


# Subversion of digital Darwinism in public healthcare facilities in South Africa

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**Dates:**

Received: 19 June 2023

Accepted: 28 Sept. 2023

Published: 10 Jan. 2024

**How to cite this article:**

Shibambu, A., 2024, 'Subversion of digital Darwinism in public healthcare facilities in South Africa', *Africa's Public Service Delivery and Performance Review* 12(1), a745.  
<https://doi.org/10.4102/apsdpr.v12i1.745>

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**Background:** Public healthcare facilities in South Africa need to face a complex and ever-changing environment with full versatility to avoid becoming victims of digital Darwinism. Digital Darwinism commences when technologies and society change faster than the ability of companies to adapt to changes. Currently, the historical medical records of patients and dispensing of medication are created or performed manually on paper and in books.

**Aim:** The purpose of this study was to investigate the subversion of digital Darwinism in public health-care facilities in South Africa.

**Methods:** The systematic literature review was used to collect secondary data in the form of empirical studies on digital Darwinism and digital technologies in public hospitals limited to articles published between 2015 and 2022.

**Results:** Findings indicate that public healthcare facilities use books and papers, as an indication that they are at an advanced stage of falling victim to digital Darwinism because they have not implemented technologies to manage patient records and recording of dispensing of medication.

**Conclusion:** It is concluded that the government should evade digital Darwinism by implementing cloud computing in order to provide omnipresent healthcare services.

**Contribution:** This study promotes convenience in terms of accessing records and it induces the national Department of Health to use technology in public healthcare facilities in order to deliver convenient services.

**Keywords:** digital Darwinism; digital technology; public healthcare; public sector; South Africa.

## Introduction

Darwinism takes place automatically when companies, and also industrial branches and entire nations, do not adapt quickly enough to the changed framework brought about by the market (Kreutzer, Neugebauer & Pattloch 2018). According to Kreutzer and Land (2017), digital Darwinism starts when technologies and society change faster than the ability of companies to adapt to changes. Jesse (2018) and Omar, Weerakkody and Sivarajah (2017) also define digital Darwinism as an era demanding organisation to compete for an unforeseeable future because of the fast pace of technological change of social evolution. During this era changes are partly evolutionary, while their impact is revolutionary. The unforeseeable may include pandemics such as COVID-19, during which people are subjected to staying in their homes as a means of reducing its spread. Solis (2017) states that in the era of digital Darwinism, the digital transformation efforts of some organisations take place in isolated pockets, sometimes with little coordination and collaboration across the enterprise. Many giant information technology (IT) companies such as Nokia, BlackBerry, Blockbuster, to mention a few, have perished or diversified their businesses in the struggle to survive digital Darwinism (Kreutzer et al. 2018). Even though Nokia and BlackBerry have diversified their businesses to telecommunications infrastructure, they fell victims of Darwinism in the aspect of smart mobile devices. On the other hand, Blockbuster struggled to withstand competition with emerging companies that provided online video streaming. These organisations became victims of digital Darwinism because of doing nothing or not doing enough to face the technological evolution. Walton (2017) adds that people, organisations, and society must respond to digital Darwinism by adapting to the different characteristics of digital information. Fehér and Szabó (2018) point out that public service organisations are less threatened by the potential impact of disruptive technologies that increase competition in the market sector given their quasi-monopolistic situation with no competition or

profit expectations. However, given the current time and emerging technologies, public healthcare service provision should be offered and received in improved ways.

