



South African Indigenous Languages and Digital Technologies: Access, Promotion and Preservation

Ndivhuwo Doctor Sundani

University of South Africa, South Africa

E-mail: sundand@unisa.ac.za

<http://dx.doi.org/10.47814/ijssrr.v6i8.1385>

Abstract

This study has adopted the non-empirical research design: a systematic review. The purpose of the study was to explore the access, promotion and preservation of South African indigenous languages using digital technologies. As a research methodology, the researcher used the "Preferred Reporting Items for Systematic Review and Meta-analysis" (PRISMA) guidelines. Thus, the data for the study was obtained by using scientific search engines such as Google Scholar, EBSCOHost, ResearchGate, ScienceDirect, Scopus, Sabinet, and Taylor & Francis. A review of the literature, which included sources from 2001 to 2022, informed the study's data. According to the findings of this study, access to digital technologies that support South African languages is limited – and this negatively affects the promotion and preservation of these languages. Therefore, the study recommends that the South African government in partnership with the Pan South African Language Board (PanSALB), the South African Centre for Digital Language Resources (SADiLaR), the United Nations Educational, Scientific and Cultural Organization (UNESCO), language experts, researchers, policymakers, and information and communications technology (ICT) companies should implement strategies that could help to prevent barriers to effective access, promotion, and preservation of South African indigenous languages, using digital technologies.

Keywords: *Digital Era; Digital Technologies; Indigenous Languages; Preservation; Promotion*

Introduction

The World Trade Organization (2021) explained that provisions related to digital technology remain particularly heterogeneous in terms of structure, language and scope. A number of initiatives have been put in place in South Africa and elsewhere on the African continent in an effort to empower African languages (Gumbi, 2019). Furthermore, Gumbi (2019) found that the South African government is still striving towards achieving the practical benefits of digital technology. Digital preservation according to

Masenya (2022) is regarded as one of the modern methods to preserve indigenous knowledge (IK) and languages as it can be shared with others and can be passed on to future generations.

In relation to languages, the study on promoting indigenous African languages through ICT localisation, which was conducted by Ndebele (2014) revealed that the integration of technologies and indigenous African languages in South Africa is an important and strategic imperative that should be adopted and embraced.

Within the South African context, the advancement of indigenous African languages has been witnessed mainly through the activities of the Department of Arts and Culture (DAC) and PanSALB, among others (Ndebele, 2014). Similarly, Gumbi (2019) explained that indigenous languages have been promoted mainly through the attempts of the DAC.

Of utmost importance, Osborn (2010) emphasised that at the beginning of the 21st century, the century in which the fourth industrial revolution (4IR) was introduced, South African national languages and cultures play a much more important role in international affairs and relations among people and governments than some 20th-century analysts and researchers had predicted.

According to Osborn (2006), indigenous languages are defined as those African languages indigenous to the continent south of the Sahara and for which there is no primary cultural centre in another region. On the other hand, Lipsmeier, Bansmann, Roeltgen and Kuerpick (2018) explained that digital technologies comprise knowledge, skills, and know-how for the creation, processing, transmission and use of digital data as well as systems and procedures for practical implementation.

The study conducted by Ndebele (2014), however, identified possible obstacles related to such an initiative: the persistent lack of expertise and collaboration among language and ICT experts, a lack of coherence between language and ICT policies, a lack of financial resources, large volumes of content to be localised, and the challenge of sustaining localised ICT products. In this regard, Olaitan, Issah, and Wayi (2021) revealed that digital illiteracy and language barriers need to be attended to if South Africa is to achieve its goal of benefitting from the 4IR; furthermore, it is important to re-skill the majority of the citizens so that they will be equipped to use and apply emerging digital devices. In other words, the number of indigenous IT professionals should be increased for the successful adoption of 4IR technologies. The article by PanSALB (2020) revealed that many role players, including ordinary South African citizens, are required to invest resources towards the development of indigenous languages.

