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Utilisation of Artificial Intelligence in South African Business Enterprises and Corporations

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Abstract:- This paper assesses factors that affect the utilisation of artificial intelligence (AI) processes and applications in South African business enterprises and corporations. South African business enterprises and companies use AI processes and applications for enhancing their quality and efficiency and for reducing operational cost. Globally, the use of AI applications has led to significant changes in industries, businesses and service delivery institutions. The paper is based on a review of the literature on the utilisation of AI in South African business enterprises and corporations. The paper shows that AI applications and processes are currently being used extensively in the finance, telecommunications, banking, healthcare and agricultural sectors and that the extent of utilisation is likely to increase significantly in the coming years and decades. The paper shows that there is a dire need for the adoption of AI and digital technologies, processes and applications in all economic sectors. It is necessary to invest sufficiently on the promotion of awareness and basic education on how to utilise AI and digital technologies effectively. Intervention should place emphasis on the adoption of digital and AI processes and applications as well as setting up the infrastructure required for the effective utilisation of AI and digital technology. AI technologies are most commonly applied in information technology and communication (ICT) and research and development (R&D) purposes in South African companies. The paper shows that the level of understanding of AI in South Africa is low. Most South Africans fear that the continued use of AI will result in job losses. The study shows that it is possible to enhance e-governance services in the public sector by investing on digital technology and AI systems. The paper also shows the need for a steady supply of electricity and enhanced security for safeguarding and protecting telecommunications and electricity infrastructure.

Keywords*: Artificial intelligence, Adoption, Education, Awareness, Digital infrastructure*.

1. Introduction and Background to Study

The objective of study is to provide a critical review of factors that affect the extent to which Artificial Intelligence (AI) technologies and processes are utilised in South African business enterprises and companies. This study identifies obstacles to the effective utilisation of AI technologies, systems, processes and applications in South African business enterprises and corporations. South African business enterprises and companies use AI processes and applications for enhancing their quality and efficiency and for reducing operational cost. Globally, the use of AI applications has led to significant changes in industries, businesses and service delivery institutions. The paper is based on a review of the literature on the utilisation of AI in South African business enterprises and corporations. The paper shows that AI applications and processes are currently being used extensively in the finance, telecommunications, banking, healthcare and agricultural sectors and that the extent of utilisation is likely to increase significantly in the coming years and decades. Research works carried out by Taljaard and Gerber (2022) and Rapanyane and Sethole (2020) show that there is a dire need for the acceptance and adoption of AI technologies among South African businesses and manufacturers to benefit from advancements made in the field of AI, machine language programming and robotic engineering.

Surveys conducted by Munoriyarwa, Chiumbu and Motsaathebe (2023) and Amoako, Omari, Kumi, Agbemabiase and Asamoah (2021) indicate that AI technologies are highly valuable for taking optimal business decisions and that entrepreneurs can enhance their level of profitability and relevance to local and international markets by utilising AI technologies. Some of the key benefits of AI include the ability to conduct effective and speedy market research, the ability to compete with well-established companies and business enterprises, and the ability to remain relevant to local and international markets. This is made possible by utilising information obtained from the use of AI technologies. Benefits derived from AI technologies are highly significant for South African business enterprises and companies, especially those working in the manufacturing sector. AI processes and technologies have the potential for narrowing and closing the gap between local and international manufacturers in terms of innovation and production capacity. AI systems and applications are highly valuable for making informed entrepreneurial and business related decisions in manufacturing companies and enterprises.

2. The Current State of AI Utilisation in South Africa

Table 1 shows a summary of the current level of utilisation of AI technologies and processes in South African companies. The table shows that about 46% of South African companies have piloted the use of AI applications and processes within their organisations. This figure indicates that nearly half of all South African businesses and companies are currently in the process of exploring the potential benefits of AI technologies and processes for enhancing productivity and lowering operational cost. A survey conducted by Barrett (2023) indicates that South African businesses and companies will continue to explore the benefits of AI technologies to ensure continued profitability and market relevance and that the adoption of AI technologies and processes will rise in the coming years and decades.

A report published by Businesstech (2023) shows that South Africa has invested about 1.6 Billion American Dollars since 2013. Most of this investment has been on digital technology, mobile cell phones, laptops, personal computers, telecommunications, use of social media, marketing and advertising. The report shows that there is a high level of expectation among South African companies and business enterprises (96%) that the use of AI technologies is helpful for lowering the cost of doing business.

Table 1: Current utilisation of AI technologies in South African companies

Indicator of utilisation of AI technologies	Percentage
Percentage of South African companies that use AI for automation	83%
Percentage of South African companies that use AI for prediction of market demand for goods, services and products, employee productivity, customer satisfaction, and downtime	70%
Percentage of South African companies that are piloting the use of AI technologies	46%
Percentage of South African organisations that view machine learning to predict cash flow	67%
Percentage of South African organisations that view smart robotics as the AI technology which is most useful to them	67%
Artificial intelligence can free up personnel, improve security measures and ensure that the business is moving in the right technology-advanced, innovative direction. According to Forbes, 70% of financial firms are using machine learning to predict cash flow events, adjust credit scores and detect fraud	70%
Percentage of South African banks and financial institutions that use AI technology for monitoring accounts of customers and for fraud detection	75%
Percentage of South African companies that have incorporated AI technologies into their routine business operation plans	50%

Source: Businesstech (2023)

South African companies and businesses that are based in urban centres utilise AI technologies relatively much more advanced and well-equipped in comparison with companies and businesses that operate in rural areas and in the rest of Africa. This is especially true in the finance, health care, agriculture and telecommunications industries (Worku & Muchie, 2019). According to the authors, the main challenge in the adoption of AI technologies in rural regions of South Africa and the rest of Africa is lack of digital infrastructure and lack of support from national and local governments in terms of training, the purchase of digital equipment, difficulty in securing a steady supply of electricity, and lack of good leadership and governance. A similar assessment has been made by Mathenjwa (2023). Outside South Africa, countries such as Kenya, Ghana, South Africa, Ethiopia and Nigeria are making a concerted effort to promote the use of AI technologies as a means of alleviating unemployment and poverty among citizens (Atlantic Council, 2023).

