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# Analysis of information quality for a usable information system in agriculture domain: a study in the Sri Lankan context

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**Abstract**

In creating a usable Information System (IS), the quality of information is crucial for making the right decisions. Although, many Information Quality (IQ) features have been identified in a broader context, only certain IQ features would become applicable for each domain from the usability perspective. This study focuses on a theoretical analysis to identify the IQ features which would be significant to produce a usable agricultural information system with respect to the developing countries. Accuracy, Credibility, Context-specific, Completeness and Timeliness are identified as the essential features of the IQ for IS in agriculture which was substantiated through the preliminary analysis of user reviews on the agriculture mobile applications.



*Keywords:* Information System; Information Quality Attributes; Information Dimensions; User-Satisfaction; Usability;

## 1. Introduction

The use of Information Systems (IS) in agriculture is vital to improve the productivity by making the business process effective and efficient. In developing countries, several ICT initiatives have been introduced as it has been identified that the improper dissemination of information is the major issue that affects the agriculture productivity

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[1-6]. With respect to the Sri Lankan context, there are few web applications such as wikigoviya [7], goviya [8] and the official website of the department of agriculture [9] are available. In addition to that the mobile applications: Krushi Advisor [10], Govi Mithuru [11], Mod Goviya [12], Govi-nena [13] and AgInfo [14] are available which can be downloaded from the Google Play store. However, there is still no significant influence from them to the Sri Lankan agricultural IS [3,15]. Moreover, Lokanathan and Kapugama (2012) have revealed that the main information sources of farmers in developing countries could be ordered as self/traditional knowledge, family and friend farmers, traders, buyers and government agricultural extension officers [16]. The use of mass media is quite low and there is no noteworthy evidence of using IS. Through the field visits and literatures in the Sri Lankan context, it has been verified that these findings are still valid for the present situation [3,15]. Although, farmers have a positive attitude of using IS that is hindered by several factors such as level of trust on ICT, lack of training, lack of digital contents, lack of farmer-oriented information and accessibility [15,17,18]. Moreover, many research works have emphasized that farmers are interested in information which is provided through IS than the design aspects of them [1,3,18-21]. For instances, they seek information related to their context such as the best crop-variety to grow with the other available crops in the farm, suitable control methods for pest and disease management based on the farmers' preferences such as chemical or non-chemical applications and appropriate fertilizers based on the soil type and the available equipment [1,2]. In article [20], the authors have identified the factors that affect the usage of ICT systems in developing countries. In which, Information Quality (IQ) has been identified as one of the key components of them [20]. Moreover, researchers have emphasized that the limited attention in providing relevant information to users through ICT initiatives have caused a negative impact to ICT usage [19-21] in countries such as India, Mali and Uganda.

It is evident through the above discussion that the stakeholders in the agricultural IS are unable to achieve their goals by using the IS as those do not focus on their intended information needs. Nigel Bevan [22] in his study has considered this as a usability issue in the broader perspective of quality which has been defined as "Quality of use". Consequently, it is evident that the IQ is a key component that makes an influence on usability of agricultural IS [3,20,23]. Thus, through this study, we conducted the theoretical analysis to identify the features to be considered under the IQ from the "Quality of use" perspective with respect to the IS in agriculture as the IQ from the quality of use perspective has not been discussed in detail in the context of IS in agriculture so far. The *DeLone & McLean (D & M)* IS success model was adapted to explore and prove the correlation between the IQ and the usability [24]. Based on our analysis, there are many IQ features have been discussed with reference to IS. From them, Completeness, Accuracy, Relevancy, Timeliness, Presentation, Understandability, Conciseness and Credibility are the most widely used features. However, all these features are not exactly relevant for all domains. Thus, it is important to identify which subset of the IQ features would become applicable for creating a usable agricultural IS. Furthermore, it is required to empirically evaluate the identified subset of the IQ features in relating to the usability of agricultural IS. In our study, as the first step, we have performed a preliminary user-review analysis on mobile applications with respect to the Sri Lankan context to verify the existence of correlation in between the identified IQ features and the IS system-use.