According to UNESCO (2023), (digital) technologies are realms in which indigenous languages have not yet occupied a meaningful place. UNESCO (2023) added that there is great potential for digital technology to contribute to language documentation, revitalisation, and promotion – if the language is well researched and if the necessary resources are produced for wider integration in the public domain, particularly the development of machine-based language solutions.

Against this background, the study focuses on how indigenous languages are accessed, promoted and preserved using available digital technologies to benefit IK owners and to be accessible to future generations of South Africa. Studies of this nature have been conducted before, but very few scientific documents are available on the presentation of South African indigenous languages using digital technologies. Therefore, the rationale behind the notion underpinning this study is that the access to, and the promotion and preservation of indigenous languages through digital technologies and platforms will encourage the upliftment and accessibility of these languages by South African society and those who might be interested to learn them in future. In addition to this, this study attempts to fill a gap by looking into the techniques and strategies being employed to document and preserve indigenous languages in South Africa.

The study is structured as follows: Following this introduction are the research questions for the study. The current state of indigenous languages in South Africa is presented in the third section. The fourth section then presents the methods for the study. The fifth section of the study is the systematic review. The limitations of the study are presented in the sixth section. The last section presents the conclusion and future directions of the study.

Research Questions

To understand the different contexts for the access, promotion, and preservation of South African indigenous languages using digital technologies, the researcher investigated three nested sub-questions:

- RQ1. What is the importance of using digital technologies to access, promote and preserve South African indigenous languages?
- RQ2. What are the barriers to effective access, promotion, and preservation of South African indigenous languages using digital technologies?
- RQ3. What are the strategies for promoting and preserving South African indigenous languages using digital technologies?

The Current State of Indigenous Languages in South Africa

Phaahla (2014) found that South Africa remains a multilingual country, whose indigenous languages are still spoken in its villages (under the auspices of traditional chiefs). However, according to the same study conducted by Phaahla (2014), speakers of black indigenous African languages believe that their languages are inherently lacking in the capacity to serve as media of communication for various purposes. The people themselves are the custodians of South Africa's indigenous languages. In the study conducted by Makgopa (2022), it was revealed that indigenous languages are the carriers of communication, culture, and identity. It is through language that one expresses one's thoughts, emotions, and feelings. The article published by the PanSALB (2020) explained that the South African indigenous languages in particular are, by their nature, lyrical and poetic and most importantly, carry the weight of the rich cultural history of its people with ease. On the other hand, Makgopa (2022) is of the view that colonialism created serious problems and obstacles in the development of indigenous languages. Looking at the drawbacks, Balfour (2019) accentuated that South African (indigenous) languages are still severely lacking in resources. This was also confirmed by SADiLaR (2021). According to SADiLaR (2021), many South African indigenous languages currently have no or very limited resources available and, additionally, they are often structurally quite different from more well-resourced languages, requiring the development and use of specialised techniques. On the other hand, authors such as Osborn (2010) strongly believe that using technologies in indigenous languages is a solution that also opens up new possibilities for more effective use of the technology. In this regard, Ndzendze (2020) believes that 4IR is capable to break language/communication barriers in rural and urban areas in Africa, South Africa included, and enable smartphones and wireless technology to communicate and interact with South Africans in their indigenous languages.

Methods

PRISMA was used as the methodology for this study. As described by authors such as Moher, Shamseer, Clarke, Gherzi, Liberati, Petticrew, Shekelle and Stewart (2015), PRISMA is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses. The above-mentioned authors further said this about PRISMA: "It is used for reporting reviews and evaluating randomised trials, but it can also be used as a basis for reporting systematic reviews". Furthermore, Moher, et al.

(2015) explained that a systematic review attempts to collate all relevant evidence that fits pre-specified eligibility criteria to answer a specific research question. It uses explicit, systematic methods to minimise bias in the identification, selection, synthesis, and summary of studies. In this regard, Ahn and Kang (2018) explained that systematic reviews and meta-analyses present results by combining and analysing data from different studies conducted on similar research topics.