Table 2 shows examples of South African companies and businesses that utilise AI technologies extensively.

Table 2: Examples of South African companies that rely on AI technologies extensively

Name of company	Core business services provided by company to customers
Potara	Financial services
Lavina Ramkissoon	Financial services
Melio AI	The provision of machine learning solutions in the cloud as well as financial, telecommunications and entertainment services
Xhuma	Digital banking services, financial services, QR (Quick Response) payments, bill splitting, budgeting and stokvel services. A QR code creates a barcode that can be read by using an app and the camera on a smartphone or tablet.
Clean Data	Search engine services and data editing services
LUMA Law	Online legal services
Funti3r AI	Provides de-risking start-up investments in Africa with AI and Block chain. The company also provides software development services, AI services, marketing and sales services, and block chain services.
Ashanti_AI	Ashanti_AI is an artificial intelligence specialist in supply chain management. The company also provides software development services, manufacturing services, retail services, transportation services, AI services, data analytics services, and logistics and supply chain management services.
Karr Dynamics	Software development, AI solutions, web space development and automation solutions.
Vambo Academy	AI solutions, data analytics, web and cloud services, African languages, cultures and traditions
DataProphet-1	AI solutions, data analytics, web and cloud services.
DiggerApp.io	AI solutions, talent advisory services, training services, data analytics, web and cloud services
Bridgement	Online business loans, auditing and accounting services, financial risk analysis and business plan development services
DiggerApp.io	Talent advisory services, AI and computer services, training services, software development services
Eden AI	Financial and accounting services, E-token services, electricity usage and payment services
Medsol AI	Digital and AI services, medical diagnosis services for breast cancer, breast cancer

Name of company	Core business services provided by company to customers
Solutions	treatment services, software development, health care and medical services, and machine learning services
Kathryn Malherbe Medical Diagnosis	AI services for health care treatment, medical diagnosis services for the health care industry, software development, and health care and medical services
IQPay	AI services, financial, accounting, auditing and digital payment services, financial fraud prevention services, biometric services, health and medical care services, human resources, and IT solutions for health care systems

Source: LEAP (Pty) Ltd (2023)

The survey conducted by Gravett (2023) has found that there is a dire need for adoption of AI and digital technologies, processes and applications in all economic sectors. It is necessary to invest sufficiently on the promotion of awareness and basic education on how to utilise AI and digital technologies effectively. Intervention should place emphasis on the adoption of digital and AI processes and applications as well as setting up the infrastructure required for the effective utilisation of AI and digital technology. AI technologies are most commonly applied in information technology and communication (ICT) and research and development (R&D) purposes in South African companies. The paper shows that the level of understanding of AI in South Africa is low. Most South Africans fear that the continued use of AI will result in job losses. The study shows that it is possible to enhance e-governance services in the public sector by investing on digital technology and AI systems. The paper also shows the need for a steady supply of electricity and enhanced security for safeguarding and protecting telecommunications and electricity infrastructure.

3. Factors that Affect the Adoption of AI Technologies in South African Companies

Adams (2021), Mathenjwa (2023), Munoriyarwa, Chiumbu and Motsaathebe (2023), Gravett (2023) and Worku and Muchie (2019) have identified various challenges and obstacles that undermine the speedy adoption of AI technologies in South African business enterprises and companies. The authors have identified factors such as lack of digital infrastructure, lack of support from national and local governments in terms of training, the purchase of digital equipment, difficulty in securing a steady supply of electricity, lack of investment in AI-related research and development (R&D) projects, lack of specialised skills in computer sciences, robotic engineering, information and communication technology (ICT), and lack of good leadership and governance. A similar assessment has been made by Mathenjwa (2023) and Rapanyane and Sethole (2020). Van Heerden, Pozuelo and Kohrt (2023) have found that it is essential to invest in digital infrastructure, maintain and expand the infrastructure, and build technical capacity and expertise by partnering with well-equipped global leaders in the fields of AI and robotic engineering. The authors have pointed out the dire need for capacity building and the acquisition of specialised skills in the manufacturing sector. Maraveas (2023) has pointed out that business enterprises and companies that are based in urban centres utilise AI technologies relatively much more advanced and well-equipped in comparison with companies and businesses that operate in rural areas and in the rest of Africa. This is especially true in the finance, health care, agriculture and telecommunications industries (Munoriyarwa, Chiumbu & Motsaathebe, 2023; Worku & Muchie, 2019).

Survey conducted in Sub-Saharan African countries by Wareham (2023) and Arakpogun, Elsahn, Olan and Elsahn (2021) have found that the adoption of AI technologies is delayed in Sub-Saharan African countries including rural regions of South Africa by obstacles such as lack of digital infrastructure, lack of ICT skills, poor planning, poor quality of education, and inability to roll out efficient e-governance services by national governments. The authors have found that low level of skills in ICT, poor infrastructure, poor leadership and lack of political stability are major obstacles to the speedy adoption of AI and digital technology in all Sub-Saharan African countries. Golden, Henly and Lambert (2020) point out the numerous benefits of investing on human capacity building, workplace training, mentorship programmes, digital infrastructure and quality education in the fields of digital technology, telecommunications, ICT, AI and computer sciences. Educational

programmes that consist of practical partnership with industry, commerce and business are highly beneficial to young graduating students.

