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Eden Adelaine Mareya
School of Modern Posts, Chongqing University of Modern Posts and Telecommunications, Chongqing, China

Liberty Artwell Mareya
Department of Computer Science and Technology China Jiliang University. China

Chen Siqi
School of Modern Posts, Chongqing University of Modern Posts and Telecommunications, Chongqing, China

Corresponding Author:
Eden Adelaine Mareya
School of Modern Posts, Chongqing University of Modern Posts and Telecommunications, Chongqing, China

Exploring the challenges and effects of implementing automation and robotics in Zimbabwe

Eden Adelaine Mareya, Liberty Artwell Mareya and Chen Siqi

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Abstract
The research was done with the main focus of finding both challenges, and effects of implementing automation and robotics in Zimbabwe as there are relatively new concepts that are gradually gaining attention and adoption in various industries. Zimbabwe has been exploring the potential benefits of automation and robotics to enhance productivity, competitiveness and economic growth. Robotics and automation are a rapidly evolving field that create intelligent machines capable of performing tasks accurately without human intervention, efficiently and ultimately improving productivity and quality in various domains. The research found out that automation and robotics in as much as it plays a pivotal role in increasing operational efficiency and improving productivity, it also has negative effects in Zimbabwe which are lack of skilled workers, training systems that are still developing, high cost, skill gap and job displacement. Therefore, the research suggested some recommendations which may address the negative impacts to lessen in future. Some of the recommendations given places much emphasis on investing in education, training programs that cater to these technologies, creating an enabling environment with supportive policies and accessible funding mechanism.

Keywords: Challenges, effects, automation, robotics, Zimbabwe

1. Introduction
Advancement in robotics technology and automation have led to the development of specialized robots namely humanoid robots, mobile robots, drones, and autonomous vehicles. These innovations have expanded the potential applications of robotics across various industries and sectors. Zimbabwe, as many other countries, is embracing automation and robotics due to their numerous benefits since they play a pivotal role in economic development of a country which we witness in developed countries. Implementing automation and robotics can enhance multiple aspects for instance productivity, improve efficiency, and reduce operational costs in various industries.

Implementing automation and robotics in a developing country like Zimbabwe comes with both challenges and opportunities which includes Identifying Relevant Industries, Infrastructure Development, Investment and Partnerships, Skill Development and Education, Regulatory Framework and Localized Solutions. Automation and robotics address challenges in Zimbabwe for instance labor shortages and high labor costs by streamlining processes and reducing the need for manual labor. By automating repetitive tasks, businesses can optimize their operations and allocate human resources to more complex and strategic activities. Additionally, automation and robotics can enhance the quality of products and services by minimizing errors and variability. This can lead to improved customer satisfaction and increased competitiveness both locally and internationally. Furthermore, automation and robotics have the potential to fuel economic growth by attracting investments, creating new job opportunities related to research, development and maintenance of such technologies. It can also contribute to skill development and knowledge transfer, fostering a more technologically advanced workforce just to mention a few.

Overall, the adoption of automation and robotics in Zimbabwe is important to stay ahead in the global market, increase productivity, reduce costs, and foster economic development. It is a step towards embracing technological advancements and reaping their associated benefits. The focus of this paper is exploring the challenges and effects in implementing automation and robotics in Zimbabwe a developing country. It places much emphasis on how automation

they impact the country as a whole in different areas. This paper touched upon the limitations of previous studies when it comes to the aspects of automation and robotics.

2. Relevant Literature

2.1. The necessity of implementing automation and robotics

Robotics and Automation has a huge potential in improving the economies of developing countries especially in Africa and which is being noticed by governments for instance economic growth, job creation, sustainable development and global competitiveness. John, an academic, proposed that robots could provide significant benefits in regions such as Africa, where there is a shortage of medical personnel but a high demand for healthcare services. Additionally, The Washington Post discussed the potential for drones to enhance productivity among African farmers, which could result in improved economic outcomes for both farmers and their communities. This highlights a global trend towards increased automation, including Artificial Intelligence (AI), robotics, and the industrial internet, across various societal processes.

These processes encompass a wide array of activities, spanning from business operations to government services (OLUWATOPE, Victor Famubode, 2018) [18]. While automation can indeed replace certain tasks traditionally performed by labor, it also works in tandem with human workers, resulting in increased productivity, higher earnings, and greater demand for labor. The effect of automation on employment hinges on whether technology complements or substitutes workers in specific tasks, determined by the nature of the job requirements.

For tasks that are routine and can be easily standardized, there is a high likelihood that algorithms can perform those tasks, potentially leading to the disappearance or transformation of associated occupations in labour-saving. The importance of education has been underscored, particularly during the COVID-19 pandemic, with technology playing a crucial role in fostering cognitive and interpersonal skills. The effectiveness of instruction remains paramount, and technology can provide valuable support and guidance in educational settings. Governments must prioritize measures to decrease the expenses associated with education while simultaneously enhancing its standards.

Technological advancements offer the potential to improve decision-making and operations within urban areas, with promising prospects for enhancing efficiency and infrastructure, as well as healthcare and everyday living. Nonetheless, despite the anticipated advantages, the implementation of Robotic Automation Systems (RAS) may introduce challenges in specific facets of urban life (Simon Marvin & Aidan, 2019) [17]. Piriya Pholphiru (2022) [14] discusses the relationship between the introduction of robots and employment shifts in companies across African and European nations. However, the information technology (IT) sector deviates from this trend, demonstrating a positive correlation between enhanced employment within firms and the integration of new technology.

