Interdisciplinary Journal of Information, Knowledge, and Management

An Official Publication of the Informing Science Institute InformingScience.org

IJIKM.org

Volume 20, 2025

DESIGNING A WEB AGRICULTURAL INFORMATION QUALITY EVALUATION TOOL FOR THE MAIZE INDUSTRY

Ester Ernest Mnzava*	Sokoine University of Agriculture, Morogoro, Tanzania and University of South Africa, Pretoria, South Africa	esterrnst@sua.ac.tz
Lorette Jacobs	University of South Africa, Pretoria, South Africa	ejacobl1@unisa.ac.za

ABSTRACT

Aim/Purpose	Despite the necessity of ensuring that reliable and recent information for economic development, particularly agriculture, is accessed and shared, the information found on websites related to agricultural topics requires assessment to ensure that only accurate information is shared with stakeholders within the maize industry in Tanzania. A rigorous tool for assessing the quality, accuracy, reproducibility, value, and use of agricultural information on the web is needed to ensure that web agriculture information can be meaningful to users. This study was undertaken to design a tool that can be used to assess the quality of agricultural information on the web.
Methodology	This study employed an interpretive qualitative case study design. The qualitative data collection involved the design of the Web Agricultural Information Quality Evaluation Tool, in which data was collected through literature analysis and interviews. Thematic analysis was the main method of data analysis, where a literature review and data from interviews were used to identify themes that may be included in quality information evaluation tools for the maize industry in Tanzania. The Web Agricultural Information Quality Evaluation Tool has two main parts. Part A is the fundamental information quality criteria, which include authority and timeliness. Part B relates to the relevancy and completeness of the agricultural information on the web.

Accepting Editor Dimitar Grozdanov Christozov | Received: April 4, 2024 | Revised: July 4, July 15, August 7, August 23, 2024 | Accepted: August 31, 2024.
Cite as: Mnzava, E. E., & Jacobs, L. (2025). Designing a web agricultural information quality evaluation tool for the maize industry. *Interdisciplinary Journal of Information, Knowledge, and Management, 20,* Article 25.
https://doi.org/10.28945/5616

Findings	The findings revealed that authority, timeliness, relevancy, and completeness are the key information quality criteria for assessing the quality of web agricultural information related to the maize industry.
Impact on Society	The value of the Web Agricultural Information Quality Evaluation Tool is that it assists stakeholders involved in the agriculture value chain to assess the quality of information available on the web to ensure that timely, trustworthy, and accurate information is used to ensure the sustainability of the maize industry.
Further Research	The research is based on the first three components of the analysis, design, development, and evaluation framework (ADDIE) model. Further research on the implementation and evaluation is needed to assess the relevance of the tool, specifically related to the maize industry and other agricultural sectors.
Keywords	information quality, information evaluation, agricultural information, web information, digital information

INTRODUCTION

One of the key sources of information that can be used to advance the achievement of sustainable development goals 2 (zero hunger) and 15 (life on land) is web information on agricultural topics such as diseases, meteorological expansion, pricing, and transport. However, most web pages offering vital farming information do not undergo editorial reviews to validate the quality, relevance, authority, and reliability of the content (Verkijika & De Wet, 2018). Although the web can be a good source of information, the lack of quality control mechanisms makes it a questionable source of information (Barau & Afrad, 2017). Ensuring the quality of agricultural information is imperative because the quality of information affects individuals' ability to make decisions pertaining to farming processes, activities, and other aspects related to the agricultural value chain (Kante et al., 2019). To address the issues related to the quality of web information, various scholars have developed different information-quality evaluation tools such as the HONcode, the Lida tool, the JAMA benchmarks, and the DISCERN, to help users assess the validity and reliability of the information available on websites (Arif & Ghezzi, 2018; Boyer et al., 1998; Castillo-Ortiz et al., 2017; Hamwela et al., 2018; Jo et al., 2018). The information-quality evaluation tools mentioned relate mainly to the health sector, not agriculture.

To improve the quality of information on offer to the agriculture sector, the study developed an information quality evaluation tool that can be used to assess the quality of maize information on the web. The article analyzed existing evaluation tools to identify key features that should be included in an information quality evaluation tool. From existing quality evaluation tools, criteria such as accuracy, reliability, usability, and relevant information were identified to help define the quality of web agricultural information (Abumandil & Hassan, 2016; Butler & Butler, 2018; Laumer et al., 2017; Tao et al., 2017; Tate, 2019). As part of the design of the quality evaluation tool, the views of agricultural extension officers on how they define quality information were also considered to determine the criteria of the proposed information quality evaluation tool. Agricultural extension officers were considered important stakeholders because they connect farmers with information, knowledge, and technology that are essential to support various agricultural activities, including the production of maize, using scientifically endorsed methods and techniques (Ntulo, 2017). Furthermore, in Tanzania, agricultural extension officers play an essential role because most of the smallholder farmers there have a low level of literacy and are thus reliant on agricultural extension officers to offer support, guidance, and information that can assist with increased maize production (Anderson et al., 2016; Msuya et al.,

2017). It was, therefore, imperative to determine the views of agricultural extension officers on quality information as they are the custodians who share information with other stakeholders in the agricultural value chain.

It is important to note that three key objectives are dealt with when proposing a web agriculture information evaluation tool for the maize industry of Tanzania. These include:

- To analyze existing information quality evaluation tools.
- To identify information to be included in a web information evaluation assessment tool.
- To propose a web information quality evaluation assessment tool for the maize industry.

Accordingly, this paper is organized into a literature review, conceptual framework, research methodology, results, and discussions. The literature review provides details on the first objective of analyzing existing information quality evaluation tools. As part of the discussion, more details are provided by the participants to assess the quality of web agriculture information. The article concludes with a proposed information quality evaluation assessment tool and suggestions for further research.

LITERATURE REVIEW

The unprecedented growth rate and the questionable quality of information on the web require due attention to help users evaluate existing web information (Chellen, 2015; Tao et al., 2017). While there are many evaluation tools available to evaluate the quality of information on the web, most of them are from the health sector (Arif & Ghezzi, 2018; Barrow et al., 2017; Castillo-Ortiz et al., 2017; Chi et al., 2017; Hamwela et al., 2018; Jo et al., 2018; Saeed & Anderson, 2017). Bernstam et al. (2005) cite 273 distinct information-quality evaluation tools used to evaluate health information. However, the most extensively used evaluation tools include the Health on the Net Code of Conduct, the Lida tool, the DISCERN instrument, and JAMA (Chang et al., 2016; Fahy et al., 2014; Moult et al., 2004; Nghiem et al., 2016; Prasanth et al., 2018; Tanabe et al., 2018). The analysis of these evaluation tools was important to obtain insights that could be considered in developing a web agricultural information evaluation tool for the maize industry. Specifically, the analysis aims to give details on information quality criteria to consider when assessing web information quality, validity, reliability, and accuracy. Briefly, the various information evaluation tools are analyzed to obtain insight into the criteria that may be considered when compiling a web information evaluation tool for the agriculture industry.

HONCODE OF CONDUCT

The Health on the Net Code of Conduct (HONcode) was developed by the HON Foundation in 1996 to address the quality and ethics of website content. More specifically, the HONcode was created to provide guidelines to consider in the evaluation of web information related to the health industry (Boyer et al., 1998). The current HONcode of conduct has been translated into 35 languages so that it could be used extensively to assess the quality of health information available via the web (Boyer et al., 2011; International Medical Informatics Association, 2019). The HONcode evaluates websites based on their adherence to the criteria of authority, complementarity, confidentiality, attribution, justifiability, transparency of authorship, transparency of sponsorship, honesty in advertising and editorial policy (International Medical Informatics Association, 2019; Varady et al., 2018). The application of these criteria helps individuals to evaluate the quality of health websites through the application of measurement scales. The overall score of the quality of the web information is automatically calculated once an individual submits an online evaluation (Health on the Net, 2019). This score is aligned with a code of conduct that provides guidance on the quality of information available on a website.

Researchers such as Baujard et al. (2010) and Boyer et al. (2011) reveal that the HONcode of conduct provides a systematic and fast evaluation of online health information. The fact that it provides certification and a seal to websites meeting the HONcode of conduct standard provides an easy way for

patients and health professionals to ascertain whether the quality of health information on a website is of acceptable quality. However, other researchers, such as Raj et al. (2016), have reported that the HONcode of conduct may not, in all circumstances, be an adequate tool to ensure that information users get quality health information on websites. For instance, a website that is HON-certified may not be easy for its users to read. This is a limitation since the readability of any written information is important to enhance access to quality information. Readability refers to the ease with which a reader can understand written text, and it depends on the vocabulary, syntax (length and structural complexity of sentences), and presentation (fonts and layout) (Iliescu, 2017). Azios et al. (2019) agree on the importance of the readability of information and on considering both the accuracy of information and readability when assessing the quality of a website.

In addition, Chang et al. (2016) report that one of the limitations of the HONcode of conduct is that it fails to reflect the scientific quality of website content. According to Chumber et al. (2015), the information on a website must provide evidence to validate the information presented on the website. However, the validity of the information cannot be guaranteed by only providing evidence of the origin of the information. Hrabal and Pruša (2015) argue that to enhance the validity of website information, it should also provide details on the ethics of the information included on the website. Because of the shortcomings of the HONcode of conduct, authors such as de Man et al. (2018), Raj et al. (2016), Prasanth et al. (2018), Tanabe et al. (2018) and Alhuwail et al. (2018) propose that additional tools such as Lida, DISCERN or EQIP be paired with the HONcode of conduct to enhance the quality review of health information available on the web.

