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INDUSTRY 4.0 TECHNOLOGIES AND OPERATIONAL PERFORMANCE OF UNILEVER KENYA AND L'OREAL EAST AFRICA

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ABSTRACT: Purpose: The purpose of the study was to investigate the impact of Industry 4.0 technologies and applications on FMCGs manufacturers in Kenya, with specific reference to L'Oréal East Africa and Unilever. **Design/Research method:** The two companies were selected for the study because they are among the largest FMCGs manufacturers in Kenya, thus the size of their operations is almost equal. Therefore, the study was conducted through a case-study design. Data was collected using an interview guide and the information interpreted through descriptive statistics. **Finding:** The study established that Industry 4.0 technologies (autonomous robots, big data and analytics, augmented reality, cloud computing, and operations) helps in enhancing operational performance in FMCGs specifically in predicting demand, understanding consumer behavioural patterns, minimizing errors and enhancing flexibility for effective decision making. **Limitation:** There was the lack of previous studies on Industry 4.0 adoption in Kenya to provide a foundation for the research this being a new area of technology adoption in organization since the study was limited to people working in Unilever and L'Oréal East Africa, thus the findings cannot be generalized to all the other manufacturing companies in the country. **Implication:** The companies can improve the integration of the technologies in their operations by developing an updated industry 4.0 implementation plan and communicate the information to employees to improve their readiness for the change.

Keywords: Industry 4.0 Technologies, Operational Performance, Unilever Kenya, L'oreal East Africa, Kenya

1. INTRODUCTION

The world is currently in the fourth wave of the industrial revolution that promises to open new doors for manufacturing companies using IT in various ways. Industry 4.0 refers to the “intelligent networking of industrial products and processes” (Nagy *et al.*, 2018). The technologies associated with Industry 4.0 are big data analytics, autonomous robotics, and real-time simulation of activities, cybersecurity, augmented reality, additive manufacturing, system integration and Internet of things (IoT). Through IoT all IT resources in the company become interconnected; thus, they communicate with each other, enabling organizations to provide real-time responses to industrial happenings (Nagy *et al.*, 2018). Already, some manufacturing companies have begun the adoption of industry 4.0, leading to the realization of numerous advantages (Liere-Netheler *et al.*, 2017). For example, companies use the cloud system to store enormous data securely and use the information to support management systems and decisions.

In recent years, the Industry 4.0 technologies and applications have become a dominant force in the operational performance of manufacturers around the globe. They have been integrated into all the activities of manufacturing companies including logistics through transportation scheduling and vehicle tracking; procurement of materials through order processing and purchasing; operations where technology is used in inventory management and production scheduling; vendor relationship management that involves information sharing, creating long-term trust and commitment (Jadhav *et al.*, 2015). Coordination of the supply chain activities helps companies to fulfill consumers' expectation, reduce inventory costs, and improves strategic planning leading to better operational performance.

Over recent years, the Kenyan FMCGs industry has experienced exponential growth. The observed increase is attributable to the entry of new local and international firms manufacturing and selling the

products to consumers (Mwanza and Ingari, 2015). Some of the well-known and top brands in the country include L'Oréal East Africa, Kevian Kenya, Kapa Oil, Bidco Oil Refineries, Coca Cola, HACO Industries, Unilever Kenya Limited and Nestle Foods Kenya among others. L'Oreal is the largest business globally providing beauty and cosmetic products and as an acclaimed marketer of beauty products for both genders commanding presence in nearly all countries in the world. L'Oréal's biggest competitor in Kenya is Unilever.

1.1. Research Problem

IT tools are integral in the enhancement of the operational performance of organizations. FMCGs manufacturers strive to safeguard their position in the competitive industry by ensuring the availability of their products in the market at all times (Lawless, 2000). FMCGs manufacturers are keen on leveraging on Industry 4.0 to manage their supply and operational activities to improve their competitive advantage in the marketplace (Magutu *et al.*, 2015; Magutu *et al.*, 2016; Mose *et al.*, 2013; Wasamba, 2008).