2.2. Increased productivity

Frackiewicz, Marcin asserted that Robotics and automation hold the potential to enhance efficiency, cut down expenses, and enhance quality, offering significant advantages for developing nations aiming to bolster their competitiveness in the global market-place. He further noted that with technological progress, an increasing number of industries are adopting automated processes and robotics to substitute human labor, with wide-ranging implications. While these technologies offer benefits such as cost reduction, enhanced efficiency, and stimulation of economic growth, they also raise various legal and regulatory concerns that require attention.

Introducing advanced technology in a developing African country like Zimbabwe holds significant potential to enhance the productivity and efficiency of its industries. Additionally, by automating repetitive tasks, businesses can boost output, decrease expenses, and enhance overall operational effectiveness. This trend can enhance competitiveness in both domestic and international markets. Millington, Kerry A (2017) [8] argues that future job expansion is expected in roles that cannot be entirely or partially automated. Particularly among low-skilled workers, certain services that necessitate in-person delivery or demand awareness and adaptability to the situation are likely to see growth. Within the high-skilled workforce, professions will increasingly depend on contemporary skills emphasizing creativity and interpersonal interactions, with digital technologies augmenting their duties.

The expanded deployment of robots in developed nations may challenge the cost advantage of outsourcing labor to developing countries. Automation has been integral to economic advancement, often entailing shifts in employment dynamics. Kenny Charles emphasizes that the adoption of farm mechanization, which substitutes human and animal labor with tractors and combines, has played a pivotal role in enabling to generate a surplus of food compared to its consumption. This transformation holds significance, given the notable reduction in the percentage of workers engaged in agriculture, plummeting from 74 percent in 1800 to roughly 1.5 percent presently. Specifically, in the United States, agriculture experienced a decline of four percentage points in employment share each decade from 1940 to 1980. Furthermore, automation played a crucial role in explaining the staggering decline in employment within pin factories in the UK, which plummeted by approximately 99 percent from 1820 to 1960, despite a substantial increase in output. Adam Smith proposed that individual workers could manufacture around 10 pins per day. However, in a factory employing the technology available in the 1770s, he approximated that each worker could produce 4,800 pins daily.

2.3. Economic Growth and Diversification

According to Novitske, Lexi the analysis indicates that Automation and robotics have the potential to stimulate economic expansion by drawing foreign investment and fostering diversification. Through the adoption of cutting-edge technologies, Zimbabwe has the opportunity to establish fresh sectors and industries, broadening its economic foundation beyond conventional areas like agriculture and mining.

Throughout the continent, spanning from Ghana to Zimbabwe, this technology holds promise for numerous beneficial transformations in fields like healthcare and finance. It has the potential to address deficiencies in physical infrastructure while meeting consumer demands, thereby enabling skilled labor to focus on tasks that require expertise and enhancing overall labor productivity.

Automation has the capacity to release resources and labor, opening avenues for the creation of new enterprises and job prospects. This can be notably advantageous in industries such as healthcare and manufacturing, which exhibit significant potential for automation. Kenny Charles (2019) [21] points out that the primary cause of poverty in developing nations is their low productivity, partly attributed to inadequate automation. These countries have yet to fully embrace existing technologies, such as tractors, combine harvesters, spindles, Bessemer plants, and electricity, to elevate their productivity levels. The sluggish spread of these technologies stems from multifaceted factors, yet it's noteworthy that poverty and the scarcity of well-compensated formal sector employment are linked with limited adoption of productive technologies, rather than their extensive utilization. The emergence of automation and robotics is prompting a displacement of labor across numerous mining operations, a trend anticipated to expand in the future owing to technological advancements and cost reductions (David Fleming-Muñoz, 2021) [4].

2.4. Technological Leapfrogging

Zimbabwe, among other developing nations, has the opportunity to utilize automation and robotics to skip certain phases of conventional industrial progress. By directly embracing advanced technologies, they can narrow the gap and with more developed economies, hastening their economic advancement. This approach allows these nations to expedite their economic expansion and advancement by capitalizing on the most recent advancements and technologies, bypassing the gradual evolution observed in more developed nations. Technological leapfrogging entails integrating advanced automation and robotics technologies without heavy reliance on outdated or labour-intensive methods. This approach can assist Zimbabwe in surmounting infrastructural limitations, resource constraints, and other obstacles, enabling it to swiftly narrow the gap with more advanced economies. Technological leapfrogging emerges as a potent catalyst for development and overcoming technological hurdles. Nevertheless, it's crucial to acknowledge that technological leapfrogging presents its own array of challenges, including the necessity for sufficient infrastructure and a skilled workforce. Will Stevens (2023) [19] asserts that despite encountering obstacles, creative strategies have surfaced within African supply chains. For instance, mobile technology has been employed in nations such as Kenya to bolster payment systems and facilitate real-time tracking of goods, resulting in enhanced supply chain efficiency.

2.5. Global Competitiveness

Integrating automation and robotics has the potential to bolster Zimbabwe's competitiveness in the global arena. Through the adoption of advanced technologies, the nation can enhance the quality, cost-efficiency, and timeliness of its offerings, positioning itself for global competition. This transition can elevate Zimbabwe's presence on the global stage, fostering rapid growth. Oluwatope, Victor Famubode (2018) [18] contends that as governance reaches digital maturity, productivity and efficiency will rise, albeit at the expense of certain jobs. E-governance is poised to utilize automation to streamline government processes and address public demands.