The Lida Tool

The Lida web information evaluation tool was developed to assist users in assessing the extent to which information available on websites can be deemed relevant, reliable, and accurate. Lida focuses on the design and content of health websites by addressing three quality criteria: accessibility (the availability of health information without restrictions), usability (the ease of obtaining health information from the website), and reliability (the ability to obtain correct and relevant information on a website) (Prasanth et al., 2018; Raj et al., 2016). Each criterion is further defined to facilitate its application. For example, the accessibility of a web page is measured based on several aspects that include page setup (features of the web page), access restrictions (access to all people, including those with disabilities), registration (whether the use of the site is free, requires a login or has to be paid for) and the type of browser being used (Minervation, 2023).

Research by de Man et al. (2018), Prasanth et al. (2018), Tanabe et al. (2018), and Alhuwail et al. (2018) shows that the Lida tool used together with other quality evaluation tools such as DISCERN and the HONcode of conduct, provides extensive opportunities for assessing the quality of the information available on health-related websites. This suggests that a combination of tools should collaboratively be used to address all aspects of assessing the information quality of websites. This is because of the differences in focus areas among various tools. Whilst the HONcode of conduct assesses the quality of a website's contents and ethics, the Lida tool assesses by evaluating the reliability of written information.

The Discern Web Evaluation Tool

As a third tool to use collaboratively with the HONcode of conduct and the Lida tool, Charnock and Shepperd (2004) propose that the DISCERN tool, developed by an expert panel in 1998, should be used to assess the quality of written information on treatment choices. The DISCERN web evaluation tool comprises 16 questions using a 5-point Likert scale rating system to assess the quality of health website information. The questions are categorized into two major categories: reliability and relevance (Charnock et al., 1999; Fahy et al., 2014). DISCERN provides inexperienced users with the opportunity to assess the extent to which health information is reliable and relevant to them. It has been praised for being user-friendly, especially for individuals who are novices at determining the relevance of information. Authors such as Shital Kiran et al. (2015), Carlsson et al. (2015), Banasiak and

Meadows-Oliver (2017), Olkun et al. (2019), and Janssen et al. (2019) advise that to enhance the extent to which more knowledgeable individuals can use the instrument to assess website information, DISCERN be used together with other tools such as the HONcode of conduct (described above) and the JAMA benchmarks.

THE JAMA BENCHMARKS

The JAMA benchmarks were established as an evaluation tool by Silberg et al. (1997) as a basic tool for the evaluation of internet information on health care. JAMA utilizes four key criteria to evaluate the quality of health information websites. These are authorship (the author's name, affiliations, and credentials), attribution (proper and effective referencing of the content presented on the website), currency (dates when the content was posted and/or updated), and the disclosure of any potential conflict of interest arising from the website's ownership (Olkun & Demirkaya, 2018). Like other tools already mentioned, JAMA has been used extensively with the HONcode of conduct and DISCERN to assess websites offering healthcare information (Janssen et al., 2019; Nghiem et al., 2016).

Toward building a conceptual framework that can be used to evaluate the quality of information offered on websites for the agricultural industry, the existing tools used by the health industry formed the foundation. Using more than one tool is essential to addressing the limitations of individual evaluation tools (Janssen et al., 2019; Olkun & Demirkaya, 2018; Olkun et al., 2019). Utilizing components of different evaluation tools helps to address the possibility of subjectivity on the reviewer's part. For example, in their study evaluating the quality of web information on breast cancer, Nghiem et al. (2016) indicated that, whereas DISCERN showed that charity websites provided the highest quality of information, these same websites were the most poorly compliant with the JAMA criteria of quality. It can also be argued that the HONcode of conduct, the Lida tool, the DISCERN instrument, and the JAMA benchmarks use various but complementary criteria to assess the quality of medical information as each tool is devised to assess information quality differently. Whereas DISCERN addresses the currency of a publication by focusing on three aspects related to the date on which the main sources of information were compiled, the date of any revisions to the publication, and the date of publication, the JAMA considers the dates on which the health information was posted and updated on the website as key criteria. Likewise, the Lida tool focuses on the accuracy and relevancy of the information provided on healthcare websites (Aghasiyev & Yılmaz, 2018). The above comparison indicates how various quality criteria can be used collectively to identify criteria to evaluate the quality of information available on various websites.

THEORETICAL FRAMEWORK

Toward identifying the criteria from the existing web information evaluation tools that could be used to develop a web agriculture information evaluation tool, the Analyse, Design, Develop, Implement, and Evaluate (ADDIE) model was used to guide this study. The ADDIE model offers flexibility in the design and development of various products and procedures related to a vast array of disciplines, such as education, the social sciences, the engineering sciences, mathematics, and different medical fields (O'Neill, 2016). The ADDIE model presents a five-component process for developing products, services, and procedures.

Figure 1 presents the ADDIE model. The phases of the ADDIE model are seen to integrate seamlessly, with the evaluative component being applied throughout each phase and remaining the key component to be considered throughout the application of the model. During the analysis phase, the designer establishes the essential requirements, such as the need for the tool, the intended goal(s), the characteristics of the users, the resources required, and the means through which users will use the tool (Branch, 2009). Koneru (2010) states that the analysis phase requires a needs analysis (what is and what needs to be), goals analysis, users of the tool analysis, task analysis, content analysis, and context analysis. The exploration can be carried out by applying various data collection tools such as surveys, interviews, observation, and an analysis of existing literature (Reinbold, 2013). Related to the

research undertaken here, the qualitative phase applies to this first phase of the ADDIE model. This meant conducting both a literature analysis of the web information evaluation tools available in various sectors and interviews with agricultural extension officers to solicit the information to be included in the web evaluation tool for the maize industry.

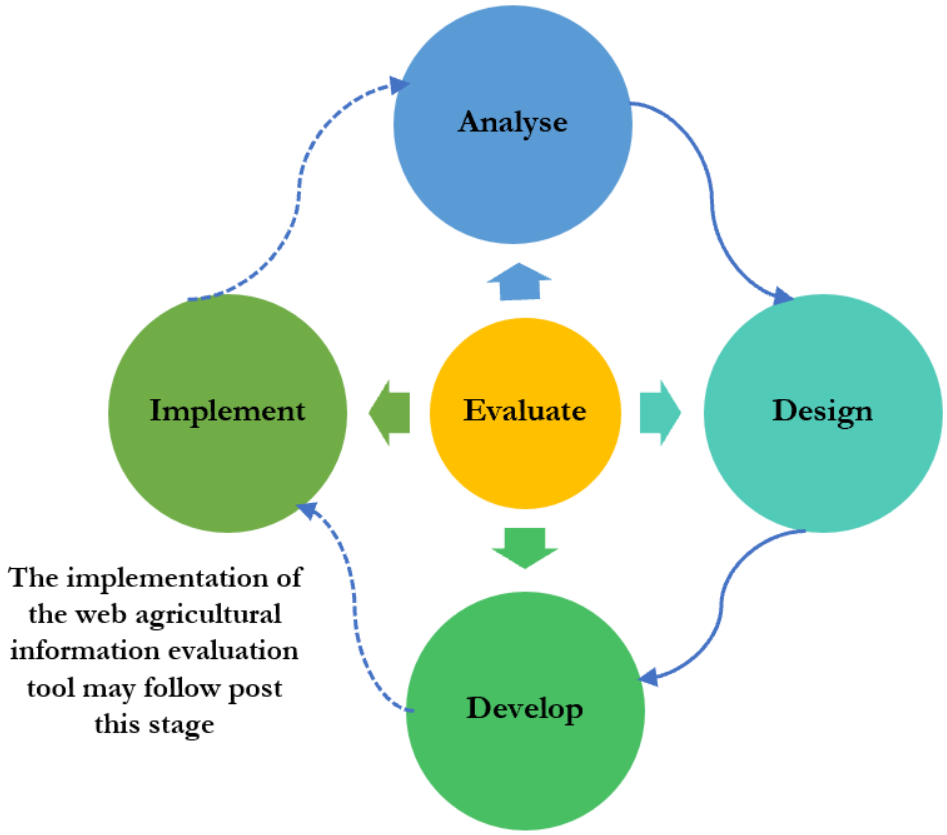


Figure 1. The ADDIE model

As the second phase, the design phase was used to create a blueprint of the expected output (web agricultural information evaluation tool) (Koneru, 2010; Reinbold, 2013). It is in this phase that all features of the tool were identified, including the outline of the content, layout, format, and other requirements. Based on details obtained from the participants (agricultural extension officers) and linked to existing literature, the web agricultural evaluation tool was designed. The design phase led to the development phase, during which the actual development of the tool was conducted (Echeverri et al., 2016; Hess & Greer, 2016; Reinbold, 2013). Within the context of this research, the researcher evaluated the tool using interrater reliability testing (Mnzava & Jacobs, 2023). The emphasis of this research is on the design and development of the tool (as shown in Figure 1). The implementation and evaluation phases, which refer to the actual use of the tool, fall outside the scope of this article.