Information and communication technology (ICT) has made significant contributions in the health sector (Farahat et al. 2018). However, Walton (2017) accentuates that the challenge for organisations is to become more skilful and to adopt a pattern that makes them responsive to change. This is one of the reasons that Kreutzer et al. (2018) confirm that many organisations can no longer afford to be non-digital. Even the organisations or public healthcare facilities that are regarded non-digital have a little technological element such as billing or teller machines. Based on the business of the organisation, elements of technology should be implemented, for instance, bills sent digitally. Adopting digital technology can create incremental, evolutionary, or radical change depending on the scope of impact across the organisation's cognitive frames, routines, and forms (Volberda et al. 2021). Walton (2017) opines that it is crucial for the organisation to sense the environment and determine the external selection pressures with sufficient certainty to be able to define the required internal selection pressures and operating model required. This is in line with the view of Kraus et al. (2022) that the success of a company depends on the rigorous pursuit of digital leadership. Omar et al. (2017) concur that the public sector should opt for digital transformation to fundamentally change the way it interacts with citizens. Nagy et al. (2018) opine that this in turn would make provision for taking appropriate action to improve interaction with customers, manage the complexity of the Fourth Industrial Revolution (4IR), as well as achieve sustainability, transparency of information usage, and compliance at the push of a button. For instance, some organisations are going ahead with a digital transformation process while others have yet to begin a formal transformation strategy. The implementation of emerging technology in order to reach out to citizens paves the way to subvert digital Darwinism.

In South Africa, some state-owned enterprises like the South African Post Office (SAPO) are severely threatened by digital Darwinism because they have not implemented any emerging technological solution to improve their services. As a result, organisations such as courier companies, PAXI at PEP Stores, and Pudo (Pick Up Drop Off) have emerged, diverting attention away from SAPO's inconvenient services. Omar et al. (2017) emphasise that attempts have been made to transform complex public service such as the National Health Service and social care in the United Kingdom through digital technologies. Kreutzer et al. (2018) cite examples of change drivers such as improved performance of available technologies and systems; digitisation covering more ground of value creation; the combination of different lines of development; and increased linking of objects and living beings using the Internet of Everything (IOE), which lead to quantum leaps in solutions and concepts. Walton (2017) submits that in order to avoid digital Darwinism, organisations need to have a short cycle time – the ability to review requirements into IT services fast and the ability to

deliver many releases in a shorter time. According to Echeberria (2020), every organisation faces digital Darwinism; however, those who adapt to changes in the early stages have an opportunity to survive.

The problem leading to this study is the delay in implementing digital technology that improves healthcare while at the same time avoiding digital Darwinism. This is because public healthcare facilities still use books and paper for record keeping and physically dispensing medication. Kreutzer et al. (2018) argue that many industries and companies still do not internalise the threat of internal change. Considering that the digital transformation phenomenon has been broadly explored in the public sector, this study focuses on digital Darwinism in public healthcare facilities in South Africa. Public healthcare facilities are not insulated from digital Darwinism; their reliance on conventional systems is fast becoming obsolete in providing quality health care, exacerbated by the widespread use of technology that can be implemented at low cost. As a result, failure to implement technology to improve services has the potential to cause digital Darwinism in public health-care facilities. Schneider (2021) suggests that many of the new technologies aim at either reducing travels to healthcare facilities and integrated records management in the health facilities. The main issue highlighted in this study is that public healthcare facilities are stuck in the past because they have not adopted relevant technology for record management and dispensing of medications to improve services to South Africans.

Therefore, this study aimed to investigate the subversion of digital Darwinism in public healthcare facilities in South Africa and the specific objectives were the following:

- To review the ICT infrastructure for records and dispensing medication implemented in public healthcare facilities in South Africa.
- To assess whether the implemented technologies in public healthcare facilities are complemented by digital literacy.

## Information and communication technology infrastructure for records and dispensing medication

Wehbe, Al Zaabi and Svetinovic (2018) highlight that technical infrastructure poses a challenge considering disparities in the field. Katuwal et al. (2018) observe that the records of patients are scattered across different entities in the value chain of the healthcare industry referred to as data silos, and sharing of data is prone to a multilevel process of permission control. Marutha and Ngoepe (2017) highlight that the South African healthcare sector continues to experience numerous challenges such as failure to properly manage records with the result that health practitioners are not able to access patient records pertaining to previous diagnoses, treatments and prescriptions. More so, Marutha and Ngoepe (2018) highlight that because of barely use of technology in managing records, other patients' files are

