their interview appointments. Participants were assured of their anonymity and confidentiality of information provided was assured. Additionally, the researcher informed the participants that the data would be used for study purposes only. The interviews were conducted and recorded using the zoom and face to face platforms as well as a voice recorder.

3.7 DATA ANALYSIS

Data analysis refers to a process which entails an effort to formally identify themes and construct ideas as they are suggested by data and an attempt to demonstrate support for those themes and ideas (Sherman & Webb, 2005). Qualitative data was analysed using thematic analysis. Thematic analysis is referred to as a method used for identifying, analysing and reporting themes (patterns) within data (Braun & Clarke, 2006). In Maxwell (2005)'s views, qualitative data is communicated through words and text, hence, the focus is not on numerical but on text and meaning. Interview video and audio recordings were transcribed, reviewed to create and initiate codes then presented in themes.

The data was analysed using Qualitative Data Analysis software (QDA). The software was used for coding, identifying themes and drawing conclusions to the study. Hagman (2021) stresses that qualitative data can be strengthened through the use of QDA software by researchers and moving away from the manual way of presenting data. The data collected was presented and discussed and four main categories (themes) steered by the research objectives were identified.

3.8 RESEARCH ETHICS

Neuman (2014) states that the law and codes of ethics identify a few clear preventions such as never cause pointless or irreparable harm to participants, secure prior voluntary consent when possible, do not ever disgrace, destroy, or release harmful information about specific persons who were enged for research purposes. All participants were informed formally about anonymity and participated voluntarily. In the study, participants were referred to as interviewees (1,2,3 to 14) or participants (1 to 14) in order not to reveal their identity. Participants were also assured that the information obtained would only be used for this study only and would be handled with confidentiality. Furthermore, participants were informed of their rights to withdraw from the study any time they wished to. This is in line with the principle highlighted by Neuman (2014) that people should never partake in research without freely agreeing to participate in the research. None of the participants withdrew from the study or interview session. The recordings of interviews are kept safe in a lockable cabinet for a period of five years. After the period expires, the transcribed documents of interviews will then be destroyed by shredding while the CD will be smashed.

3.9 SUMMARY

This chapter presented how the study was carried out. It started off with the discussion on research design. It further detailed the population of the study and the method used to determine the study sample. Additionally, the chapter discussed the research instrument used to collected data and the procedures used in carrying out the study. The chapter also discussed how data analysis was carried out to bring out meaning to the study. In the final section, the chapter discussed the ethical measures that were followed as the study was carried out.

CHAPTER 4: RESULTS AND DISCUSSIONS

4.1. INTRODUCTION

This chapter presents and analyses data obtained through interview. The chapter begin with the response rate from the participants and profiling of participants. It further presents and discuss the data under the following themes; NAMCOL's infrastructure in place for adaptation of 4.0IR, employees' skills towards adaptation of 4.0IR at NAMCOL, implementation status of automation at and NAMCOL and challenges experienced by NAMCOL in adopting automation. Lastly the chapter conclusion concludes the presentation.

4.2 DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

The researcher sought to obtain data about the participants' educational level or qualification, position, working experience and responsibilities. The data collected through this process are presented below:

Table. 4.1 Demographic Characteristics

Participants	Gender	Educational qualifications	Position	Experience	Responsibility
Interviewee 1	Male	Bachelor's Degree	IT Support agent	5 years	ICT
Interviewee 2	Male	Bachelor's Degree	Administrator	6 years	administration
Interviewee 3	Female	Bachelor's Degree	Cashier	5 years	Cash handling and booking
Interviewee 4	Male	Bachelor's Degree	TVET Instructor	20 years	Training
Interviewee 5	Female	Bachelor's Degree	Area Coordinator	23 years	Coordinating
Interviewee 6	Female	Master of Business Administration,	Area Coordinator	19 years	Coordinating
Interviewee 7	Male	Master of Education,	Area Coordinator	15 years	Coordinating

Interviewee 8	Male	Diploma in Accounting and Auditing, ICDL	ICDL Facilitator	9 years	Training ICDL programme
Interviewee 9	Male	Certificate in Office Administration, ICDL	ICDL Facilitator	10 years	Training ICDL programme
Interviewee 10	Male	Certificate in Office Administration, ICDL	ICDL Facilitator	7 years	Training ICDL programme
Interviewee 11	Female	Master of Business Administration, BA, PGDE	Area Coordinator	23 years	Coordinating
Interviewee 12	Female	Bachelor's Degree	Distance Education Coordinator	17 years	Student support and coordinating
Interviewee 13	Female	Diploma in Business administration	Assistant administrator	15 years	Administration
Interviewee 14	Female	Bachelor's Degree in Human Resources	Administrator	6 years	Administration

4.2.1 Educational level and Qualification (table 4.1)

All participants had furthered their studies after grade 12. The study revealed that seven (7) of the participants held an honours degree, while three (3) of participants are holders of master degrees. The remaining four (4) was equally shared by participants who are diploma holders and those who are certificate holders at one (1) representation each for the study. The study revealed that NAMCOL northern region has fairly qualified staff members to implement automation technology. In support Manda and Dhaou (2019) echoed that the 4th industrial revolution requires a highly qualified workforce for successful implementation.

The educational qualification is important for the study since there is an aspect of the study that focuses on the employees' skills and knowledge. It is of further importance

for the study to establish if NAMCOL is employing people with the needed educational level to meet up the 4.0IR. The findings revealed that the participants' qualifications were in accordance with their appointed duties.

Most of the participants indicated further that they are enrolled with different institutions of higher learning to upgrade their qualifications. Participant 2 highlighted that "I am currently studying for a master degree in Business Administration. Mogos *et al.,* (2018) shared similar findings that learning institutions must have the knowledge and skills in automation to be compatible to new technologies. Hence, the need for continuous further study by the employees to acquire new sets of skills.

4.2.2 Position (Table 4.1)

Participants were asked about their position at work with the purpose of establishing the degree of involvement into the implementation or preparation of 4.0 industrial revolution for NAMCOL. The college comprises of different divisions. The above chart shows that four (4) of participants are Area Coordinators that are representing the college in the northern four political regions in Namibia: Oshana, Oshikoto, Ohangwena and Omusati region. They are followed by three (3) represented by administrative officers and one (1) of the sample was made up of facilitators at TVET programmes mainly Office administration and International Computer Driving Licence. The remaining One (1) of the sample was made up of Distance Education Coordinator for tertiary programmes.

The sample as well included the instructor and IT support Officer proportioned equally at one (1) of the sample each. The study established that participants are employed at different positions and may have different level of involvement in the integration of 4.0IR. Similar findings were reported by Halili (2019) that not all the jobs are affected

by 4.0IR especially in the field of education. Those in administration and not at management level are involved in less interaction with students therefore they utilise platforms such as e-learning and MOOC.

4.2.3 Experience (Table 4.1)

The years of experience refers to the years that the employees have been rendering the service to NAMCOL. This is necessary to the study to establish on how employees at the college have been adopting to different changes. It further helps to show for how long the employees have been doing the same work for some years. The above chart shows that of seven (7) participants fall in the category of 5 – 9 years' experience, while four (4) participants are in the category of 15 – 19 years' experience.

