Rethinking Education in the Industry 4.0 in Africa: The Effective Management and Leadership of Education Post-COVID-19 Pandemic Towards Digital Transformation

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The study investigates management and leadership ideas and practices that can guide the education sector toward digital transformation propelled by the Fourth Industrial Revolution following the COVID-19 epidemic. The study's fundamental claim is that due to the rapid changes in the political, cultural, social, economic, and technological environments, 21st-century society is demanding more on its members and the education sector to be better prepared for the global technological transformation right policies and principles in the management and leadership should be implemented. The systematic literature review analysis revealed that there should be less external management control and more decentralization in school administration and leadership. In this way, the education sector should advance the ideas of school-based administration, equifinality, and the idea that schools are self-managing systems. In other words, the industry should shift away from old notions that favour centralization, standard organization towards implementing school-based management of schools, a strategy for reducing COVID-19';s unfavourable short- and long-term consequences, giving the industry a stronger advantage in the age of technological transition.

Keywords: Covid-19, digital transformation, education, effective management

INTRODUCTION

The society of the 21st century places a high level of expectation on its members as a result of the rapid changes that are occurring in the political, cultural, social, economic, and technological environments. The situation is made even more precarious by the fact that the COVID-19 pandemic is still ongoing. COVID-19 will change our society, as the global pandemic fostered and expedited innovation and advancement, particularly in the digital arena. History teaches us that crises reshape society, and it is clear that COVID-19 will reshape our society. To halt the progression of COVID-19, the majority of nations' governments around the world decided to temporarily close schools, leading many families to turn to homeschool as an alternative. Because educational materials could be accessed from a distance and educational technologies, often known as EdTechs, were being developed and distributed to facilitate education, homeschooling became an option for parents. The COVID-19 epidemic offered a fresh window of opportunity for the school system to make use of emerging EdTechs. EdTechs have undergone a period of rapid innovation in recent years, and its primary applications include the digitalization of textbooks and other instructional materials as well as new IT gadgets. According to Kang (2021), even if these EdTechs make education

more efficient, they do not make education more effective and, as a result, they do not substantially revolutionize the education service.

Even though distance learning techniques were already in place before the COVID-19 pandemic, it was uncommon, and the majority of learning activities took place inside the classroom. Due to the COVID-19 pandemic, educators were compelled to investigate and implement methods of distance learning on a larger scale than they ever had before. According to Kang (2021), interactive online learning has also become a trend in the education sector. However, despite the numerous benefits of the various online learning platforms, the majority of lectures are pre-recorded, which makes it comparable to past generations of remote learning. Scholars believe that certain EdTechs, such as the learning management system (LMS), will bring about a significant shift in the traditional education sector. An LMS, or learning management system, is a type of software application that assists with the management, documenting, tracking, and reporting of educational programs and courses, as well as training, learning, and development activities. The Learning Management System (LMS) is now being utilized in the education service on a wider scale than it was previously used in businesses to provide online training courses for employees. However, despite the benefits of LMS, they were traditionally expensive. However, in recent years, the advent of cloud-based LMSs has led to a reduction in both the initial and ongoing costs associated with these systems.

It is believed that there are several reasons why an LMS should be included in the education service. Two of these reasons are the improvement in the effectiveness of teaching preparations and communications among students and instructors. Students, for instance, have the option of submitting their homework assignments online. As a consequence, teachers do not have to print out materials and assignments, which results in cost savings and increased time for teachers to prepare for class. In addition, some LMSs come equipped with a social networking service function that enables teachers, students, and parents to communicate with one another. Importantly, a learning management system (LMS) promptly notifies instructors of education performances. This is made possible by the fact that it enables students and teachers to confirm attendance, submit assignments, as well as complete examinations and straightforward surveys online. By examining the data on the system, a teacher can get insight into a topic or a student's performance and provide feedback that is pertinent to any of these areas. The educational service will eventually benefit from improved teaching materials and procedures as a result of such initiatives. One more essential component to take into consideration is the availability of comparable services via applications for mobile devices.

On the other hand, teaching tools that are based on artificial intelligence are generally recognized as being the most inventive of the recently developed education tools. Tools powered by artificial intelligence (AI) gather data on a student's current level of knowledge, do an analysis of that data, and then recommend ways to strengthen students' understanding. It should come as no surprise that the educational system is transforming in light of all these recent developments. After the COVID-19 epidemic, the question that needs to be answered is, "What are the management and leadership concepts that may enable the education sector to go in the correct direction?" The research questions the rate and size of disruptions caused by the COVID-19 pandemic, as well as the fact that the ongoing Fourth Industrial Revolution calls for a complete overhaul of the way educational institutions are managed and led.

The implementation of the appropriate policies and guidelines in the management and leadership of the education sector not only has the potential to enable the sector to minimize the effects of disruptions, but it also has the potential to better place the sector to be ready for the technological transformation that is currently taking place all over the world. Due to the rapid shifts in the political, cultural, social, economic, and technological situations, the society of the 21st century places a high level of expectation on its members. The situation was made much more difficult by the fact that the COVID-19 epidemic was occurring at the same time. The purpose of this study is to investigate the management and leadership principles that can assist the education sector in moving in the right direction following the COVID-19 pandemic in the direction of digital transformation powered by the Fourth Industrial Revolution. The investigation will use conceptual and documentary analysis of peer-reviewed journals.