The next section discusses the theories which have been adopted under this study. Accordingly, section 3 describes the derived features of IQ with reference to the IS in agriculture. Finally, the importance of addressing IQ features for a usable agricultural IS and gaps to be addressed have been emphasized.

## 2. Theoretical background

### *2.1. Usability and quality*

For many years usability aspect is a broadly discussed area and several definitions for usability have been given by different people. However, the definitions provided by the International Organization for Standardization (ISO) are widely accepted since it provides definitions that can be easily adapted by any domain [25]. However, many practitioners and researchers face challenges in finding an appropriate definition for usability and the usability measures relevant to their context. Nigel Bevan [22] has classified these ISO standards into two categories namely "*top-down*" and "*bottom-up*" approaches that enable the selection of relevant usability definition for each IS. The *bottom-up* approach focuses on the *product-oriented view* which concentrates on the design aspects of the product,

for example, creating well-designed user interfaces. This is mostly concerned with the features related to ease-of-use aspects such as efficiency (i.e., resource utilized, execution speed), functionality, and reliability. These are the features which are generally evaluated before delivering the final system or product to the end users. Moreover, this is a way of evaluating the usability of product from the designers' (i.e., software engineers') perspectives. On the other hand, the top-down approach focuses on the *broad quality view* which is related to the intended purposes of system-users. The *broad quality view* discusses the usability as "*quality of use*" and it evaluates whether the system or product is suitable for the intended purpose of the end users (users' perspective) in a particular context. To this end, the context that the system is used is important which includes: *users*, *tasks*, *equipment* and *environment*. For example, usability of a system is evaluated based on the task that the users perform, the equipment that is the hardware, software and material that the users have and the real-environment that the users use the system. Moreover, the usability evaluation in *product-oriented view* is a subset of the usability in *broad quality view.* In agricultural IS point of view, most initiatives have evaluated the usability in designers' perspective (i.e., *product-oriented view*) by focusing less on the intended purpose of the users (i.e., broader quality view) [2,3]. For instance, *product-oriented* view, usability evaluation is done based on the features such as: intuitive design, ease of use, memorability, execution speed and accessibility [2, 17, 26]. Even though, these design aspects are important to create a usable application, it would be of no use if it is unable to achieve users' needs. Therefore, the usability evaluation of the IS from the perspective "*Quality of use*" is used in this study to assess whether the specified purpose of IS could be achieved by the specified users in the context for which that system is used.

In the agriculture domain, farmer is the main stakeholder who intends to access the right information through a system to make the right farming decisions which enables to gain high yield and in turn to get the best price at the end. If a system is unable to support this objective, it would not be a useful system to the stakeholders though it is good in terms of design aspects or in other words *product-oriented* perspective. Furthermore, researchers have revealed through surveys that when selecting an information system, farmers give priority to the features of information/data contents than design features such as accessibility, ease of use and ability to feedback [3,19,20]. Therefore, these research works [3,19,20] are evident that the agricultural IS would be evaluated based on the *quality of use*. Accordingly, the definition ISO 9241-11 [25] "*the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use*." [25] can be adapted for the agriculture domain. The term Effectiveness refers to "*how users can achieve specified goals with accuracy and completeness*" [25]. Efficiency states "*what rate users achieve goals with respect to the accuracy and completeness*" [25]. For instances, the number of steps used or time taken to achieve the goal is considered under the efficiency aspect. Satisfaction refers to "*the extent to which the user's physical, cognitive and emotional responses that result from the use of a system, product or whether the service meets the user's needs and expectations*." [25]. Moreover, Nigel Bevan [22] has stated that the features defined in the ISO definition [25] are related to "*quality of use*" and Effectiveness, Efficiency and Satisfaction are the measures of it. Therefore, through our study, the focus would be given to the usability from the *quality of use* perspective in order to direct the information systems' designers to come up with usable and thus, successful agricultural IS solutions.