missing without a trace. Kassab et al. (2019) suggest that data created when a patient seeks medical attention at a healthcare facility must be stored to be accessible later by a healthcare provider within the same or even a different network or context. Creation of files in every hospital or healthcare facility that a particular patient visited leads to a trail of silo records for patients. According to Katuwal et al. (2018), when patients' data are scattered across different entities in the value chain of the healthcare industry, it is referred to as data silos – and sharing of data is prone to multilevel processes of permission control. Crucial data are not accessible and available at the time of urgent need. Wehbe et al. (2018) contend that patients often lack the infrastructure for easy access to their historical records, while providers retain primary ownership, which is not shared with other facilities because of reasons of confidentiality.

Deploying blockchain to records would ensure that there is always the existence of a complete picture of all records and transactions that took place (Marwala & Xing 2018). Kalpana et al. (2022) contend that before contemporary technology was invented, medical records relied on paper to store data. However, Ngoepe and Saurombe (2016) argue that records are not managed properly because of a lack of skills from staff, poor infrastructure, budget constraints, and a lack of support from mechanisms like public archives repositories. Given the rapid pace at which technology is moving, Kreuzer et al. (2018) suggest that digital Darwinism will not spare the historically successful players, even though they have been operating successfully for many decades in the market. The proliferation of nascent technologies and their inclusion in the health sector has reformed the quality of health services provided while containing the cost (Arvanitis, Loukis & Diamantopoulou 2016). On the IT infrastructure, internet service providers such as Vodacom, Telkom, MTN, Cell C, and fibre optic providers are collaborating with the government to connect South Africa. However, not every organisation in the public sector is coping with the changes brought about by ICT because of various issues ranging from a lack of resources to a lack of digital literacy. Finn (2022) opines that the illiterates of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn. It is crucial to discover the exact causes of digital Darwinism in public healthcare and how to subvert it. Awad et al. (2021) emphasise that digital healthcare revolutionises the healthcare sector, moving away from the traditional 'one-size-fits-all' approach of the healthcare management towards real-time personalised monitoring. Some of the low-hanging solutions that can be implemented in the public healthcare to subvert Darwinism include cloud computing because it is inexpensive when compared to developing a new infrastructure. Xing and Marwala (2018) and Lin et al. (2018) demonstrate that the 4IR technologies such as drones, internet of things, blockchain, artificial intelligence, among others, have proved relevance within the public healthcare facilities. Even though these technologies were developed in the 20th century, they have become more effective in the 21st century. According to Schneider (2021), Africa is hesitant to embrace technologies that improve

healthcare because of challenges that include poor infrastructure. Long distances to healthcare facilities, as well as the associated requirements of finding adequate transport and the cost, are major barriers to rural communities receiving timely care. However, the Rwandan government, in collaboration with Zipline, has successfully implemented drone technology to deliver medical supplies to hard-to-reach areas (Nyaaba & Ayamga 2021). Following its usefulness, Schneider (2021) adds that Ghana, Tanzania, and Nigeria have implemented the same technology to distribute medicines through drones to day-long journeys that are now covered in 30 min or less. Hiebert et al. (2020) indicate that the United States of America has deployed drones to reach patients who are expected to fetch their medication on an interval basis, implying that even if they are unable to visit the healthcare facility, medication will be dispensed. Furthermore, Schneider (2021) highlights innovations such as smart lockers and taxi-hailing that are used to dispense medications in South Africa. The ability to change and transform is the most critical source of competitive advantage for organisations today (Reeves & Deimler 2011). Finn (2022) alludes that just as research into digital transformation is at the nascent stage, so is the established knowledge on the causes of its implementation failure. Despite the fact that 4IR technologies were invented in the 20th century and became popular in the 21st, it remains unclear which technologies have been deployed to subvert Darwinism in South African public healthcare facilities.