Outside South Africa, countries such as Kenya, Ghana, South Africa, Ethiopia and Nigeria are making a concerted effort to promote the use of AI technologies as a means of alleviating unemployment and poverty among citizens (Atlantic Council, 2023). The industrial revolution has set mankind free from shortcomings related to physical labour. By so doing, the industrial revolution has enabled mankind to realise the efficient production, manufacturing and distribution of goods, products and services worldwide (Waltersmann, Kiemel, Stuhlsatz, Sauer & Miehe, 2021). The high cost of labour as well as the time taken for production and distribution has been reduced significantly due to the industrial revolution (Javaid, Haleem, Singh & Suman, 2022). Artificial intelligence (AI) enables mankind to think and imagine creatively. This has enabled people to solve difficult problems by designing creative solutions to chronic problems such as the diagnosis and treatment of cancer. A typical AI machine has an above-average intelligence quotient (IQ) score (Mariani, Machado, Magrelli & Dwivedi, 2023). For example, the IQ scores of Bing AI and GPT4 are above 110. These figures exceed comparative figures of human beings. It has been pointed out that AI machines are as intelligent as the top 1% of human thinkers in terms of innovative thinking and creative thinking. AI processes are now being used to diagnose and treat diseases such as cancer. AI processes have enabled researchers to use machine-learning to detect and diagnose cells that are susceptible to cancer, tumours and lesions at an early stage. AI processes are used for treating patients and for effective communication. Advancements achieved in the past few years in the fields of AI and digital technology have enabled teachers and learners to communicate effectively, overcome geographical distance and differences in time zones, and share innovative ideas and concepts in all economic sectors. In this regard, countries in the developed world have benefited most due to their infrastructural capabilities, good leadership and the availability of adequate resources including suitably skilled manpower. The survey carried out by Crompton and Burke (2023) shows that advancements achieved in the fields of AI and digital technology are central to the success achieved in North American universities and technical colleges.

Mavhandu-Mudzusi, Mudau, Shandu and Dorah (2021) have conducted a survey in the Eastern Cape region of South Africa on the use of online methods of teaching and learning. The authors have shown that it is essential to set up digital infrastructure and provide basic education on the use of digital equipment and technology in order to be able to benefit from digital technology effectively. The survey has shown that setting up, maintaining and expanding digital infrastructure requires partnership with private South African businesses and companies.

Mbunge and Batani (2023) have pointed out that South African companies and businesses that possess appropriate infrastructure and technological skills will remain viable, whereas companies and businesses that lack such knowhow and infrastructure will fail to benefit from the growth in digital technology. The authors have pointed out the need for intervention, especially in poorly resourced businesses. The study conducted by Mbanjwa and Makhoba (2020) shows that the Covid-19 crisis has led to increased reliance on digital and online methods of conducting business. The trend of using robotic machines and AI systems is likely to increase within and outside South Africa in the coming years and decades. Zhang, Kang, Chen, He, Zhu and Li (2022) have shown that the same trend is going to be seen in Chinese mines as well as a result of increased demand for automation in deep and dangerous mines. One of the key motivating factors is the need to reduce the cost of mining and labour. The other motivating factor is the need to reduce accidents and costly injuries in deep mines. It is expected that the acceptance and adoption of digital technology, AI processes and online methods of conducting business operations will continue to rise sharply in the coming years and decades. In this regard, the key responsibility of the South African Government is to promote awareness, education and setting up digital and telecommunications infrastructure as well as a steady supply of electricity (Van der Westhuizen, Nel & Van Zyl, 2021; Petersen, Nkomo & Mengesha, 2021; Mathenjwa, 2023).

At the end of the 1980s, Davis (1989:319-340) pointed out that the acceptance and adoption of digital processes and technology had the potential for enhancing productivity and reducing the cost of conducting routine business in all economic sectors. The same is true with the acceptance and adoption of AI technology. The successful adoption of AI technology has the potential for reducing the cost of doing business significantly. It is

also highly valuable for sharing real time data among businesses and customers alike. In South Africa, sectors such as health care, automotive industry, agriculture and mines are exploring ways and means of using AI technology and automation for cost-cutting and enhancing productivity levels. The use of AI technology, robotic machines and automation has the potential for lowering the cost of labour in South African mines. The use of AI technology and robotic engineering has enabled mines operating in China, Canada, Australia, Argentina, Brazil and Russia to lower the cost of production significantly. South African mines are expected to follow suit in the coming years and decades (Ghazaleh, 2023; Hlatshwayo, 2023; Kejriwal, 2022).

Companies such as Google, Amazon, Microsoft Azure, Salesforce, IBM Cloud, Facebook, Alibaba Cloud and DataRobot are major users of AI technology and processes (Kejriwal, 2022). These companies use a combination of robotic machines and AI applications to enhance productivity at the workplace. In this regard, a key example is that of Google (2023), which is a global leader in the use of AI technology and processes. The annual report published by Google (2023) shows that Google has succeeded significantly in motivating and encouraging ordinary people living and working in all parts of the world as well as local and global business enterprises and companies of all sizes and sectors to utilise its range of digital and internet based services for seeking business-related information and for exchanging digital messages and valuable data in real time. Major surveys conducted by Neilson (2023), Yadav, Kumar, Kumar, Shivani, Kusum and Yadav (2023), Cataldo, Faniel, Buhler, Brannon, Connaway and Putnam (2023) and Bowen and Zhu (2023) show that free services that are provided by Google to the world community are highly valuable and immensely appreciated in all parts of the world.

The study conducted by Hlatshwayo (2023) shows that the South African mining industry is using robotic machines that are guided by AI systems for reducing the cost of human labour. The authors have pointed out that South African mines are quite deep and dangerous as a result of which the cost of mining South African mines is relatively higher in comparison with the cost of mining in regions such as Latin America, Australia and Russia. In all parts of the world, people are moving onto digital methods of sharing information, storing data and conducting research activities. The same trend is followed in South Africa. South Africans use cell phones for making and receiving text messages. They use cell phones for making and receiving voice calls and digital data.

Weyers (2023) points out that South African mines and agricultural companies use drones for minimising the loss of productivity and risk quite well. The use of drones has been found highly valuable for ensuring effective surveillance the safety of wild animals such as the rhino in Kruger National Park, which is the largest wild life and game park in the world and a major tourist attraction locally and internationally. The use of AI technology in drones has made drones highly versatile, effective, accurate, reliable, responsive, easy to operate and maintain, and user-friendly. AI technology has made it quite easy to use algorithms in drones to make them very highly accurate, easy to manage, easy to maintain, and easy to programme and give instructions. In drones, the precise identification of objects, navigation, and the analysis of information in real time have been made significantly easy due to the use of AI technology and processes. Merhi and Harfouche (2023) predict that the adoption of artificial intelligence techniques will be much faster in the coming years due to socioeconomic and financial incentives in the business sector. The survey carried out by Chirau, Blaser-Mapitsa and Amisi (2021) shows that it is essential to promote acceptance and adoption in South African businesses and companies by way of providing education and assisting poorly resourced businesses with digital equipment, software, access to the internet, the supply of electricity, and the installation, maintenance and expansion of digital infrastructure.