RESEARCH METHODS

This study employed an interpretive qualitative approach, following a case study design. The qualitative approach offers opportunities to study contextual factors such as perceptions and beliefs (qualitative) about agricultural information quality to develop a tool to assess the quality of web information for the maize industry. The case study design was considered relevant because the focus is on the maize industry in Tanzania. The case study allows for the exploration of different requirements pertaining to the development of a new instrument (Creswell & Plano Clark, 2018). Leavy (2017) maintains that the case study design is commonly used when the purpose of the research is to introduce a new intervention, where the researcher is required firstly to explore the need and nature of the intervention before the actual development. Aligned with the conceptual framework, the case study design provides an opportunity for the researcher to explore the need for and design as well as develop the web agricultural information evaluation tool by collecting qualitative data through interviews. The study involves the analysis of existing information evaluation tools and interviews with agricultural extension officers to obtain insights on important information quality evaluation components. Interviews with agricultural extension officers provided the researchers with insight into the needs and expectations of extension officers to be considered during the development of a web agriculture information evaluation tool. Agricultural extension officers were selected as they play an important role in connecting farmers with the necessary information, knowledge, and technology to support various agricultural activities in Tanzania (Ntulo, 2017).

Data was collected through online interviews. Prior to the interviews, the participants were asked to complete the consent forms and were assured anonymity. Instead of using names, a coding system was used to present the views of participants. The target population of this research was the agricultural officers who were working with maize farmers in the Morogoro region and who had experience in using web information to support various agricultural activities. Their main role is to support farmers in accessing various services and information resources related to crop challenges such as diseases and pests, organize and promote collaborations among farmers, connect with and educate farmers on good agricultural practices and technologies and how to manage finances to ensure the sustainability of maize crop farming. This research used purposive sampling to select research participants (agricultural officers). Purposive sampling is an extensively used method to identify and select information-rich cases (Patton, 2002). It involves identifying and selecting research participants with specific knowledge and experience related to the study's research objectives (Creswell & Poth, 2018).

The saturation principle was applied to address the issue of "how many." The saturation principle requires researchers to collect data until data no longer yields additional insights (Merriam, 2009). Merriam and Tisdell (2016) explain that since purposive sampling aims to maximize information, interviews are terminated when no new information is obtained from the participants. Using the advice and experience given by Merriam (2009) as well as Merriam and Tisdell (2016), the researchers approached 60 research participants tentatively as the initial sample size. However, the data were collected until saturation was attained after 41 interviews. Therefore, the actual number of agricultural officers selected for this research is 41.

Regarding the analysis of qualitative data, the thematic analysis approach was employed. Thematic analysis is a data analysis approach that aims to identify, analyze, organize, describe, and report themes in qualitative data (Braun & Clarke, 2006). This analysis approach was chosen because the study aimed to solicit information from existing quality information evaluation tools and the views of the agricultural extension officers and to draw inferences from these in support of the appropriate development of the web agricultural information evaluation tool.

RESULTS AND DISCUSSION

This section is presented and organized according to the objectives of the article.

AN ANALYSIS OF THE EXISTING INFORMATION QUALITY EVALUATION TOOLS

The analysis of existing evaluation tools as per objective one reveals that information-quality criteria form part of each information-quality evaluation tool. Components were identified and further defined/described to facilitate understanding and evaluation of the concept of quality information. The details included in quality information evaluation tools allowed for the combination of tools to obtain a more comprehensive view of the criteria to assess the quality of website information. A summary of these is presented in Table 1.

Table 1. Summary of key components of exiting information quality evaluation tools

	Name of a tool	Authority	Focus	Users of a tool	Dimension	Measure-ments	Remarks
1	The Health on the Net Code of Conduct	Health on the Net (2019)	Health-related websites	Individual consumers and health information providers.	Authorship, attribution, currency, reliability, balance, mission/target audience, privacy, interactivity, and overall reliability.	16-item interactive multiple-choice questions returning a % score	The total score is calculated automatically with the respective recommendation(s).
2	LIDA tool	Minerva-tion (2023)	Health-related websites	Individual consumers, health information providers, and web developers.	Accessibility, usability, and reliability.	41 questions (4-point scale ranging from always to never)	Total score is calculated manually. The interpretation of the total scores is also given. The scores lower than 50% were low quality, between 50 and 90% were medium, and equal to and above 90% were taken as high quality.
3	DISCERN	Charnock et al. (1999)	Written health information about treatment choices	Patients and information providers.	Reliability of the publications and specific details about treatment choices.	15 questions rated on a scale of 1–5, questions 1-8 address reliability, whilst questions 9-15 address treatment choices	The overall quality of the publication as a source of information about treatment choices uses a rating scale of 1-5, 1= low-serious or extensive shortcomings, 5= high- minimal shortcomings.
4	JAMA bench-marks	Silberg et al. (1997)	The medical information on the net	Consumers of medical information and providers.	Authorship, attribution, disclosure, and currency.	None	Web sites and other Internet-based sources of medical information that fail to meet at least these basic standards are considered questionable.

Based on the analysis of the different tools as per Table 1, the criteria for evaluating the quality of the website content may include those presented in Figure 2. These components or dimensions are explained in detail in the following sections.

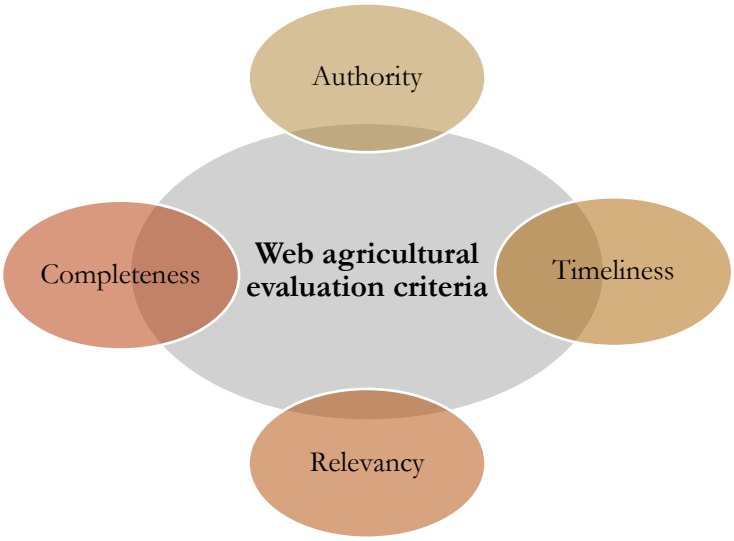


Figure 2. Criteria of a proposed web agricultural information evaluation tool

Authority

Authority refers to the extent to which content can be verified and validated as having been created by a person/persons or organization possessing authority in a specific subject area. The authority of information can be identified on a website by using various criteria, including the logo of the organization, the name(s) and qualifications of the author(s), their contact information, the source of the information (i.e., proper references) and the copyright information (Tate, 2019). The Brock University Library (2022) states that the authority of information available on the web can be assessed when the educational qualifications and/or the work experience of the author(s) of a website are included and communicated (presence of the contact information). Banasiak and Meadows-Oliver (2017) insist that the dimension of authority can only be achieved when the contact information of the author or organization is made available on a website because this makes it possible for users to seek further information on or clarification about the topic. The availability of contact information also shows a willingness on the side of the author or organization to communicate with website viewers and to bear responsibility for information posted on the website.

Timeliness

Timeliness is defined as the age of the information displayed on a website, from the time of its creation or posting to the end of the period during which it remains visible (Al-Hakim, 2007). It is the extent to which the information is revised and updated so that the most recent information is presented on a website (Eppler, 2006; Tate, 2019). While it is easy to determine how current a print information resource such as a book or a journal article may be, it is more difficult to determine when web information has been created, updated, revised, or posted on the web (Tate, 2019). Though many websites will show a "last updated" date at the bottom of a site, not all websites provide this information, which makes it even more difficult to determine how recent the information is. This is a limitation for those users who need current information to make an informed decision. For instance, farmers need timely information about weather conditions, the market prices for their produce, the technological tools that can be used to improve harvests, the price of products such as fertilizers, which are needed to enhance crop production, and better seedling quality (Arce & Caballero, 2015; Dao et al., 2015; Ghimire et al., 2016; Gondal et al., 2017). Considering the date when the infor-

mation was posted or created is important to ensure access to up-to-date information (Butler & Butler, 2018). If the web information has been revised, the last revision date should also be indicated (Health on the Net, 2019). Tate (2019) further insists that when the information is time-sensitive, the frequency of updates has to be indicated. Depending on the importance of ensuring timely information, authors and organizations may opt for the frequent reviewing and updating of web information – weekly, bi-weekly, or monthly (Banasiak & Meadows-Oliver, 2017). In the context of this research, the timeliness of the agricultural information on the web will be assessed by ascertaining whether the dates of creation, posting, or last update of the information on the web are given or not. The content will be regarded as out of date if it is more than two years old. According to Gondal et al. (2017) and Tate (2019), the timeliness of agricultural information on websites will be based on the assumption that maize is grown once or twice per year, depending on the agroecological zone involved. Therefore, updated information relating to agricultural technology, practices, and innovations must be applied within the context of the periods during which maize crops are farmed in specific regions.

Relevancy

Relevancy refers to the quality of being appropriate to the matter at hand (Merriam-Webster Dictionary, 2023). This indicates that information is considered relevant if it is capable of addressing specific information needs. This definition aligns with the views of Patma et al. (2021), who insist that information must meet or exceed users' expectations. Relevancy is specific because it depends on the needs of the user at a specific point in time (Friberg et al., 2011). Relevancy is also determined by the language that is used to communicate information (Kolshus et al., 2015). This suggests that the language used to communicate information must be familiar to the website's intended users and should be easily understandable to ensure its relevance. Regarding this study, website information is considered relevant for maize production if it provides easily understandable information related to topics such as seed selection, fertilizer application, pesticide application, maize storage, and marketing maize. Related to the language, Swahili and English are official languages used in Tanzania to communicate. Websites that offer information in either Swahili or English will, therefore, be more relevant in supporting the information needs of individuals interested in maize-production information.