## Summary of past studies

As previously mentioned, most giant IT companies have either perished or diversified their businesses because of falling victims to digital Darwinism. This section provides a brief review of some research supporting this. For example, a study by Li, Goh and Jhanjhi (2021) aimed to propose a medication management system to regulate medication mismanagement and automate the processing of restocking of medicines using drone technology. The study proposed a system that contributes to the adoption of the latest Internet of Things (IOT) for the elderly community. Hii, Courtney and Royall (2019) investigated the impact of drone transportation on the quality of a drug. The study recommended that tests be carried out to determine drone security and its effect of failure on medicine and the environment. Walton (2017) revealed that people, organisations, and society need to adapt to different forms of digital transformation to avoid digital Darwinism. Bhavnani and Harzand (2018) investigated the false-positives to technological Darwinism, controversies in digital health. It concluded that the pursuit of advancement could create a digital divide of digital technological Darwinism between practices and patients who adopt versus those who do not. This is influenced by the imbalanced distribution of connectivity in some areas. Omar et al. (2017) reported that race against Darwinism in the public sector has caused failures of several high-profile large-scale digitally enabled service transformation projects. Their analysis revealed that institutional actors and

structures are shaped through actions that are influenced by knowledge power and norms. The study by Jesse (2018) highlighted that the success of a company depends on the rigorous pursuit of digital leadership. This study concluded that lifelong learning is a requirement. Udovita (2020) conducted a study with the intent of investigating the concept of digital transformation and the dimensions of digital transformation that provide a holistic view of the digital transformation strategy, based on an empirical study in the available literature. The study concluded that to avoid digital Darwinism, organisations must integrate and accompany digital agility. Marutha and Ngoepe (2018) carried out a study with the aim of developing a framework for the management of medical records to support healthcare services in hospitals in Limpopo province of South Africa. This study revealed the lack of a framework for managing medical records in public hospitals and demonstrated the need for an integrative framework for medical records. Olaitan, Issah and Wayi (2021) investigated South Africa's state of readiness for the technologies that enable the 4IR. The study revealed that South Africa has low technological capability, declining economic complexity, and a decline in digital technological readiness. Lastly, Ngoepe and Marutha (2021) conducted a literature review to demonstrate the need for a framework that involves the use of blockchain technology for security to integrate healthcare records in public hospitals in South Africa. The study revealed that one of the elements that hinders the integration of health records in South Africa is information security.

## Methods

Systematic literature review was the methodology used in this study. According to Drahota and Dewey (2008), systematic literature review helps researchers to identify, select, and critically appraise research material to answer the research questions. Systematic literature review uses secondary data and Johnston (2014) suggests that secondary data are still empirical and can be used for main data collection. Secondary data for this study consisted of peer-reviewed research articles on digital Darwinism and digital technology in the public healthcare published between 2015 and 2022. The selected period is crucial for this study in view that it coincides with the Fourth Industrial Revolution. These articles were searched in the scholarly databases such as Google Scholar, EBSCOhost, Springer, and Science Direct.

## Selection of primary studies

Primary studies relevant for this research were selected using keywords, titles, and abstracts from the above-mentioned databases. The researcher explored the identified keywords, titles as well as abstracts grounded on each specific platform (Payne & Payne 2004). According to the researcher, keywords were preferable in the search to quickly and accurately retrieve the results in line with the research question of this

study where Boolean operators 'AND' and 'OR' were used in search strings. The search strings comprised 'digital Darwinism', 'Darwinism in public healthcare or health-care or health care'. Takahashi et al. (2009) argue that the use of predefined literacy studies provided credible sources allowing the researcher to critically analyse the abstracts, methodology, findings, and assumptions.

All the results from the search between 2015 and 2022 were percolated through the exclusion and inclusion measures. The timeframe was informed by the interest in establishing any development on the use of integrated systems at health facilities since the 4IR was introduced. In line with Dewey and Drahota (2016), these measures proved relevance because the objective was to critically appraise this study towards formulating research questions. Wohlin (2014) further indicated that these measures enabled the production of results that underwent snowballing. This means in some articles, the researcher established other interesting articles relevant to the study.