Planning Phase

The data for the study was obtained by using seven scientific search engines which include: Google Scholar, EbscoHost, ResearchGate, ScienceDirect, Scopus, Sabinet, and Taylor & Francis. The search was performed using a query consisting of extensive terms such as: “South African indigenous languages”, “digital technologies”, and “information and communication technologies.” The researcher made sure that the query was modified to fit the specific requirements of each of the databases searched.

Scholarly Documents Selection Phase

The researcher selected scholarly documents to answer the above-mentioned research questions. Figure 1 depicts the various steps followed by the researcher during the process of searching for scholarly documents. In this study, the initial search yielded 50 records, with an additional 10 records for a total of 60 records. Due to information duplication or failure to meet the inclusion criteria, 10 records were excluded from this total. The remaining records numbered 50, of which 40 were screened further. As a result of the screening, 10 records were eliminated because they contained irrelevant information, leaving 30 records. The eligibility of the remaining 30 records was then determined. In addition, 14 scholarly documents were removed because they contained unwanted information about other countries. Finally, only 16 scholarly documents were used in this study.

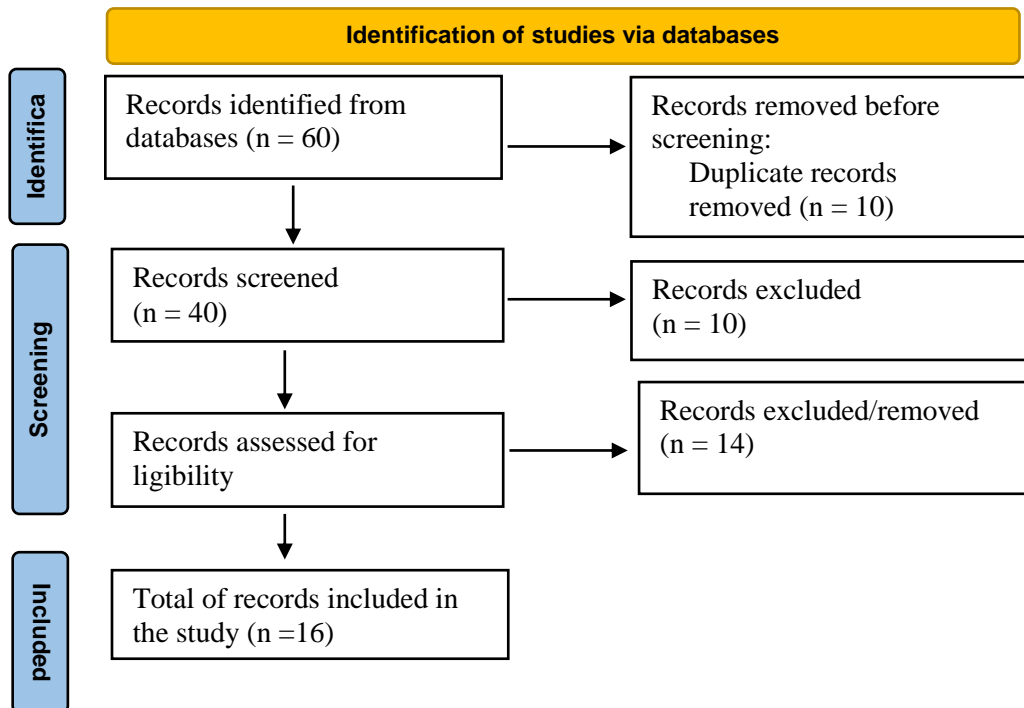


Figure 1: *PRISMA flow diagram*. From: Page, Moher, Bossuyt, Boutron, Hoffmann, Mulrow, Shamseer, Tetzlaff, Akl, Brennan, Chou, Glanville, Grimshaw, Hróbjartsson, Lalu, Li, Loder, Mayo-Wilson, McDonald, McGuinness, Stewart, Thomas, Tricco, Welch, Whiting & McKenzie (2020)