The remaining three (3) participants are in the category of 20 years of experience and above. Notably the data revealed that none of the participants falls in the category of 1 – 4 years' experience nor in 10 – 14 years' experience. This shows that NAMCOL northern region is comprises of experienced employees. Long serving employees are like to resist changes as they arise in organisations (Mosic, 2019). Even though, experience is needed in organisations, the highly experience team, could have staff members who would not be comfortable in embracing new technologies.

4.2.4 Responsibilities (Table 4.1)

The participants were asked on their responsibilities at NAMCOL. The researcher asked this information in order to establish the different roles of participants at the college. This could help in knowing on how each participant is affected by the 4.0 IR in their daily activities. Participants provided responses as per table 4.1 last column. The study findings agreed to Xing and Marwala (2019) and Hussin (2018) studies that revealed that some activities in organisation are less or not to be affected by 4.0IR

(Xing & Marwala, 2019, Hussin, 2018). Based on the responses from the study, some participants' responsibilities are less of automation while others require more automation in their daily operations.

4.3 NAMCOL'S INFRASTRUCTURE IN PLACE FOR ADAPTATION OF 4.0IR

In response to the question on *what infrastructure is in place at NAMCOL in response to industry 4.0IR.* Majority of the participants responded positively and emphasised that there is enough infrastructure to support Industry 4.0IR. Participant fourteen (14) said

> "*I believe the infrastructure currently in place at NAMCOL are mostly software kind of applications and they are invented to respond to 4th Industrial revolution like E-Learning and ITS system kind, this will be supported by computers, printers and fax machines"* The same sentiment was shared by participant 11 and respectively "*Yes, because it has some technological infrastructure in place already and have started implementing par of automation already" and "Yes, NAMCOL is ready since it is using ITS integrate 4.0, and Online learning programme called e-learning and notemaster, and internet facility".*

The study revealed that, infrastructure needed for adaptation of 4.0IR at NAMCOL are partly in place. NAMCOL as an educational institution, offering mainly distance open learning needs different infrastructure from those needed by manufacturing industries.

However, participant 2 stated that there is a need for additional equipment because the infrastructure is not enough to support Industry 4.0IR. Participant 2 further said

> "*Secondly, will be strong internet connection that allows communication throughout the work and staff intranet".* Participant 3 said, *"NAMCOL have few systems or technologies in place that in response to 4th industrial revolution, they have IT infrastructure, computers, internet facilities, ERPS system called ITS that is run by the college to carry out its functions".*

The study indicates that the infrastructure at NAMCOL are not enough for implementation but NAMCOL have started with embracing 4.0IR.

The researcher also asked on the equipment that is needed for the types of automation that NAMCOL is involved in. Participants pointed out that there is need for NAMCOL to improve on its equipment in order to sustain 4.0IR. The equipment that was mentioned mostly are the IT equipment that includes more computers and laptops. Participants also pointed out that there is a need to have strong internet connection, as stated by participant 5 who said

> "*There is a need for robust servers to alleviate internet speed problems. There is a need for security cameras and control rooms to take over invigilation's of exams in halls. Examinations should be online; hence more computers are required*."

In addition, 8 out of the 14 participants raised an issue of huge storage devices that would allow to store software and applications that are required to implement 4.0IR. Participant 7 said "*Computers, a much bigger server with big storage for data storage.*

From my knowledge most of these infrastructure *are already there it is a matter of activating them."* According to the participants, more IT devices, fast internet and huge storage devices are needed.

The study reveals that the NAMCOL uses e-learning platform and ITS system. These supporting software and applications to implementation of 4.0IR are supported by computers, printers, internet facilities and other electronic devices. Mogoş et al (2018) highlighted the lack of knowledge and expertise in using ICT tools and adapt them to the educational activities requirements. The study results further pointed out that, NAMCOL have few systems and technologies in place to respond to 4.0IR. However, Singh and Mehra (2020) indicated that for an organisation to be regarded ready for 4.0IR, infrastructure needed for implementation of 4.0IR must be in place to smoothen the implementation and adaption process.

Concerning the issue of infrastructure, the researcher asked the participants if NAMCOL is ready for 4.0IR when it comes to infrastructure. Most participants think that NAMCOL is ready for 4.0IR. Participant 14 said:

> "*Yes. I think this time around, Infrastructure wise the institution is 95% ready for the 4th Industrial revolution because it has a functioning E-learning which is accessible by every registered student, the Institution also has internet facility in place. In terms of resources there are students that do not have access to this E-Learning because they do not have computers and laptops".*

Seven (7) participants responded almost the same with participant 14 response. However, six (6) participants said that they do not think NAMCOL is ready for 4.0IR

when it comes to infrastructure. Their reasons being that there is no adequate infrastructure sustain the initiative. Participant 9 said

> "*NO, the institution has to do more in terms of having the right* infrastructure *in place. Some staff members are even still using old types of computers and there is no provision made to staff members in terms of network when they are out of campus".*

Participant 12 had a difference response to the question. The participant said:

> "*Not sure, since I believe there are many* infrastructure *that the college need to acquire to fully implement automations. In terms of skills there is also some skills needed in the college".*

Moreover, the study results indicated that there is a need for NAMCOL to boost its infrastructure in responses to adaptation to 4.0IR. An increase on IT equipment, computers laptops, fast internet facilities and mass storage devices is a need to the college. The study finding further, revealed that NAMCOL does not have sufficient infrastructure in place, hence the need for the boost.

The above discussion serves as a yard stick to the model used in the study. Seven (7) responded indicated that college is ready in terms of facilities is not enough as opposed to the other seven (7) giving different views on infrastructure readiness. Based on the model used in the study, NAMCOL can be placed at level 2 which is referred to as intermediate on the inside gauge while on the outside gauge of the model it is labelled as learners. The progress made by the college on infrastructure indicates that the college is not at newcomer level as it has started to embrace 4.0IR already.

4.4 EMPLOYEES' SKILLS TOWARDS ADAPTATION OF 4.0IR AT NAMCOL

The interviewer asked the interviewees if they are computer literate and if it is a 'YES' they should state what level they are, beginner, intermediate or advanced. If it is a 'NO' they should state, why? All of the interviewees are computer literate and some are advanced and intermediate. The chart below illustrates participants' computer literacy and levels.

Employees' skills sets and skills acquisition are regarded as crucial elements of readiness towards 4.0IR (Abdullah, 2020). According to the study findings, all the responded indicated on computer literacy as one of the main employees' skills needed to adapt automation in this field. Ally and Walk (2020) agrees that for the people to operate fully within the 4.0IR world, they must be digital literate. They further that if there is no digital literacy, the implementation of automation technologies will just be a dream and not a reality. The study further revealed that nine (9) of the responded are at advanced level in terms of computer literacy.