### 2.2. *Information system success model*

Assessing the success (effectiveness) of IS is important to ensure whether the IS enable to achieve the organizations' or individuals' goals [24]. However, it is a difficult task without a proper method such as a model or a framework [24]. Thus, in 1992, DeLone & McLean have been proposed a model to guide the researchers and developers to build effective IS [27]. This model: *DeLone & McLean (D & M) IS success model* has been cited in more than 300 articles in refereed journals and has been empirically evaluated [24]. This model shows the association among IS quality aspects, user satisfaction and IS usage [24]. User-satisfaction has been measured under three aspects which are the *users' information satisfaction*, *decision making satisfaction* and *user-interface satisfaction* [28]. In here, the user-satisfaction mainly has been evaluated with respect to the *quality of use*.

In this study, as our intention is also to explore the usability relating to '*Quality of use'* perspective as explained before, the D & M model was adopted. This model has been updated in 2003 and describes IS quality under three dimensions namely: *Information quality*, *System quality* and *Service quality* [24]. IQ describes the characteristics of information to be provided as an output of IS. For an example, IQ characteristics defined in the model with respect

to the E-commerce domain are personalized, relevance, timeliness, understandability, completeness and security [24,29]. The technical success is measured under system quality by focusing mostly on *product-oriented* usability aspects such as ease of use, reliability, flexibility and response time [24, 29]. Service quality considers the quality of support to be delivered after the product given to the users.

Based upon the research work [1-3, 20] it has been highlighted that the IQ plays a key role in creating usable agricultural IS. However, the developers usually provide more emphasis on to the system quality of the IS [2,17,26]. Moreover, authors in [17] have evaluated the success of agricultural IS based upon the business perspective such as E- commerce and Business to Consumers by adopting the D & M IS model. In which, the System and Service quality have been identified as the top dimensions. The same conclusion has been made by researchers for the area like banking, marketing and enterprises in other domains [28-31]. However, our discussion relates to the IS in agriculture which produce personalized information for farmers whose intention is to improve their productivity by accessing the right information at the right time. When considering such systems, users' attraction goes to the systems which enable them to fulfill their informational needs. Thus, we turn the attention of practitioners of agricultural IS to the information quality because at one end, it is the feature that strongly influences groups like farmers to judge whether or not the information systems are used [1,3]. On the other end, information quality and user satisfaction (usability) work in hand in hand when evaluating the success of IS [32].

### *2.3. Classification of information quality (IQ)*

Making quality decisions is required in each stage in farming to make profits at the selling stage. A quality decision cannot be made based upon poor quality information. Thus, information quality has been identified as the key component of the IS success [24,29,31]. Due to numerous dimensions of the data and information quality are available, scholars have categorized those considering three different perspectives such as data, real-world and user perspective [32 -34]. The data and real-world IQ perspectives engage with the quality characteristics of the product development. The user perspective discusses the IQ features that are considered by end users to assess whether the data are appropriate for use based on their tasks (i.e., quality of use) [32]. Therefore, IQ features can vary with respect to the context [33] as the users' IQ views are different from one context to another. Based on the fact, our study discusses the IQ in terms of user perspective under the agriculture context as the stakeholders in agriculture select the IS based upon the IQ features [3,20,35]. For that, we adapted Wang and Strong [32] IQ classification as they have classified the IQ in terms of information consumers' perspective.

Wang and Strong [32] have grouped IQ into four categories: Intrinsic, Contextual, Representational and Accessibility. Intrinsic information quality measures are Accuracy, Believability, Reputation, Objectivity which implies the information has quality on its own right. The characteristics such as relevancy, timeliness, completeness, value-added and the appropriate amount of data have been identified as contextual information quality which depends on the context and tasks that the users are performed. Representational (interpretability, ease to understand, consistency, and concise representation) and accessibility (accessibility and access security) information qualities are attached to the system and its design aspects. The categorization has been incorporated in later researches with the D & M IS Success model to show the influence between the user-satisfaction and each categorization of information quality [31,36]. Furthermore, we used the Wang and Strong [32] information quality attribute list to explore the frequently discussed features with the user-satisfaction that has been elaborated in the next section.