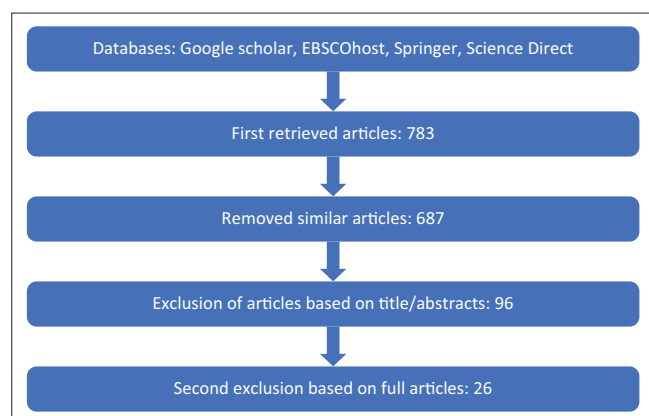
## The inclusion and exclusion measures

It should be stated that all selected articles for systematic literature review were the empirical results from the case studies. These case studies should have been carried out in the research on the effects of digital Darwinism in the public healthcare and digital technology in the public healthcare facilities. However, the researcher ensured that all the qualifying articles should have been peer-reviewed and written in English. For instance, the inclusion and exclusion measures were applied in three ways.

1. English literature (included). All articles preceding 2015 and not in English (excluded).
2. Empirical articles (data) linked adoption of technology in public healthcare facilities (included). Government reports (excluded).
3. Link to digital Darwinism (included). Articles not addressing digital Darwinism (excluded).

## Selection and screening of outcomes

Searching digital Darwinism from the scholarly databases such as Google Scholar, EBSCOhost, Springer, and Science Direct retrieved 783 articles. This number was significant as it indicated that this area was well-researched. However, there were many duplications and some articles preceded 2015 and were not in English. After removing similar or duplicate articles, only 687 remained. Following this, only 96 research articles were retained after being excluded based on their abstracts and titles. The researcher went further to perform exclusion based on reading full papers leading to only 26 articles that remained. This process is graphically demonstrated in Figure 1. It should be stated that during this process Kitchenham and Charters (2007) were followed where evaluation of the quality of the articles was performed to extract the relevant research papers connected to the research inquiries that were unbiased and with validity of the empirical data.



Source: Cho, H.Y., MacLachlan, M., Clarke, M. & Mannan, H., 2016, 'Accessible home environments for people with functional limitations: A systematic review', *International Journal of Environmental Research and Public Health* 13(8), 826

**FIGURE 1:** Extraction process of articles.

## Discussion

The purpose of this study was to investigate the subversion of digital Darwinism in public healthcare facilities in South Africa. Based on the literature reviewed, various technologies have been invented; however, too little has been done with regard to public healthcare facilities. For instance, majority of the studies revealed that the public healthcare facilities have not shifted from the manual records management and physical collection of medication. Given the existence of the technology, records would be saved from loss while patients would not miss their medicine because of a lack of economic resources. A plethora of studies highlighted the progress made in some developing and developed countries such as Rwanda, Ghana, Nigeria, and the United States where Darwinism has been subverted through implementing the IoT, drones, among others, to reach the patients. However, the same cannot be said about South Africa and some delays can be attributed to the legislative framework and poor infrastructure.

As shown in literature reviewed, failure to participate in technology has negatively affected many organisations bringing them to a state of poor performance and inconvenience (Chigada & Hirschfelder 2017). Supported by literature, Kreutzer et al. (2018) concur and mention that companies such as Nokia, BlackBerry, and Blockbuster, among others, have not sustained their trademark businesses because of Darwinism. These organisations were overtaken by technological events leading to them closing shop or diversifying their popular businesses or acquired by their competitors. In accordance with Fehér and Szabó (2018), because of the quasi-monopolistic nature of the government, this does not necessarily mean that the public healthcare facilities in South Africa will close; instead they will deprive themselves and the public of effective and efficient public healthcare service provision attained through technologies. The 4IR brought about elements of technology that are capable to simplify the ease of providing healthcare. This finding is consistent with literature as Farahat et al. (2018) point out that ICT has made significant contributions in the

health sector. The minimal technology implemented such as registration of patients is not enough to evade Darwinism – it is less agile to improve the lives of the patients or improving the systems when it is not pervasive.