The interviewer also asked if NAMCOL has a policy/procedures on Automation Technologies. Most of the participants shared the same sentiments as they concur that NAMCOL has a policy on automation technologies. The 10 participants stated that the policy is covered with the IT department policy and can be integrated to accommodate the automation technologies. Participant 9 emphasized that:

> "*Yes, the college have an ICT policy and I also think the strategic plan have provision for this things. Similarly, the management resolved recently that all new prospect academic staff members must have done a course related to developing of online courses or materials."*

Participant 5 stated that he/she is not aware of any policy at the institution. Participant 10 also said he is not sure if there is any policy. Participant 13 said that he has not seen any.

Furthermore, the study results revealed that NAMCOL have policies in place addressing the automation technologies. In agreement with the study carried out in India on readiness for industry 4.0 that highlighted the organisations that are ready to embrace 4.0IR have put in place policies and procedures in place on dealing with adaptation of automation and other 4.0IR elements (Singh & Mehra, 2020). Despite the above revelation, the study also established that there are some staff members who are not aware of the organisation policies or not well informed on different policies in place in the college.

The interviewer went on to ask how the staff is encouraged/motivated to improve their skills towards new technologies and automation. The participants pointed out that there are variety of strategies that the college is utilising to encourage/motivate its staff to improve their skills towards new technologies and automation. Most of the participants point out that the college avail funds for the staff to further their studies at different educational institutions. They moreover offer free online courses for them to study. Similarly, ICDL is compulsory to staff; whereby all the staff are required to have basic computer skills. Participant 2 said

> "*NAMCOL offers a free bursary and study loans to staffs as an encouragement to them to take up studying opportunity with high learning institution. Secondly, they offer free online courses that focuses on online technology or e-learning platform or anything that have to do with IT infrastructure since we are moving online learning and automation."*

Some participants only mentioned about continuous training as the only tool being used by the college to motivate/encourage its staff members to improve their skills towards new technologies and automation. Some participants indicated that, although the college offers the staff with different opportunities to improve their computer skills and education in general; some staff do not partake in the initiative due to different reasons such as workload, inadequate time and some fear that they might fail and did not want to be questioned on that. Some indicated that some staff members are encouraged to pursue their studies especially on ICT due to the demand in the job market and they hope to grow further in their career as well as competing for promotional positions within the college and outside.

The study further revealed that NAMCOL has different ways in place to motivate its employees to improve their skills. Based on the study results, NAMCOL avail funds to its staff members to study further and professional improve their skills. Additionally, the college do offers free online courses to it employees on MOOC and other necessary field. This includes developing of online materials and online assessments. Furthermore, the study reveals that computer literacy is a must requirement to enter the college. Manda and Dhaou (2019:9) support that the 4th industrial revolution requires a highly skilled workforce which unfortunately South Africa has been struggling to produce. It is evident from the findings that NAMCOL have a working continuous profession development (CPD) plan in place that includes skills audit and professional development of employees, and much have been done to upgrade employees' skills; nevertheless, the participants expressed inadequate skills to fully implement the requirements of 4.0 industrial revolution. This indicates that NAMCOL needs to strengthen the continuous development on 4.0 industrial revolution as Farsi

and Zio (2019) stressed that human resources plays a major role in realisation of industry 4.0 as skills possessed by employees are major assets to organisation.

The study finding suggest that NAMCOL's level on the industry 4.0 model rating in terms of employees set of skills and employees skills acquisition is at level 2. This is because the organisation has taken significant steps such as formulating policies towards readiness. But, formulation of policies alone is not enough. NAMCOL must ensure that awareness is done to all the employees so that no one will be left behind as the organisation readied itself toward automation.

4.5 DETERMINING IMPLEMENTATION STATUS OF AUTOMATION AT NAMCOL

The interviewer also asked the interviewees if they thought NAMCOL was implementing the 4.0IR and automation. Most interviewees pointed out that NAMCOL is implementing the 4.0IR and automation in daily activities. All the 14 participants gave examples of the e-learning system, ITS and online registration. Participant 8 said:

> "*Yes, NAMCOL has ITS and E-Learning platforms. It gives staffs and students access to the real –time data and sharing needed information efficient."*

One (1) participant out of the 14 said:

> "*he is not sure if operations like e-learning and ITS can be considered as 4.0IR*".

Some participants further indicated that they implement 4.0IR daily specially to communicate. Participant 2, stated that*:*

"Our communication is based mainly on technology; messages and conversations are done through emails, some meetings are done through google meet and tweet etc".

In support, participant 14 stressed that:

"tertiary programmes workshops, marking of examinations and assignments as well as examination preparations are done through face to face and online".

The students are encouraged to use the E-learning system to attend lessons, workshops, do activities and upload assignments. The returning students are further encouraged to register online and they are supported by the IT department when they experience difficulties with the system. The tertiary programme tutors are trained and supported to use NAMCOL e-learning system. Similarly, the registration of NSSCO has improved and an upgraded system is being used which is fast and more effective. Contrary, participant 12 view that

"The new system comes with many complications, which sometimes delay the process, especially registration; sometimes the network is poor and at times there are errors within the system that might require you to re-do, sometimes I prefer manually to avoid many complications within the new system".

The interviewer asked how the institution is preparing staff for Automation technologies. 14 out of 14 participants acknowledged that NAMCOL is preparing the staff for Automation technologies through continuous trainings especially on newly acquired technologies. Participant 6 emphasized this by saying

"*The college have gone into partnership with different institutions of education locally and internationally to offer training to staff members on online programs and courses."* Similarly, participants 14 stressed that *Namcol is committed to its employees as they are the assets of the institution, with this the institution always make sure that they offer its employees with latest technology, when new technology is introduced we get training in order to get to know and understand it better before the students, by so doing it helps with service delivery to our clients.*

4.6 Rating the success of NAMCOL implementation of automation.

The participants were asked to rate of success of NAMCOL implementation of 4.0IR using; successful/not successful/intermediate. They were also supposed to give reasons for their rating. The rating was only recorded between intermediate and successful. None of the participants rated the implementation as unsuccessful.

Participants gave their own assessment on the rating of NAMCOL implementation status for automation technologies. The study reveals data as it follows; 12 participants rated intermediate, two (2) participant rated successful and none of the participant rated not successful. The 12 participants explained that:

"*Intermediate, most of the work/submissions are converted into technology, less use of hard copies or manuals. Examinations are loaded into NotesMaster".*

The remaining two (2) participants explained that:

"*Successful, because they have implement some system and programmes in response to industry 4.0. Such as ITS and some strategies in the strategic plan responding to 4.0IR".*

According to the study findings, NAMCOL is on course to successful implementation of automation technologies, this is credited to 12 positive responses by participants. Unlike Amadi and Ememe (2013) who reported that some countries were not ready to implement 4.0IR due to staff and students' poor ICT knowledge; the 12 of participants in this study pointed out that NAMCOL is at intermediate level on implementation rate of automation. The study revealed that NAMCOL is implementing automation in daily activities as it has introduced different systems such as ITS, e-learning platform that gives staffs and student access to data and share them efficient. This agrees with Farsi and Zio (2019) who reinforces that human role in implementation process and realisation of I4.0 is crucial since more sophisticated devices are used and need to be control by human being. At NAMCOL, activities such as online registrations are examples to implementation of automation. The response was backed by notion that most of the work are converted into automation, more soft copies and use of application such as NoteMaster. Moreover, the strategic plan accommodates implementation of automation as per participants' responses. However, none on the participant was able to provide a specific strategy from the strategic plan that respond to automation technologies. Contrary, Akdil, Ustundag and Cevikcan (2018) indicated that after the adoption of Industry 4.0, most organisational strategies will be revised, including a change in vision, mission, values, goals and key performance indicators. The model used in the study focussed on strategy and investment made by the organisation on implementing 4.0IR.