Completeness

Completeness refers to the range and depth of the information given under a particular topic (Tate, 2019). In terms of extent, it means providing all the necessary parts, elements, and/or steps to make the specific information accessible to readers (Merriam-Webster Dictionary, 2023). Regarding the completeness of web information related to maize farming, Eppler (2006) explains that comprehensiveness should be considered to be part of completeness. This suggests that information is considered to be complete or comprehensive in supporting maize production if it provides all the necessary details regarding certain production activities. For instance, the information supplied on maize seeds should include a discussion of seed varieties, the agroecological zone(s) involved, the maturity period, the yield per specific land area, the seeding rate, and the planting space. Information on these details is required as it has implications for various production decisions, including seed selection (Dao et al., 2015; Ghimire et al., 2016).

Information to be Included in a Proposed Web Information Evaluation Assessment Tool

To determine the information needs of different agricultural stakeholders, the aim of objective two was to obtain details on the agricultural information required by the industry. Interviews were conducted with agricultural extension officers. The participants indicated that they used the web for different purposes, but within the context of the maize industry, they used it to obtain agricultural information related to maize farming that could be distributed to other stakeholders and for their need to keep abreast of new developments. Key information that agricultural extension officers are interested in is presented in the sub-sections that follow.

Maize management

Regarding the various information needs of maize farmers, the participants (referred to as AO1, AO2, etc.) noted the following different information needs:

- pesticides information (AO1, AO3, AO6, AO7, AO8, AO9, AO11, AO13, AO17, AO18, AO19, AO22, AO27 and AO34);
- maize seeds information (AO1, AO3, AO4, AO11, AO12, AO13, AO20, AO22, AO23, AO27, AO35);
- weather information (AO1, AO2, AO3, AO4, AO6, AO7, AO8, AO9, AO10, AO11, AO13, AO14, AO17, AO18, AO20, AO21, AO23, AO24, AO25, AO26, AO27, AO28, AO32, AO34, AO40 and AO41);
- credit-related information (AO1, AO2, AO3, AO4, AO5, AO6, AO7, AO8, AO9, AO10, AO11, AO12, AO13, AO14, AO17, AO18, AO20, AO21, AO23, AO24, AO25, AO26, AO27, AO28, AO29, AO30, AO32, AO34, AO40 and AO41).

Participants AO8, AO17, and AO35 explained that they used the web to equip themselves with new information related to the maize value chain. Participant AO8 explains: "I use the web to update myself with information related to maize storage and post-harvest techniques." Relating to maize grain storage, participant AO17 noted that he/she uses the web "because it contains different information on the storage of the maize grains, including the storage facilities and techniques." Thirty-two participants believed that they used the web to obtain agricultural information on diseases affecting maize and on the control of pests such as fall armyworms. Participant AO1 explained that "the knowledge that was acquired during school time alone is not enough to address some of the crop production challenges and apply new crop production techniques. For example, it was difficult to address the invasion of the fall armyworms by using the old techniques". Participant AO3 noted that "the invasions of the fall armyworm (new species of the maize pest) caused severe damage to the maize plants. Therefore, both farmers and agricultural extension officers were searching for solutions from various information sources, including websites". Participant AO14 confirmed: "I use web information to address the invasion of the fall armyworms."

Maize production

Selecting appropriate maize seeds was one of the important areas where agricultural extension officers searched for information (Dao et al., 2015; Ghimire et al., 2016). Nine participants were noted using web information to select maize seeds. Participant AO13 explained that "sometimes it is important that you work proactively by seeking suitable maize seeds from different sources, including the web." Upon further probing, participant AO13 further stated that "although the input providers sell the maize varieties sometimes, they miss new maize varieties." Fourteen participants said that they used the web to get updates relating to new agricultural technology. Participant AO24 noted that "one of my farmers adopted modern weeding technology after obtaining the information relating to the technology (specifications, details of application, price, and how to buy) from one of the agricultural websites." This participant had acquired new knowledge relating to weeding technology and transferred it to the farmer to enhance maize productivity. Participant AO21 volunteered that "some farmers have gone very far with the adoption of new agricultural technologies because of the development of information and communication technologies (ICTs) that facilitate accessing information from various sources including the web."

The findings revealed that agricultural extension officers are aware of the contribution and use of web agricultural information in supporting various decisions related to pest management, the selection of maize seeds, the adoption and use of agricultural technology, and the storage of maize grains in maize farming. It is evident that agricultural extension officers are concerned with searching for information on the web-based mainly on the information needs of those they serve (Abass et al., 2014; Idiake-Ochei et al., 2016). This suggests that agricultural extension officers need to be knowl-

edgeable and have relevant and reliable information available to support, especially maize crop farmers. The fact that the participants struggled to obtain relevant and reliable information on fall armyworms suggests that limited information may be available on the web to address urgent information needs. Uddin et al. (2019) insist that web information should be recent so that agricultural extension officers can continually update their knowledge on various issues, such as pest control and techniques for improved soil fertility, storage, protection, and processing.

Information quality

Even though participants were aware of and embraced the use of the web to access information, they also mentioned experiencing issues when accessing such information. Twelve participants mentioned the challenges they faced when accessing web agricultural information. These challenges are related to the high cost of internet packages and the inadequate quality of agricultural information. Participants AO7, AO31, and AO37 explained that the high cost of internet packages was a challenge because the agricultural office did not provide any financial assistance to help agricultural extension officers access web agricultural information. Furthermore, the agricultural office did not have supporting infrastructure such as internet connectivity. Regarding the quality of agricultural information on the web, participant AO37 commented on poor web information: "I spend a lot of time searching for usable pesticide information. Some of the information related to pest control lacks some important details, including the application information."

Upon further probing, participants AO3, AO4, AO6, and AO7 noted that few of the farmers use the web to find agricultural information. This statement was supported by participant AO11, who explained that "most of the farmers do not use the web as a source of information because they are illiterate and therefore rely on other information sources such as agricultural extension officers, friends, and radio." Yet participant AO24 revealed that "one of my farmers are using the web and has learned of modern weeding technology from the websites." Research by Abass et al. (2014), Djido et al. (2021), and Temba et al. (2021) aligns with the findings on the information needs of farmers as identified by participants. These authors also indicate that maize farmers need information about maize seeds, fertilizers, and pesticides, as well as financial support and maize storage. However, most farmers are either not able or are reluctant to use the web to find such information themselves. They rely on agricultural extension officers to provide them with web information to support their decision- making in various agricultural activities. The research participants were asked to describe agricultural information with good quality. Participants revealed that information quality can be defined by seven criteria: authority, completeness, timeliness, user support, accuracy, geographical location, and the language used to communicate particular information. Table 2 presents a list of agricultural information quality criteria proposed by participants.

Table 2. Agricultural information quality criteria

Completeness	Authority	Timeliness	User support	Accuracy	Specifying of agroecological zone (specifying soil characteristics and weather conditions, specifying location)	Language

As indicted in Table 2, completeness refers to the degree of comprehensiveness of information (Sarfin, 2020). Eppler (2006, p. 76) also equates completeness with comprehensiveness, which he defines as the degree to which information is of adequate detail for a given task. Information is thus considered to be complete (comprehensive) if it gives all the necessary details about a particular topic (Tate, 2019, p. 15). Participants AO1, AO2, AO3, AO4, AO5, AO6, AO8, AO11, AO12, AO13, AO14, AO16, AO17, AO18, AO19, AO20, AO22, AO23, AO25, AO27, AO28, AO29, AO30,

AO32, AO36, AO37, AO38, and AO41 emphasized the importance of completeness as a key criterion in determining the quality of web agricultural information. Participant AO28 explained further that "agricultural information that is meant to support certain agricultural activities should be complete to support proper decision making. For example, for proper selection of maize seeds, the information about maize seeds should include the agroecological zone, maturity period, plant spacing, and seeding rate". Participant AO37 stated that "websites with incomplete information waste my time searching for complete information because most of the web agricultural information was not complete, therefore I have to use more than one source to get complete information." Participant AO30 agreed with participant AO37: "most of the web agricultural information is not complete; therefore, I opt to use agricultural information from Google scholar." The complaints by participants AO30 and AO37 suggest that incompleteness of web agricultural information is a challenge that users of web agricultural information face. The findings of this research support the previous research by Eppler (2006) on the features of information quality, which revealed that a lack of necessary detail results in poor-quality information. Laumer et al. (2017) explain that completeness is one of the contextual information quality criteria that influence user satisfaction because it reflects the degree to which information fits the needs of users. Therefore, the user of particular information requires complete information to make informed decisions. The findings of this research further propose that the presence of incomplete information on the web has negative implications for user costs (measured in time and the price of internet bundles). The explanations given by participant AO37 are a particular case in point.