2.6. Economic Implications

Additionally, the integration of automation and robotics raises apprehensions about job displacement, a significant issue for many individuals in Zimbabwe as routine or low-skilled tasks become automated. This could potentially lead to job loss or reduced employment opportunities for workers, especially those lacking the skills to transition to alternative roles. However, proponents argue that technology adoption can also foster the emergence of new job prospects in areas such as robotics, monitoring, maintenance, and programming. It's imperative to thoroughly assess the economic ramifications to grasp the potential effects of introducing automation and robotics into Zimbabwe's economy. Historical advancements in industrial technology have often sparked social concerns, commonly known as "automation anxiety," regarding substantial job losses. One notable historical instance is the Luddite movement during the Industrial Revolution, where English textile workers protested against the automation of textile production, fearing it would jeopardize their livelihoods. There have been recurring episodes of concern regarding automation's impact on the job market, spanning from the integration of computers in offices and robots in factories during the 1960s to the rise of personal computers in the 1980s. Despite these apprehensions, overall employment experienced substantial long-term growth (Economist, 2016). Historically, job displacement and losses resulting from technological advancements have been inherent aspects of economic advancement. Boosting productivity through technology's substitution of human labor while enhancing the capabilities of existing and incoming workers fosters economic expansion. This process liberates both human and financial resources for allocation in sectors with greater returns and diminishes the necessity for individuals to engage in physically strenuous, repetitive, or hazardous tasks. However, in developing countries like Zimbabwe, where the unemployment rate is particularly high among university graduates, predominantly from the upper echelons of the income spectrum, automation is perceived as a dual-edged sword. While it offers benefits, it also presents the challenge of job displacement, which can be burdensome to bear. According to Gaurav Nayyar (2019) [22], automation elevates the standards required for success in export-oriented manufacturing, with the feasibility agenda playing a central role in broadening available opportunities. The key challenges within this agenda encompass competitiveness, capabilities, and connectedness, often abbreviated as the 3Cs. As emerging technologies that save labor diminish the significance of low wages in cost determination, African nations must fulfill increasingly stringent ecosystem prerequisites related to infrastructure, logistics, and regulatory frameworks. Chipo Mutongi and Billy Rigava (2024) [2] explain that the utilization of healthcare robots in Africa, including Zimbabwe, is constrained by various obstacles such as apprehension of the unfamiliar, cultural considerations, power and connectivity constraints, and insufficient awareness.

2.7. Skill, Technologies and New Jobs

Ramped-up automation will result in the emergence of fresh tasks and employment opportunities. However, these new roles will necessitate updated skill sets. Consequently, the integration of advanced machinery in industries will demand workers capable of acquiring these new skills. According to Mckinsey Global Institute (2017), in developing nations, the swiftest employment growth is observed in positions necessitating a college diploma or higher. For instance, in China, there is substantial demand for occupations currently requiring university degrees or higher. Simultaneously, around 60 million positions presently mandate a high school diploma. Furthermore, despite automation's impact, India anticipates a demand for approximately 100 million new employees with a high school education. Automation necessitates heightened skill levels. The acquisition of additional digital competencies and the synergy of critical skills are crucial for individuals to adapt to digital transformation and automation (CEDEFOP, n.d.). Hence, the industry will require highly skilled professionals whose expertise will be highly sought after and who will be capable of instructing other workers to effectively grasp and adapt to the new responsibilities arising from automation. By 2022, 54% of employees will need to acquire new skills to fulfill the demands of the tasks created by automation. Specifically, 35% of these workers will require training lasting at least six months, while 9% will necessitate training exceeding six years, and 10% will need training lasting more than one year (World Economic Forum, 2018). A common issue arises from the discrepancy between required skills and available technologies, as workers often lack the necessary expertise to utilize new technologies effectively within industries. These requisite skills typically demand a high level of education or practical experience, which is often lacking among workers. Additionally, employers frequently struggle to find workers proficient in the new roles and tasks brought about by extensive automation. The implementation of Autonomous Robotic Construction (ARC) in construction sites and the utilization of automation and robotics in the manufacturing sector have been associated with potential job reductions, as noted by Josephine Llale (2020) [6]. Mvuyisi Mabungela (2023) [11] highlights that automation and the deployment of manufacturing robots offer substantial cost savings in labor and product expenses, particularly in developed nations where labor costs are high. Robots present numerous benefits, including continuous operation unaffected by factors like illness, family responsibilities, strikes, or vacations. Unlike human workers, robots enable mass production, prompting numerous businesses to increasingly depend on technology to enhance their production capacity.