Participants also answered to the question whether NAMCOL staff is ready for Automation Technologies and they should justify their answer. Interviewees had different opinions concerning this question. Three (3) out of 14 interviewees point out that some staff members are ready and some are not ready. Participant two (2) justified this sentiment by saying:

> "*Some are staff members are ready and some are not ready judging by way we are working in the environment. Some lack certain skills needed for automation and we also have different role and responsibilities at the college. Hence it depends on the employees' skills".*

This was in agreement with participant 7 as by echoed that:

> *"Not really, some staff members are off pace and need skills update to keep and get ready".*

Seven (7) out of 14 interviewees point out that the NAMCOL staff is ready for Automation Technologies. Participant 11 justified this view by saying:

> "*Yes, most of the employees are in possession of ICDL certificate and are computer literate."*

Three (3) out of 14 said that there are not sure if they are ready or not because the skill pool that the college has is sufficient. Only one participants said that the staff at NAMCOL is not ready.

Implementation is part of a revolution process hence; employees have to be prepared for the implementation stage of automation revolution. Although (Schwab, 2018) has

concerns that organisations might be unable to adapt; governments could fail to employ and regulate new technologies to capture their benefits.

The study revealed that NAMCOL is preparing its employees for automation by through continuous training of employees on new development on automation field. Secondly, the college has made agreements or partnership with educational institution both locally and internationally to upgrade employees' skill. Thirdly, NAMCOL has made a computer literacy as mandatory requirement for prospective employees before joining the college. Schwab (2018) regards human resource readiness as a strategic activity in an organisation to prepare for inevitable changes in the industry; the study revealed different opinions as some participants pointed out that some staff members are ready while others are not ready. There was a further indication from participants that the college skills pool is not sufficient to qualify the college as ready.

Based on the model used in the study the jar stick point to or place NAMCOL in the newcomers' level. To be specific at level one (1) for industries or organisation that are classified as beginners. The point that there are some employees not yet ready for automation and new strategies and other facilities being readied indicated that NAMCOL is in process and it just getting there with time. Notably, the college is making efforts on implementing the automation technologies.

4.7 CHALLENGES EXPERIENCED BY NAMCOL IN ADOPTING AUTOMATION TECHNOLOGY

The interviewees point out a variety of challenges experienced by NAMCOL in adopting automation technology. The challenges stated by all the interviewees are as follows:

4.7.1 Funding for automation

Most Participants pointed out lack funds as the main challenge facing NAMCOL's adoption of automation technologies. Participant 2 said:

> "*Firstly, lack of funds because we are aware that automation and technologies* infrastructure *are very expensive. Hence, the cost for such activities as meeting IR 4.0 demand comes at a higher cost. I think the college lack funds to fully implement new technologies that can help it to be at a successful rate".*

Similarly, participant 12 stated that:

> "*financial constrain to buy the much needed* infrastructure *and provide for trainings from much expert institution is what is missing".*

Participant 7 and 11shared same views that:

> *"The financial resource to fund the full implementation since the college is subsidised by the government and do get a limited budget", "I would say the main challenge is finances as expansion of technological infrastructure is highly costly".*

The study findings concur with the report by the Economist Intelligence (2018) that lack of funding is one of the main challenges to implementation of automation technologies. The responses from participants indicated that insufficient fund at the college affects the full implementation of automation. Although Ahmad *et al.* (2010) advocates for financial readiness, NAMCOL as a non-profit making rely main on the governmental support or funding to take care of its budget. The limited budget allocation to NAMCOL by the central government placed limitation on activities that the college have to perform.

The cost of technological innovation is mostly high, especially to organisations in developing countries since new technologies have to be sourced from the international market to the local. The lack of funds leads to lack of resources, infrastructure and equipment, need for adoption of automation technology in the organisation. According to the model used in the study, funding is an investment element that has an impact on the organisation's current and future operations. The study further revealed the need to prioritise automation technologies during budgeting activities and a need to allocate more funds to automation technologies.

4.7.2 Employee resistance

Four (4) participants indicated that employees' resistance is a challenge. Participant 14 responses that:

> "*Resistance to changes (There are still employees that feel that it is time consuming and too much work for their students to type their assignments and prefer manual work instead)". Similarly, participant 1 and 6 indicated that there some employees who are not in support of changes, more especially the technological ones".*

The finding reveals that the 4.0IR affected their lives through the adoption of modern technology to deliver the services at the college. Schwab (2016) conveyed that the 4.0IR can fundamentally change how we live, work, and relate to one another. The study revealed that employees are insensitive to changes and there is a lack of understanding. Most respondents indicated that some employees, especially those in the late stage of their careers are resistant to change and stuck to the old way of operations.

Participants further indicated the lack of understanding of automation technologies among some employees at NAMCOL as another challenge affecting the implementation process. Some employees are finding it difficult to adapt to innovation in the organisation. The industry 4.0 Model used to frame the study, points out employees as a crucial element to be considered when evaluating the readiness of an organisation. Hence, challenges on employees are a pointer to the level of readiness of the organisation for the fourth industrial revolution. Employee resistance to automation technology affects the quality of service delivered by the college to its clients.

4.7.3 Students' readiness challenge

Based on the question on challenges half of participants raised the issue of resistance to changes as pressing one. participant 14 responded that

> "*Resistance to changes (There are still students that feel that it is time consuming and too much work to type their assignments and prefer manual work instead)"*. The same was shared by participant 2 by stating that *"we must look at the clients and determine whether they are responsive to these technologies and if they are adopting to it too. Hence, the other challenges come from NAMCOL's clients that they are not responsive and that the college may introduce technologies".*

Participant 3 said*:*

> *"The challenge is end user not being ready to make use of the automated services".*

Students are the end users of the service that NAMCOL provide as the institution is a college of open learning. On the student readiness the study revealed the challenge of

lack of responsiveness from the students. Al-Baadani and Abbas (2020) Concluded that it is very challenging for every educational institution to have the learning process online fully for the first time. Responses showed that students are not so knee to embrace the newly provided facilities, platform and avenues. Students prefer the traditional method of learning therefore they are being resistant to e-learning platform and the ITS platform provided as part of automation technologies. Student resistance do happen as a result of knowledge gap on utilising new learning platforms. Moreover, the findings highlighted out that resistance by students is also attributed to lack of support by the college. NAMCOL as an educational institution does not have e-library. The implementation of automation at NAMCOL is for improved service delivery hence the aspects of clients (students) was crucial to the study.