In relation to the second criterion highlighted by the participants (authority), Tate (2019) explains that the authority of information can be determined by several elements, such as an organization's logo, the author's name, and the author's qualifications. Participants AO7, AO9, AO14, AO16, AO18, AO19, AO20, AO22, AO23, AO24, AO25, AO28, AO29, AO31, AO33, AO34, AO35, AO36, AO37, AO38, AO39 and AO41 explained that the information quality criteria that can be used to evaluate the content of the agricultural information on websites include the source of the information, the names of the authors and authors' qualifications. Participants AO7 and AO9 noted that some web information had no authors and that the lack of authors with their qualifications made the information available on these websites questionable. Their concern implies that the names and qualifications of the authors are important criteria in determining the quality of information available on websites. The concerns of participants AO7 and AO9 were echoed by participants AO23 and AO25, who insisted that agricultural information on the web must be given by agricultural professionals only. However, some participants had different opinions regarding who is supposed to share information on the web. Participant AO31 stated that "sharing of agricultural information on the web should not be restricted to the professionals only because there are people who have accumulated knowledge based on their experience in agricultural practices and their environment."

While it is important to consider the names and qualifications of the author, in the online environment, anyone can call the person an expert (Tate, 2019). Indicating one's qualifications, affiliation to a professional organization, or expertise is not enough to prove the authenticity of information available on websites. Instead, contact information, such as a phone number and a mailing and/or an email address, may be used to verify the legitimacy of an author related to particular website content. Furthermore, when authors or site owners provide their contact information, it indicates their willingness to take responsibility for any consequences that may arise as a result of information consumption (Banasiak & Meadows-Oliver, 2017). Therefore, the presence or absence of author qualifications or experience in a specific subject is, on its own, not enough to ascertain the quality of website content.

Other criteria that were also mentioned by participants, but to a lesser degree, included accuracy, timeliness, specificity of information, language, and user support. Accuracy refers to the measurement of the correctness of relevant information. A lack of correctness or exactness in web information is a serious concern because it may lead to detrimental effects on an end-user who decides to

apply the (incorrect) information. Seven participants said accuracy is an essential dimension of agricultural information quality because incorrect information can negatively impact maize production. For example, planting space has implications for the health of the maize plants and the maize yield (Participant AO17). Upon further probing by the researcher on the matter of assessing the accuracy of maize information on the web, Participants AO17 and AO27 explained that their knowledge of the subject field had made it clear to them that it was imperative to assess the accuracy of available web information before using it or sharing it. This suggests that the accuracy of a particular information can only be determined based on prior experience or specific knowledge.

In a study related to Sri-Lankan agriculture, Wilson et al. (2021) proposed that whereas the accuracy of web agricultural information could be determined by agricultural experts such as agricultural extension officers and researchers, the needs of farmers using web agricultural information meant that web agricultural content had to be validated by credible information providers before it reached the farmers. This research by Wilson et al. (2021) supports the DeLone and McLean (2016) information systems success model, in which information quality is dependent on users' intention to use, actual use, and user satisfaction. According to Saleem et al. (2017), the perception that particular information is of high quality is reliant on trust as a factor in the intention to use certain services or products. If agricultural experts are known to trust the information provided on a website, the use of that website for web agricultural information will increase.

The notion of trust also applies to the dimension of timeliness of information. As seen earlier, timeliness is one of the contextual information quality criteria that reflects the extent to which information remains relevant in addressing information needs (Laumer et al., 2017). Participants AO1, AO3, AO14, AO15, and AO29 expressed the opinion that timeliness is one of the important criteria of information quality. Upon further probing, the participants shared their experiences on this matter and said that some of the available web agricultural information had been published more than five years before. However, Participants AO1, AO14, and AO15 explained that some agricultural information is more time-sensitive than other agricultural information. This included weather information (needed before a planting season) and information about the maize price (required after harvesting). Various researchers, such as Naruka et al. (2017), agree that timeliness is an essential factor in the agricultural industry because agricultural stakeholders require information on time to support different agricultural activities. Mbagwu et al. (2017) insist that at every point, agricultural production requires timely and relevant information. This implies that information provided on the web should be accurate, reliable, and timely to support user needs.

Website information also has to offer user support in the shape of opportunities to obtain additional information that may assist in catering to users' information needs (Nong & Gainsbury, 2020). In the view of Participant AO7, "the presence of user support is helpful to address the issues related to incomplete information because information users can request for the missed parts of given agricultural information." Participant AO22 noted that users are more at ease with and appreciate "some of the agricultural information providers who were ready to give more information through mobile phone. This was possible because there were phone numbers on the websites". Curty and Zhang (2013) explain that contact information is essential because it helps to build and maintain a good relationship between website owners/information providers and the users of a particular website. Furthermore, as expressed by participant AO7 and confirmed by participant AO22, who said that "contacts information can be used to request missing information," with the proviso that "persons/organizations responsible for web agricultural information have to be committed to the user information needs" before this happened. On the other hand, Participant AO10 and previous research by Banasiak and Meadows-Oliver (2017) revealed that although some websites and/or information providers supply contact information and/or allow information users to communicate with them by using special forms, they do not respond to the queries sent in by users.

According to Participants AO4, AO7, and AO14, the importance of having access to contact information to ask for or explore additional information that may be available to the website creators/authors is particularly important within the context of agroecological information pertaining to climatic parameters and to natural resource characteristics such as rainfall, solar radiation, and soil characteristics. Tanzania has seven main agroecological zones, each with different characteristics (Luhunga et al., 2017). In addition to making information available on websites and providing updated information where needed, creators/authors of websites must also be sensitive to the context in which this information is provided. AO24 explained that "some agricultural information that is location-sensitive in its application such as information about maize seeds varieties and fertilizers is important to note on websites to assist agricultural stakeholders to plan for maize production." These findings are supported by Hannachi (2015), DeLone and McLean (2016), Mavetera et al. (2017), and Butler and Butler (2018), who all insist on the need to give information based on the relevancy of information to a particular user group. Luhunga et al. (2017) insist that because of the differences that exist between the agroecological locations, each location requires specific information, for example, on seed types and the growing season.

Similarly, Mascarenhas et al. (2021) argue that information that is needed by specific user groups must also consider the use of language to make that information accessible to users. Tanzania has more than 150 native languages and two official languages, namely Swahili and English (Muzale & Rugemalira, 2008). Participants AO3, AO25, and AO27 noted that language is important in determining the quality of shared website information. Participant AO25 explained that "the language used by some of the websites was either too technical or uses difficult language for the normal user like farmers to understand." The use of technical or difficult language is challenging, and according to Mubofu and Malekani (2020), it hinders the effective use of information to support stakeholders in the maize value chain. Similarly, Idiegbeyan-Ose et al. (2019) revealed that the English language was one of the challenges facing agricultural information provision in Nigeria and thus advised agricultural personnel to use indigenous languages for the sharing of information. The importance of considering the language of the intended users when sharing information was also stressed by Mubofu and Elia (2017) and Brhane et al. (2017). The inappropriate use of language was one of the major barriers to farmers' development in Uganda. It is thus evident that the choice and understandability of the language used are key when sharing website information (Hilary et al., 2017).

The viewpoints of the participants in this research and of other researchers concerning the criteria of agricultural information quality revealed that the key criteria to be considered in determining the quality of web agricultural information in support of maize production include authority, completeness, timeliness, user support, accuracy (requires expertise or relevant experience), relevancy and language. The information quality criteria that were identified here agree with those provided by Wilson et al. (2021), who explain that accuracy, credibility, relevancy (context specificity), completeness, and timeliness are the applicable information quality criteria to be used to determine the quality of agricultural information. However, this research considered additional information quality criteria, including user support (contact information) and relevancy to user needs, as essential criteria in assessing agricultural website information quality. This suggests that a comprehensive list of the key quality criteria for web agricultural information should include authority (including contact information/user support), completeness (including agroecological location), timeliness, and relevancy. Regarding the relevancy dimension suggested by Wilson et al. (2021), this research considers agricultural information relevant if it supports different activities of maize production, such as planting, pest control, fertilizer application, and crop handling.

Development of the Web Information Evaluation Assessment Tool for the Maize Industry

In line with the viewpoints of research participants as expressed in the findings as well as detail obtained from the literature, Arce and Caballero (2015), Dao et al. (2015), Banasiak and Meadows-Oliver (2017), Ghimire et al. (2016) and Tate (2019), suggest the composition of the proposed web agricultural information evaluation tool as per Table 3.

Table 3. Proposed web agricultural information evaluation tool

Criteria	Attributes	Available/ not available
✓= The Information is available, x = The information is not available		
SECTION A: FUNDAMENTAL INFORMATION QUALITY CRITERIA		
Authority	Names of authors, creators, or contributors	
	Authors', creators', or contributors' contact information (such as phone numbers and email addresses)	
Timeliness	Does the information have a date for when it was created/posted/last revised?	
Specific quality criteria for various activities of the maize industry ✓= The Information is available, x = The information is not available		
SECTION B: COMPLETENESS OF INFORMATION TO SUPPORT MAIZE INDUSTRY		
Seeds	1. Variety	
	2. Agroecological zone	
	3. Sowing time	
	4. Seed rate (kg/ha)	
	5. Planting/sowing spacing	
	6. Maturity period (in days)	
	7. Yield/ha (depends on factors such as planting space)	
Fertiliser(s)	1. Type	
	2. Time/stage of the application	
	3. Soil information	
	4. Method of application	
	5. Application rate (kg/ha)	
	6. Interval/frequency of application	
Pesticide(s)	1. Pest type	
	2. Pesticide type	
	3. Time/stage of the application	
	4. Plant stage	
	5. Method of application	
	6. Application rate (e.g. litres/ha)	
	7. Interval/frequency of application	
Maize grains handling	1. Cleaning	
	2. Drying	
	3. Storage conditions	
	4. Storage facilities	
Weather information	Location	
	Publication time (not older than a month)	

Note: The decision about whether the particular information is relevant or not remains in the hands of the information user. Although this tool supports the safe use of web agricultural information, it does not replace the role of agricultural professionals in dispensing information or advice. Therefore, information users are encouraged to seek professional guidance when they feel they will benefit.