LITERATURE REVIEW

Industry 4.0

According to Mhlanga (2020), industry 4.0, commonly referred to as the fourth industrial revolution (4IR), can be defined as the introduction of cyber-physical systems that involve entirely new capabilities for both humans and machines. The capabilities of the Industry 4.0 are dependent on the technologies and infrastructure of the third industrial revolution, but the 4IR, in and of itself, represents whole new ways in which technology can become ingrained into society and even within individuals' bodies. According to Schwab (2015), the fourth industrial revolution (also known as 4IR) is described as the fusion of technologies that are blurring the borders between the biological, digital, and physical worlds. Klaus Schwab, the founder and executive chairman of the World Economic Forum, is credited as being the one who first came up with the term "4IR." Some people compare the 4IR to an approaching rainstorm since it is a widespread pattern of change that can be seen in the distance and approaches at a speed that leaves little time to make preparations. Some people are prepared to face the challenge, armed with the tools to brave the shift and take advantage of the consequences it will have, but other people are not even aware that a storm is on the horizon thanks to the 4IR (Lasi, Fettke, Kemper, Feld and Hoffmann,2014, Mhlanga 2020, Mhlanga, 2021, Mhlanga 2022).

The Fourth Industrial Revolution is having an impact on almost every aspect of our day-to-day lives, including how people interact with technology and how and where work is performed. An additional way to have an understanding of industry 4.0 is to have an appreciation for the technology that is being used in this revolution. A number of these technologies include "artificial intelligence and robotics, ubiquitous linked sensors, virtual and augmented realities, additive manufacturing, blockchain and distributed ledger technology, advanced materials and nanomaterials, energy capture, storage, and transmission, new computing technologies, biotechnologies, geoengineering, neurotechnology, and space technologies". Other technologies include advanced materials and nanomaterials, energy capture, storage, and transmission, and advanced materials and nanomaterials. Some of the forces that are propelling the fourth industrial revolution into the 21st century are listed here.

### A Brief Background of the Education 4.0

Around the beginning of the new millennium, students and teachers started embracing technology in fundamental ways in the classroom. The term "Education 2.0" has been coined to describe this development. Because of the increasing prevalence of technology in the educational system, both sides have begun to exploit technology in fundamental ways (James 2019). As a result of these technical breakthroughs, which included the broad adoption of a more user-generated internet, Education 3.0 came into being as a result of these advancements. Students in schools using the education 3.0 model had to access to information, the opportunity to learn in a virtual environment, and platforms that made it easy to communicate with both the teaching staff and other students in their classes. The traditional model of education, in which students and teachers communicated with one another in a back-and-forth fashion, gave way to one in which each student had a direct connection to a variety of various information sources. Instead, a more networked approach was taken in education, with each student having direct access to several various information sources. The concept of "Education 4.0" refers to a desired method of education that is aligned with the currently unfolding "Fourth Industrial Revolution." Now, this industrial revolution is focused on areas such as artificial intelligence, robots, and smart technology, all of which are now having a significant impact on the world.

Digital Transformation

In the context of business, "digital transformation" refers to the process of utilizing digital technologies to develop new or adapt existing company processes, culture, and customer experiences to accommodate the requirements imposed by the organization and the market. The process of rethinking how a company should operate in the digital age is referred to as digital transformation. Students are currently being prepared, in today's educational system, to enter a global workforce that is going through a huge digital

transition. The transformation brought about by digital technology is causing many educational institutions to revise their perspectives on not just what students need to learn, but also on how they should be learning. The classrooms of today are undergoing a transition as a result of the introduction of new technology. Figure 1 demonstrates the positive effects of this digital transformation on education.

FIGURE 1
THE BENEFITS OF DIGITAL TRANSFORMATION IN EDUCATION
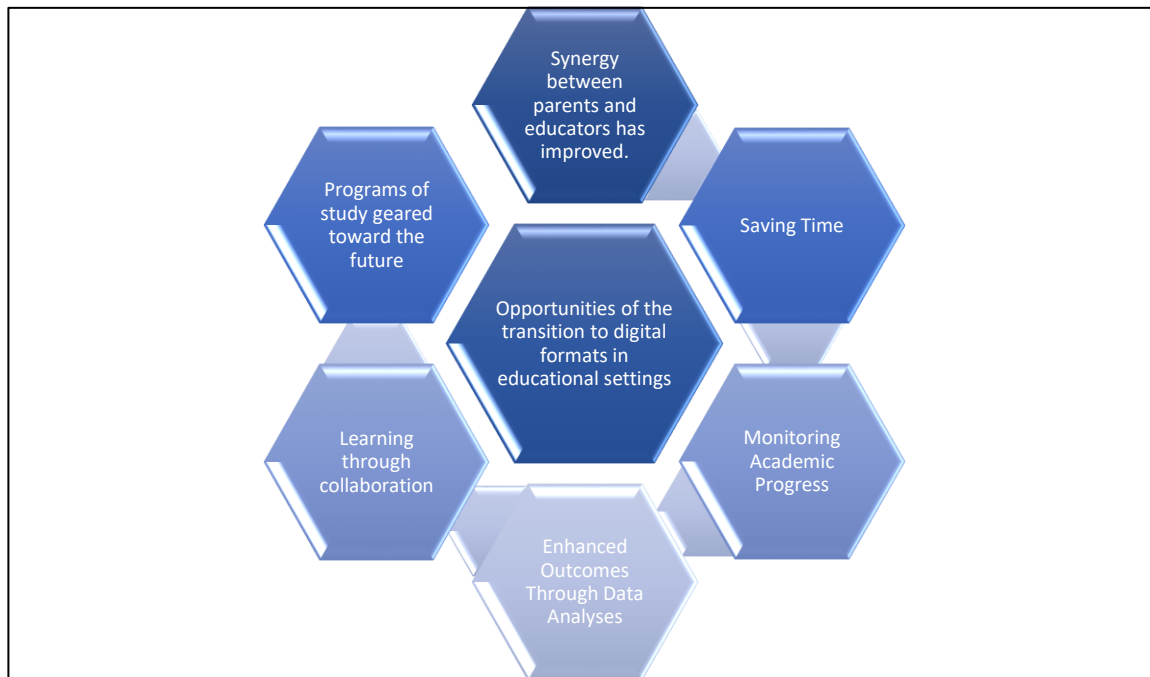
Technology can play an essential role in capturing the detail of students' work, which assist parents and educators monitor how a student is progressing academically. Digitalization introduces a more realistic approach to tracking students' performance, making the process of monitoring academic progress through digitalization more straightforward. One illustration that is provided by James (2019) is that during the process of detailing writing style or creative output, analogies can be made at interims against content that has already been stored digitally. This can lead to a better understanding of who is getting better and who needs more attention. One more essential component worth mentioning is that the digital transformation process might result in improved outcomes by analyzing data. Through the analysis of data gathered from the kids' usage of technology in the classroom, educators can have a better grasp of what individual children and classrooms require. This allows schools to employ analytics to track performance and improve outcomes.