Execution Phase

In this phase, the researcher validated the retrieved documents to ensure the quality of the study. As indicated in table 2, the study has focused on sixteen scholarly documents. Therefore, the researcher reviewed every article to determine if the inclusion and exclusion criteria were met. Table 1 below depicts the inclusion and exclusion criteria.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Scholarly documents in the English language.	Scholarly documents not published in the English language.
Scholarly documents covering the variables of the study.	Scholarly documents that did not cover the variables of the study.
Scholarly documents on access, promotion, and preservation of South African indigenous languages using digital technologies.	Scholarly documents that did not focus on access, promotion, and preservation of South African indigenous languages using digital technologies.
Global studies that covered variables of the study.	Global studies that did not cover the variable of the study.
Scholarly documents published from 2001 to 2022.	Scholarly documents published before 2001.

Table 2. Summary of the Scholarly Documents Used in the Study

The current study included sixteen scholarly documents published in various databases. In this regard, table 2 depicts a representation of the entire process of the researcher's search.

Author(s), Year and Country of Publication	Consulted Documents	Methods	Theoretical/Conceptual Framework(s)
Manda & Backhouse (2018), South Africa	Conference paper	Qualitative, Interpretive, Document analysis, Semi-structured interviews	Institutional theory
Osborn (2006), United States	Conference paper	Qualitative	N/A
Makgopa (2022), United States	Book chapter	Qualitative	N/A
Kinuthia (2006), United States	Book chapter	Qualitative	N/A
Adedokun & Zulu (2022), United Kingdom	Journal article	Qualitative, Statistical analysis	Digital divide

Rice & Pearce (2015), United Kingdom	Journal article	Quantitative, Moderation analysis	Diffusion of innovations theory
Padilla, de Jesús Ávila & Cervantes (2015), Brazil	Journal article	Quantitative, Macro analysis	Grounded theory
Averweg (2001), South Africa	Online article	Qualitative	N/A
Mawela (2021), South Africa	Online article	Qualitative	N/A
Dyson, Hendriks & Grant (2007), United States	Book	Qualitative & Quantitative	N/A
Dia (2014), Indonesia	Journal article	Qualitative	N/A
Gumbi (2019), South Africa	Journal article	Qualitative	Constructivist theory
Balfour (2019), South Africa	Conference paper	Qualitative	N/A
National Planning Commission (2020), South Africa	Report	Quantitative	N/A
Azubuike & Aji (2021), United States	Journal article	Qualitative	N/A
Malatji & Lesame (2019), South Africa	Journal article	Qualitative and quantitative approaches, Survey and online observation, Statistical methods and semiotic analysis, Personal interviews and focus groups, Thematic analysis	African linguistic dynamism theory & Uses and gratifications theory

Problematisation of South African Indigenous Languages and Digital Technologies

In a multi-cultural and multi-lingual society like South Africa, implementing equitable digital services is challenging as the process has to overcome language and cultural differences and long-standing hostilities (Manda & Backhouse, 2018).

Despite the examples cited in the previous section, the use of African languages in ICT appears to be marginal in Africa (Osborn, 2006). In support of the problem mentioned by Osborn (2006), authors such as Makgopa (2022) expressed that European languages are used in Africa and are rated as official languages of African countries while indigenous languages are sidelined and marginalised.

Furthermore, Osborn (2006) explained that some of the obstacles to the use of African languages in ICT – on the levels of policy, attitudes, and sometimes orthographic issues – are similar to those encountered in promoting African language literacy. In addition to this, Kinuthia (2006) suggested that “when misapplied, the consequences of ICT can be repercussive: when it is introduced to indigenous groups it brings along mass media, popular culture and global languages that can potentially conflict with local traditions”.

In relation to the problematisation of South African indigenous languages and digital technologies, Osborn (2006) emphasised that another constraint points to the reluctance of foreign sponsors to invest in ICTs and African languages.

The Importance of Using Digital Technologies to Promote and Preserve South African Languages

According to Osborn (2006), African languages seem to be a research topic or point to debate rather than a broad communication medium in cyberspace. Many websites in African languages have their audience outside the African continent. The above-mentioned statement proves that researchers see a need for the preservation of African languages using digital technologies.