Cilliers and Greyling (2020) point out that the level of reliance on digital and remote working has improved due to the Covid-19 crisis. Difficulty in the management of personal contact and communication during the crisis has motivated experts in digital technology to consider using digital and internet-based technology and processes for conducting business. Even though the Covid-19 crisis has reduced significantly, businesses are still using digital and online technologies for conducting business. This is a result of the valuable aspects of digital and online business processes. In this regard, a key advantage has been cost-saving and the reduction of time required for completing business transactions and activities with customers who live and work in all parts of the world. The use of digital technology has been made greatly simplified by using AI technology and processes.

4. Theoretical Framework for the Use of AI Technologies

The general theory of artificial intelligence was proposed by Allen (1984: 123-154). The theory states that AI enables programmed machines to perform tasks that are intellectual in nature. AI technology enables machines to perform duties that are normally performed by humans. The pioneer and father of AI technologies and processes is John McCarthy (Hub, Channels, Tools & Guides, 2023). John McCarthy has worked with Alan Turing, Marvin Minsky, Allen Newell, and Herbert A. Radical discoveries and inventions put forward by John McCarthy have ultimately led to the first AI humanoid robot, Sophia. Amazon uses Alexa, who provides virtual assistance to customers of Amazon.

Taherdoost and Madanchian (2023:5) point out that AI applications and processes are highly beneficial for cost reduction, the enhancement of productivity and for ensuring the quality and reliability of services that are provided to consumers in all economic sectors. The authors point out that AI systems require human input and oversight to perform appropriately and make decisions in ambiguous situations. Oliveira and Silva (2023:4) state that AI cannot replace the intelligence and thinking power of human beings and that it is a highly valuable tool which is here to play a complementary role to humans. AI technologies should be used with care and ethical responsibilities.

AI technologies are currently being used for replacing data capturers, telemarketers, factory employees, cashiers working in retail shops, drivers, travel agents and bank tellers. The success achieved at Amazon warehouses and distribution centres shows that AI technologies have the potential to be used to perform duties of employees in virtually all positions of employment that are known to mankind. The realisation of this basic fact has resulted in anxiety among truck drivers working in the USA (Gittleman & Monaco, 2020; Wang, Mack, Van Fossen, Medwid, Cotten, Chang, ... & Baker, 2023). Workers argue that AI tools should be used as a complementary tool to humans and should not be allowed to take over human jobs and duties. From the point of view of employers, the use of AI technologies enables employers to save the cost of production and that AI technologies should be used where possible with no restrictions. The prospect of AI technologies being used by industry affects virtually all economic sectors including education, the defence industry, agriculture, mining, the automotive industry, finance, construction and health care (Wareham, 2023). The banking and security industries are currently using AI technologies for detecting and minimising fraudulent activities.

In the African continent, South African companies and business enterprises rely much more heavily on AI technologies and applications in comparison with companies that operate in the rest of Africa (Barrett, 2023). South African companies utilise AI technologies in various economic sectors including health care, finance, agriculture, wild life and tourism. It is estimated that about 3.3 million jobs could be lost in South Africa by the year 2030 due to increased utilisation of AI technologies in various economic sectors that are labour-intensive at the moment (McKinsey & Company, 2023). The report also estimates that 4.5 million new jobs will be created in the same period due to the net benefits of AI technologies and processes. Budhwar, Chowdhury, Wood, Aguinis, Bamber, Beltran, ..., & Varma (2023) point out that AI creates more benefits than harm. For example, AI technologies replace 15% of jobs that are performed by humans, but also augment 47% to 56% of all work related activities at the same time. The argument is that AI technologies lead to a net gain if they are properly regulated and managed to complement tasks that are performed by humans. AI technologies are currently used for improving the quality of health care services, financial services, and for addressing problems arising from climate change, poverty and hunger.

Hoppe, Harting and Rahmel (2023: 225-249) point out that AI technologies are highly valuable if they are managed with care and the correct set of ethical guidelines. A few examples in which AI technologies make a valuable contribution to humans are voice assistants working in call and help centres, AI technologies that predict adverse weather condition, AI technologies that watch over priceless wild animals such as the rhino, voice based chatbots that are used in telemedicine for assisting patients and for screening purposes, AI technologies that are used for entertainment streaming services, AI technologies that are used for personalised marketing of goods and services, AI technologies that are used for correcting grammar mistakes and for editing purposes, AI technologies that are used for travel and navigation, neural networks that are used for making

intelligent decisions under tricky circumstances, predictive models that are used by humans for forecasting possible future events, autonomous vehicles that transport people at all times, machine learning programmes that are used for teaching slow learners, facial recognition software, the detection of fraudulent activities, the implementation of safety, security and surveillance activities in risky conditions, internet-of-things that are helpful for conducting business by using online and digital platforms, the development of software, and for performing repetitive tasks at the workplace.

5. International Best Practice in the Fields of AI and Digital Technology

Internationally, there is a growing consensus supported by the USA and China to use AI in an inclusive manner to ensure the responsible use of AI for promoting human development and knowledge. AI can be used for promoting good or harmful aims and objectives. A survey conducted by Cannas, Ciano, Saltalamacchia and Secchi (2023) has found that applications of AI have been used successfully for easing supply chain related difficulties without escalating operational cost and jeopardising service level agreements with recipients of merchandise and goods. Ghazaleh (2023) has pointed out that applications of AI have enabled to ease labour-related congestions and delays by automating routine operations in the world's busiest ports. The author has shown that cost-saving automation and applications of AI are highly valuable for utilising robotic machines for enhancing efficiency without increasing operational cost.