4.7.4. Fourth Industrial revolution resources

Responses from the study, further imply that, resources such as computers, laptops and network devices are not enough at NAMCOL. Participant 1 shared that:

> "*Lack of resources (Not enough funds for the institution to introduce more technological innovations like incubators)".*

Participants 14 echoed that:

> *"lack of sufficient* infrastructure *as well as keeping up with the trends".*

While participant 9 stated:

> *"the level of technology in the country is behind the world level of technology, the end users of the service have shortcoming in apprehending the skills needed to utilise the service".*

Similarly, to participant 12 who indicated that:

> "*The other challenge is the technology level in the country that is not yet advance to fully accommodate automation technology"*

However, Darling-Hammond *et al.* (2019) highlighted that some higher educational institutes have been facing challenges in implementation due to financial constraints. Apart from financial constrain, the study results moreover, pointed out the network problem in Namibia as another pressing issue on NAMCOL's implementing automation technologies. Network, internet facilities are needed for the adaption of automation at NAMCOL due to the nature of service and how it is delivered to clients.

Further challenges revealed were lack of expert knowledge in the country and the technology level in Namibia is at sub – standard thereby any institution within the country cannot outperform its host. Equipment and infrastructure are the focal aspects to automation technologies. NAMCOL's automation are mostly on e-learning, ITS, and automated responds due to the form of industry it operates in. Moreover, human resources are equally important to adaptation of automation technologies at NAMCOL.

Due to the number of revealed challenges, there is an indication that NAMCOL is not at the top performer nor expert in the automation technologies. The mirroring model for the study with six levels suggest the challenges could place NAMCOL in either intermediate of beginner level of 4.0IR with the focus on automation technology.

4.8 STRATEGIES THAT NAMCOL SHOULD EMPLOY IN RESPONSE TO READINESS FOR AUTOMATION

Participants were asked to give the best recommendation to employ in response to readiness for automation. Participants made different recommendation based on what the deem as challenges facing the adoption of automation at NAMCOL. Participant 2 suggested that:

> *"The college must solicit funds or align. And direct more funds on automation and improving IT* infrastructure. *Secondly, the college should align its strategies and daily operations to industrial 4.0 and this would help to achieve this. Thirdly, there should also carry out a study to test if the systems in place are ready to meet 4.0IR".*

In support of what was suggested by participant 2, participant 7 stated that:

> *"The college must increase the budget for IT department and also form partnership with education institutions with more advanced technology. The college must continuously include automation in its strategic plan"*

Other recommendations were made by participants: the strengthening of students' awareness on automation technology by means of students' orientation, with the focus on computer learning and accessing of NAMCOL's learning platforms. Participant 3 said that:

> "*The induction or orientation of students to focus more on computer learning and accessing our learning platforms".*

The issue of partnership and awareness was further stressed by Participant 9 by saying:

> "*The college to continue twining with international universities and colleges to model their operations. Source for more funds, increase the awareness to*

the customers. Source or enter into partnerships with network provides for portable network devices".

Additionally, other participants also made a recommendation on how NAMCOL should adopt automation technology. Participant 8 said that:

"The college must assess whether staff members have reliable technological skills before recruiting them by doing a skills audit on staff members".

Similarly, participant 10 said:

"Invest on new technology, invest on new skills development and improve on IT infrastructure*".*

Participant 12 also made recommendations by stating that:

"The college needs to do a skills audit to determine the status of employees' skills level in the company. The college must also allocate more funds to the response towards industry 4.0. the other thing must be the strategic objectives for the college must include strategies responding to automation".

Moreover, the same recommendations were also shared by participant 13. Proper planning in terms of strategic plan, allocation of more funds on response to automation. Skills upgrade too is needed.

The study revealed that participants had similar suggestions on the strategy that the college can employ to successfully adopt automation into its operations. The researcher sums up the suggestions as follows: The college must solicit funds for proper adaptation of automation technology. Furthermore, align its strategies and daily operations to industrial 4.0. Moreover, NAMCOL should carry out a study to test if the system in place is ready to meet the 4.0IR. This could lead to conducting of skill

audits on staff members and then invest in new technology, skills, IT infrastructure and offer necessary training to staff. Additionally, the study revealed the need to create awareness to its clients and do more partnerships with global institutions to learn from them.

4.8 CHAPTER SUMMARY

The chapter focused on presentation of results from the collected data and analysis of the findings. Data was presented as per the research objectives since the instrument used to collect data was designed based on the research objectives. The researcher analysed data provided by participants on examining the readiness of the Namibia College of Open Learning in adopting automated technologies for improved service delivery. The study findings provide pointers on the level of readiness that NAMCOL is on regarding the Industry 4.0 readiness model used in the study.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter concludes the study by presenting the conclusions of the study. It further presents recommendations from the findings. The chapter starts off by outlining the main findings, afterwards, the chapter summarises the recommendations of the study. The final analysis and study recommendations were done based on the analysed data, in line with the research objectives formulated to examine the readiness of the Namibian college of Open learning in adopting automation technologies for improved service delivery.

5.2 CONCLUSIONS

The conclusions of the study are based on the objectives of the study. The first objective focused on examining NAMCOL's infrastructure for adaption to the 4.0IR, while the second focused on analysing employees' skills towards adaptation to the 4.0IR at NAMCOL. The third objective focused on determining the implementation status of automation at NAMCOL. Lastly, the fourth objective analysed the challenges experienced by NAMCOL in adopting automation.

5.2.1 Objective 1: To examine NAMCOL's infrastructure in place for adaption to the 4.0IR

The study results showed that automation technologies are embraced at NAMCOL. The college has started to implement certain elements of the requirements of the fourth industrial revolution to improve the quality of service delivery to its clients. The study findings on examining the readiness of NAMCOL in adopting automation technologies for improved service delivery have revealed that NAMCOL is at Level

two of the industry 4.0 model. Level 2 is classified as intermediate and falls in a group of learners in the implementation level. NAMCOL's readiness for adoption of automation technologies as per the study findings is a work in progress and the college continuous to prepare itself for the implementation of strategies to operate in the 4th industrial revolution. The focus of the study has been on employees' readiness, strategies and organisation, smart factory and smart operation.

The study concludes that NAMCOL has some infrastructure in place for adoption of automation technologies. However, NAMCOL does not have sufficient infrastructure to accommodate and fully implement automation technologies. The study establishes that an increase in the infrastructure such as mass storage, internet connectivity and information technology devices. The study hence, acknowledges the embracement of automation technologies by NAMCOL as it concluded that NAMCOL is at the level of learners and has passed the newcomer level on the provision of infrastructure needed for adopting automation technology. If NAMCOL fails to boost its infrastructure in line with the 4.0IR it will be found wanting as revolutions are not choice things.