Industry 4.0 is a new concept that has attracted much interest globally. Industry 4.0 also known as smart factory is the fourth wave of the industrial evolution that began in Germany to improve the competitiveness of the country's manufacturing sector. Industry 4.0 extends the functioning of advanced digital technologies leading to creation of a system that allows the interconnection of people and machines through information technologies (Lin *et al.*, 2018). Moreover, Industry 4.0 technologies lead to the realization of numerous benefits such as integration of services, lower costs, inventory reduction, and elimination of production wastes leading to better operational performance (Youssef and Youssef, 2018).

Although Industry 4.0 technologies were introduced in the Western countries, their implementation is highest in the Asian countries most notably China and Turkey. In Africa, Industry 4.0 is still in the early development stages and its implementation rate varies between countries and companies (Deloitte, 2017). There has been gradual adoption of Industry 4.0 by FMCGs manufacturers in Kenya; the trend is indicative of the growth in understanding and appreciation of the influence of these technologies and their applications. Industry 4.0 application has not been adopted in many companies, thus studies on these technologies are narrow (Manda and Ben-Dhaou, 2019). No study has been conducted to investigate how Industry 4.0 affects the operational performance of FMCGs manufacturers in Kenya. Therefore, the study aimed at bridging this gap by answering the research question "what is the impact of Industry 4.0 on operational performance of FMCGs manufacturers in Kenya." The study objectives were: to establish the extent of adoption of Industry 4.0 technologies by Unilever and L'Oréal East Africa; to determine the type of Industry 4.0 technologies used by Unilever and L'Oréal East Africa; and to establish the impact of Industry 4.0 technologies on the operational performance of Unilever and L'Oréal East Africa.

2. LITERATURE REVIEW

The literature review focused on synthesizing past literature focusing on the impact of IT on operational performance of organizations. The section documents the type of IT resources used in organizations, and how they relate to the operational performance measures.

2.1. Theoretical Literature Review

Various theories have been used to explain the impact of IT on organizational operational performance; however, this study focused on two theories; Technology Acceptance Model 3 and Diffusion of Innovation Theory.

Technology Acceptance Model: TAM 3 is arguably one of the most popular theories used to explain the implementation of technological systems in organization. TAM 3 theorizes that two primary factors influence the utilization of IT resources in a company namely perceived ease of use and perceived usefulness of the system. According to Venkatesh and Bala (2008), perceived usefulness is the degree to which employees' belief that the IT resources improved their performance. Perceived ease of use is the second factor that influences IT implementation. Venkatesh and Bala (2008) defines perceived ease of use as the extent to which a person believes that the employing the IT systems will be free of effort.

TAM 3 is a relevant theory in the study because it explains the factors influencing IT adoption in organizations. The theory shows that a company's decision to adopt a new technology like Industry 4.0 is dependent on perceived usefulness and its ease of use. Moreover, the two aspects are linked to internal and external factors. Therefore, the study focused on these external and internal factors to determine the extent of Industry 4.0 adoption in the organizations.

Diffusion of Innovation Theory: The diffusion of innovation theory (DOI) is another relevant school of thought that explains the implementation of IT systems in organizations. E. M. Rogers developed DOI

and it explores factors influencing the adoption of innovations, which refers to new ideas or products in a company. According to the theory, five elements affect the adoption of new ideas in organizations. One is the relative advantage of the innovation that is the perception that a new product is superior to the existing assets. Two is the compatibility of the innovation with existing organizational features like values, behavioral standards and customer needs. Three is the complexity of the innovation that is the ease of using the new products. Four is observability of the results produced by the innovation. Lastly is triability of the information system that is the ability to experiment the system before its implementation.

Undoubtedly, the DOI theory is relevant to the study and Unilever and L'Oréal East Africa used it to evaluate the difference in the Industry 4.0 innovation. The IT innovation adoption rate differs between companies. Some organizations are innovators meaning that they are in the frontline of trying innovations, while others laggards that they are conservative and take a lot of time to embrace the changes introduced in the industry (Sahin, 2006). Therefore, the theory helped to determine the stage of Industry 4.0 adoption in the targeted manufacturing companies.

2.2. Industry 4.0 Technologies and Applications

Industry 4.0 is the latest stage in industrial revolution. It mainly focuses on real-time data, interconnectivity, machine learning and automation.