We would not be able to diagnose these flaws in such a quick and accurate manner without the assistance of technology. A teacher in a classroom with 30 or more kids would be unable to do so. The other significant factor that contributed to increased synergies between teachers and parents was. When parents are interested in their children's academic performance, not only do their children have higher academic achievement, but they also have better overall health. Parents receive electronic copies of their child's progress report and attendance report, as well as a reminder to pay their child's tuition on time, thanks to automation. They are also more at ease regarding the safety of their child because they are continually notified every time the youngster is absent from school or out on leave, and they can track the school bus from anywhere at any time. The parent-teacher connection benefits from an improvement brought about by technology in the form of more transparency among all parties. Technology has the

potential to enhance the learning that occurs when people work together. Through the use of learning platforms, which can make it simple for educators to form and oversee groups, digital learning facilitates and amplifies collaborative learning.

It is now much simpler for teams located anywhere in the world to collaborate on the creation of papers and presentations by using collaborative authoring platforms such as Google Docs, Twiddla, Edmodo, and others. Because businesses already make use of collaborative technologies of this kind, educational institutions need to impart the necessary knowledge and skills to students before they enter the profession. The synergy that exists between educators and parents has improved as a result of digital transformation. It is widely held that when parents are interested in their children's academic performance, not only do their children have higher academic achievement, but they also have better general health. The other issue is that automation reminds parents to pay their ward's fees on time and electronically provides progress reports and attendance reports to parents. Another advantage is that parents will have less anxiety about their child's safety because they will be informed immediately if their child is away from school or out on leave, and they will be able to monitor the location of the school bus regardless of where they are or what hour it is. The shift brought on by digital technology can help save time. In the modern world, where time is money, digitalization is a huge help in terms of saving time. In a great number of cities, the public transportation system is not yet fully established, except for metros. Students have a travel time that is measured in hours to get to their respective educational institutions. A digital course can be a lifesaver for students in this situation, even if they are located in the most inaccessible corners of the country. Once more, digital transformation can be of assistance with academic programs that are oriented toward the future.

Education During the Covid-19 Pandemic

According to the World Bank (2021a), the COVID-19 epidemic has triggered rapid and deep changes around the world. The World Bank also noted that this pandemic is the largest shock to education systems in decades, with the longest school closures mixed with an impending recession. According to the World Bank (2021a), the epidemic impeded the progress that had been achieved toward achieving global development goals, particularly those targets that centred on education. As a result of the global and national economic crises, countries are forced to implement austerity measures, the number of people living in poverty rises, and there are fewer resources available for investments in public services, which come from both domestic spending and foreign aid. The culmination of all of these factors will result in a crisis in human development that will persist for a significant amount of time after disease transmission has ceased. According to the World Bank (2021b), the widespread shutdown of schools because of COVID-19 has resulted in substantial disruptions to the education system around the world. There was evidence to suggest that the pandemic was responsible for an increase in learning losses as well as an increase in inequality.

Less prosperous lower-middle-income countries, which are likely to be hit even harder, need to incorporate learning recovery programs, protect instructional budgets, and plan for future shocks by building back better to lessen and reverse the long-term negative effects. These countries are likely to be hit even harder because of their lower levels of wealth. During the height of the pandemic, nations all around the world decided to close their schools, which had the effect of affecting 185 million pupils. Teachers and administrators were unprepared for this change due to the suddenness of the crisis, and they were compelled to construct emergency remote learning systems relatively soon. However, one of the drawbacks of emergency remote learning is that there is no opportunity for direct one-on-one communication between the instructor and the student. With broadcasts, this kind of connection is simply not feasible. Several nations have demonstrated initiative by exploring new means, such as electronic mail, social media, the telephone, and even the post office, to enhance the quality of the experience of receiving an education at a distance. The interruptions brought on by the epidemic were responsible for significant learning gaps and deficits. Although it is commendable that so much work has been put into providing instruction via remote access, this type of education has shown to be a very poor replacement for learning that takes place in person. Even more disturbing is the possibility that many children, females, in particular, will not return to school even after it has been determined that schools will reopen. It is estimated that the

impacted children's future earnings will be reduced by an amount equal to $10 trillion as a result of school closings and the disruptions that occur to school attendance and learning as a direct result of such closures.

Brief Literature Review

The study of digital transition, specifically the effect, that the pandemic has had on digital transformation, is becoming increasingly popular. According to Iivari, Sharma, and Venta-(2020) Olkkonen's research, digital technology has been present in the lives of today's youngsters from the moment they were born. According to Iivari et al research's (2020), children of today are not equally prepared for the technology-rich future that lies ahead of them. Many different types of digital gaps still exist in society, and these divisions affect the young generation and their digital futures. Many people believe that for schools and the teaching of children to be able to fulfil the demands of the younger generation and their more digitalized future, there should be a significant shift toward the use of digital technology. The COVID-19 epidemic has unexpectedly and abruptly compelled schools and education to engage in such a shift, according to Iivari et al., (2020). Iivari et al., (2020) investigated the digital revolution prompted by the COVID-19 epidemic in the fundamental education of the younger generation, the many digital gaps that emerged and were maintained, and the potential roadblocks that were noted along the way.