## 3. Information quality features for a usable information system in agriculture

### *3.1. Information quality features*

Wang and Strong [32] have captured the attributes of IQ by concerning the consumers' point of view. The information consumers are the users who use the information with further processing to achieve their intended goals. Moreover, based on that experience, users decide whether the product or system is useful for their purpose. As IS in agriculture show the same nature, we analyzed how the information features affect the usability of the agricultural IS. For that, the frequently discussed information features were initially identified through the theoretical analysis

and explored how those factors have been addressed in agricultural IS. We selected eighteen (18) indexed articles [28,30-32,35-48] (i.e., SCOPUS, Web of Science) in the refereed journals which have high citations. According to our analysis, Accuracy, Completeness, Relevancy, Timeliness, Concise Representation (Presentation) and Understandability have been identified as the most reviewed IQ features (Table 1). Among them, we identified the information completeness takes the top place followed by accuracy, relevancy and timeliness in the order. The same results were identified in [37]. However, they have mentioned that timeliness is the most discussed IQ feature.

In addition to the mentioned features, credibility has been considered under the intrinsic IQ in our study as it has been revealed through the empirical study as a significant IQ feature for the agricultural IS in developing countries [3]. The credibility has been referred to as believability in the Wang and Strong IQ attribute list [32]. The definitions of the IQ features in Table 1 were adapted considering the user perspective and the agriculture context. For the reason that the definitions infer the different meanings with respect to the quality approaches. For an instance: completeness under the data perspective implies the missing values. Under the real-world perspective, completeness is the coverage of information that are needed for meaningful representation of the real-world [32] and under the user perspective, the completeness is the granularity of the information, or in other words, the amount of information is sufficient for the tasks [32].

Table 1. Frequently discussed features under the information quality.

| Category [22] of IQ | IQ measures | Definitions [22, 28] & examples relating to the agriculture domain | Number of Citations | Reference |
|---|---|---|---|---|
| Intrinsic | Accuracy | The extent in which information are correct, reliable and agree with the underlying reality.<br>e.g.: the crop details are correct with the information available in the Department of Agriculture | 14 | 28,32,35-46 |
| | Credibility | The extent to which information are agreed or regarded as true, real and trustworthy<br>e.g.: the information has been verified through the Department of Agriculture / relevant authorities | 5 | 32,36,39,46,47 |
| Contextual | Completeness | The extent to which relevant information are sufficient to fulfill tasks to be performed<br>e.g.: the provided crop information is sufficient for me to decide the crop to be cultivated. | 17 | 24,28, 30-32,35-46 |
| | Relevancy | The extent to which information are appropriate and applicable to fulfill context specific tasks<br>e.g.: the provided pesticide information is relevant to the given crop, soil type and the pest details. | 14 | 24, 28,30-32,35,37-39,41,42, 44,45,48 |
| | Timeliness | The extent to which up-to-date information are available to satisfy specific task on time<br>e.g.: Latest fertilizer information has been provided with respect to the crop and the soil type. | 14 | 28,30-32,36-44, 45 |
| Representational | Presentation | Refers the way of information are organized in a way that users can easily understand<br>e.g.: the provided fertilizer details are in the usual formats. | 12 | 28,30-32,35,38,40-42,44,46,48 |
| | Understandability | The extent to which information is clear, and unambiguous and easily interpretable to users' context<br>e.g.: the provided pest and diseases can be easily understood with supplementary documents, images, and videos. | 9 | 24,31,32,36,39, 42-44,48 |

### *3.2. Information quality attributes in the agriculture perspectives*

It is difficult to find IS in agriculture which consider all the necessary information quality factors identified in Table 1 in designing the system. However, the representational and accessibility information quality has been widely discussed with the system quality in researches and the system developments [2, 17, 26]. It has been revealed that less focus on the intrinsic and contextual IQ make the agricultural IS not usable and useful [1,3,20]. Thus, our concentration provided to the intrinsic and contextual IQ further.