The study conducted by Adedokun and Zulu (2022) on digital inclusion in South Africa revealed that people see the need to be digitally inclusive and to be part of the fascinating historical development of ICTs. The term digital inclusion describes the ability of people and groups to access and use ICTs (Rice & Pearce, 2015; Padilla, De Jesús Ávila & Cervantes, 2015).

Also, the study conducted by Averweg (2001) in South Africa indicated that ICTs are an enabler to preserve and revitalise IK, indigenous cultures and languages. In relation to this, Mawela (2021) is of the opinion that central to the digital technologies and 4IR is language, as the 4IR is coined, envisaged, and expressed through the medium of language. According to the above-mentioned author, without language, it is not possible to talk about the 4IR.

The study by Osborn (2006) revealed several reasons why the use of digital technologies in African languages is of interest. The author added that as long as a language is spoken and used in other spheres of activity, it is worth at least providing the opportunity for it to be used in various ways with the new technologies. Furthermore, ICT in (South) African languages could be important in post-literacy and in the dissemination and generation of knowledge.

The multimedia capabilities (e.g. digital video and recording devices), storage capacity (e.g. online databases), and communication tools (e.g. the Internet and digital technologies) offered by the latest technologies “provide new opportunities to preserve and revitalise indigenous cultures and languages” (Dyson, Hendriks & Grant, 2007).

Barriers to Effective Access, Promotion and Preservation of South African Languages Using Digital Technologies

The potential of indigenous African languages to catalyse sustainable development has long been overlooked by national and international stakeholders, as pointed out by Dia (2014).

According to the evidence from the study conducted by Gumbi (2019), there is still a lack of clear advocacy and mediation on digital content in South Africa. One could concur that this lack of a clear advocacy affects the access, promotion and preservation of South African languages using available digital technologies.

One of the barriers that could be affecting the access to, and the promotion and preservation of South African languages was discovered by Balfour (2019). The above-mentioned author explained that South African (indigenous) languages are still severely lacking in resources when compared to mainstream languages.

As stated by the National Planning Commission (2020) of South Africa, paradoxically, digital inequality is increasing as more people are connected. Apparently, digital inequality is affecting how indigenous languages are accessed, promoted and preserved using digital technologies in South Africa.

Strategies that Promote and Preserve South African Languages Using Digital Technologies

As part of the strategies that promote and preserve South African languages using digital technologies, Azubuike and Aji (2021) explained that there is a need for information professionals to devise a means of collecting, documenting, repackaging, and easily disseminating IK and indigenous languages using a technological tool which forms the crux of the discourse.

South Africa has adopted digital transformation as one of its strategies for promoting inclusive growth. This is a case study of South Africa, a developing country that has embraced the digital transformation agenda to promote the transformation of government, business and society, among other things (Manda & Backhouse, 2018).

In the study conducted by Gumbi (2019), it was revealed that if South Africans are committed to taking part in the knowledge economy and the implementation of a multilingual policy, every effort must be made to prevent digital exclusion of African languages.

The study conducted by Malatji and Lesame (2019) showed that in this digital era, the dominance of English could be less of a concern to proponents of African languages because one has the opportunity to use and promote any language on social media. In addition to this, the study conducted by Manda and Backhouse (2018) emphasised that inclusion and digital access also require a more integrated approach to the coordination and implementation of social and economic policy that extends beyond technology. Inclusion and digital access, therefore, should help to promote South African indigenous languages.

Limitations of the Study

Several limitations of this study are recognised. The study was mainly focusing on exploring the access, promotion and preservation of South African indigenous languages using digital technologies. Thus, this study was unique to this specific context. Since there are a tiny number of scientific documents available on the presentation of South African indigenous languages using technologies, other contexts that support the promotion of indigenous languages using digital technologies can be investigated in future. Again, for future research, the applicability of this study should be cross-validated in other African

countries using the same data sets. Although this study contributes to the knowledge of the relationship between indigenous languages and digital technologies in South Africa, it has limited generalisability to other developing countries with similar levels of socio-economic development and similar political backgrounds.