5.2 2 Objective 2: To analyse the employees' skills towards adoptation of the requirements of the 4.0IR at NAMCOL

On the analysis of employees' skills, the study concludes that at NAMCOL, most employees' skills are in line with the needed skills for adoption of automation technologies. However, not all employees are at the same level. The study further established that NAMCOL has put in place different strategies to upgrade employees' skills to fill up the gap between the possessed skills and the desired skills for adoptation of automation technologies. The study places NAMCOL employees' skills at the learning level, indicating that there are skills needed to be acquired by employees at

NAMCOL before the institution can regard itself ready for automation technologies. Automation technologies do not fully replace employees' skills but they can become obsolete in terms of application to the technology in use.

5.2.3 To determine implementation status of automation at NAMCOL

The study determined that NAMCOL is implementing automation technologies at a snail's pace. Even though, the college does intergrade automation technologies in its daily operations, a lot still needs to be done. NAMCOL gradually implements automation and has made automation technologies part of the strategic plan. However, the study also concludes that there is a need for more strategic objectives on automation technologies and great investments with regards to automation.

The implementation status at NAMCOL is at the newcomers' level. NAMCOL is a beginner, with a lot of ground-work to be done in terms of planning, prioritising, fund allocation and implementation. The implication of slow implementation of automation to NAMCOL is that the college will end up being a revolution behind and this could affect its operations as it deals with external stakeholders that could be ahead of it. Furthermore, the cost implications for rapid implementation to catch up with the next revolution and other industries are a challenge.

5.2. 4 To analyse the challenges experienced by NAMCOL in adopting automation

It was established that NAMCOL faces different challenges in adopting automation technologies and these challenges include: resistance to changes, lack of understanding of automation technologies, lack of funds, lack of required skills, poor responsiveness by clients, shortage of infrastructure, network connectivity problem, the level of

technology in Namibia and lack of expertise in the country. Analysing the challenges experienced by NAMCOL could help to navigate through to successful implementation of automation. The established challenges posed disruption to the adoption of automation, hence, a need for mitigation strategies to reduce their impact.

5.3 RECOMMENDATIONS

Successful adoption of automation technologies can lead to improved service delivery at NAMCOL. Therefore, there is a need to ensure the readiness of NAMCOL for adoption. This can be attained through the following recommendations:

The study recommends that the college must solicit funds for proper adaptation of automation technologies. Since, the study established the lack of funds for implementation of automation, there is a need to find other sources of funds by the college other than the central government. The college should either strengthens its business units to generate additional income or seek donations from international organisations. The college could also enter into more partnerships with different organisations even in other industries such as manufacturing and hospitality.

The study recommends an establishment of an e-library by NAMCOL and other e-resource platforms. This would enable students to have access to more resources for their comfort. Providing an e-library to students is good for NAMCOL toward quality service delivery. Students need to be provided with most resources to enable them to complete their studies successfully.

The study further recommends, the realigning of strategies and operation to 4.0IR. The realignment would help the speedy implementation of automation. The study further suggestes for more investment in new technologies, skills and IT infrastructure. Accumulation of both new technologies, skills and IT infrastructure would elevate the

college to a higher level of readiness towards adoption of automation and embracing the 4.0IR. The fourth industrial revolution must become a priority in planning and budgeting for the institution.

NAMCOL needs to establish the exact skills gap need by the institution for implementation of automation. Therefore, the study recommends skills auditing on staff members. Upon completion of the skills audit activity, a further suggestion is made that training be provided to staff members that are identified to be in need of it. Similarly, the study advocates for tests on systems and application to establish their compatibility and importance towards the readiness process. It helps to identify if short-comings are from the human resources side or infrastructure, systems and application side.

Finally, the study recommends for an increased awareness to customers. The student being the customers, need to be prepared for changes to prevent slow responsiveness from them. The awareness can be created by means of providing valuable orientation and training to new and old students. Upon introduction of new technologies, students must be given a platform to know how they will be interacting with the college and it can help make them comfortable hence, improved service delivery would be guaranteed

5.4 AREAS FOR FURTHER STUDY

Based on the study findings, the researcher recommends for similar studies to be done at other educational institutions offering ODL as a mode of study. The researcher could look at a larger population of the study in the future and study different ODL institutions. The research also recommends for similar studies to be carried out on educational institutions offering the face to face mode of study.

REFERENCES

Adam, S., & Widarman, S. (2020) *The Effectiveness of Entrepreneurship Training Programes Toward the Bumiputesa Entrepreneurial Perfoemance in Johor*. 103. 101. 244.127

Ahnmad, A. (2010) *The Atlas Simulation Infrastructure: The Europian Physical Journal*. Doi 10.1140/epjc/s

Akdil, K, Y., Ustandag, A., & Cevikcan, E. (2018) *Maturity and Readiness Model for Industrial 4.0 Strategy.* Springer International Publishing, Switzerland

Akdil, K. Y., Ustundag, A. & Cevikcan, E. (2018). *Maturity and Readiness Model for Industry 4.0 Strategy*. Springer. Birmingham. https://doi.org/10.1007/978-3-319-57870-5_4

Alakrash, H. M., & Razak, N. A. (2020b). *Towards the Education 4.0, Readiness Level of EFL Students in Utilising Technology-Enhanced Classroom. International Journal of Innovation, Creativity and Change*, Vol 13(10).

Al-Baadani, A., & Abbas, M. (2020). *The impact of Coronavirus (COVID-19) pandemic on higher education institutions in Yeme: Challenges and Recommendations for the future. European Journal of Education Studies,* 7(7). 10.46827/ejes.v7i7.3152

Ally, M., & Walk, N. (2020). *Sustainable Development and Education in the Fourth Industrial Revolution (4IR)*. Athabasca University. Commonwealth of Learning: Burnaby, British Colombia

Amadi & Ememe. (2013). *Rethinking Higher Education in Nigeria to meet Global Challenges in the 21st Century. International Perspectives on Education and Society.* Vol 21

Barreto, L., Amaral, A., & Pereira, T. (2017). *Industry 4.0 Implication in logistics: An overview: Proceida Manufacturing*. Vol 12, 2017

Braun, V., & Clarke, V,. (2006). "*Using thematic analysis in psychology." Qualitative research in psychology* 3.2, 77-101.

Creswell J.W. (2013). *Qualitative Inquiry and Research Design*. (3rd ed). University of Nebaska, Lincoln

Darling-Hammond, L.,Flook, L., Cook-Harvey, C., Barron, B., & Osher,D. (2019). *Implication for Educational Practice of the Science of Learning and Development. Applied Development Science*. http://doi.org

De Vos, A.S., Strydom, H., Founche, C.B., & Delport, C.S.L. (2011). *Research at GrassRoots: For the Social Science and Human Science Service Professions.* 4th Edition. Van Schaik publishers. Hatfield. Pretoria

Dean, A., & Gibbbs, P. (2015). *Student satisfaction or happiness? Quality Assurance in Education.* Vol 23, No 1, pg 5-19

Dintoe, S. (2018). Information and communication technology use in higher education: Perspectives from faculty. *International Journal of Education and Development using ICT*, *14*(2). Open Campus, The University of the West Indies, West Indies.

Doepker, M. (2019). *The Future of Jobs*: World economic forum.