3. Research Methodology

The research method was done through telephone in interviews. This decision was made for two reasons which are literature review results showing the existing studies of challenges and effects of implementing automation and robotics in Zimbabwe from a technological perspective. This research collected primary data through interviewing and questionnaire survey to propose appropriate challenges and effects of implementing automation and robotics and how they can be tackled and mitigated. Second, rich contextual information from interviewees deepens both researchers and practitioners' understanding of challenges and effects faced when implementing automation and robotics in a developing country. The semi-structured interviews were conducted for two purposes, first, identifying challenges and exploring effects in implementing the two technological advancements. The Automation and robotics' challenges and effects are based on the literature review were first provided to interviewees for validation. The final results were presented in Table 1. Subsequently, interviewees were asked to provide their experiences and perspectives pertaining this topic. The semi-structured interviews with various players achieved the aim to provide an investigation of the implementation of Automation and Robotics in a developing country specifically Zimbabwe. Specifically, key players in the were considered, including private companies, Labor Unions, Academic Institutions, Industry Associations, Government, Entrepreneurs and Start-ups. Telephone interviews were conducted in Chongqing, China because the following reasons: The writer of this paper is in China, surrounded by students from Zimbabwe who are studying in China and some students who come from other nearby African countries including South Africa, Zambia, Tanzania, and Mozambique. A total of 20 semi-structured interviews were conducted. Most interviewees were workers in Zimbabwe, students in Zimbabwe and students who are studying in China who resided in China for more than 2 years. The participants' stay in China and rich working experience present that the participants were likely to produce reliable results in the data collected. The interview duration was approximately 60 minutes on average, indicating that the participants' opinions were fully acknowledged in the interview.

4. Questionnaire Survey

The questionnaire was prepared to collect data about the challenges and effects in implementing automation and robotics in Zimbabwe. It provides future alternatives that can be taken in the future. The questionnaire for this research is divided into four sections which includes demographic information, and questions were set out to get information about the types of work, sector, income etc. Section-B described the level of execution and development including the questions whether the company uses robotics and automation technologies. Section-C described the challenges for the execution of robotics and automation in Zimbabwe. Section-D describes the barriers and factors for the implementation of robotics and automation in Zimbabwe. The total number of questionnaires sent to the respondent was 10. The questionnaires were sent to the respondents through Instagram, WeChat and WhatsApp. They were requested to return filled questionnaires within a week of receiving. The remainder letter was also emailed to each respondent for better response. The response rate from the respondents is shown below.

4.1 Data Presentation and Analysis

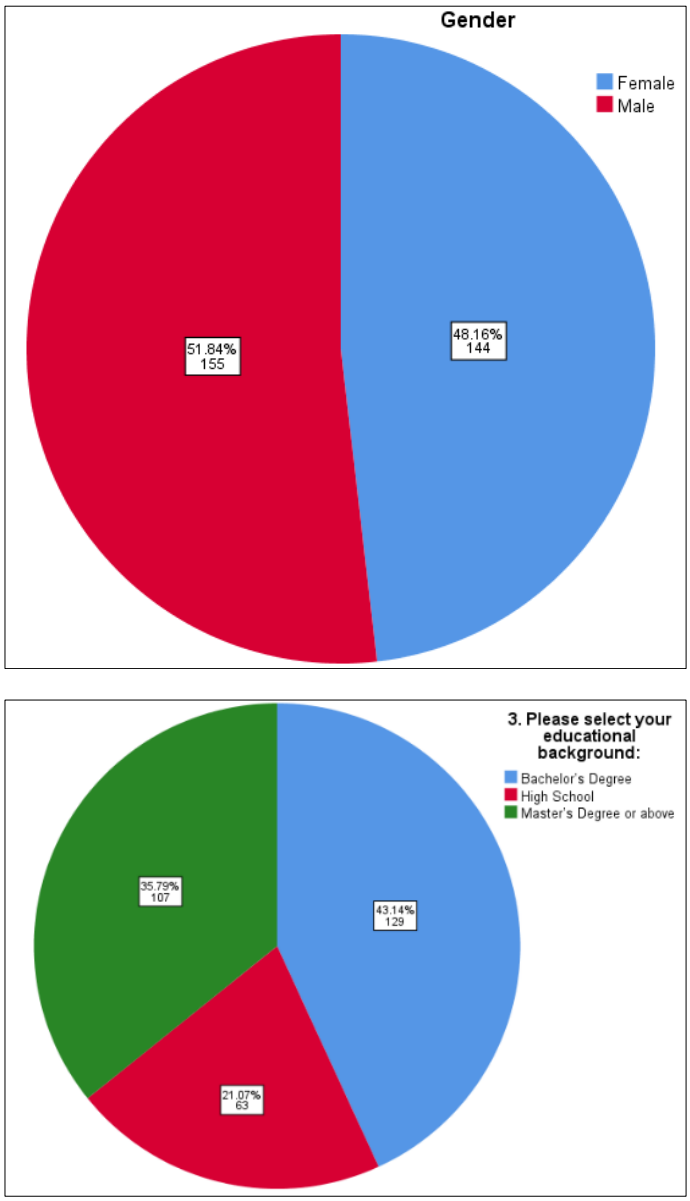
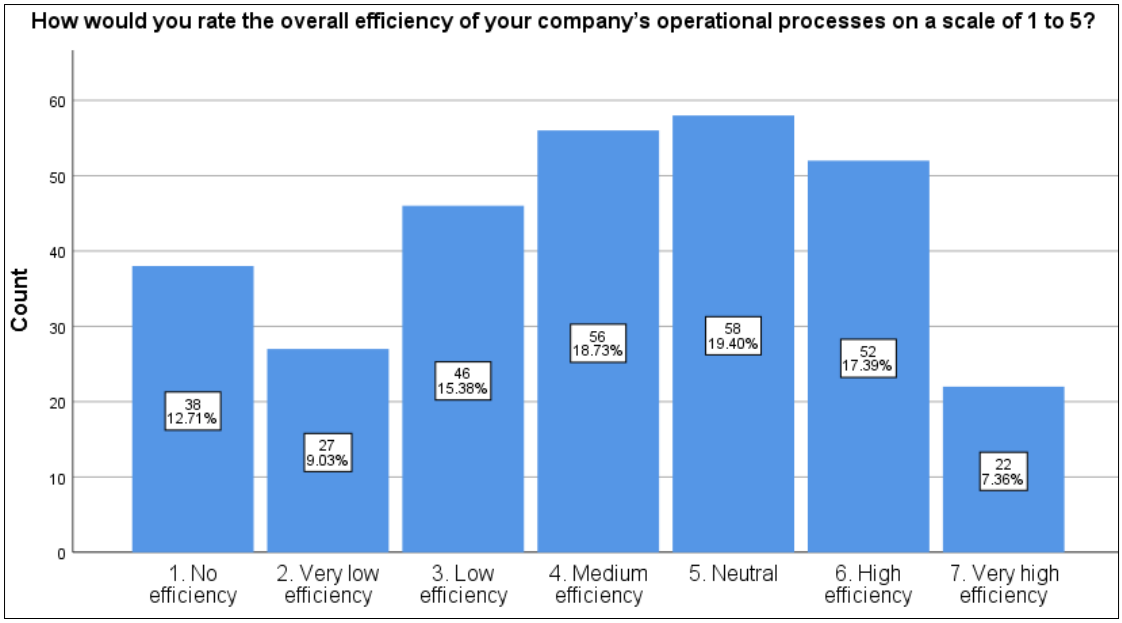
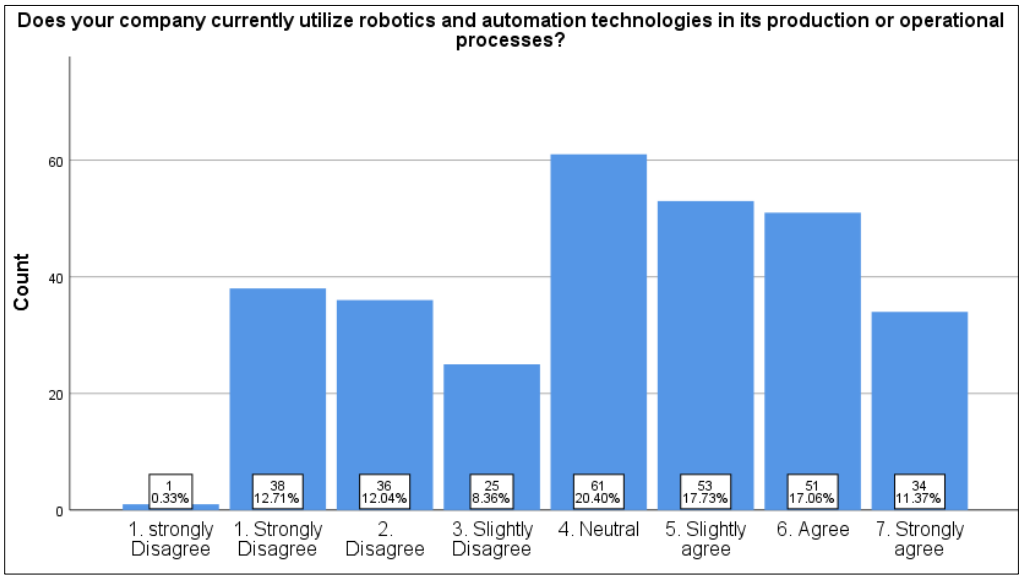