Conclusions and Future Directions of the Study

The results of the study highlight the importance of using the opportunities presented by digital technologies to promote and preserve South African languages. There are barriers to the effective access to, and promotion and preservation of South African languages using digital technologies. Those barriers include a lack of expertise and collaboration among indigenous language and ICT experts, a lack of implementing equitable digital services using indigenous languages, and lack of a clear advocacy and mediation on digital content in South Africa, among others. These findings are valuable for understanding the mechanisms between indigenous languages and digital technologies. Based on the findings, different recommendations to promote and preserve South African indigenous using digital technologies were suggested. Future directions include the following:

- South African government should implement policies that strictly focus on the promotion and preservation of South African languages using digital technologies.
- PanSALB, SADiLaR and UNESCO should advocate for the incorporation of indigenous languages by ICT and digital technology companies when they develop digital technologies.
- Language experts, researchers, policymakers and ICT companies should implement strategies that could help to prevent barriers to the effective access, promotion, and preservation of South African languages using digital technologies.
- Financial resources should be made available by the South African government and companies to promote indigenous languages. The call for financial resources was also emphasised by PanSALB.

Acknowledgments

The author has read and agreed to the published version of the manuscript.

References

- Adedokun, T. A., & Zulu. S. P. (2022). Towards digital inclusion in South Africa: The role of public libraries and the way forward. *Interdisciplinary Journal of Economics and Business Law*, 11(4), 127–154.
- Ahn, E., & Kang, H. (2018). Introduction to systematic review and meta-analysis. *Korean Journal of Anesthesiology*, 71(2), 103–112.
- Averweg, U. R. (2001). *The role of information and communication technologies in indigenous knowledge preservation*. Retrieved from <https://www.ethnosproject.org/wp-content/uploads/TheRoleofICTIndigenous.pdf>.
- Azubuikwe, F. C., & Aji, T. C. (2021). Role of information and communication technologies (ICTs) in repackaging indigenous knowledge: A 21st century perspective. *Library Philosophy and Practice (e-journal)*, 1–14.

- Balfour, R. (2019). *The impact of the fourth industrial revolution on indigenous languages as priorities for teaching and learning in higher education in South Africa*. Retrieved from [https://news.nwu.ac.za/sites/news.nwu.ac.za/files/files/Robert.Balfour/Address%202019_10_18.UNI SA.Impact-of-4IR-on-indigenous-languages.doc](https://news.nwu.ac.za/sites/news.nwu.ac.za/files/files/Robert.Balfour/Address%202019_10_18.UNI%20SA.Impact-of-4IR-on-indigenous-languages.doc).
- Dia, I. A. (2014). African languages, and information communication technologies and development. *International Journal of the Sociology of Language*, 225, 113–130.
- Dyson, L. E., Hendriks, M. & S. Grant, S. (2007). *Information technology and indigenous people*. Hershey: Information Science Publishing.
- Gumbi, P. (2019). IsiZulu as an indigenous African language, and technology in the basic education sector in KwaZulu-Natal. *South African Journal of African Languages*, 39(2), 204–210.
- Kinuthia, W. (2006). *Instructional Design and Technology Implications for Indigenous Knowledge: Africa's Introspective*. In: L. E. Dyson, M. Hendriks and S. Grant (eds.) *Information Technology and Indigenous People*, Chapter VIII, 105-116, Hershey, PA, USA: Information Science Publishing.
- Lipsmeier, A., Bansmann, M., Roeltgen, D., & Kuerpick, C. (2018). *Framework for the identification and demand-orientated classification of digital technologies*. Retrieved from <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8691135>.
- Makgopa, M. (2022). *Implications of the fourth industrial revolution (4IR) on the development of indigenous languages of South Africa: Challenges and opportunities*. Retrieved from <https://www.igi-global.com/chapter/implications-of-the-fourth-industrial-revolution-4ir-on-the-development-of-indigenous-languages-of-south-africa/289294>.
- Malatji, E., & Lesame, C. (2019). The use of South African languages by youth on social media: The case of Limpopo Province. *Communicare*, 38(1), 76–95.
- Manda, M., & Backhouse, J. (2018). *Inclusive digital transformation in South Africa: an institutional perspective*. In Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance, Galway, Ireland, April 2018.
- Masenya, M. T. (2022). Digital preservation of indigenous knowledge in South African rural communities. In *Handbook of Research on Protecting and Managing Global Indigenous Knowledge Systems*, edited by R. Tshifhumulo, T. J Makhnikhe. Hershey. IGI Global.
- Mawela, R. (2021). *The role of language in the 4th industrial revolution*. Retrieved from <http://hdl.handle.net/20.500.11911/218>.
- Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). “Preferred reporting items for systematic review and meta-analysis protocols (PRISMAP) 2015 statement”. *Systematic Reviews*, 4(1), 1–9.
- National Planning Commission. (2022). *Digital futures: South Africa's digital readiness for the fourth industrial revolution*. Retrieved from https://researchictafrica.net/wp/wp-content/uploads/2021/01/021220_Digital-Futures_SAs-Digital-Readiness-for-4IR_01.pdf.
- Ndebele, H. (2014). Promoting indigenous African languages through information and communication technology localisation: A language management approach. *Alternation*, 13, 102–127.