Balel (2023) has shown that AI applications are highly valuable for easing the task of conducting empirical research. The use of AI applications significantly simplifies research processes. Gupta, Gaurav, Panigrahi and Arya (2023) have shown that AI applications are highly valuable for promoting cost-effective and sustainable entrepreneurship.

Sezgin (2023) has pointed out that the use of AI technologies in the health care industry is complementary to services that are rendered to patients by health care professionals and that the use of AI should be promoted with a view to enhance efficiency and lower the cost of health care services. The author has argued that AI processes are highly valuable for ensuring the promotion of optimal health care services and that humans will continue to have a meaningful role to play in the health care industry. Advancements made in telemedicine are attributable to advancements achieved in the past several years in digital technology and AI applications.

The research work conducted by Noble and Mende (2023) shows that the retail sector has been significantly transformed due to advancements made in the field of AI and digital technology. The authors have shown the benefits of AI applications along with aspects of AI technology that require careful monitoring. According to the authors, reckless applications of AI technology should not be allowed to invade the privacy of consumers and learners and that it is helpful to regulate the use of AI applications. The authors have provided examples on how AI technologies should be put to use in the retail industry to reduce the cost of goods, products and services and to simplify the task of passing valuable information to consumers.

Tait and Pierson (2022) have provided an application of AI technologies that is highly valuable for sharing information effectively in libraries. The framework proposed by the authors requires the use of robots that are guided by AI technologies. The research shows the necessity of closely monitoring the use of AI technologies and robotic machines. AI methods and processes are driven by massive data sets that are gathered from individuals in which behavioural tendencies and choices including marked related and product preferences are simulated and predicted. Large companies and corporations have access to information gathered from individuals and they use the information for marketing and advertising on a continuous basis. Behavioural choices and preferences of individuals are predicted accurately by using AI techniques and simulations.

Vrontis, Christofi, Pereira, Tarba, Makrides and Trichina (2022: 1237-1266) have provided numerous examples of AI applications in industry and business. AI methods are routinely used for finding out directions to a destination as part of a Google map or navigation system which is based on a global positioning system (GPS). AI methods are used routinely for predicting the likelihood of health-related problems such as heart attacks in humans. Robotic machines are routinely guided by AI processes and applications to perform labour-intensive

jobs and operations in the mining, construction and transportation industries. These are examples in which AI is used for human benefit. Studies conducted by Rikap (2023),

Kejriwal (2022), Rikap, Lundvall, Rikap and Lundvall (2021), and Raj, Kalaivani, Kaur, Cbsa, Mohali, Vij and Murthy (2023) show that companies such as Google, Amazon, Microsoft and Facebook rely quite heavily on AI applications and processes for enhancing their efficiency without incurring additional cost. These companies are capable of rendering valuable services to users by virtue of their capacity to utilise AI processes and applications to their advantage. The companies spend massive resources on cutting edge research and development projects in order to catch up with their business rivals and competitors. This process has been highly beneficial to their customers and users. Amazon uses technologies such as machine learning, chatbots, voice recognition, fraud detection, sorting and the identification and proper storage and labelling of products in warehouses. It also uses AI technology for labelling and identifying items speedily. Artificial intelligence and machine learning are used routinely in Amazon products such as Alexa. Amazon routinely relies on AI and machine learning processes to store, identify and distribute items from its gigantic and numerous warehouses.

Bick and Fuchs-Schundeln (2020) have pointed out that digital technology has enabled people to overcome outbreaks such as Covid-19 and that valuable lessons have been learned by business enterprises and companies about the benefits of using modern technology for conducting business operations. Digital technology and AI processes have enabled small, micro, medium-sized and large companies to enlarge their scope of work and outreach significantly locally and internationally without incurring a huge operational cost. Ordinary people, retailers and consumers alike have been able to appreciate and acknowledge the huge benefits of digital technology and AI applications.

Based on results obtained from surveys conducted by Neilson (2023) and Cataldo, Faniel, Buhler, Brannon, Connaway and Putnam (2023), Google serves the global community on a non-stop basis and has now become trustworthy, immensely convenient and highly valuable for business and information sharing processes. As a result, ordinary users go to Google to seek information about issues that affect their business activities. People living and working in all countries of the world routinely rely on Google services and AI processes to communicate effectively and seek market-related information. Highly valuable trade information and data are exchanged through Google services internationally. The annual report published by Google (2023) for the financial year 2021/2022 shows that the global demand for routine Google services is increasing sharply among all nations of the world.

Most of the services that are offered by Google are free of charge and come with great ease of use and efficiency. Google views its relationship with its global community of users as mutually beneficial and productive. By rendering essential services free of charge and efficiently, Google gets access to information that is highly valuable for targeted marketing. Free services that are provided by Google to users free of charge include Cloud Storage, Google maps, Google search, YouTube, Google scholar and Gmail services. Each one of these services is highly valuable to users. The company also provides customers assistance in terms of capturing high quality photos, processing and transferring images, the use of pixel phones for translation in multiple languages, YouTube applications that are highly valuable for generating and exchanging videos and teaching materials for slow learners and disabled people, the provision of Natural Language Processing (NLP) technology, email services through GMAIL applications, cloud storage services, and highly effective advertisements.

6. The Need for Regulation and Ethical Conduct in AI Technologies

AI technologies should be used by business enterprises with care and due consideration for the basic human and privacy-related rights of people. AI programmes have enabled large corporations to gather massive data on the personal behaviours of consumers. AI processes have enabled such companies to predict human behaviour and shopping preferences with great ease and remarkable accuracy. Such information can easily be used to invade privacy and promote aggressive and scrupulous marketing. For this reason, there is a growing tendency to impose regulation on large corporations that use AI technologies and processes (Dhirani, Mukhtiar, Chowdhry & Newe, 2023; Crawford, Cowling & Allen, 2023; De Almeida, Dos Santos & Farias, 2021). Machine learning

algorithms predict human behaviour and shopping preferences. Institutions such as Google and Facebook offer free services to people in exchange for basic information on people who use their services (Bowen & Zhu, 2023). Services that are provided by such companies are highly valuable for people and are appreciated. As such, people do not mind sharing their personal information with such service providers. Information gathered by using AI processes and methods from users is simulated with a view to predict human behaviour, shopping preferences and tendencies. Such information enables marketers to target the most likely people to utilise services, goods and products that are available in the market. When simulations are used extensively on data sets with large sample sizes, it is possible to predict shopping preferences, buying behaviour and tendencies in decision-making with accuracy.