Chart 1: Gender and Education Background



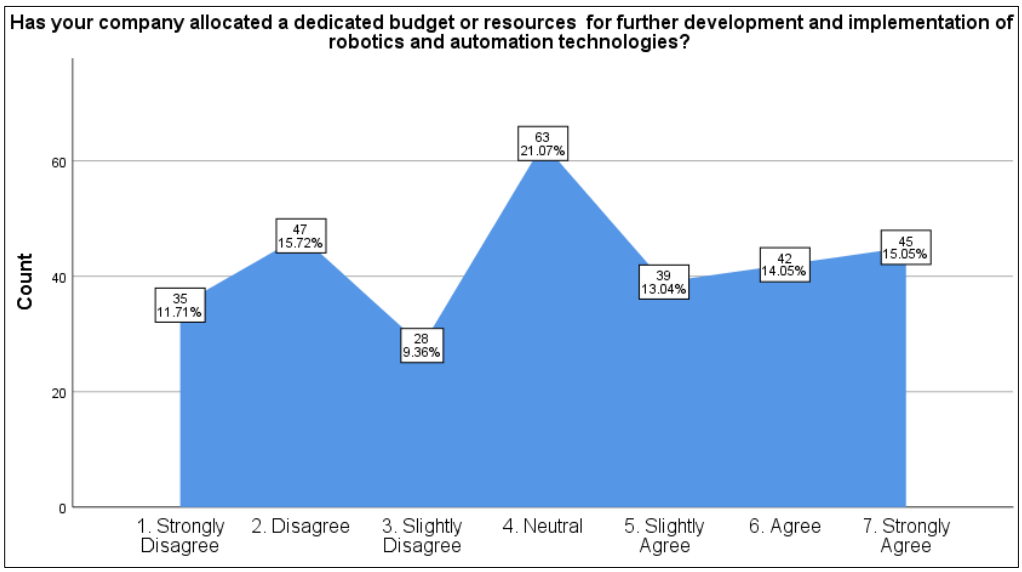
Graph 1: Rating the overall efficiency of a company processes