Accuracy is the correctness of information that agreed with underlying reality and which is positively associated with the timeliness [33]. The timeliness refers to the availability of up-to-date information to fulfill the tasks at hand [32]. In the agriculture, farmers make decisions in the various farming stages such as crop selection, pre-sowing, Growing, Harvesting, Post-harvesting and selling [1,16]. In each stage, accurate information is required timely to make the right decisions. For instance, the correct information such as market demand, price, growing problems and weather conditions are required to select the best crop to be cultivated at the selection stage to gain high yield at the harvesting stage and in turn to make profits at the selling stage. Inaccurate information will affect the farmers' entire farming life cycle. Moreover, farmers make decisions believing that the provided information through the IS are accurate at the time of decision making. They are not capable of verifying whether the provided information is free of errors [33]. Thus, the accuracy of the information is needed to validate through credible information providers such as agriculture experts, researchers, and extension officers before making it available to the farmers. Furthermore, the required information for farmers can be divided into two categories: static and dynamic [1]. Static information is unlikely to be changed for a significant amount of time. For examples, static information in the domain of agriculture would include information such as crop variety details, pesticides, fertilizers, disease and pest management. The market price, the market demand and the behaviour of consumers are considered as the dynamic information which rapidly changes over time, maybe on an hourly or daily basis [1]. Thus, providing the accurate and updated dynamic information is a challenging but necessary task. The technologies such as SMS-based services and online community-based services are needed to incorporate with IS to provide dynamic information timely to the farmers [50,51].

The completeness and relevancy are crucial factors that the tasks to be performed highly depends on them. The provided information can be incomplete for one farmer, even though it has been verified as complete by another farmer. Thus, the completeness of information to be provided varies from a farmer to farmer. Therefore, this has to be evaluated subjectively. Moreover, we identified through the users' review analysis on mobile applications, considerable number of negative comments have been given to the government mobile application [10] regarding the completeness. It is 14% out of total valid comments of the content including the comments related to the missing information (Table 2).

The relevancy of the information is widely discussed under the IS in agriculture in terms of context-specific information. Mahindarathne and Min [3] has described this in terms of specific and localized information. The term context is referred under the agriculture as farm environment, types of farmers, preferences of farmers and farming stages [1,2]. The information relevant to the location of the farm has been considered as the farm environment such as rainfall, climate zone, humidity and soil factor. The types of farmers can be small-scale, medium-scale, large-scale, and garden farmers. Moreover, the information can be accessed with the intention of producing high yield or reducing the cost of farming. This has been accounted as the preferences of farmers. For an instance, farmers can seek disease/pest resistant crop-variety details in order to reduce the expenses of pesticides. Furthermore, the fertilizers, crop-varieties information and control methods can be accessed based on the farm size, location and available equipment to earn high income at the selling stage. Scholars have highlighted that the context specific information is required at the right time to minimize the difficulties that can be faced by farmers such as over-production, loss of income, pest attacks and damages upon the weather conditions [2, 49]. Without taking into account the specific information needs, the agriculture IS are unable to satisfy the farmers intended goals. In article [51], it has been mentioned that the information provided through certain web-based systems, SMS-based services and mobile applications are not relevant to the individual context. Therefore, they promote the village-based network in which the information brokers act as a mediator between knowledge source and local farmers in order to provide relevant information effectively. Moreover, as it is realized that the requirement of specific information to the Sri Lankan farmers, the mobile applications such as "Govi-Nena" [13] and "Govi Mithuru" [11] have been

introduced to provide the customized contextual information. These applications are available to download in the Google play store and the "Govi Mithuru" application has 50000+ users. When compared to the available mobile applications, "Govi Mithuru" is on the top based on the number of downloads and there are 56% positive reviews for it out of 52 valid comments (Table 2).