The study established that public healthcare facilities are facing Darwinism by using methods that were relevant before technology emerged. This is demonstrated by patients' records scattered across different entities in the value chain of the healthcare industry. Supported by literature, challenges are experienced because patients' records relating to previous diagnoses, treatments, and prescriptions cannot be accessed (Marutha & Ngoepe 2017). The proliferation of nascent technologies and their inclusion in the health sector has reformed the quality of health services provided while containing the costs (Arvanitis et al. 2016). According to the study, implementing technology to counter Darwinism can be deterred by various issues ranging from a lack of resources to the inability to use resources. In this regard, the nascent technologies need to be complemented with digital literacy. Cloud computing is one of the easiest elements of the 4IR because it does not have many IT infrastructure requirements; it can save costs and benefit healthcare centres by virtually sharing records with patients.

## Conclusion and recommendations

This study demonstrated that regardless of how long organisations have deployed and used technology to provide services, they can still become victims of Darwinism. According to the current study, public healthcare services are not yet effective for patients or citizens in the aspect of providing services using technology. For instance, patients' records are manually filed on paper format and stored in the strong room instead of using cloud or blockchain technologies which promote easy retrieval. The use of drone technology to dispense medication to far-flung patients is more convenient than travelling to the public healthcare facilities. It should be indicated that implementation of emergent technologies while evading digital Darwinism is not predicted to substitute healthcare practitioners or records management practitioners, but to complement the existing healthcare systems by supporting records management and medical interventions. Public healthcare is already at the stage of Darwinism. The study makes the following recommendations:

- The National Department of Health should consider reviewing the legislation that supports the implementation of technologies to ease public healthcare services. For instance, Section 17.2.(i) and (j) of the *National Health Act of 2004* No. 61 does not support the use of any electronic systems which should be helpful to improve records management. In other words, the Act rejects the use of blockchain, cloud storage, Big Data, to mention a few, while it promotes manual storage which at times leads to missing files. The Act provides that anyone involved in the connection or modification of records warrants a conviction. One other main concern of regulatory systems is to ensure that patients can use digital technologies with

confidence, knowing that their identities and data are safeguarded.

- Deploy public healthcare technologies to subvert Darwinism. Technologies such as internet of things, cloud computing, big data, blockchain, among others, are crucial to have them implemented in order to improve the management and easy access of records.
- Deploy technologies to improve public healthcare services. As noticed in countries such as Rwanda and Ghana, the health departments have successfully deployed drone technologies to dispense crucial healthcare supplies to the areas that are hard to reach. This limits unnecessary queues and travelling to collect medication.
- Train and develop public healthcare staff by providing digital literacy. Considering the novelty of these technologies in records management or archiving, it is necessary to develop digital literacy in order to operate them effectively. This implies that eluding Darwinism should embrace training staff how to use drones for medical dispensing, cloud, blockchain, among others, to digitally preserve patients' files.
- Promote public-private partnership in implementing ICT infrastructure so that patients can benefit from public healthcare technologies. The government should improve the partnership with internet service providers to enhance connectivity in the areas that have poor network coverage. The government of Rwanda is in a public-private partnership with Zipline to deploy drone technologies to deliver medicine to places that are hard to reach.

## Limitations

There is no perfect research because limitations and shortcomings are always noticeable. Noticeable limitations for this research include the research approach employed where reviewed literature was limited to the three academic databases and that the literature dated to between 2015 and 2022. This may not have identified other relevant literature published in other databases resulting in systematic literature review bias. Therefore, future researchers should consider extending the scope to few more databases and extend the dates. Other instruments such as interviews may also be considered for data collection in related future studies.

## Acknowledgements

### Competing interests

The author declares that no financial or personal relationships inappropriately influenced the writing of this article.

### Author's contributions

S.A., is the sole author of this research article.

### Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

## Funding information

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## Data availability

The author confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

## Disclaimer

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