The overall efficiency in this survey has 19.40% level of efficiency which is neutral which indicates that the respondent neither strongly agrees nor disagrees with the statement. Furthermore, thus suggest that the respondents do not strongly perceive either positive or negative impacts which indicate a balanced and uncertain viewpoint. This might indicate a lack of firsthand experience with automation, uncertain about its specific impacts or a need for more information. Moreover, some might be having concerns that includes fears of job displacement, specifically in labour-intensive industries, potential economic inequality and the need for upskilling the workforce. It must be noted that there are also some who views this in a very positive view as the graph shows that 17.39% which indicates "High Efficiency'' hence that means there are some who are aware of its negative impacts and threats to their professions, however they are not paying a blind eye to its positive impacts that can benefit companies' efficiency.



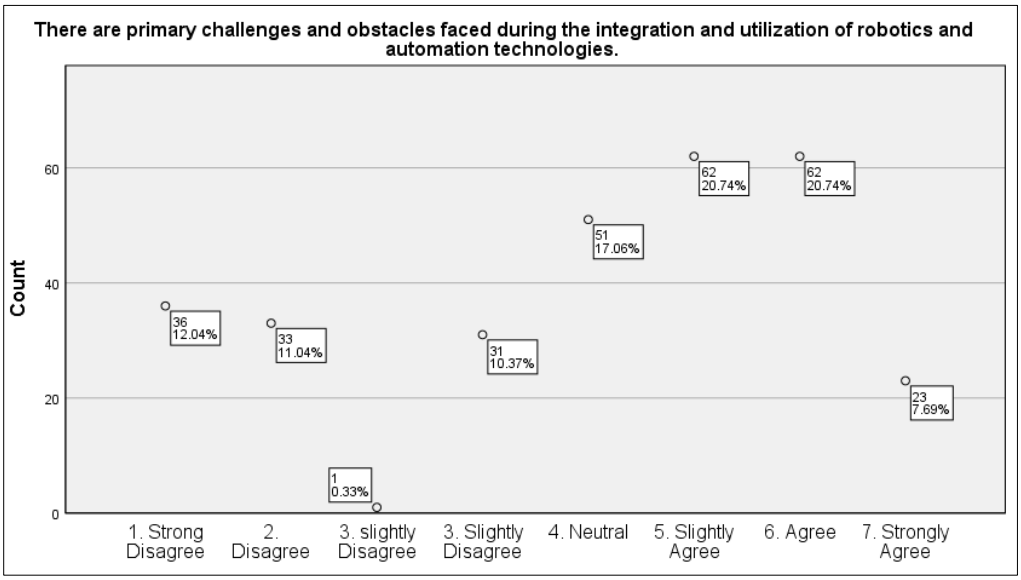
Graph 2: Utilizing robotics and automation technologies in companies

Neutral suggests that a significant portion of respondents neither agree nor disagree about their company's use of robotics and automation. This might indicate a lack of clear stance or awareness among participants. The second-highest response, "Slightly Agree" at 17.73%, suggests a moderate inclination towards agreement which could imply that a portion of respondents sees some level of utilization or potential benefit in incorporating robotics and automation, but they may not be fully convinced or committed. This might be caused by lack of Information. Respondents might not have sufficient knowledge about the company's current utilization of robotics or automation, leading to a neutral response. Furthermore, Uncertainty about Benefits or Risks: Individuals may be unsure about the potential benefits or risks associated with the implementation of robotics and automation in the company concerns about Job Security. Some respondents might have concerns about how automation could impact job security, leading to a neutral stance. Moreover, Past Experiences plays a pivotal role as in previous experiences or perceptions about the effectiveness of automation in similar contexts could influence respondents' neutrality.



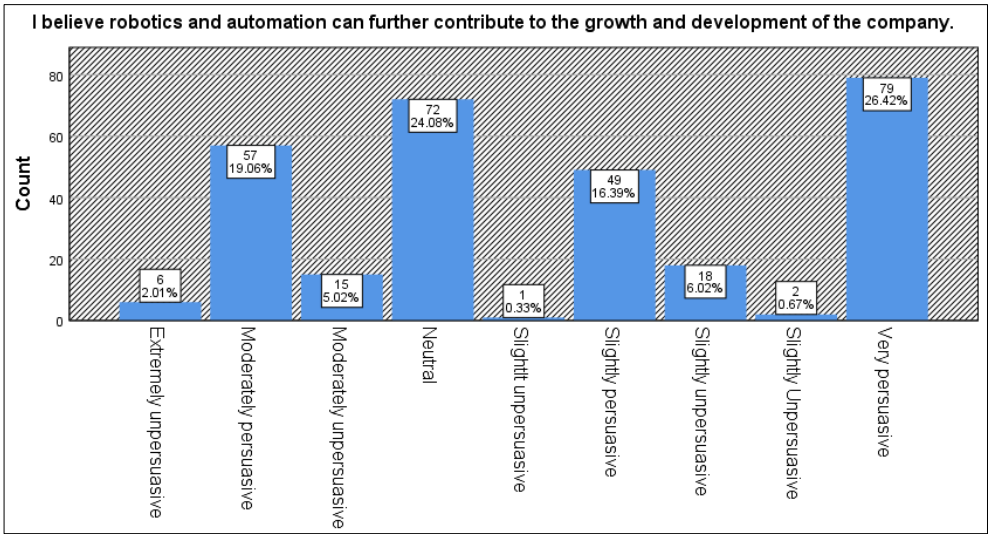
Graph 3: Allocation of a dedicated budget or resources

In this case, the highest audience response was neutral (21.07%), indicating a lack of strong inclination either way. However, it's noteworthy that 11.71% strongly disagreed, suggesting a portion of respondents might not be supportive of allocating resources for robotics and automation. This may be due to Budget Constraints, companies might be facing financial challenges, making it difficult to allocate dedicated resources to new technologies. Some respondents might be sceptical about the return on investment and uncertain about the tangible benefits of implementing robotics and automation.