Autonomous Robots: Autonomous robots are a critical technology in Industry 4.0 that are transforming the manufacturing industry. Historically, robots have been an integral component in manufacturing firms to perform routine and repetitive tasks. Robotics technologies have been advanced through the different industrial waves including Industry 1.0 in 1784, Industry 2.0 in the 1870's, Industry 4.0 in the 1969's, and Industry 4.0 today (Karabegović and Husak, 2018). Advantages of autonomous robots are faster product development, increased efficiency, reduced errors, and better human and machine collaboration (Deloitte, 2019). As a result, the adoption of autonomous robots is key in improving operational performance.

Big Data and Analytics: Big data refers to the large and complex data sets generated by manufacturing companies. The size of big data varies from company to company; it may be a terabyte or petabytes depending on the size of operations. Big data collected from varied sources including sensors, customers, manufacturing processes, logistic vehicles, and other technological devices in organizations (Wang and Hajli, 2017). Advantages of using big data analytics are faster decision making, reduction of operational costs, and new product development (Erboz, 2017). In addition, big data analytics leads to the development of new competitive advantages that improves their performance.

Augmented Reality: AR is a central technology in Industry 4.0. AR is an interactive technology that involves using computer-generated display to represent the real environment, thus it enhances the users experience and understanding of their surroundings (Erboz, 2017). AR uses computerized simulations to represent real images. One of the most commonly used AR devices globally is Google Glasses that collects visual and audio information in the surroundings. However, AR has a broad application in the manufacturing industry as it is used to create the

Horizontal and Vertical System Integration: Horizontal and vertical system integration leads to the development of smart manufacturing. Vertical integration refers to the combination of physical infrastructure and information systems at different hierarchical levels in an organization to achieve production agility. Horizontal integration, on the other hand, is the interconnection of stakeholders in the supply chain. Vertical integration is supported by the Cyber-Physical Systems (CPS).

Cloud Computing: Cloud computing (CC) is arguably the most well-known technologies of Industry 4.0. CC refers to subscription information storage resources that are available to organizations. CC supports the remote storage and access of data at any time or place. There are three types of CC namely; Platform as a Service (PaaS) which allows individual customers to access information in the cloud; Software as a Service (SaaS) where customers must subscribe to cloud services; Infrastructure as a Service (IaaS) where information storage capabilities are provided (Erboz, 2017). Advantages of CC are lower information storage cost, effective data management, flexibility, and improved efficiency (Alcácer and Cruz-Machado, 2019).

Simulations: Simulation tools are an integral feature of Industry 4.0. Simulation tools are used to solve manufacturing challenges through detailed analysis processes. Simulations are undertaken using real-life data that is collected from multiple areas of a company leading to development of effective solutions (Rodič, 2017).

Radio Frequency Identification and Barcode Scanners: RFID systems are critical IT resources in the manufacturing industry. RFID are automatic identification technological systems that collect, store, and

process data used to increase production efficiency. According to [Gengel et al. \(2016\)](#), RFID has three elements including a tag which is a chip with an antenna; a reader which emits radio waves communicating the location of a device; middleware which manages the whole system. RFID system application areas in manufacturing companies include production whereby it monitors equipment and raw materials on the production floor; supply chain to provide real-time data on manufacturing inputs and outputs in transit and also used in inventory management to track the movement of raw materials and equipment in the warehouse.

Internet of Things: IoT is an emerging technological system founded within the fourth wave of the industrial revolution commonly known as Industry 4.0. Unlike the previous industrial movements based on improving mechanical processes in organizations, Industry 4.0 supported by the Internet and communication capabilities. According to [Rghioui and Oumnad \(2017\)](#), IoT refers to the interconnection of devices via the Internet and communication software that support the intelligent sharing of information in an organization. IoT allows for real-time transmission of data between devices, and this increases the rate of efficiency in a company. [Patel and Patel \(2016\)](#) describe IoT from three dimensions; one is the interactions from people to people through communication systems; people to machine, where employees automatically issue commands to the production machinery; machine-to-machine communication through the Internet. IoT characteristics are device interconnectivity, heterogeneity of devices, safety from unauthorized parties, and enormous scale of the system.