- Ndzendze, B. (2020). *The fourth industrial revolution and its implications for African languages*. Retrieved from <https://www.usaf.ac.za/wp-content/uploads/2020/12/Keynote-Address-by-Dr-Bhaso-Ndzendze.pdf>.
- Olaitan, O. O., Issah, M., & Wayi, N., (2021). A framework to test South Africa's readiness for the fourth industrial revolution. *South African Journal of Information Management*, 23(1), 1–10. <https://doi.org/10.4102/sajim.v23i1.1284>.
- Osborn, D. (2006). *African languages and Information and Communication Technologies: Literacy, access, and the future*. Retrieved from <http://www.lingref.com/cpp/acal/35/paper1299.pdf>.
- Osborn, D. (2010). *African languages in a digital age: Challenges and opportunities for indigenous language computing*. Cape Town: HSRC Press.
- Padilla, R., de Jesús Ávila, M., & Cervantes, M. (2015). Inequalities among young people using the Internet in Aguascalientes, Mexico: An analysis of statistically significant differences between socioeconomic levels. *Journal of Latin American Communication Research*, 5(2), 3–24.
- Page, M. J, Moher, D., Bossuyt, P. M, Boutron, I, Hoffmann, T. C, Mulrow, C. D, Shamseer, L., Tetzlaff, J. M, Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A, Whiting, P., & McKenzie, J. E. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews, *BMJ*, 372(71).
- Pan South African Language Board (PanSALB). (2022). *The survival of African languages in a digital era*. Retrieved from <https://www.pansalb.org/the-survival-of-african-languages-in-a-digital-era/>.
- Phaahla, P. (2014). Indigenous African languages as agents of change in the transformation of higher education institutions in South Africa: Unisa. *Nordic Journal of African Studies*, 23(1), 31–56.
- Rice, R. E., & Pearce, K. E. (2015). Divide and diffuse: Comparing digital divide and diffusion of innovations perspectives on mobile phone adoption. *Mobile Media and Communication*, 3(3), 401–424.
- South African Centre for Digital Language Resources (SADiLaR). (2021). *2nd workshop on resources for African indigenous languages*. Retrieved from <https://www.sadilar.org/index.php/en/2-general/286-rail-2021>.
- United Nations Educational, Scientific and Cultural Organization (UNESCO). (2023). *State-of-the-art of indigenous languages in research*. Retrieved from <https://www.unesco.org/en/articles/state-art-indigenous-languages-research>.
- World Trade Organization. (2021). *Adapting to the digital trade era: Challenges and opportunities*. Retrieved from https://www.wto.org/english/res_e/booksp_e/adtera_e.pdf.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).