Credibility is the quality of information which is being trusted and believed in. In agriculture point of view, the credibility of a particular information sources/channels is "*the degree to which a source or channel is perceived as trustworthy and competent by the receiver*" [52]. The article [53] has mentioned that to build credibility "*the agricultural communicators should consider the trustworthiness and perceived expertise of sources, such as representatives from regulatory agencies, educational institutions, members of the agriculture sector, or environmental organizations*". For the Sri Lankan context, the credibility takes high priority after the context-specific factor that influence for the selection of information sources [3]. In brief, the main fact that influences the credibility of the information sources is the credibility of the information provider (i.e. the expertise of sources). Furthermore, in developing countries, experts such as agriculture instructors and research assistants in the agriculture research centers, have established the credibility of information given to the farmers after the information received from the colleague farmers [3,16]. Moreover, it has been verified that credibility has positively correlation with the contextual information quality [54]. For an example, through a system, if a farmer can access up-to-date, complete and context-specific answers to their queries that makes a system more credible.

## 4. Discussion

It has been revealed that the farmers' main goal/intention of using an IS is to access the right information to make the right decision at the right time [1,2]. For that the farmer context (Fig. 1, No. 06) is important as we described in section 2.1 and 3.2. Thus, the farmers will get attracted to agricultural IS if the farmer's intention can be fulfilled. To this end, in the article [3] have listed many features with a priority rank that should be there for an IS in order for farmers to get attracted [3]. From this list, the IQ features take the priority as illustrated with the rank numbers in Fig. 1(No. 07) whilst the other features are design related.

We produced the diagram in Fig. 1 to illustrate the association among the theories presented on usability as quality of use [22], IS quality dimensions from the user satisfaction perspective (i.e., the D & M IS success model) [24], and the IQ features related to the agricultural IS as defined in [3]. We unveiled through theoretical reviews the associations that IQ features [3] have with the quality of use [22] and the IS quality dimensions [24] which are depicted by the relationships numbered 01 and 03 in Fig. 1 respectively.

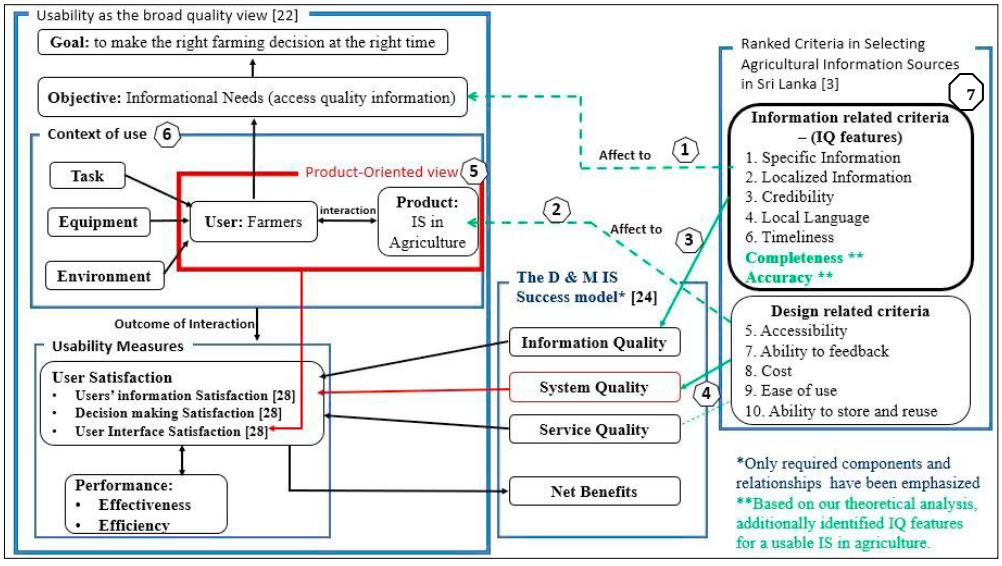


Fig. 1. Influence of information quality to quality of use aspect in agricultural IS.