2.3. Operational Performance

Operational performance refers to quantitative measures of organizational processes like warehousing, inventory management, and order processing ([Bengtsson et al., 2009](#)). Companies spend a significant amount of funds purchasing the latest IT systems to enhance their productivity. Therefore, companies need to measure the effectiveness of the IT systems to determine whether their purchase decisions are appropriate or not depending on their effectiveness level.

Operational performance measures the effectiveness of organizational strategic planning. According to [Devaraj et al. \(2007\)](#), operational performance is usually measured along four dimensions namely product quality, which is measured by average production time; flexibility, which is measured by a company's responsiveness to order changes; delivery, which is measured by lead-time; cost that is measured by workers' productivity. [Hwang et al. \(2014\)](#) used the SCOR model to develop the operational performance metrics used in monitoring and evaluating manufacturers, which include order fulfillment cycle time, cost of goods sold, price to make, perfect order fulfillment and inventory available for supply. [Bengtsson et al. \(2009\)](#) proposes the following operational performance measures; product quality, delivery lead-time, volume flexibility, delivery dependability and production lead-time.

3. RESEARCH METHODS

This section highlights the procedural approach of conducting the study.

3.1. Research Design

This study adopted a case study research design. According to [Mills et al. \(2017\)](#), a case study is one of the most popular qualitative research methods; it refers to an intensive and systematic study of a specific phenomenon. Case studies have several advantages including in-depth understanding of complex phenomenon, easy to use, less costly, and it does not require sampling. Through the case study, the researcher identified how Industry 4.0 influences operational performance.

3.2. The Population and Sample

The respondents of the study were the two study units namely, Unilever and L'Oréal East Africa. Equal representatives were selected from the two study units and they provided information regarding Industry 4.0 in their respective companies.

3.3. Data Collection

The research relied on primary data. The primary data were collected through an interview guide. The interview guide facilitated the collection of comprehensive information through interviews. The interview guide was divided into different sections evaluating the different aspects of Industry 4.0 used by the target population. The interview guide helped the researcher to understand the level of Industry 4.0 awareness in

the manufacturing industry, the extent of adoption of Industry 4.0 technologies and the impact of Industry 4.0 technologies on the operational performance of FMCGs manufacturers in Kenya.

3.4. Data Analysis Method

Content analysis was used to interpret the data collected during the research. Content analysis refers to the process of making inferences from textual materials, oral communication or documents used in a research. Content analysis is systematic process involving four steps that is decontextualisation, contextualization, categorization, and compilation of information. Through the content analysis, the in-depth details of the interview were examined and presented in a simple and understandable format to help in evaluation of the level of Industry 4.0 awareness in the manufacturing industry; the extent of adoption of Industry 4.0 technologies; and the impact of Industry 4.0 technologies on the operational performance of the two study units.

4. RESULTS AND DISCUSSIONS

4.1. Introduction

This section focused on the presentation of the empirical results of the study. The purpose of the study was to find out the impact of Industry 4.0 on operational performance of L'Oréal East Africa and Unilever, the two largest FMCGs manufacturers in Kenya. Data was collected from 20 respondents using an interview guide, which was created in close reference to the research objectives. The use of the interview guide facilitated the collection of detailed information about the adoption of Industry 4.0 in the study units.

4.2. Extent of Industry 4.0 adoption by Unilever and L'Oréal East Africa

Based on the responses, there is a higher rate of Industry 4.0 adoption in L'Oréal East Africa compared to Unilever. All the respondents from L'Oréal believed that the organization knew about Industry 4; they defined Industry 4.0 as smart manufacturing, human-machine interactions, use of robotics and automation in the company and intelligent systems. These definitions are consistent with [Nagy et al. \(2018\)](#) description of Industry 4.0 as “intelligent about networking of industrial products and processes.” The findings shows that respondents have different perceptions about the rate of Industry 4.0 adoption in Unilever. 60% of respondents believed that the company had fully implemented the technologies, 30% indicated the adaption was partial, while ten (10) percentage felt that the Unilever had not incorporated Industry 4.0 in its operations. Some of the respondents were aware of the meaning of Industry 4.0, but it was obvious that some of them had not heard about the concept before the interview. However, the respondents that were aware of Industry 4.0 in Unilever gave the same consistent definition of the technologies as the interviewees from L'Oréal East Africa.