According to Iivari et al., (2020), research on information management should more adequately address children, their increasingly digitalized everyday lives, and their basic education as key areas of concern. Mirzaian and Franson (2021) presented the argument that the global COVID-19 epidemic has not only presented a challenge to education but also presented an opportunity to pioneer a digital revolution and the new delivery of a Pharm.D. curriculum. According to Mirzaian and Franson (2021), the process of transforming the curriculum in a way that is both sustainable and iterative involved multiple steps. These steps included communication, maintaining faculty engagement, allowing for outside-the-box thinking, providing resources and tools, and creating accountability and timelines. According to Mirzaian and Franson (2021), the implementation of digital transformation in any sector is not a straightforward process. Nevertheless, Mirzaian and Franson (2021) believe that successful implementation can be achieved through proper planning, alignment of organizational interests, consistent and regular communication, provision of resources and tools, engagement of faculty, and creation of accountability along with timelines and deliverables.

According to Mirzaian and Franson (2021), once the global pandemic has passed and educational institutions have resumed in-person classes after having gone through the stages of digital transformation, we will have the ability to accept these changes and transform education without having to reproduce the educational systems that were in place before the pandemic. Additionally, Nurhas, Aditya, Jacob, and Pawlowski (2021) suggested that the COVID-19 pandemic is the driving force behind the rapid digital transformation that is taking place, which is compelling organizations and higher educational institutions to adapt their ways of working and learning. In the context of higher education, Nurhas et al. (2021) investigated the difficulties brought on by the rapid digital revolution that occurred during the pandemic. The Q-methodology was utilized by Nurhas et al., (2021) to gain an understanding of the nine challenges that were faced by higher education. These challenges were viewed in a variety of ways as four main patterns: digital-nomad enterprise; corporate-collectivism; well-being-oriented; and pluralistic. The research conducted by Nurhas et al., (2021) contributes to a more comprehensive knowledge of the digital change, particularly in the context of higher education. According to Nurhas et al. (2021), the nine challenges and four patterns of transformation actors serve as a starting point for organizations in continuing to support technological choice and strategic interventions, based on individual, group, and organizational behavioural levels. This can be done by providing a starting point for organizations in supporting technological choice and strategic interventions.

In addition, Nurhas et al., (2021) believe that five propositions, based on the competing concerns of these issues, build a framework for comprehending the ecosystem that permits rapid digital transformation. This framework is based on competing concerns. According to Nurhas et al., (2021), the cyber-society ecosystem reaps benefits from the strategies, requirements, and critical elements that are implemented during the process of developing digital technologies. According to Packmohr and Brink (2021), the

proliferation of digital technology is a macrotrend that is compelling enterprises to transform digitally. This phenomenon, which is also influencing the field of higher education, is referred to as "digital transformation." According to Packmohr and Brink (2021), higher education institutions (HEI) should digitize their internal operations and provide education services that can be provided through digital technology.

METHODOLOGY

For this investigation, the literature was carefully reviewed. According to Tawfik, Dila, Mohamed, Tam, Kien, and Ahmed (2019), you should conduct a preliminary search to find relevant articles, make sure there are enough articles for carrying out an in-depth study, confirm the veracity of the supplied idea, avoid answering the same questions more than once and avoid answering the same questions twice. The themes should also concentrate on the issues that are most crucial to the study's research questions (Dziopa and Ahern 2011, Mhlanga 2021, Mhlanga, 2022). In addition, Tawfik et al. (2019) argued that participating in relevant conversations and watching relevant movies are crucial for being familiar with the research issue and gaining a complete understanding of it, which in turn enhances the recollection of the findings. These steps are crucial to avoid duplicating prior research and wasting time on a topic that has already been explored extensively (Tawfik et al., 2019). As proposed by Vassar, Atakpo, and Kash (2016), the authors of this study investigated every feasible method to lessen the influence of bias. One of these alternatives was to perform an explicit hand search to look for reports that might have been overlooked during the initial search. The authors of the study concluded that there was no evidence of discrimination. Within the confines of this inquiry, a total of five different manual search techniques were performed.

These included searching for references inside the papers and reviews that were cited, speaking directly with authors and subject-matter experts, looking at relevant literature, and looking at articles that were cited in Google Scholar, Scopus, and Web of Science. To improve and hone the findings of the manual search, the reference lists of the publications that were included were initially searched. With this stage, the process got started. The reviewers next engaged in citation tracking, a method that entails keeping a record of all the publications from which each of the papers used in the compilation receives citations. In conclusion, a database search online was performed as part of the overall search in addition to the manual search. In the final stage of the inquiry, objects that were "connected to" and "similar to" other concepts were examined. As recommended by Tawfik et al. (2019), independent reviewing was finished by assigning each team member a unique "tag" and approach. This was carried out to enhance retrieval, reduce bias, and consolidate all findings at the conclusion for comparing and assessing the significant differences. The primary consideration in deciding whether or not to include a study was its application to the issues we were considering, over time since the study's publication served as a secondary consideration. The choice was made to give preference to works that were published after 2000. Most articles are rejected because they were duplicated, didn't include the entire text, weren't relevant to the topic, or just contained abstracts. These exclusion criteria were specified to shield the researcher from any bias. Figure 2 displays a flowchart that illustrates the screening and selection procedure.

The screening and selection criteria are displayed in Figure 2. The whole literature review was analyzed from a total of 44 papers, as shown in Figure 2 above. We provide a data verification stage, as advised by Tawfik et al. (2019), in which each included article is compared to its equivalent in an extract sheet by supporting images. Bias and human error are expected to occur, thus we provide this stage to identify these mistakes.