Thus, we brought out the influence of the IQ to the usability of the agricultural IS through using the D & M IS success model (Fig.1, No. 01 and No. 03) [24]. The D & M model defines how IQ influences the user-satisfaction of the IS as explained under the section 2.2. Although, many IQ features have been identified in a broader context, only a certain set of IQ features would become applicable for each domain from the usability perspective. This applicable set of IQ features would differ from one domain to another [32,33]. To this end, we further analyzed eighteen articles in the refereed journals to identify the most widely discussed IQ features (Table 1). As a result, the set of IQ features highly applicable to the usability perspective of agricultural IS were recognized. The IQ features such as accuracy, credibility, relevancy (context-specific), completeness and timeliness are identified as the applicable features that are considered by the farmers in the domain of agriculture. This is an enhancement to the priority list presented in [3] with two additional IQ features (completeness and accuracy) which could be uncovered through the review process.

Furthermore, the importance of addressing the IQ features was confirmed through the preliminary analysis of users' reviews on mobile applications with respect to the Sri Lankan context (Table 2). For that, two mobile applications: "Krushi Advisor" [10] and "Govi Mithuru" [11] were selected which are available to download in the Google Play Store and have 10000+ and 50000+ downloads respectively. Moreover, the latest updated versions of them are being provided. Both applications provide information related to all the crops, fertilizer recommendations, pest and disease management and harvesting. "Krushi Advisor" is offered by the Department of Agriculture in Sri Lanka and it is free of charge and provide additional extension services. But "Govi Mithuru" charges a fee for information services and the content is accessed from the Department of Agriculture and authorized bodies. However, it has 40000+ excess downloads compared to the "Krishi Advisor". The significant of the "Govi Mithuru" is providing the customized contextual advisory services for the farmers. That implies farmers are eager to access the information in the context specific manner though it is a paid service (i.e., cost of services related comments: 40%). Moreover, there are no significant issues related to the content of "Govi Mithuru". When considering the feedback given on "Krushi Advisor" excluding general comments such as appreciation, acknowledging, and emoji expressions, there are 36% (14) comments related on the content such as requesting up-to-date information, highlighting incompleteness of information and information localization issues. There are 12% comments on the system quality such as ease of use, UI comfortability and installation. This derives that farmers are keen to find IS which provides the quality contextual information to satisfy their informational needs.

Table 2. The summary of number of comments on the popular mobile applications in agriculture in Sri Lanka.

| Mobile Application | Description | Valid Comments | No. Comments on issues in the content | No. Comments on issues in the System |
|---|---|---|---|---|
| Krushi Advisior [10] | Downloads: 10000+ | 43 | 14 | 05 |
| | Reviews: 4.5 | System: 05 | Timeliness: 02 | Interface font: 02 |
| | Last update: 15/19/2020 | Content: 14 | Completeness: 02 | System loading: 03 |
| | | General: 24 | Local Language: 05 | |
| | | | Other: 05 | |
| Govi Mithuru [11] | Donloads: 50000+ | 52 | 01 | |
| | Reviews: 3.8 | Content: 01 | | |
| | Last update: 03/11/2020 | System: 23 | | Cost: 21 |
| | | General: 28 | | |

## 5. Conclusion

Through this study, our effort is to turn the attention of the researchers and practitioners in agricultural IS to *quality of use* aspects of IS that has been slightly focused previously, and to this end we justified that maintaining information quality is important to make usable IS. Based on the theoretical analysis with respect to the developing countries, we revealed that practitioners and researchers in agriculture domain have focused the usability in the