Graph 4: Primary challenges and obstacles in integration and utilization

The challenges faced during the integration of robotics and automation technologies, notes that the highest combined percentage which is (20.74%) for "Slightly Agree" and "Agree" suggesting a notable portion of respondents acknowledging challenges. Conversely, the lowest response (0.33%) for "Slightly Disagree" indicating minimal disagreement. A significant portion of respondents acknowledges facing challenges, pointing to shared concerns or issues during the integration of robotics and automation technologies. Consensus on Difficulties: The absence of strong disagreement suggests a broad consensus among respondents about the existence of obstacles, emphasizing the universality of challenges in this context.



Graph 5: Robotics and Automation contributing to growth and development of the company

The belief in the contribution of robotics and automation to company growth reveals a significant positive sentiment with the highest response at 28.42% for "Very Persuasive," it suggests a substantial portion of respondents strongly believe in the positive impact of these technologies. Additionally, the low rate of 2.01% for "Extremely Unpersuasive" indicates minimal scepticism. High Positive Perception: The dominant response of "Very Persuasive" implies a strong consensus among respondents regarding the potential positive influence of robotics and automation on company growth. Limited Skepticism: The low rate of "Extremely Unpersuasive" indicates that a negligible percentage of respondents are highly doubtful about the benefits, reinforcing the overall positive sentiment. Given the overwhelmingly positive perception, there may be an

opportunity for aligning organizational strategies with the positive views on robotics and automation to drive growth.

4.2. Results and Discussion

The results among the interviewees regarding the challenges and effects of automation and robotics in Zimbabwe indicates a divided opinion, with 50% perceiving positive effects, such as enhanced productivity and efficiency, while the other 50% see negative impacts, which might include concerns about job displacement or other potential drawbacks. This might be influenced by a lack of understanding how it is used in companies and some are not that open to advanced technologies yet. The survey results indicate a slightly higher participation from males (51.84%) compared to females (48.16%). In terms of education background, the majority of respondents have a Bachelor's Degree (43.14%), followed by Master's Degree or Above (35.79%), and High School Students (21.07%). These findings provide a demographic overview of the survey these demographics might influence the survey responses on automation and robotics. Demographics, such as gender and education level, can influence survey responses on the challenges and effects of implementing automation and robotics in Zimbabwe in several ways including: Perspective Variation: Different genders and educational backgrounds may lead to distinct perspectives on technological changes. For example, individuals with higher education might focus on the economic benefits, while those with lower education might be more concerned about job displacement knowledge Base: Respondents with varying educational levels may possess different levels of knowledge about automation and robotics. This could impact the depth and insightfulness of their responses. Furthermore, Cultural Influence: Gender and education can be associated with cultural factors that shape perceptions. Cultural values may impact how respondents view the role of automation and robotics in Zimbabwe, influencing their perceived challenges and effects. Moreover, Career Impact: Education level might influence how individuals perceive the impact of automation on their careers. Those with higher education might focus on the potential for skill development, while others may be more concerned about job security.

In addition, Access to Information: Education often correlates with access to information. Respondents with higher education might be more informed about the subject, affecting the nature and depth of their responses compared to those with lower educational backgrounds. It is crucial to analyse survey responses while considering these demographic factors to draw meaningful insights and understand the diverse perspectives within the surveyed population. In graph 1 results suggest a diverse range of opinions regarding the overall efficiency of the company's operational processes. The highest percentage falls under the "Neutral" category, indicating a significant portion of respondents may have mixed views or find the efficiency level neither particularly high nor low.

In graph 2 a breakdown of the responses is as written: this Strongly Disagree (1): 12.71% Disagree (2): 12.04%, Disagree (3): 8.36% Neutral (4): 20.40%, Slightly Agree (5): 17.73% Agree (6): 17.06% Strongly Agree (7): 11.37%. The highest percentage falls under the "Neutral" category, indicating a significant portion of respondents are unsure or have a neutral stance on the company's current use of robotics and automation technologies.

To add more, in graph 3 the highest percentage falls under the "Neutral" category, indicating a significant portion of respondents are unsure or have a neutral stance on whether their company has allocated resources for robotics and automation development. Factors influencing the respondents might be Company Size and Industry, Financial Health, Awareness and Understanding, Leadership Priorities and Regulatory Environment.

In graph 4 has effectively assessed the audience's views on the challenges and obstacles faced during the integration and utilization of robotics and automation technologies. The nature of these challenges can be identified by adding specific questions for instance

Operational Challenges: What specific challenges do you think your company faces in the day-to-day operation of robotics and automation technologies?

Cost-Related Issues: How do you perceive the cost implications of implementing these technologies in your organization?