FIGURE 2
FLOW DIAGRAM OF STUDIES' SCREENING AND SELECTION

Google scholar(n-67) Scopus (n-65)	Total articles (n=132)	
	Duplicate Excluded (n=13)	
	Title and Abstract Screening (n=119)	**Qualitative Synthesis (n=44)**
		Total number of articles included from the Manual search (n=5)
	Articles Excluded (n=80)	Irrelevent (n=57)
		No full text avalable (n=23)

RESULTS AND DISCUSSION

The chaos that erupted in every school was caused by the mass distribution of COVID-19. We learned through the pandemic that school management and leadership should be more decentralized, especially in Africa because of capacity variations when shocks like Covid-19 hit. The pandemic specifically taught us this lesson in Africa. The outbreak gave us the chance to learn this information. We found that schools in many African nations had to come up with their very own special solutions to save the school year. On the other hand, because schools differ so much from one another, some schools had to wait to act until they had received direction on the subject from the national government. The degree of effect that individual schools in Africa, especially those that are located in more rural areas, may have is directly correlated with the resources available to those institutions. One of the things we were able to learn from the outbreak that occurred was this particular discovery. In other cases, the local school's administration was compelled to make local decisions about the kinds of precautions that needed to be in place to ensure that students could continue with their regular academic endeavours. These choices centred on the kinds of protections that ought to be in place to guarantee that students can carry on with their normal academic endeavours. Teachers were placed in places where they had to come up with their educational strategies, which they based on the specifics of the workplace environment and the resources at hand at the time. The following question, which needs to be addressed in light of the Fourth Industrial Revolution's after-COVID-19 disruptions, is: What management and leadership concepts will enable the education sector in Africa to advance in the proper direction toward digital transformation? The fourth industrial revolution's upheaval catalyzed this investigation. Decentralization in school leadership and management, together with the other

strategies that were addressed, was discovered to be able to help many schools in Africa make the transition to a digital transformation, as shown in figure 1 below.

FIGURE 3
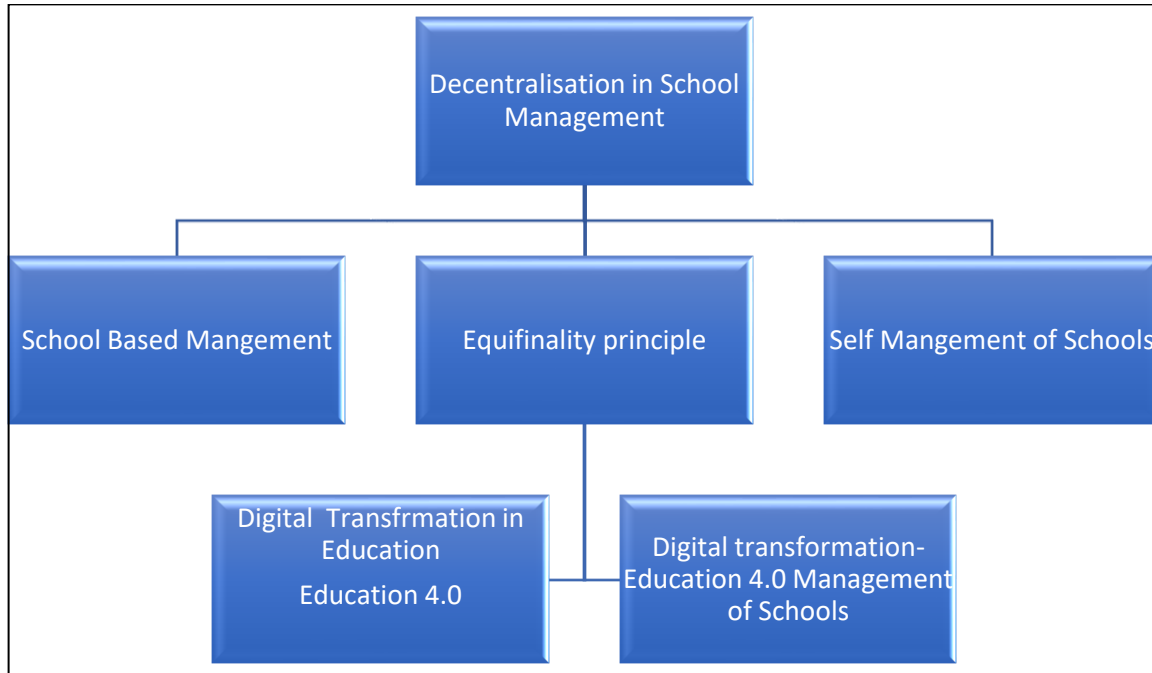**SCHOOLS MANAGEMENT TOWARDS DIGITAL TRANSFORMATION IN SCHOOLS**

Figure 1 above illustrates the need to adhere to several standards, notably in the management of schools if schools in Africa are to transition to digital transmission. These concepts are based on the decentralization of African school administration. These tenets include the management of schools as a whole, the equality principle, the autonomy of schools, and the use of digital tools for management and leadership.

School-Based Management (SBM)
The most extreme type of educational decentralization is commonly referred to as "school-based management," or "SBM." The SBM procedure comprises giving the school-level decision-making authority. SBM can be implemented in a variety of ways, depending on which group of stakeholders holds the majority of the decision-making authority. SBM is a form of decentralization that views each school as the primary unit of improvement and depends on the transfer of decision-making power [to the school level] as the main way to encourage and maintain improvements. To do this, the school is designated as the main improvement unit, and decision-making power is transferred to the school level. SBM, or school-based management, is a system that transfers a significant amount of decision-making power from the Central Office to the numerous individual schools intending to enhance education. SBM enables administrators, teachers, students, and parents to have more control over the entire educational process by delegating decision-making authority over issues like the curriculum, staff, and finances.