Zuboff (2023) posits that targeted marketing promotes surveillance capitalism. Targeted marketing and advertising are made possible with AI processes and applications. Micro-behavioural targeting enables companies to identify buying customers easily and rapidly. AI processes are often used for surveillance activities. Surveillance can be used for ensuring safety by detecting reasonable security related risks. It can also be used for spying on people unfairly. These examples show the need for using AI processes and applications responsibly in a regulated environment. For regulations to be effective, major players must be prepared to be signatories to mutually beneficial and ethical codes of conduct. Such an agreement should be unanimously embraced, promoted and actively supported by all stakeholders including individual users worldwide. The USA and China have expressed support for such a regulation on the responsible use of AI processes and applications.

Yang, Eckles, Dhillon and Aral (2023) posit that the irresponsible use of AI promotes surveillance capitalism and the invasion of privacy worldwide. AI processes and systems are commonly used for guiding robotic machines in industry. Robotic machines provide labour, whereas AI processes provide procedural and operational guidance. By so doing, employers have managed to replace humans by robotic machines. In such processes, the main losers are human employees who supply manual labour at the workplace. Labour-intensive operations have been taken over by robotic machines that function with assistance from AI processors. Traditional jobs in the automotive industry, trucking industry, and large scale industrial manufacturing have been taken over by robotic machines. Amazon.Com uses robotic machines in its warehouses for identifying, storing and distributing goods and products. In the trucking industry of the USA, human drivers have lost their jobs to robotic machines that are guided by AI processes and applications. Traditional teaching jobs that are performed by teachers can now be replaced by robotic machines that are guided by AI processes and applications. Health care workers can be replaced by robotic machines that are guided by AI processes and applications.

AI processes and technologies promote micro behavioural targeting, surveillance capitalism and the invasion of privacy (Shah, Gardas, Narwane & Mehta, 2023). Automation of traditional jobs has been made possible due to advancements made in the fields of AI and robotic engineering. AI processes are commonly used for maximising utility and objective functions with a view to lower the cost of labour at production and manufacturing sites. Autonomous AI processes pose a threat to jobs that are performed by humans. Augmented AI processes support people to do their jobs better and more efficiently by way of assisting them to be more efficient and productive at the workplace. Augmented AI processes allow mutual collaboration between humans and robotic machines. Under augmented processes, humans view robotic machines and AI processes as an ally, and not as a threat. For this reason, augmented AI processes are deeply appreciated by humans, whereas autonomous AI processes are resented by humans.

The study conducted by Peres, Schreier, Schweidel and Sorescu (2023) shows that advancements achieved in the use of AI technologies have advantages and disadvantages and that it is helpful to regulate the use of such technology with a view to set standards for utilisation of such technologies for the wellbeing of all of humanity. People rely on AI processes and applications on a daily basis even though they are often not aware of such processes. Common examples are cell phones that are used by people, tablets, computers and laptops that are used by people for writing notes, keeping records, and performing data analysis, health monitoring devices and machines that are used for assessing health conditions, equipment that are used in clinics for making diagnosis and laboratory tests, cars that are driven by people, buses and trucks on the road, traffic light signals, health

monitoring gadgets that are used by people, gadgets with computer games, cell phones that are used for communicating with people, cash withdrawal machines that are used by people, and advanced medical equipment that are used by health care professionals for examining and treating patients on a daily basis.

De Almeida, Dos Santos and Farias (2021) have proposed a framework for the regulation of artificial intelligence applications. The authors have highlighted the need to protect the basic human rights and privacy of individuals and vulnerable groups. Justo-Hanani (2022) has proposed a similar framework for members of the European Union. The work done by these authors shows that there are benefits as well as disadvantages that are associated with the use of AI applications and processes.

Agent based AI models are computer simulations that are used for exploring and understanding interactions among individuals (Platas-Lopez, Guerra-Hernandez, Quiroz-Castellanos & Cruz-Ramirez, 2023). These are stochastic models that are constructed by analysing individual attributes. When the sample size of study is large (in cases when data is gathered from a large number of individuals), estimated or fitted models predict individual behaviour accurately. This makes it easy to identify groups of consumers who share similar characteristics with regards to purchasing behaviour and preferences.

AI has produced applications that are used for processing language. Chat Generative Pre-Trained Transformer (Chat GPT) is such an application that is commonly used by learners to suggest plausible answers to questions (Baidoo-Anu & Ansah, 2023). A chatbot enables learners to conduct human like conversations with the chatbot. The chatbot relies on AI technology and is commonly used by learners worldwide for providing answers to questions, composing essays, and suggesting plausible answers to subjective and objective questions. Chat GPT has been criticised for deceiving humans by creating fake conversations that could be used to manipulate other users and influence their decisions. Ethical guidelines and principles should be adhered to in the course of using Chat GPT in order to minimise harm that could arise from the unregulated use of Chat GPT by learners. For this reason, persuasive suggestions have been made to closely monitor and regulate the use of Chat GPT by learners in schools and universities (Crawford, Cowling & Allen, 2023).

The use of Chat GPT requires the exchange of data and information with the system. This poses potential risks in terms of data protection and security. It is important to take appropriate security measures to ensure that sensitive data is protected and does not fall into the wrong hands. Chat GPT is helpful to learners who lack in-depth understanding about a subject matter, specialised, numeracy and analytical skills. AI tools should be used with care and learners have a duty to confirm that answers suggested by Chat GPT are sensible and objective enough (Lund, Wang, Mannuru, Nie, Shimray & Wang, 2023).