Farsi, M & Zio. E (2019) *Industry 4.0: Some Challenges and Opportunities for Reliability Engineering. Internation Journal of Reliability, Risk Safety: Theory and Application.*Vol.2/Issue1/2019

Goh, P.S., & Abdul-Wahab, N. (2020). *Paradigms to Drive Higher Education 4.0. International Journal of Learning, Teaching and Educational Research*, 1. Retrieved from http://doi.org/10.26803/ijlter.19.1.9

Hagman. J (2021). *Centering analysis strategies and open tools for qualitative data analysis.* University of Illionis Urbana-Champaign

Halili, S, H. (2019). *Technological Advancement in Education 4.0. The Online Journal of Distance Education and E-Learning*, Vol 7, No 1

Henning, K., Wahlster, W., & Helbig, J. (2013). *Recommendations for Implementing the Strategic Initiative Industries 4.0: National Academy of Science and Engineering*. Washington DC, USA

Hussian, A.,A. (2018). "*Education 4.0 made simple: Ideas for Teaching". International Journal of Educatoin and Literacy Studies*, Vol 6, No 3, pg 92-98

Iilonga, A., Opomutale, D., & Tomas, N. (2020). *Challenges Experienced by Students Studying through Open and Distance Learning at a Higher Education Institution in Namibia: Implications for Strategic Planning*. Department of General Nursing Science. Faculty of Health Science, University of Namibia (UNAM). Rundu, Namibia

Johnson, R, B., & Christensen, L. (2017). *Quantitative, Qualitative and Mixed Approaches.* 6th edition. University of South Alabama. SAGE Publication. London.UK

Kentnor, H, E. (2019). *Distance Education and the Evolution of online Learning in the United State. Curriculum and Teaching Dialogue*. Vol 17. No 1, Pg 21-34

Kumar, R., (2011). *Research methodology: A step by step guide for beginner*. Sage publication

Lase, D. (2019). *Educational and Industrial Revolution 4.0.* Doi:10.24224/jh.v10i1

Li, G., Hou, Y., & Wu, A. (2017). *Fourth Industrial Revolution: technological drivers, impacts and coping methods*. *Chinese Geographical Science*, *27*(4) 626–637. https://doi.org/10.1007/s11769-017-0890-x

Lichtblau,K., Stich,V., Ing. Bertenrath, R., Blum, M., Bleider., Millack, A., Schimitt, K., Schimitz, E., & Schroter, M. (2015). *Industrie 4.0 Readiness.* Aachen, Cologne.

Liu, T., & Zhou, L.T .(2016). *Industry 4.0: Towards future industrial Opportunities and challenges.* 12th International Conference on Fuzzy Systems and Knowledge

Longo, F., Nicoletti, L., & Padovano, A. (2017). *Smart operators in industry 4.0: A human – centred approach to enhance operators' capabilities and competencies within the new smart factory context, computers & industrial engineering*, 113,144-159

Longo, F., Nicoletti, L., & Padovano, A. (2017). *Smart operators in industry 4.0: A human centered approach to enhance operators' capabilities and competencies within the new smart factory context*. Computers & Industrial Engineering, 113, 144-159.

Lucato W,C., Pacchini, A, P,T., Facchini, F., & Mummolo, G. (2019). *Model to evaluate the Industry 4.0 readiness degree in Industrial Companies*. Elsevier

Manda, M. I., & Backhouse, J. (2016). *Towards a "Smart Society" through a connected and smart citizenry in South Africa: a review of the national broadband strategy and policy*. International Conference on Electronic Government, 228–240. doi:10.1007/978-3-319-44421-5_18

Manda, M. I., & Dhaou, S. (2019). *Responding to the challenges and opportunities in the 4th industrial revolution in developing countries*. ACM International

Conference Proceeding Series, Part F1481, 244–253. doi:10.1145/3326365.3326398

Marwala, T. & Xing, B. (2017). *Implications of the Fourth Industrial Age on Higher Education*. The Thinker, 73: 10-15.

Maxwell, J. A. (2005). *Qualitative research design: An interactive approach*. Thousand Oaks, Califonia: Sage Publications.

Ministry of Education Arts and Culture. (2020). *The Minister Budget Speech 2020 – 2021 Budget.* Windhoek, Namibia

Mogos, R., Lazarou, E., Dascalu, M. & Trifan, L. (2018). *Technology enhanced learning for industry 4.0 engineering education*. Retrieved from http/researchgate.net/330638538

Mohamed, N, A., Johari, N.,Mohd, T., & Senawa, A. (2019). *Readiness Aspects in Education Sector to Succeed in Industry 4.0 (IR 4.0)*: A Review. Esteem Journal of Social Science and Humanities. Faculty of Architecture, Planning and Surveying. Universiti Teknologi Mara (UiTM). Vol 3. November, pg 38-47.

Nambadja, C. (2021, March 04). *Pupils 'overwhelm' NAMCOL*. The Namibian, p. 3

NAMCOL. (2016). *Annual Report 2015-2016*. Windhoek, Namibia

NAMCOL. (2020). *Annual Report 2019-2020.* Windhoek, Namibia.

Neuman, W.L. (2014). *Social research methods: Qualitative and Quantitative approaches.* England: Pearson Education Limited

Nias. B.N.K (2019). *Education and industrial Revolution 4.0*. Research gate publication

Onobrakpeya, A.S., Nana, O.G., & Odu, P.E., (2018). *Improving service delivery through ICT in Manufacturing Industries*. Journal of management science and technology, 5(2)

Oztemel, E., & Gursev, S., (2018). *Literature review of Industry 4.0 and related technologies.* Journal of Intelligent Manufacturing. Doi: 10.1007/s10845-018-1433-8

Palanivel, K., & Josef, K.S. (2020). *Robotic Process Automation to Smart Education. International Journal of Creative Research Thoughs* (IJCRT). Vol 8, Issue 6 June 2020. www.ijcrt.org

Palvia, S., Aeron, P., Gupta, P., Mahapatra, D., Parida, R.,Rosner, R. & Sindhi, S. (2018). *Online Education: Worldwide Status. Challenges, Trends and Implications. Journal of Global Information Technology Management.* Vol 21. No 4, pg 233-241

Pillay, K., Ori, A. & Merkofer, P. (2016). *Industry 4.0- Is Africa ready for digital transformation*? South Africa.

Rasheed, R, A., Kamsin, A., & Abdullah, A. (2020). *Computers and Education: Challenges in the online components of Blended Learning*: A systematic Review. Vol 144.103701

Salmon, G. (2019). *May the fourth be with you: Creating Education 4.0.* Journal of Learning for Development. 6(2) 95-115

Sari, D. C., Berutu, E.P., Pranoto, H., & Sitepa, E., S. (2020). *Personal Competency Readiness in Facing Industry 4.0 Model. 4th International Conference for Social Science* (4th BICSS)

Schwab, K. (2016). *The Forth Industrial Revolution: What it means and how to respond*. Retrieved from https://www.foreignaffairs.com/articles/2015-12-12/fourth-industrial.