As can be viewed in Table 3, the proposed tool was designed to cater to two different sections. The first section provides an overview of the key criteria related to authority and timeliness, while the second provides detailed information to assess the completeness of information provided on a particular website. Pertaining to Section A, fundamental information quality criteria include authority, aimed at addressing the relevance of the source of information (a person or organization recognized as having definitive knowledge of a given subject area), while timeliness refers to the date on which information was uploaded and the relevancy of that information given the uploaded date. Section B relates specifically to the completeness of the web agricultural information. Information available via websites should be complete enough to help users make an informed decision. For example, if the site gives information about maize seeds, it must state all the important information needed on, for instance, the seed variety, the agroecological zone, the sowing time, the seed rate (kg/ha), the planting/sowing spacing, the maturity period (in days) and the size of yield/ha. The lack of information on a single component related to the planting phase may hinder the application of the rest of the information to produce sufficient maize crops. The second section on completeness, therefore, provides details on maize seeds, fertilizers, pesticides, the handling of maize grains, and the weather. Information users are supposed to check that web information contains all necessary details before using that information. It is envisaged that the criteria included in the proposed web agriculture information tool can assist stakeholders in the maize value chain to assess the quality of information available on websites. Such evaluation is imperative to ensure that the right information is offered at the right time to stakeholders in the maize value chain to advance the growth of crops that will reduce hunger and support the achievement of sustainable development goals.

CONCLUSION

The lack of an evaluation tool for agricultural information created a need for a web agricultural information evaluation tool for the maize industry. The findings revealed that authority, timeliness, and completeness are the key information quality dimensions that should be used to assess the quality of web agricultural information related to the maize industry. The basis for selecting these dimensions lies in analyzing the views given by the research participants, who were supported by the literature. In the context of this research, authority can be determined by the identity of the persons or organizations that create or post-agricultural information on the web and their contact information. The contact information is essential to verify the authority of the given information and help to seek further information when needed.

Relating to completeness, this criterion requires that agricultural information provide all necessary details. The findings (key information quality, authority, timeliness, and completeness) have implications for the information users and providers. Information users need to consider the authority, timeliness, and completeness of the web agricultural information. To the information providers, authority, timeliness, and completeness can be used to guide the sharing of information on the web to ensure that information users get agricultural information with appropriate quality. While authority and timeliness are the basic quality information quality criteria, the completeness of information depends on the type of information. Different agricultural information has different levels of detail. An extended web agricultural information evaluation tool is therefore needed to assess the extent to which compressive detail is provided to website users to guide them toward improving maize production in Tanzania.

The proposed web agricultural information evaluation tool has unique contributions in the fields of information science (assist information providers in disseminating high-quality agricultural information on the web) and agriculture (ensure that farmers receive information with good quality; hence, they can make informed decisions about various agricultural activities).

Furthermore, the proposed web agricultural information evaluation tool was meant to assess the quality of agricultural information on the web for maize and other cereal crops; thus, the tool may

not be appropriate for other crops such as vegetables and oil crops. Therefore, further research is required to develop an evaluation tool for other crops. Research is also needed to validate the proposed web agricultural information evaluation tool by allowing information users such as farmers and agricultural officers to apply the tool to assess web agricultural information. This will ensure the completion of the key steps in the ADDIE model towards developing a comprehensive evaluation tool that can be used positively within the context of improved maize production farming.

REFERENCES

Abass, A. B., Ndunguru, G., Mamiro, P., Alenkhe, B., Mlingi, N., & Bekunda, M. (2014). Post-harvest food losses in a maize-based farming system of semi-arid savannah area of Tanzania. *Journal of Stored Products Research, 57*, 49-57. https://doi.org/10.1016/j.jspr.2013.12.004

Abumandil, M. S., & Hassan, S. (2016). Information quality and decision-making effectiveness: A study of banks in Palestine. *International Review of Management and Marketing, 6*(7S), 127-132.

Aghasiyev, R., & Yılmaz, B. S. (2018). The accuracy of information about orthodontics available on the internet. *Turkish Journal of Orthodontics*, *31*(4), 127-132. https://doi.org/10.5152/TurkJOrthod.2018.18007

Al-Hakim, L. (2007). Information quality factors affecting innovation process. *International Journal of Information Quality*, *1*(2), 162-176. https://doi.org/10.1504/IJIQ.2007.014607

Alhuwail, D., AlMeraj, Z., & Boujarwah, F. (2018). Evaluating hospital websites in Kuwait to improve consumer engagement and access to health information: A cross-sectional analytical study. *BMC Medical Informatics and Decision Making, 18*, Article 82. https://doi.org/10.1186/s12911-018-0660-4

Anderson, J., Marita, C., & Musiime, D. (2016). *National survey and segmentation of smallholder households in Tanzania.* CGAP. https://www.cgap.org/sites/default/files/publications/Tanzania%20CGAP%20Smallholder%20Household%20Survey%20Report.pdf

Arce, C. E., & Caballero, J. (2015). *Tanzania agricultural sector risk assessment.* World Bank Group. http://documents1.worldbank.org/curated/en/248961468001158010/pdf/94883-REVISED-Box393201B-PUBLIC-Tanzania-Ag-Risk-Assessment-web-6-29-15-JK-jtc.pdf

Arif, N., & Ghezzi, P. (2018). Quality of online information on breast cancer treatment options. *The Breast, 37*, 6-12. https://doi.org/10.1016/j.breast.2017.10.004

Azios, J. H., Bellon-Harn, M., Dockens, A. L., & Manchaiah, V. (2019). Quality and readability of English-language internet information for aphasia. *International Journal of Speech-Language Pathology, 21*(1), 1-9. https://doi.org/10.1080/17549507.2017.1362034

Banasiak, N. C., & Meadows-Oliver, M. (2017). Evaluating asthma websites using the Brief DISCERN instrument. *Journal of Asthma and Allergy, 10*, 191-196. https://doi.org/10.2147/JAA.S133536

Barau, A. A., & Afrad, S. I. (2017). An overview of social media use in agricultural extension service delivery. *Journal of Agricultural Informatics, 8*(3), 50-61. https://doi.org/10.17700/jai.2017.8.3.395

Barrow, A., Palmer, S., Thomas, S., Guy, S., Brotherton, J., Dear, L., & Pearson, J. (2017). The quality of web-based information for osteoarthritis: A cross-sectional study. *Physiotherapy*, *104*(3), 318-326. https://doi.org/10.1016/j.physio.2018.02.003

Baujard, V., Boyer, C., & Geissbühler, A. (2010). Evolution of health web certification, through the HONcode experience. *Swiss Medical Informatics*, *26*(69), 53-57. https://doi.org/10.4414/smi.26.00233

Bernstam, E. V., Shelton, D. M., Walji, M., & Meric-Bernstam, F. (2005). Instruments to assess the quality of health information on the world wide web: what can our patients actually use? *International Journal of Medical Informatics*, *74*(1), 13-19. https://doi.org/10.1016/j.ijmedinf.2004.10.001

Boyer, C., Baujard, V., & Geissbuhler, A. (2011). Evolution of health web certification through the HONcode experience. *Studies in Health Technology and Informatics*, *169*, 53-57. https://pubmed.ncbi.nlm.nih.gov/21893713/

Boyer, C., Selby, M., Scherrer, J.-R., & Appel, R. D. (1998). The Health on the Net code of conduct for medical and health websites. *Computers in Biology and Medicine*, *28*(5), 603-610. https://doi.org/10.1016/S0010-4825(98)00037-7

Branch, R. M. (2009). *Instructional design: The ADDIE approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Brhane, G., Mammo, Y., & Negusse, G. (2017). Sources of information and information-seeking behavior of smallholder farmers of Tanqa Abergelle Wereda, central zone of Tigray, Ethiopia. *Journal of Agricultural Extension and Rural Development*, *9*(4), 47-52. https://doi.org/10.5897/JAERD2016.0850

Brock University Library. (2022). *Evaluating information sources*. https://researchguides.library.brocku.ca/external-analysis/evaluating-sources

Butler, R., & Butler, M. (2018). Assessing the information quality of phishing-related content on financial institutions' websites. *Information & Computer Security*, *26*(5), 514-532. https://doi.org/10.1108/ICS-09-2017-0067

Carlsson, T., Bergman, G., Karlsson, A. M., & Mattsson, E. (2015). Content and quality of information websites about congenital heart defects following a prenatal diagnosis. *Interactive Journal of Medical Research, 4*(1), e4. https://doi.org/10.2196/ijmr.3819

Castillo-Ortiz, J. D., de Jesus Valdivia-Nuno, J., Ramirez-Gomez, A., Garagarza-Mariscal, H., Gallegos-Rios, C., Flores-Hernandez, G., Hernandez-Sanchez, L., Brambila-Barba, V., Castaneda-Sanchez, J. J., Barajas-Ochoa, Z., Suarez-Rico, A., Sanchez-Gonzalez, J. M., & Ramos-Remus, C. (2017). Readability, relevance and quality of the information in Spanish on the Web for patients with rheumatoid arthritis. *Reumatología Clínica, 13*(3), 139-144. https://doi.org/10.1016/j.reuma.2016.04.009