Furthermore, respondents from Unilever were unaware of the company's plans to implement Industry 4.0 in its operations. According to the interviewees, no formal program or plan was describing how the company intended to adopt the new technologies. However, they stated that they had gone through training to learn new technical skills in the last two years due to the digital transformations occurring in the company. Examples of the digital transformations occurring at Unilever include automation of activities and the use of big data for product innovation processes. Undoubtedly, the ongoing digital transformation in Unilever is a sign that the company is in the process of adopting Industry 4.0 in its operations.

4.3. Type of Industry 4.0 Technologies used by L'Oréal East Africa and Unilever

The study sought to establish the types of Industry 4.0 technologies used by the study units. Based on the responses, the two companies have implemented most of the Industry 4.0 technologies. The leading Industry 4.0 technologies in the two companies are big data and analytics, barcoding and cloud computing. There is a lower adoption rate of other Industry 4.0 technologies, namely horizontal and vertical system integration, warehouse scanners, drones and IoT. However, the research findings show that Unilever and L'Oréal East Africa are yet to implement Augmented Reality (AR), as neither company has adapted smart gloves and smart glasses technologies.

Industry 4.0 technologies are used in different departments in the two companies. Foremost, these technologies are used in the production process for various functions. Robots are used to perform repetitive tasks during the production process, for example, loading raw materials into the machines. The

companies attach sensors to equipment and machinery on the production floor to monitor their performance. Moreover, the sensors transmit critical information about the production process to the management and this is used as the basis for formulating production decisions.

Additionally, drones were used to monitor the progress of the manufacturing process, inspect the quality of goods and to transport raw materials from the warehouse into the production line. According to the respondents, Unilever and L'Oréal use big data to predict the demand for goods, thus the information is used to determine the production capacity. The adoption of these technologies is slowly leading to the development of smart factories in the two companies.

Both Unilever and L'Oréal use Industry 4.0 technologies to manage warehouse operations. Drones are one of the technologies used in warehouse management; it is used for transporting the finished products from factory to storage. According to one of the respondents, sensors improve warehouse operations by facilitating timely detection of system failure, thus preventing a breakdown on time. On the other hand, warehouse scanners are used to automate data collection of the companies' operations by skimming the labels from different distances through the help of drones. Scanners capture accurate information; thus, they minimize the risk of error during the order fulfillment process. Also, robots are used in the warehouse to stack the finished products into the storage area and palletizing orders in preparation for deliveries. As a result, these technologies have led to the creation of seamless operational systems in the warehouses. These findings are synonymous with those of [Moayyad et al. \(2013\)](#) that established IT integration in organizations improves operational performance.

The respondents linked the adoption of Industry 4.0 technologies with numerous benefits in the organization. Some of the advantages of Industry 4.0 in L'Oréal and Unilever are better business decisions, higher employee satisfaction rates, improved product quality, and higher efficiency. Moreover, these technologies increase the visibility of the organizational, operational system, improve customer satisfaction and reduce operational costs. For example, cloud computing reduces the amount of money spent on the data storage process.

Therefore, the study confirms the advantages of Industry 4.0 as noted by [Bengtsson et al. \(2009\)](#) including improving communication efficiency, simplification of organizational processes and optimization of the supply chain.

Furthermore, the study established that Unilever and L'Oréal encountered several challenges in implementing Industry 4.0 technologies. The challenges include high implementation costs, employees' resistance, the inadequacy of infrastructure and high training expenses. Besides, some of the technologies were incompatible with existing systems; thus, it was difficult for the employees to operate the whole system. As a result, Industry 4.0 adaption is still lower in the two companies.