If SBM involves educators, parents, and other community stakeholders in the process of making these crucial decisions, kids will have access to learning environments that are more supportive of their development. This concept stands out as the most practical approach when considering the challenges that the majority of African schools encounter. Regarding their resources and ability to develop into digital learning environments, rural schools in Africa are in a different situation than metropolitan ones. As a result, it is imperative that every institution work toward digital transformation while taking into account the resources at their disposal. The universal strategy cannot be used in Africa since there are so many schools

that run the risk of being forgotten. According to King and Ozler's (2000) articulation, there is a widespread belief that local government is more successful economically. Actors with the most to gain or lose and the finest knowledge of what occurs in schools are best able to decide how schools should use their increasingly limited resources and how kids should be taught, according to King and Ozler (2000). This is because these actors are the most knowledgeable about what truly happens in classrooms. In the same line, Winkler, Gershberg, Roldán, and Garchet (2000) emphasized that it stands to reason that the voter-consumer voice will be stronger the more local the decision. This means that the voice of the voter-consumer will be stronger at the school level than it will be at the municipal level, and it will be stronger in governments with a single purpose like school districts than it would be in governments with several purposes. Even more social welfare will be improved if local governments control education funding and availability. This is because the average voter and consumer will only tax themselves up to the point when the marginal costs of taxes and the marginal benefits of education are equal.

According to the professional school-based management theory, school personnel are better equipped with the information and skills needed to choose the educational options that would benefit both the students and the institution where they are enrolled. Professionals will also have the chance to share their knowledge about education in fields like curricula, pedagogy, student learning, and school administration. Professionals who participate in the management of their schools may discover that their involvement has increased their inspiration and dedication to the classroom. The board of directors, "supervisors, principals, teachers, parents, and students, among others, have a much greater degree of autonomy and responsibility for the use of resources to find solutions to problems and carry out educational activities that are effective for the long-term growth of the school. According to scholars, the tasks of school management are determined by the qualities and requirements of the school itself" (Cheng 1996, Ulfatin, Mustiningsih, Sumarsono, and Yunus 2021, Iswan, Priharta, Bahar, and Miyati 2021). SBM is encouraged as a method for improving administrative effectiveness. The justification for this is that utilizing SBM as a tool for administrative efficiency makes sense because the school is in the best position to properly distribute resources to match the needs of the pupils. As a result, SBM is advised as a technique for enhancing administrative effectiveness. But when responsibilities are outsourced, central ministry offices must become smaller for there to be a rise in overall efficiency. This is because fewer individuals are required to carry out each task.

Many decentralized systems create agencies that are separate from the system's administration and help with the system's monitoring and evaluation tasks to increase responsibility at the central level. These initiatives are made to increase central responsibility. After this decrease in the size of the central bureaucracy, administrative efficiency will likely rise. SBM can also be used as a method to increase how much money local schools can bring in financially. According to the theory, parents will be driven to enhance their level of engagement with the school and will also be more inclined to provide money, labour, and other resources to the school if parental involvement in school-level decision-making is encouraged and welcomed. This is founded on the hypothesis that involving parents in decisions that affect the school will raise their level of support for the institution (Bandur 2018, Koc and Bastas 2019, Smalley, Hainline and Sands 2019). In light of this historical backdrop, this study aims to propose that school-based management is essential in the setting of Africa, where resources are scarce, to advance more quickly toward digital transformation.

Self-Management of Schools

The third point that we are bringing out in this post is that the self-management of schools idea ought to be at the forefront in Africa if African states are going to make faster progress toward digital transformation in light of the lessons learned from the COVID-19 pandemic. When moving toward digital transformation, it is very important to ensure that self-management is one of the priorities in as many African schools as possible. This is because of the negative consequences that are linked with technology, which are a part of digital transformation. Self-management of schools is a beneficial initiative that gives schools the leeway to manage themselves and address their own specific needs. For self-management to be effective, it is essential for stakeholders including parents, communities, educators, learners, businesses,

and the government to work together. The bureaucratic organizational structure has recently been challenged by a variety of organizations that promise to give employee emancipation and autonomy through self-management, self-organizing, or "holacracy," according to the findings of a study that was carried out by Martela (2019). It has been demonstrated that the radically decentralized model of authority that is at the core of self-managing organizations can lead to solutions to these problems. These solutions are founded on peer-based accountability and rewarding transparency of key information, and bottom-up emergent processes. In these processes, employees have the authority and responsibility to identify necessary tasks and make sure that they are completed.

According to Martela (2019), self-management organizations have the potential to assist in addressing issues associated with traditional bureaucratic organizational structures. These structures include "organizing, task division, task allocation, rewarding desired behaviour, eliminating freeriding, providing direction, and ensuring coordination. It has been determined that the self-managing organization is, in fact, a novel style of organizing that, in comparison to the other paradigms of organizing, can provide an explanation that is more satisfactory for several real-life organizational anomalies". It is argued to be especially viable in industries with limited interconnectedness between different units, highly specialized outputs, and high staff competence and motivation. As a result, studies conducted on organizations like this can provide some novel insights that are pertinent to the theory as well as the practice of organization design. The reason why this study recommends that for African schools to become digitally transformed, it is imperative to establish self-management in schools is because of the rationale stated above. It is widely held that instructing students in self-management skills leads to improvements in academic performance, productivity, and time spent on tasks, as well as a reduction in problem behaviour; furthermore, it is believed that self-management strategies for students begin before the occurrence of problem behaviours.