Chang, D. T., Abouassaly, R., & Lawrentschuk, N. (2016). Quality of health information on the internet for urolithiasis on the Google search engine. *Advances in Urology, 2016*(1), Article 8243095. https://doi.org/10.1155/2016/8243095

Charnock, D., & Shepperd, S. (2004). Learning to DISCERN online: Applying an appraisal tool to health websites in a workshop setting. *Health Education Research, 19*(4), 440-446. https://doi.org/10.1093/her/cyg046

Charnock, D., Shepperd, S., Needham, G., & Gann, R. (1999). DISCERN: An instrument for judging the quality of written consumer health information on treatment choices. *Journal of Epidemiology & Community Health, 53*(2), 105-111. https://doi.org/10.1136/jech.53.2.105

Chellen, S. (2015). *The essential guide to the internet for health professionals*. Routledge. https://doi.org/10.4324/9780203426920

Chi, E., Jabbour, N., & Aaronson, N. L. (2017). Quality and readability of websites for patient information on tonsillectomy and sleep apnea. *International Journal of Pediatric Otorhinolaryngology*, *98*, 1-3. https://doi.org/10.1016/j.ijporl.2017.04.031

Chumber, S., Huber, J., & Ghezzi, P. (2015). A methodology to analyze the quality of health information on the internet: The example of diabetic neuropathy. *The Diabetes Educator, 41*(1), 95-105. https://doi.org/10.1177/0145721714560772

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Sage.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed). Sage.

Curty, R. G., & Zhang, P. (2013). Website features that gave rise to social commerce: A historical analysis. *Electronic Commerce Research and Applications*, *12*, 260-279. https://doi.org/10.1016/j.elerap.2013.04.001

Dao, A., Sanou, J., Gracen, V., & Danquah, E. Y. (2015). Identifying farmers' preferences and constraints to maize production in two agroecological zones in Burkina Faso. *Agriculture & Food Security*, *4*, Article 13. https://doi.org/10.1186/s40066-015-0035-3

DeLone, W. H., & McLean, E. R. (2016). Information systems success measurement. *Foundations and Trends® in Information Systems*, 2(1), 1-116. https://doi.org/10.1561/2900000005

de Man, A. M., Rashedi, A., Nelen, W., Anazodo, A., Rademaker, A., de Roo, S., Beerendonk, C., & Woodruff, T. K. (2018). Female fertility in the cancer setting: Availability and quality of online health information. *Human Fertility*, *23*(3), 170-178. https://doi.org/10.1080/14647273.2018.1506891

Djido, A., Zougmoré, R. B., Houessionon, P., Ouédraogo, M., Ouédraogo, I., & Diouf, N. S. (2021). To what extent do weather and climate information services drive the adoption of climate-smart agriculture practices in Ghana? *Climate Risk Management, 32*, 100309. https://doi.org/10.1016/j.crm.2021.100309

Echeverri, L. B., García, J. H., & Barreneche, J. G. (2016). Diseño de modelo de capacitación en procesos asistenciales relacionados con dispositivos medicos [Training model design in healthcare services involving medical devices]. *Revista Ingeniería Biomédica*, *10*(20). https://doi.org/10.24050/19099762.n20.2017.1070

Eppler, M. J. (2006). *Managing information quality: Increasing the value of information in knowledge-intensive products and processes*. Springer. https://doi.org/10.1007/3-540-32225-6

Fahy, E., Hardikar, R., Fox, A., & Mackay, S. (2014). Quality of patient health information on the internet: reviewing a complex and evolving landscape. *The Australasian Medical Journal,* 7(1), 24-28. https://doi.org/10.4066/AMJ.2014.1900

Friberg, T., Prödel, S., & Koch, R. (2011, May). Information quality criteria and their importance for experts in crisis situations. *Proceedings of the 8th International ISCRAM Conference, Lisbon, Portugal,* 145-149.

Ghimire, S., Sherchan, D. P., Andersen, P., Pokhrel, C., Ghimire, S., & Khanal, D. (2016). Effect of variety and practice of cultivation on yield of spring maize in Terai of Nepal. *Agrotechnol*, *5*(2), 144.

Gondal, M. R., Hussain, A., Yasin, S., Musa, M., & Rehman, H. S. (2017). Effect of seed rate and row spacing on grain yield of sorghum. *SAARC Journal of Agriculture*, *15*(2), 81-91. https://doi.org/10.3329/sja.v15i2.35154

Hamwela, V., Ahmed, W., & Bath, P. A. (2018). Evaluation of websites that contain information relating to malaria in pregnancy. *Public Health*, *157*, 50-52. https://doi.org/10.1016/j.puhe.2018.01.001

Hannachi, R. (2015). Information quality in customer relationship management. *Global Journal of Management and Business Research*, *15*(6), 39-48.

Health on the Net. (2019). *Health website evaluation tool*. https://www.hon.ch/HealthEvaluationTool/

Hess, N. A., & Greer, K. (2016). Designing for engagement: Using the ADDIE model to integrate high-impact practices into an online information literacy course. *Communications in Information Literacy*, *10*(2), 264-282. https://doi.org/10.15760/comminfolit.2016.10.2.27

Hilary, R. S., Sseguya, H., & Kibwika, P. (2017). Information quality, sharing and usage in farmer organizations: The case of rice value chains in Bugiri and Luwero Districts, Uganda. *Cogent Food & Agriculture*, *3*(1), Article 1350089. https://doi.org/10.1080/23311932.2017.1350089

Hrabal, J., & Pruša, T. (2015). Evaluation of medical information quality. *ProInflow*, *7*(1), 41-54. https://doi.org/10.5817/ProIn2015-1-5

Idiake-Ochei, O., Onemolease, E. A., & Erie, G. O. (2016). Information-seeking behaviour of extension personnel in Edo State, Nigeria. *Scholars Journal of Agriculture and Veterinary Sciences, 3*(4), 318-325. https://doi.org/10.21276/sjavs.2016.3.4.10

Idiegbeyan-Ose, J., Owolabi, A., Segun-Adeniran, C., Aregbesola, A., Emmanuel Owolabi, S., & Eyiolorunshe, T. (2019). Information provision by public library to agricultural extension agents in a developing country. *Public Library Quarterly, 38*(1), 103-115. https://doi.org/10.1080/01616846.2018.1555412

Iliescu, D. (2017). *Adapting tests in linguistic and cultural situations*. Cambridge University Press. https://doi.org/10.1017/9781316273203

International Medical Informatics Association. (2019). *Health On the Net*. https://imia-medinfo.org/wp/health-on-the-net-foundation-hon/

Janssen, S., Fahlbusch, F. B., Käsmann, L., Rades, D., & Vordermark, D. (2019). Radiotherapy for prostate cancer: DISCERN quality assessment of patient-oriented websites in 2018. *BMC Urology,* 19, Article 42. https://doi.org/10.1186/s12894-019-0474-4

Jo, J. H., Kim, E. J., Kim, J. R., Kim, M. J., Chung, J. W., & Park, J. W. (2018). Quality and readability of internet-based information on halitosis. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, *125*(3), 215-222. https://doi.org/10.1016/j.oooo.2017.12.001

Kante, M., Oboko, R., & Chepken, C. (2019). An ICT model for increased adoption of farm input information in developing countries: A case in Sikasso, Mali. *Information Processing in Agriculture, 6*(1), 26-46. https://doi.org/10.1016/j.inpa.2018.09.002

Kolshus, K., Pastore, A., Treinen, S., & Van der Elstraeten, A. (2015). *E-agriculture 10-year review report: Implementation of the World Summit on the Information Society*. Food and Agriculture Organization of the United Nations.

Koneru, I. (2010). ADDIE: Designing web-enabled information literacy instructional modules. *DESIDOC Journal of Library & Information Technology*, *30*(3), 23-34.

Laumer, S., Maier, C., & Weitzel, T. (2017). Information quality, user satisfaction, and the manifestation of workarounds: a qualitative and quantitative study of enterprise content management system users. *European Journal of Information Systems*, *26*(4), 333-360. https://doi.org/10.1057/s41303-016-0029-7

Leavy, P. (2017). *Research design: Quantitative, qualitative, mixed methods, arts based, and community-based participatory research approaches*. Guilford.

Luhunga, P., Chang'a, L., & Djolov, G. (2017). Assessment of the impacts of climate change on maize production in the Wami Ruvu basin of Tanzania. *Journal of Water and Climate Change, 8*(1), 142-164. https://doi.org/10.2166/wcc.2016.055

Mascarenhas, A. C., Bryceson, D. F., Ingham, K., & Chiteji, F. M. (2021). *Tanzania.* Encyclopaedia Britannica. https://www.britannica.com/place/Tanzania

Mavetera, P., Lubbe, S., & Jan, A. (2017). A student perspective into information quality of web sites. *The African Journal of Information Systems*, 9(3), 149-170.

Mbagwu, F. C., Benson, O. V., & Onuoha, C. O. (2017). *Challenges of meeting information needs of rural farmers through internet-based services: Experiences from developing countries in Africa.* https://sci-hub.st/http://library.ifla.org/2195

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. Jossey-Bass.

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey Bass.