Workforce Impact: In your opinion, how does the integration of robotics and automation affect the current workforce in terms of job roles and responsibilities?

Technological Barriers: Are there specific technical challenges hindering the smooth integration and utilization of these technologies in your company?

Training and Skill Development: Do you believe there are adequate training and skill development programs in place to support the workforce in adapting to these technologies?

In graph 5 The questionnaire results provide insights into respondents' beliefs regarding the contribution of robotics and automation to the growth and development of the company.

Extremely Unpersuasive (1): 2.01%
Moderately Persuasive (2): 19.06%
Moderately Unpersuasive (3): 5.02%
Neutral (4): 24.06%
Slightly Unpersuasive (5): 0.33%
Slightly Persuasive (6): 0.33%
Slightly Unpersuasive (7): 0.67%
Very Persuasive (8): 26.42%

The highest percentage falls under "Very Persuasive," signifying a significant portion of respondents strongly believe in the positive impact of robotics and automation on the company's growth and development. The findings also reveal a diversity of opinions, emphasizing the importance of understanding varying perspectives in the organization.

5. Conclusion

This research aimed to explore the challenges and effects of implementing automation and robotics in Zimbabwe, considering these relatively new concepts gaining traction across industries. Zimbabwe has been examining automation and robotics to boost productivity, competitiveness, and economic growth. While these technologies offer potential benefits, such as increased efficiency and productivity, they also present challenges,

including a lack of skilled workers, developing training systems, high costs, skill gaps, and job displacement. Recommendations were proposed to mitigate these negative impacts, emphasizing investments in education, training programs, supportive policies, and accessible funding mechanisms. Survey results indicated a divided opinion among interviewees, with 50% perceiving positive effects and 50% expressing concerns, potentially influenced by varying levels of understanding and openness to advanced technologies. Demographic factors such as gender and education level may influence perspectives on automation and robotics, impacting survey responses. Graphical analysis revealed a significant portion of respondents holding neutral views on efficiency, current use, and resource allocation for automation technologies. Specific challenges identified included operational issues, cost implications, workforce impact, technological barriers, and training needs. The interviewees provided diverse perspectives on the implications of automation and robotics in Zimbabwe. Overall, while there are concerns and challenges, interviewees also highlighted the potential benefits of automation and robotics for Zimbabwe's economy and workforce. Despite diverse opinions, a majority of respondents believed in the positive contribution of robotics and automation to company growth and development, highlighting the importance of understanding varied perspectives within the organization.

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Appendix

These are the responses from interviewees when exploring the challenges and effects of implementing automation and robotics in Zimbabwe.

Interviewee 1	Loss of jobs due to automation and robotics. This technology could replace human workers, particularly in sectors like manufacturing and agriculture, leading to unemployment and social unrest.
Interviewee 2	Skills gap are quite challenging as it will be hard to adapt to automation and robotics.
Interviewee 3	There is need for training programs and educational initiatives to ensure that workers have the necessary skills to work alongside these new technologies.
Interviewee 4	Automation and Robotics can impact the economy positively as it will increase productivity and efficiency which could result in economic growth.
Interviewee 5	Due to inequality and digital division, these technologies could be limited to larger or wealthier organizations, leaving smaller businesses and marginalized communities at a disadvantage.
Interviewee 6	There is need for effective policies and regulations pertaining data privacy, cybersecurity, and the ethical consideration

	surrounding the use of these systems.
Interviewee 7	The initial costs of implementation and the potential adverse effects on small businesses and informal sectors may not be able to adopt the technology.
Interviewee 8	Automation and robotics is an opportunity for Zimbabwe to foster innovation and attract investments.
Interviewee 9	The advanced technologies will open doors for new industries, job creation in high tech sectors and the country's ability to become a regional hub for high technology.
Interviewee 10	This will lead to improved quality and safety by minimizing human error, these technologies can ensure the reputation of Zimbabwean goods and safe working environment.
Interviewee 11	Automation and robotics can help Zimbabwe diversify its economy by reducing its reliance on traditional sectors. This can contribute to long-term economic stability and promote a more balanced and sustainable growth trajectory.
Interviewee 12	This can attract foreign investment, promote innovation, and position the country as a regional leader in adopting cutting-edge technologies.
Interviewee 13	Automation and robotics can greatly enhance productivity and efficiency in various industries. This could help Zimbabwe in scaling up its manufacturing capabilities and improving the overall output.
Interviewee 14	Zimbabwe could become overly dependent on foreign countries for the supply, maintenance, and upgrading of automated systems and robotic technology. This dependency could have negative implications for the country's economic and national security interests.
Interviewee 15	Automation and robotics could disrupt traditional industries that form the backbone of Zimbabwe's economy, such as agriculture or textiles. This might have negative consequences for local businesses, particularly smaller enterprises that struggle to adapt to the rapidly changing technological landscape.
Interviewee 16	Without proper investments in education and training initiatives, there could be a significant mismatch between job requirements and the available workforce, further exacerbating unemployment.
Interviewee 17	The lack of adequate skills and training programs to prepare the workforce for the new demands posed by automation and robotics.
Interviewee 18	This may disadvantage students in rural areas as they may have limited access to the education and the training required to participate in the technology-driven job market.
Interviewee 19	Automation and Robotics is a chance for future job opportunities in the field of technology and robotics especially for engineering students.
Interviewee 20	Automation can enhance productivity, improve efficiency and contribute to economic growth in the long run.