The second issue is that instructors have so many responsibilities to take care of every school day, and in today's digitally transformed schools, management is not something that teachers have to decide on or take care of on their own. This is not something that should be the case either. The process of self-management in the classroom ought to include the participation of the students. Learning, whether it be academic topics, other content areas, or skills such as playing a musical instrument, requires a significant amount of self-management on the part of the learner. Students who can self-manage are better able to carry out their plans for completing assignments, studying for examinations, and maintaining focus while in class. When it comes to adults, it is essential for accomplishing goals related to learning or life, such as gaining a new professional skill or reaching a certain objective. Haymovitz, Houseal-Allport, Lee, and Svistova brought attention to one more essential facet of school autonomy, which is the concept of "self-management" (2018). According to Haymovitz et al. (2018), schools in the modern day are confronted with the difficulty of providing pupils with the abilities they need to succeed in life outside of the classroom while also instructing them in the required academic subject. Teachers are being asked to create environments in which children may learn academic content in addition to social and emotional competencies more frequently than ever before. It is increasingly recognized that punitive models of school discipline have a negative impact not only on the culture of the school but also on the individual growth of students. As a result, schools have been given the responsibility of developing constructive alternatives with the goal of improving student engagement and the culture of the school. Participants in Haymovitz et al (2018)'s study indicated an evident influence on faculty productivity, student well-being, peer connections, and the overall climate of the school. As a result of these experiences, we now understand the need of having leadership that is robust, stable, and long-term as well as a more robust parental participation policy, both of which may be best ensured by school social work specialists. This demonstrates that it is essential for educational institutions in Africa to foster a culture of self-management in their students if they wish to make faster progress toward digital transformation.

The Principle of Equifinality

Equifinality is the ability of open systems to arrive at a desired state of equilibrium by more than one path, and it is defined as the ability to do so. In every system, there is some kind of hardware capacity, some kind of software tool, some kind of person who is a part of the system, some kind of cultural norm, and

some kind of data that is either predetermined or organically created. Equifinality is a theory that examines the factors that decide an individual's behaviour. Having a firm grasp on this idea is essential because it suggests there is more than one path to achievement rather than just one. It gives the impression that there are many roads to travel to solve a problem and that there are many destinations to visit on the way there. The concept of equifinality can also be seen as a theory that holds that distinct routes of development might converge on the same destination. The conceptualizations of morphogenic processes that are provided by systems theorists provide a helpful framework for characterizing growth and development in complex adaptive self-directing organisms, according to Feiring and Lewis (1987). These processes entail changes in the structure, status, or functioning of a system, as well as discontinuities in its growth and at least two different kinds of developmental paths: equifinality and multifinality.

According to Feiring and Lewis (1987), the theory of equifinality asserts that a particular outcome can be attained from any number of different developmental paths, whereas the theory of multifinality asserts that similar initial conditions can lead to different outcomes. Both theories were formulated by Feiring and Lewis. An illustration of equifinality was provided by Feiring and Lewis (1987) in the form of a sample of children who were watched interacting with their mothers at the ages of three and twenty-four months. At three months, there were a few social behaviors in which the groups differed; however, at twenty-four months, there was just one in which they did. Therefore, the individual variations that were detected at three months did not lead to any differences at the 24 month mark. With the awareness of the difficulties that the educational system in Africa is experiencing in terms of resources, It is essential to recognize that the principle of egalitarianism is capable of being utilized in the process of driving digital transformation in the education sector. The disparities in capability that emerged during the pandemic demonstrate that to achieve entire change in the educational system, a variety of approaches need to be taken, each of which should be tailored to the specific conditions that are present in the various settings. Jones, Thorn, Chow, and Wild (2002) explored the controversy around the two competing integration strategies of total inclusion and segregation in their research. According to Jones et al. (2002), an alternative ideology called equifinality, which is a new premise of a student-centred integration strategy, was developed.

The findings of a survey that asked students with special needs about their feelings regarding the concepts of inclusion, segregation, equifinality, and teacher workload in an inclusion setting revealed that students with special needs showed a relatively higher level of acceptance of the notion of inclusion as well as the concept of equifinality in comparison to participants in the survey who did not have students with special needs. This is the reason that the principle of equifinality is supported in this study in the administration of schools that can guarantee success towards digital transformation in industry 4.0. Rana, Kiminami, and Furuzawa (2022) introduced Trajectory Equifinality Modeling to the case studies of male and female entrepreneurs to examine the relationships between social capital, empowerment, and technology adoption in an entrepreneurial ecosystem in the haor region of Bangladesh. This was done to investigate the relationships between these three factors. In the haor region of Bangladesh, the findings of an analysis using Trajectory Equifinality Modeling provided clarity that social capital is extremely necessary for both male and female entrepreneurs, but that education is more important to women for both empowerment and the adoption of technology.

Rana et al., (2022) also discovered that although entrepreneurial activities have significantly improved the region's economic situation, the level of social capital that each social group possesses and the rate at which it adopts new technologies result in significantly different levels of performance. This is the reason why this study proposes decentralization and the application of the principles of equifinality in the management of schools. This is done to ensure that any effort towards the digital transformation of schools is done in light of the local capabilities, as well as the level and quality of social capital, amongst other important variables. Because of this, the consequence of the policy implies that the government should pay more attention to the socio-political transformation that is taking place through social innovation in the various communities when developing any policies that would drive schools towards digital transformation.

CONCLUSION AND POLICY IMPLICATIONS

The purpose of this study was to investigate the management and leadership principles that, in the wake of the COVID-19 epidemic, can assist the education sector in making progress toward digital transformation under the propulsion of the Fourth Industrial Revolution. The research raises questions about the rate and extent of the disruptions caused by the COVID-19 pandemic. As a consequence, the application of the appropriate policies and principles in the management and leadership of the education sector could not only enable the sector to minimize the effects of disruptions but could also better position the sector to be prepared for the technological transformation that is currently taking place all over the world. The central thesis of the research is that the society of the 21st century places a high level of expectation on its members as a result of the rapid changes occurring in the political, cultural, social, economic, and technological environments; furthermore, the existence of the COVID-19 pandemic makes the situation even more precarious. The study found that the management and leadership of schools should have a greater tilt toward decentralization in school administration with little external control management. This was determined via the use of a comprehensive literature review. The education sector ought to promote the principles of school-based management, equifinality, and the principle of considering schools as self-managing institutions in this way. To put it another way, the industry should shift away from the old ideas of standard structure and centralization, which consider schools solely as implementers of systems, and toward principles that favour school-based administration. This necessitates the sector to make additional investments in the digital transformation of the sector, such as making huge investments in digital technologies that can assist in the management and leadership of educational institutions. According to the findings of the study, implementing school-based management in educational institutions may be an efficient strategy for minimizing the negative short-term and long-term effects of COVID-19, and it may also provide a better advantage for positioning the sector in a better position in the era of technological transformation.