Merriam-Webster Dictionary. (2023). *Relevance.* https://www.merriam-webster.com/dictionary/relevance

Minervation. (2023). *The Lida Instrument: Minervation validation instrument for health care websites.* https://www.minervation.com/wp-content/uploads/2024/02/minervalidation_2023_update.pdf

Mnzava, E., & Jacobs, L. (2023). Evaluation of web-based online agricultural information relevant to Tanzanian maize producers. *The African Journal of Information and Communication*, *31*, 1-21. https://journals.co.za/doi/pdf/10.23962/ajic.i31.15944

Moult, B., Franck, L. S., & Brady, H. (2004). Ensuring quality information for patients: Development and preliminary validation of a new instrument to improve the quality of written health care information. *Health Expectations*, *7*(2), 165-175. https://doi.org/10.1111/j.1369-7625.2004.00273.x

Msuya, C. P., Annor-Frempong, F. K., Magheni, M. N., Agunga, R., Igodan, C., Ladele, A. A., Huhela, K., Tselaesele, N. M., Msatilomo, H., Chowa, C., Zwane, E., Miiro, R., Bukeyn, C., Kima, L. A., Meliko, M., & Ndiaye, A. (2017). The role of agricultural extension in Africa's development, the importance of extension workers and the need for change. *International Journal of Agricultural Extension 5*(1), 51-58.

Mubofu, C., & Elia, E. (2017). Disseminating agricultural research information: A case study of farmers in Mlolo, Lupalama and Wenda villages in Iringa district, Tanzania. *University of Dar es Salaam library journal*, 12(2), 80-97.

Mubofu, C., & Malekani, A. W. (2020). Agricultural information sources, channels and strategies for sharing agricultural research findings among farmers in Iringa district in Tanzania. *Library Philosophy and Practice, 4223*.

Muzale, H. R., & Rugemalira, J. M. (2008). Researching and documenting the languages of Tanzania. *Language Documentation & Conservation, 2*(1), 68-108.

Naruka, P. S., Shilpi Verma, Sarangdevot, S. S., Pachauri, C. P., Kerketta, S., & Singh, J. P. (2017). A study on role of WhatsApp in agriculture value chains. *Asian Journal of Agricultural Extension, Economics & Sociology*, *20*(1), 1-11. https://doi.org/10.9734/AJAEES/2017/36498

Nghiem, A. Z., Mahmoud, Y., & Som, R. (2016). Evaluating the quality of internet information for breast cancer. *The Breast*, *25*, 34-37. https://doi.org/10.1016/j.breast.2015.10.001

Nong, Z., & Gainsbury, S. (2020). Website design features: Exploring how social cues present in the online environment may impact risk taking. *Human Behavior and Emerging Technologies, 2*(1), 39-49. https://doi.org/10.1002/hbe2.136

Ntulo, G. R. (2017). *Provision of agricultural information services to small scale crop farmers in Rukwa region, Tanzania.* [Doctoral dissertation, Moi University, Kenya].

Olkun, H. K., & Demirkaya, A. A. (2018). Evaluation of internet information about lingual orthodontics using DISCERN and JAMA tools. *Turkish Journal of Orthodontics*, *31*(2), 50-54. https://doi.org/10.5152/TurkJOrthod.2018.17042

Olkun, H. K., Demirkaya, A. A., & Aras, B. (2019). The quality of internet information on lingual orthodontics in the English language, with DISCERN and JAMA. *Journal of Orthodontics*, *46*(1), 20-26. https://doi.org/10.1177/1465312518824100

O'Neill, J. L. (2016). Weeding with ADDIE: Developing training for deselection at an academic library. *Reference & User Services Quarterly, 56*(2), 108-115. https://doi.org/10.5860/rusq.56n2.108

Patma, T. S., Fienaningsih, N., Rahayu, K. S., & Artatanaya, I. G. L. S. (2021). Impact of information quality on customer perceived value, experience quality, and customer satisfaction from using Go food application. *Journal of Indonesian Economy and Business*, *36*(1), 51-61. https://doi.org/10.22146/jieb.59810

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.) Sage.

Prasanth, A. S., Jayarajah, U., Mohanappirian, R., & Seneviratne, S. A. (2018). Assessment of the quality of patient-oriented information over internet on testicular cancer. *BMC Cancer*, *18*, Article 491. https://doi.org/10.1186/s12885-018-4436-0

Raj, S., Sharma, V. L., Singh, A. J., & Goel, S. (2016). Evaluation of quality and readability of health information websites identified through India's major search engines. *Advances in Preventive Medicine*, *2016*, Article 4815285. https://doi.org/10.1155/2016/4815285

Reinbold, S. (2013). Using the ADDIE model in designing library instruction. *Medical Reference Services Quarterly, 32*(3), 244-256. https://doi.org/10.1080/02763869.2013.806859

Saeed, F., & Anderson, I. (2017). Evaluating the quality and readability of internet information on meningiomas. *World Neurosurgery, 97*, 312-316. https://doi.org/10.1016/j.wneu.2016.10.001

Saleem, M. A., Zahra, S., & Yaseen, A. (2017). Impact of service quality and trust on repurchase intentions – The case of Pakistan airline industry. *Asia Pacific Journal of Marketing and Logistics*, *29*(5), 1136-1159. https://doi.org/10.1108/APJML-10-2016-0192

Sarfin, R. L. (2020). *Characteristics of data quality.* Precisely. https://www.precisely.com/blog/data-quality/5-characteristics-of-data-quality

Shital Kiran, D. P., Bargale, S., Pandya, P., Bhatt, K., Barad, N., Shah, N., Venkataraghavan, K., & Ramesh, K. (2015). Evaluation of Health on the Net seal label and DISCERN as content quality indicators for patients seeking information about thumb sucking habit. *Journal of Pharmacy & Bioallied Sciences, 7*(Suppl. 2), S481-S485. https://doi.org/10.4103/0975-7406.163509

Silberg, W. M., Lundberg, G. D., & Musacchio, R. A. (1997). Assessing, controlling, and assuring the quality of medical information on the Internet: Caveant lector et viewor—Let the reader and viewer beware. *JAMA*, 277(15), 1244-1245. https://doi.org/10.1001/jama.1997.03540390074039

Tanabe, K., Fujiwara, K., Ogura, H., Yasuda, H., Goto, N., & Ohtsu, F. (2018). Quality of web information about palliative care on websites from the United States and Japan: Comparative evaluation study. *Interactive Journal of Medical Research, 7*(1), e7. https://doi.org/10.2196/ijmr.9574

Tao, D., LeRouge, C., Smith, K. J., & De Leo, G. (2017). Defining information quality into health websites: A conceptual framework of health website information quality for educated young adults. *JMIR Human Factors, 4*(4), e25. https://doi.org/10.2196/humanfactors.6455

Tate, M. A. (2019). *Web wisdom: How to evaluate and create information quality on the Web*. Boca Raton, Florida: CRC Press. https://doi.org/10.1201/b22397

Temba, B. A., Darnell, R. E., Gichangi, A., Lwezaura, D., Pardey, P. G., Harvey, J. J., Karanja, J., Massomo, S. M. S., Ota, N., Wainaina, J. M., Fletcher, M. T., & Kriticos, D. J. (2021). The influence of weather on the occurrence of Aflatoxin B1 in harvested maize from Kenya and Tanzania. *Foods, 10*(2), 216. https://doi.org/10.3390/foods10020216

Uddin, I. O., Agwu, A. E., & Anugwa, I. Q. (2019). Information needs and challenges of agricultural researchers and extension workers in Edo State, Nigeria. *Path of Science*, *5*(6), 6001-6011. https://doi.org/10.22178/pos.47-7

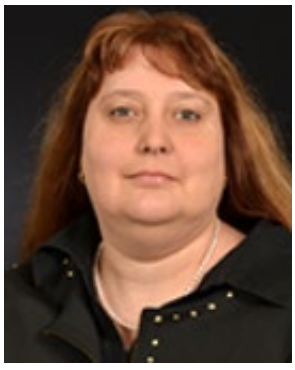
Varady, N. H., Dee, E. C., & Katz, J. N. (2018). International assessment on quality and content of internet information on osteoarthritis. *Osteoarthritis and Cartilage, 26*(8), 1017-1026. https://doi.org/10.1016/j.joca.2018.04.017

Verkijika, S. F., & De Wet, L. (2018). Quality assessment of e-government websites in Sub-Saharan Africa: A public values perspective. *The Electronic Journal of Information Systems in Developing Countries*, *84*(2), e12015. https://doi.org/10.1002/isd2.12015

Wilson, R. S. I., Goonetillake, J. S., Ginige, A., & Indika, W. A. (2021). Analysis of information quality for a usable information system in agriculture domain: A study in the Sri Lankan context. *Procedia Computer Science, 184*, 346-355. https://doi.org/10.1016/j.procs.2021.03.044

AUTHORS

Ester Ernest Mnzava holds a doctorate from the University of South Africa and works as an instructor, researcher, and librarian at the Sokoine University of Agriculture in Tanzania. She is also a Research Fellow at the University of South Africa, South Africa. Her research interests include information management, library services, information communication, digital literacy, and information dissemination.



Prof. Lorette Jacobs is the Chair of the Department of Information Science at Unisa. Her interests range from records management to using ICTs in information practices, information literacy development, curriculum development, and improving teaching and learning practices in higher education. She is currently involved in the artificial intelligence project of InterPARES, part of the International Council on Archives related to the access and use of digital records by ESARBICA citizens.