4.4. Impact of Industry 4.0 On Operational Performance of Unilever and L'Oréal

4.4.1. Product quality

The respondents also answered questions regarding the impact of Industry 4.0 technologies on product quality. 90% of the respondents agreed that Industry 4.0 technologies aid in the standardization of production processes leading to the output of consumer goods of uniform quality. The technologies help in minimizing errors during production, warehousing, packaging, and delivery of the final output to consumers. Moreover, Industry 4.0 facilitates the collection of big data regarding the manufacturing process; the information becomes the basis for decision-making in the organization. The use of Industry 4.0 in the two companies is consistent with the [Patel and Patel \(2016\)](#) research that states that organizations use sensors to gather data on inventory usage among other operational areas. Effective decision-making leads to the manufacture of high-quality products that are customized as per the clients' needs. Therefore, consumers would accept the companies' products.

4.4.2. Delivery Lead-Time

The researcher asked the respondents to describe how the adoption of Industry 4.0 affected the company's delivery lead-time. First, the technologies capture essential information about factors influencing the delivery lead-time that is used to predict the variable. Prediction of the delivery lead-time helps the companies to create a fixed schedule. As a result, the companies minimize time wastage in the receipt of raw materials because the supplier abides by the schedule; thus, there is the timely delivery of the final products. The use of Industry 4.0 technologies in the companies significantly improves delivery-lead time, which according to [Eshikumo and Odock \(2017\)](#) improves customers' loyalty, as they are able to supply products into the market in a timely manner.

4.4.3. Volume Flexibility

The researcher evaluated the impact of Industry 4.0 on volume flexibility. One of the respondents revealed that sensor technology linked the communication system in the organization and facilitated the collection of real-time customer data in the market. Access to real-time data increased the supply chain's responsiveness to sudden changes in consumers' demands. According to one of the respondents, automation of production processes reduced the changeover period from one production line to another when the focus is on customization of the final output. The findings were synonymous with the advantages of automation outlined by [Deloitte \(2019\)](#) namely better efficiency; reduced errors and human-machine collaboration leading to improved operational performance.

Big data and analytics were instrumental in the achievement of volume flexibility in the two companies. According to the respondents, big data was a powerful tool for forecasting product demand, thus the company had enough time to adjust production levels upwards or downwards depending on the findings. The big data is collected through IoT that facilitates the collection of real-time information ([Nagy et al., 2018](#)). Therefore, there is no doubt that Industry 4.0 technologies are associated with better operational performance.

The research assessed whether Industry 4.0 influenced delivery dependability in the company. 70% of the respondents strongly agreed that technologies affected the companies' ability to honor customers' orders. This is because the horizontal and vertical integration in Industry 4.0 creates a coordinated production and logistics systems that facilitate the quick production of organizational items. As a result, the company produces quality products as per the schedule. Furthermore, big data analytics helps companies to understand product demand trends and anticipate orders. Moreover, automation reduced delays in production and delivery processes. Therefore, the company has enough time to plan for production leading to dependable delivery. These findings are consistent with those of [Youssef and Youssef \(2018\)](#) who argues that Industry 4.0 aids in the development of effective supply chains that are characterized by delivery dependability.

20 % of the respondents were unsure Industry 4.0 technologies contributed to delivery dependability. The respondents believed that better coordination of activities were inadequate in ensuring the timely delivery of products; they felt that the supply of raw materials influenced the organization's ability to honor its delivery promises into the company. Lastly, 10% of the respondents thought that Industry 4.0 did not affect delivery dependability because they had not noticed any significant changes since the integration of technologies into the company's activities.

4.4.5. Production Lead Time

The research respondents were required to indicate their agreements regarding the impact of Industry 4.0 on production lead-time. 80% of the respondents agreed that Industry 4.0 reduced the production lead-time in various ways. They found out that drones and robots improved the speed of manufacturing and warehousing activities in the company resulting in the shortening of the production lead-time. According to [Deloitte \(2019\)](#), robots help to improve human and machine collaboration and this increases the speed of operations in organizations. Besides, cyber-physical systems help in the interconnection of factory activities that further helps to shorten the lead-time. As a result, the customers are supplied with their preferred products on time, resulting in a high rate of customer satisfaction.

20% of the respondents were unsure about the relationship between Industry 4.0 technologies and production lead-time. They felt the company spent more time on product customization processes than in the typical manufacturing processes. Although the product customization utilized the same system and procedures, there was a risk that the company took longer to complete the lifecycle for such products. Therefore, it was difficult to state that Industry 4.0 technologies improved product lead-time conclusively.