Researchers in the field of AI state that AI cannot achieve self-awareness (Nguyen, Ngo, Hong, Dang & Nguyen, 2023). When AI achieves self-awareness, a robotic machine using AI technology will be capable of acquiring human-level consciousness and emotions (Von Krogh, Roberson & Gruber, 2023). However, the use of AI technologies and processes will lead to robotic machines that are highly intelligent, efficient and capable in terms of replacing human labour at production centres and the workplace (Chen, Chen & Lin, 2020). It has been pointed out in the literature that AI technologies and processes are highly valuable for enhancing thinking capabilities in underprepared learners and among employees who are required to perform at high cognitive and intellectual levels.

AI technologies utilise massive data for constructing fairly accurate predictive models. Such models are used for predicting choices that are made for goods, products and services at the market place. The models predict human behaviour with high levels of accuracy by using quantitative data sets and subjective information. AI technologies and processes have reduced the cost of doing business by 40% and the cost of operation by 30% (Guo, Zhang, Qin, Chen & Wei, 2023). Voting patterns can be established and predicted by using AI applications and processes in all countries of the world. Cluster analysis is used to identify groups in a dataset that share similar characteristics. In 4IR, cluster analysis can be used for market segmentation, customer segmentation, and to identify patterns in data (Falade, Adebiyi, Ayo, Adebiyi & Okesola, 2019).

Worku and Muchie (2019: 349-362) conducted a survey to assess and evaluate the extent to which 180 South African business enterprises operating in Johannesburg utilised digital and online methods for conducting routine business activities. The authors used a composite index defined by Bonson, Royo and Ratkai (2017) for assessing effective utilisation of digital and online business services. Table 3 shows a summary of the results obtained from the survey. The results show that family businesses accounted for 44% of businesses. About 70% of enterprises were operated by people with at least a Bachelor's degree level academic qualification. The percentage of senior managers was 6%. The percentage of operational employees was 41%. The percentage of respondents who possessed adequate knowledge and skills in the use of computers for conducting online and digital business activities was about 93% based on the composite index defined for assessment by Bonson, Royo and Ratkai (2017).

The results show that participants of the study were fairly well educated. The percentage of participants with doctoral level academic qualifications was 4%. The percentage of participants with Master's level academic qualifications was 42%.

Six percent of participants held senior managerial positions in their business enterprises. Forty one percent of participants were responsible for routine operations on a daily basis. The percentage of clerical employees was 29%. Six percent of participants had worked in their businesses for less than a year at the time of study; thirty two percent of participants for one to two years; fifteen percent of participants for three to five years; and forty seven percent of participants for six years or longer.

At the time of the study, six percent of participants had acquired working experience in digital and online business services for less than 12 months; twenty percent of them for one to two years; thirty four percent of them for three to five years; forty percent of them for six years or longer.

Eleven percent of participants possessed adequate level of skills in the utilisation of computers for conducting online and digital business activities; fifty eight percent of them possessed high level of skills; twenty four percent of them possessed barely enough level of skills; seven percent of participants possessed low level of skills. Eight percent of participants possessed adequate level of skills in the utilisation of the internet for conducting e-commerce business activities; forty eight percent of them possessed high level of skills; thirty seven percent of them possessed barely enough level of skills; and seven percent of them possessed low level of skills.

Table 3: General profile of business enterprises in the survey (n=180)

Variable of study	Number (Percentage)
Type of business enterprise	Family business: 44% Private enterprise: 37% Public enterprise: 9% Others: 10%
Economic sector of business enterprise	Finance: 45% Healthcare: 30% Manufacturing: 17% Technology: 7% Others: 1%
Level of formal education of business manager	Certificate or less: 24% Diploma: 7% Bachelor's degree: 23% Master's degree: 42% Doctoral degree: 4%

Variable of study	Number (Percentage)
Position held in business enterprise	Senior manager: 6% Operations manager: 41% Clerical employee: 29% Other: 24%
Duration of experience in business enterprise	Less than a year: 6% One to two years: 32% Three to five years: 15% Six years or longer: 47%
Duration of experience in conducting digital and online business services	Less than a year: 6% One to two years: 20% Three to five years: 34% Six years or longer: 40%
Level of skills in the utilisation of computers for conducting online and digital business activities	Adequate: 11% High level: 58% Just enough: 24% Low level: 7%
Level of skills in the utilisation of the internet for conducting E-Commerce activities	Adequate: 8% High level: 48% Just enough: 37% Low level: 7%

7. Implications of study

AI technologies and processes are highly valuable for reducing operational cost in large business enterprises and corporations. This is achieved by automating repetitive tasks and streamlining business processes. AI is commonly used for saving valuable time in industry and large manufacturing centres. Robotic machines that are guided by AI processes perform routine operational tasks and functions much more efficiently, reliably and consistently in comparison with humans. Employers save money and time by using robotic machines that are guided by AI processes. The use of AI enables managers to allocate more time to the task of mastering strategic and creative tasks. AI is used extensively in South Africa in the financial, banking, health care and agricultural sectors. AI can also be used effectively in the South African education sector for alleviating the acute shortage of skilled teachers and laboratory technicians. The use of AI is expected to grow in the health care industry between 2024 and 2030 significantly. The South African health care industry is ranked 49th out of 89 countries. In the year 2017, healthcare spending was valued at R414.5 billion. In the year 2018, this figure increased by 7.5% in 2018. Total spending is projected to increase at an average annual rate of 0.4 per cent, from R64. 6 billion in 2022/23 to R65. 4 billion in 2025/26.

The use of AI is expected to increase significantly in the coming several years in South Africa. The main sectors in which the use of AI is expected to increase steadily are mining, construction, agriculture, health care, education and car manufacturing and assembly. This implies that South Africa needs to invest on the acquisition and mastery of AI technologies and processes. It is also necessary to meet infrastructural requirements in sectors such as telecommunications, power, railroad, education, health care, mining and agriculture. AI technologies require infrastructural investment and capacity building. This is because it is not possible to benefit from AI technologies without having skilled manpower which is capable of using AI technologies effectively. It is also necessary to install, expand and maintain digital, telecommunications and ICT (information and

communication technology) infrastructure. It is essential to ensure a steady and predictable supply of electrical power in order to benefit from AI technologies and processes in all economic sectors.