Schwab, K. (2017). *The Fourth Industrial Revolution*: Encyclopaedia Britannica. Inc. Chicago. USA

Shah, N., Irani, Z., & Sharif, A.M. (2017). *Big data in an HR context: Exploring organizational change readiness, employee attitudes and behaviors.* Journal of Business Research, 70, 366-378.

Sherina, M.F., Shahnaz & Maznah R.H. (2016). "*Designing Instruction for Active and Reflective Learners in the Flipped Classroom*". Malaysian Journal of Learning and Instruction, Vol 13, No 2, pg147-173

Sherman. R, R & Webb. R, B. (2005). *Qualitative Research in Education focus and Methods*.Routledge.London.UK

Singh & Mehra. (2020). *India's Readiness for Industry 4.0: A focus on Automotive Sector*. Confederation of Indian Industry. Grant Thornton

Slusarczyk, B. (2018). *Industry 4.0 – are we ready? Polish Journal of Management Studies*, 17 (1) 232-248

Smith, S., & Albaum, G, S. (2010). *An Introduction to Marketing Research*. University of Mexico. Mexico

Tay, S, I., Lee, T.C., Hamid, N.Z., & Ahmad, A.N. (2018). *An overview of industry 4.0: Definition, components, and government initiatives*. J. Adv. Res. Dyn. Control Syst. 2018, 10, 1379–1387.

The Economist. (2018). *The Automation Readiness Index. Who is ready for the coming wave of automation? Intelligence Unit Repo*t. ABB

Ulrich, T. (2018). *Recent Changes of financing higher education in German and their intended and unintended consequences*. International Journal of Educational Development. Vol 58, pg 37-46

Urban, J., A., D., Kamarudin, D., & Mudin, D. (2018). *Industrial Revolution 4.0: Role of Universities, Borneo Journal of Medical Sciences (BJMS):* Borneo journal of medical sciences volume 12, issue 1, 2018

Violeta S., Georgiana I.G., Jonel, S., & Dumitru, N. (2020). *Influences of the Industry 4.0 Revolution on the Human Capital Development and Consumer Behavior: A Systematic Review*. MDPI, Basel, Switzerland.

Xing, B. (2015). *"Massive online open course assisted mechatronics learning, a hybrid approach". In Furthering Higher Education Possibilities through Massive Open Online Courses*. Chapter 12, Pg 245-268. Hershey, USA

Xing, B. (2019). *Towards a Magic Cube Framework in understanding Higher Education 4.0 for the Fourth Industrial Revolution*. In D.B.A. Khosrow-Pou (Ed.) Handbook of research on challenges and opportunities in launching a technology driven international university (pp. 107-130). Hershey: IGI Global.

APPENDICES

APPENDIX A: INTERVIEW GUIDE

1. Opening

My Name is Ngeendina Sem Ntinda, a Master of Business Administration (MBA) student associated with Namibian Business School. I am carrying out a study titled "Examining the readiness of Namibian College of Open learning in adopting automation technologies for improved service delivery" for completion of the master programme (study purposes).

You are here by informed that the researcher will ensure that research ethics are practiced:

a) The participants' identity will be kept anonymise
b) The participant has the right to withdraw from the research anytime he/she feel not comfortable.
c) The data collected will only be used for this study.

The researcher is hereby informing you that the interview will be recorded in order to get detailed information. The data will be transcribed for analysis purpose. The researcher hope that the data collected will be of outmost important for completion on the study.

The interview will take place in a range of 10 to 15 minutes.

2. Interview questions

Profiling

i) Briefly introduce yourself in relation to your Position, Qualification, Experience and responsibilities (duties).

Objective 1: To examine NAMCOL's infrastructure in place for adaptation of 4.0IR

i) In your views, what are the infrastructure in place at NAMCOL in response to Industry 4.0 (automation technologies)

ii) What do you think are the equipment needed for the types of automation that NAMCOL is involved in?

iii) Do you think that NAMCOL is ready for IR 4.0 when it comes to infrastructure? Explain your answer

Objective 2: To analyse the employee's skills towards adaptation of 4.0IR at NAMCOL

i) Are you computer literate? If 'YES', what is your level of computer literacy (beginner, intermediate, advanced)? If 'No' why?

ii) Does NAMCOL as a higher institution of learning has a policy/procedures on Automation Technologies?

iii) How are the NAMCOL staff encouraged/motivated to improve their skills towards new technologies and automation? (Do you have continuous development training on modern technologies and automation as a way to improve service delivery?)

Objective 3: To determine implementation status of automation at NAMCOL

i) Do you think NAMCOL is implementing the IR 4.0 and automation in daily activities of service delivery? Explain in details and give practical examples

ii) How is the institution preparing you for Automation technologies?

iii) If you are to rate the successes of NAMCOL implementation of automation; which stage will you rate it? (successful/not successful/intermediate) Explain to support your answer

iv) In your views, are NAMCOL staff ready for Automation Technologies? Justify

Objective 4: To analyse the challenges experienced by NAMCOL in adopting automation

i) What are the challenged experienced by NAMCOL in adopting automation technology?

ii) Can you share the best recommendation that you thing NAMCOL should employ in response to readiness for automation?

The time you took to participate in this interview is high appreciated.

APPENDIX B: LANGUAGE EDITING CERTIFICATE

Dr.GM

The Rev. Dr. Greenfield Mwakipesile
ThD, MBA, HBS | mwakipg@outlook.com

CONTACT

PO Box 99539,
UNAM,
Namibia

LANGUAGE & COPY-EDITING CERTIFICATE

5th January 2022

RE: LANGUAGE, COPYEDITING AND PROOFREADING OF NGEENDINA SEM-TANGI NTINDA's THESIS FOR THE MASTER OF BUSINESS ADMINISTRATION DEGREE OF THE NAMIBIA BUSINESS SCHOOL OF THE UNIVERSITY OF NAMIBIA

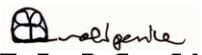
This certificate serves to confirm that I copyedited and proofread **NGEENDINA SEM-TANGI NTINDA's** Thesis for the **MASTER OF BUSINESS ADMINISTRATION DEGREE** entitled: **EXAMINING THE READINESS OF THE NAMIBIA COLLEGE OF OPEN LEARNING IN ADOPTING AUTOMATION TECHNOLOGIES FOR IMPROVED SERVICE DELIVERY**

I declare that I professionally copyedited and proofread the thesis and removed mistakes and errors in spelling, grammar, and punctuation. In some cases, I improved sentence construction without changing the content provided by the student. I also removed some typographical errors from the thesis and formatted the thesis so that it complies with the University of Namibia's guidelines.

I am a trained language and copy editor and have edited many Postgraduate Diploma, Masters' Thesis, Dissertations and Doctoral Dissertations for students studying with universities in Namibia, Zimbabwe, Eswatini, South Africa and abroad. I have also copy-edited company documents for companies in the region and abroad.

Please feel free to contact me should the need arise.

Yours Sincerely,



The Rev. Dr. Greenfield Mwakipesile

greenfield.mwakipesile

@mwakipg

+264813901701

Dr. Greenfield Mwakipesile