4.4.6. Productivity Levels

All the respondents agreed that Industry 4.0 technologies improved organizational productivity levels. The respondents had noticed that the introduction of a new technology corresponded with an immediate increase in the production capacity of their respective companies. Initially, the respondents felt intimidated by Industry 4.0 technologies and were afraid of their impact on their jobs. With time, employees began to accept the technologies in their work; they were motivated since they reduced the amount of work pressure, stress and improved their safety.

Moreover, the Industry 4.0 technologies improved production efficiency through sound planning, facilitating communication between devices, tracking of machinery, preventing systems breakdown

throughout the organization, and optimizing production levels. Besides, the rate of production errors reduced with the incorporation of Industry 4.0 technologies in the organization. These findings are synonymous with those of [Bengtsson et al. \(2009\)](#) who argues that IT integration improves efficiency in manufacturing companies by providing access to real-time inventory monitoring, among other functions.

4.5. Summary of Research Findings

The rate of Industry 4.0 adoption differs between Unilever and L'Oréal. Noteworthy, L'Oréal is at the forefront of implementing Industry 4.0 technologies. The company has a clear strategy for Industry 4.0 implementation that is purchasing new technologies and creating an employee-training program to help them learn how to use the devices. Conversely, there is low awareness of Industry 4.0 technologies in Unilever. Moreover, the company has not communicated its technological plan to employees. However, Unilever routinely organizes technology training for employees focusing on the use of modern technology applications in different departments. These findings prove that Industry 4.0 adoption is still low in African countries.

The leading Industry 4.0 technologies incorporated in the two companies are cloud computing, big data and analytics, and barcode scanners. The companies are in the initial stages of integrating the other Industry 4.0 technologies in their operations, including IoT, sensors, drones, autonomous robots, and horizontal and vertical system integration. However, it is essential to note that both companies are yet to adopt AR, including smart glasses and gloves, and simulation technologies. These technologies are used in all the organizational departments, including production, human resource management, warehouse management, finance, and quality improvement.

There is a significant positive relationship between Industry 4.0 technologies and operational performance in Unilever and L'Oréal. Industry 4.0 technologies improve product quality by minimizing production errors, product standardization and customization of orders to meet consumers' needs. The majority of the research respondents strongly agreed that Industry 4.0 technologies improve the delivery lead-time by collecting essential information predicting customer demands, reducing production period and minimizing time wastage within the supply chain. In addition, these technologies give organizations volume flexibility by making it easy to adjust production capacity upwards and downwards, while maintaining a high level of delivery dependability. In addition, the study revealed that Industry 4.0 technologies improve productivity levels, while at the same time reducing the product lead-time.

5. CONCLUSION

The study concludes that Industry 4.0 positively influences operational performance for FMCGs manufacturers. The operational performance measures of Unilever and L'Oréal East Africa, including product quality, delivery lead-time, flexibility, delivery dependability, production lead time, and productivity levels remarkably improved with the implementation of Industry 4.0 technologies. The improvement in operational performance is attributable to the key advantages of Industry 4.0 technologies, including the collection of big data about the supply chain, eliminating errors, increasing visibility of the supply chain, improving operational efficiency, employee motivation, and customization of orders. As a result, Industry 4.0 technologies help Unilever and L'Oréal East Africa to fulfill the customers' demands by ensuring the availability of products in the market.

6. RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The study faced two major limitations. Foremost was the lack of previous studies on Industry 4.0 adoption in Kenya to provide a foundation for the research. The study explores a new area of technology adoption in organizations. Secondly, the study was limited to people working in Unilever and L'Oréal East Africa, thus the findings cannot be generalized to all the other manufacturing companies in the country.

However, the adoption of Industry 4.0 technologies in Unilever and L'Oréal is still slow. The companies can improve the integration of the technologies in their operations by developing an updated industry 4.0 implementation plan and communicate the information to employees to improve their readiness for the change.

Future studies should focus on identifying the benefits of Industry 4.0 on FMCGs in the market. The benefits should go beyond better operational performance by focusing on other metrics of

organizational performance. Secondly, future studies are required to identify the challenges of Industry 4.0 use in organizations.

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