REFERENCES

Bandur, A. (2018). Stakeholders' responses to school-based management in Indonesia. *International Journal of Educational Management*.

Cheng, Y.C. (1996). A school-based management mechanism for school effectiveness and development. *School Effectiveness and School Improvement*, *7*(1), 35–61.

Feiring, C., & Lewis, M. (1987). E*quifinality and Multifinality: Diversity in Development from Infancy into Childhood.*

Government of South Africa. (2022). *How Covid-19 Changed the Way we Learn*. Retrieved from https://www.statssa.gov.za/?p=15197

Haymovitz, E., Houseal-Allport, P., Lee, R.S., & Svistova, J. (2018). Exploring the perceived benefits and limitations of a school-based social–emotional learning program: A concept map evaluation. *Children & Schools*, *40*(1), 45–54. Retrieved from https://www.worldbank.org/en/news/opinion/2021/04/02/the-impact-of-covid-19-on-education-recommendations-and-opportunities-for-ukraine

Iivari, N., Sharma, S., & Ventä-Olkkonen, L. (2020). Digital transformation of everyday life–How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care? *International Journal of Information Management*, *55*, 102183.

Iswan, A.S., Priharta, A., Bahar, H., & Miyati, E. (2021). The Influence of School-Based Management Implementation on the Improvement of Education Quality in Primary Schools. *Journal of Hunan University Natural Sciences*, *48*(4).

James, F. (2019). *Everything You Need to Know About Education 4.0*. Retrieved from https://www.qs.com/everything-you-need-to-know-education-40/

Jones, M.N., Thorn, C.R., Chow, P., & Wild, C. (2002). Equifinality: Parents' and students' attitudes towards a student-centered approach to integration. *Education*, *122*(3).

King, E., & Ozler, B. (2000). *What's decentralization got to do with learning? Endogenous school quality and student performance in Nicaragua*. Development Research Group, World Bank, Washington, DC.

Koc, A., & Bastas, M. (2019). Project Schools as a School-Based Management Model. *International Online Journal of Education and Teaching*, *6*(4), 923–942.

Lasi, H., Fettke, P., Kemper, H.G., Feld, T., & Hoffmann, M. (2014). Industry 4.0. *Business & Information Systems Engineering*, *6*(4), 239–242.

Martela, F. (2019). What makes self-managing organizations novel? Comparing how Weberian bureaucracy, Mintzberg's adhocracy, and self-organizing solve six fundamental problems of organizing. *Journal of Organization Design*, *8*(1), 1–23.

Mhlanga, D. (2020). Industry 4.0 in finance: the impact of artificial intelligence (ai) on digital financial inclusion. *International Journal of Financial Studies*, *8*(3), 45.

Mhlanga, D. (2021). Artificial intelligence in the industry 4.0, and its impact on poverty, innovation, infrastructure development, and the sustainable development goals: Lessons from emerging economies? *Sustainability*, *13*(11), 5788.

Mhlanga, D. (2022). The Role of Artificial Intelligence and Machine Learning Amid the COVID-19 Pandemic: What Lessons Are We Learning on 4IR and the Sustainable Development Goals. *International Journal of Environmental Research and Public Health*, *19*(3), 1879.

Mirzaian, E., & Franson, K.L. (2021). Leading a digital transformation in pharmacy education with a pandemic as the accelerant. *Pharmacy*, *9*(1), 19.

Nurhas, I., Aditya, B.R., Jacob, D.W., & Pawlowski, J.M. (2021). Understanding the challenges of rapid digital transformation: the case of COVID-19 pandemic in higher education. *Behaviour & Information Technology*, pp. 1–17.

Packmohr, S., & Brink, H. (2021, September). Impact of the pandemic on the barriers to the digital transformation in higher education-comparing pre-and intra-covid-19 perceptions of management students. In *International Conference on Business Informatics Research* (pp. 3–18). Springer, Cham.

Rana, S., Kiminami, L., & Furuzawa, S. (2022). Role of entrepreneurship in regional development in the haor region of Bangladesh: A trajectory equifinality model analysis of local entrepreneurs. *Asia-Pacific Journal of Regional Science*, pp. 1–30.

Schwab, K. (2015). The Fourth Industrial Revolution. What It Means and How to Respond? *Snapshot*. Retrieved May 25, 2020, from https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

Smalley, S., Hainline, M.S., & Sands, K. (2019). School-based Agricultural Education Teachers' Perceived Professional Development Needs Associated with Teaching, Classroom Management, and Technical Agriculture. *Journal of Agricultural Education*, *60*(2), 85–98.

The World Bank. (2021a). *The Impact of COVID-19 on Education – Recommendations and Opportunities for Ukraine*.

The World Bank. (2021b). *Mission: Recovering Education in 2021*. Retrieved from https://www.worldbank.org/en/topic/education/brief/mission-recovering-education-in-2021

Ulfatin, N., Mustiningsih, Sumarsono, R.B., & Yunus, J.N. (2022). School-based management in marginal areas: Satisfying the political context and student needs. *Management in Education*, *36*(3), 124–134.

Winkler, D.R., Gershberg, A.I., Roldán, M.B., & Garchet, P.M. (2000). *Education decentralization in Latin America: The effects on the quality of schooling* (pp. 203–225). PREAL.