AI technologies and processes are currently used in South Africa in various economic sectors. The main motivation of using AI technologies is the need to reduce operational cost (Van der Westhuizen, Nel & Van Zyl, 2021). A conceptual model for the remote work environment in South Africa. South African Journal of Human Resource Management, 19, 1-11.). Artificial Intelligence for Industries of the Future: Beyond Facebook, Amazon, Microsoft and Google. New author, 2023). Sectors such as mining, agriculture and health care are the leaders in the use of AI technologies. In the next several years, labour-intensive operations are likely to benefit from advancements made in AI technologies. The use of AI technologies is expected to reduce the cost of operations and labour with a view to enable South African goods, services and products to remain affordable and competitive in local and global markets. Examples of 11 South African companies that use AI technologies and processes for conducting routine business operations are shown below.

Gans (2023) and Bakker and Demerouti (2014) posit that the use of automation in labour-intensive sectors is viewed as a cost-saving effort by businesses worldwide and that businesses will continue to explore aspects of digital technology and AI with a view to remain competitive in local and global markets. According to the authors, labour-intensive activities in areas such as mining, transportation, the manufacturing and assembly of vehicles, the storage and movement of goods and agriculture will continue to rely more heavily on robotic machines and AI technologies to remain competitive in local and global markets. Automation, the use of robotic machines and advances in the field of AI will be essential to lower the cost of production and minimise disruption in the supply and distribution of goods, services and products. Gans (2023) points out that the pace of automation and adoption of AI technologies will continue to increase and evolve at a much faster pace in the coming years.

8. Framework for Ensuring A Speedy Adoption of AI Technologies

Based on findings obtained from this research work, the following framework is proposed with a view to help promote the current level of awareness and adoption of AI technologies and processes in South African business enterprises and corporations. The framework entails meeting the basic technological and organisational needs and operational requirements of business enterprises. The framework requires commitment from the relevant stakeholders in terms of the promotion of awareness, the provision of intellectual and material assistance to business enterprises as capacity building, and monitoring and evaluation.

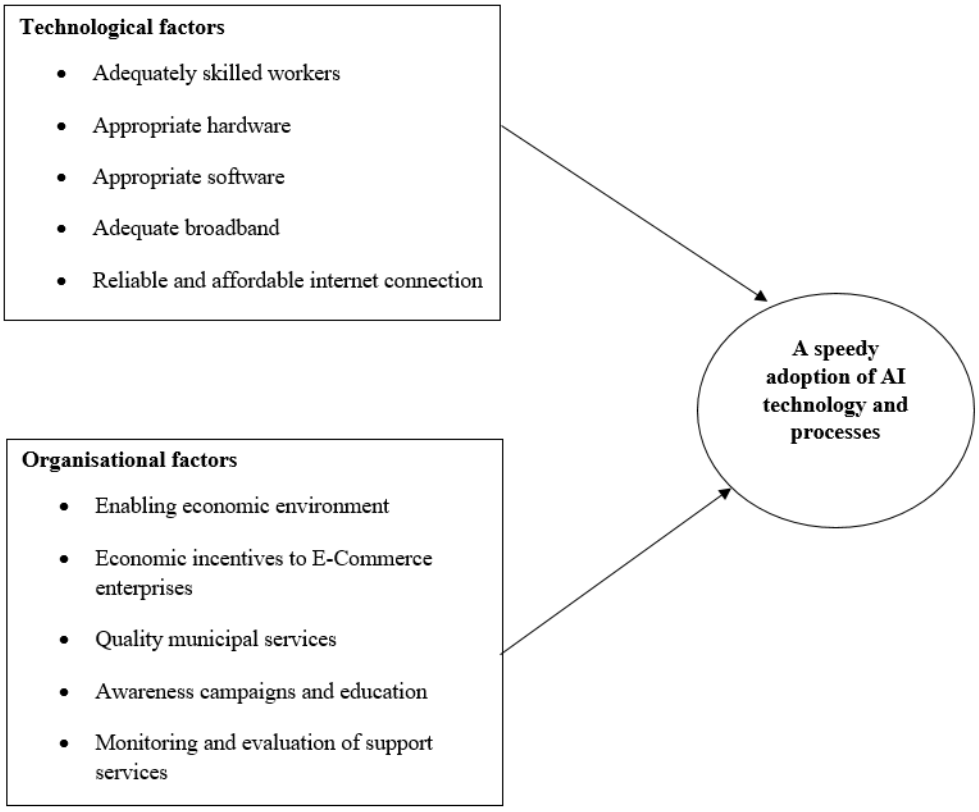

Figure 1: Framework for ensuring speedy adoption of AI technologies

Source: Adopted from Worku and Muchie (2019: 349-362)

9. Conclusion

The study has shown the numerous benefits of AI technologies and processes for South African business enterprises and companies. South African business enterprises and companies are the leaders in the African continent in the adoption and utilization of AI technologies and processes in all economic sectors. At the moment, AI applications and processes are currently being used extensively in the finance, telecommunications, banking, healthcare and agricultural sectors and that the extent of utilisation is likely to increase significantly in the coming years and decades. The study has shown that there is a significant need for the adoption of AI and digital technologies, processes and applications in all economic sectors. It is necessary to invest sufficiently on the promotion of awareness and basic education on how to utilise AI and digital technologies effectively. Intervention should place emphasis on the adoption of digital and AI processes and applications as well as setting up the infrastructure required for the effective utilisation of AI and digital technology. AI technologies are most commonly applied in information technology and communication (ICT) and research and development (R&D) purposes in South African companies. The paper shows that the level of understanding of AI in South Africa is low. Most South Africans fear that the continued use of AI will result in job losses. The study shows that it is possible to enhance e-governance services in the public sector by investing on digital technology and AI systems. The paper also shows the need for a steady supply of electricity and enhanced security for safeguarding and protecting telecommunications and electricity infrastructure.

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