*product-oriented* perspective as depicted by the numbers 02, 04 and 05 in Fig. 1 and not from *quality of use* perspective. According to the user perspective, IQ plays a vital role in producing a usable IS in agriculture. Thus, we explored the IQ and identified the applicable features to be considered in designing agricultural IS. Context-specific and credibility are identified as highly influential features to the use of IS in agriculture followed by accuracy, completeness and timeliness. However, to create a usable IS, it is required to address all three major quality dimensions highlighted in the D & M IS success model. Thus, it is required to build a complete model or a framework to direct the practitioners in agricultural IS to come up with usable and thus, successful IS.

## References

[1] Walisadeera, A.I., Ginige, A., and Wikramanayake, G.N. (2015) "User centered ontology for Sri Lankan farmers." Ecol. Inform. **26**, 140–150.

[2] De Silva, L.N.C., Goonetillake, J.S., Wikramanayake, G.N., and Ginige, A. (2013) "Farmer Response towards the Initial Agriculture Information Dissemination Mobile Prototype." Computational Science and Its Applications – ICCSA 2013. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 264–278.

[3] Mahindarathne, M.G.P.P., Min, Q. (2019) "Factors that Influence Farmers' Information Seeking Behaviour: A Study of Sri Lankan Vegetable Farmers." J. Inf. Knowl. Manag. **18**, 1950037.

[4] Gawade, S., Turkar, V. (2019) "A Role and Potential of E-Krishimitra Tool in Usability Improvement of Agricultural Domain." Int. J. Comput. Appl. **178**, 6–12.

[5] David Rees, Martha Momanyi, Joseph Wekundah, Felister Ndungu, Jacob Odondi, A. O. Oyure, Dymphina Andima, Marion Kamau, Jessica Ndubi, Francis Musembi, Lucy Mwaura and Rita Joldersma. (2000) "Agricultural knowledge and information systems in Kenya - implications for technology dissemination and development" Agricultural Research and Extension Network Paper 107. URL https://www.odi.org/publications/4219-agricultural-knowledge-and-information-systems-kenya-implications-technology-dissemination-and (accessed 9 December 2020).

[6] Mittal, S., Mehar, M. (2012) "How Mobile Phones Contribute to Growth of Small Farmers? Evidence from India" Quarterly Journal of International Agriculture **51(3):** 227-244.

[7] The Audio Visual Centre of the Department of Agriculture. wikiGoviya. (2013). https://www.facebook.com/Wikigoviya-130262877169925/ (accessed 29 December 2020).

[8] Goviya: Traditional Sri Lankan Agriculture. (2020). http://goviya.com/ (accessed 29 December 2020).

[9] Government in Sri Lanka. Department of Agriculture. https://www.doa.gov.lk/index.php/en/ (accessed 29 December 2020).

[10] Department of Agriculture Sri Lanka. "Krushi Advisor" (updated 20 December 2020). https://play.google.com/store/apps/details?id=com.prasadbandra.krushiadvisor&hl=en&gl=US (accessed 29 December 2020).

[11] Dialog Axianta. "Govi Mithuru". (updated 03 November 2020). https://play.google.com/store/ (accessed 29 December 2020).

[12] Genx Code Labs. "Mod Goviya". (updated 30 November 2020). https://play.google.com/store/ (accessed 29 December 2020).

[13] Govi-Nena. "Govinena- farmer (Early Access)". (updated 15 November 2020). https://play.google.com/store/ (accessed 29 December 2020).

[14] Olexto Digital Solutions. "AgInfo". (updated 16 April 2016). https://play.google.com/store/ (accessed 29 December 2020).

[15] Mahindarathne, M.G.P.P., Min, Q., (2018) "Developing a model to explore the information seeking behaviour of farmers." J. Doc. **74**, 781–803.

[16] Lokanathan, S., Kapugama, N. (2012) "Smallholders and Micro-Enterprises in Agriculture: Information Needs and Communication Patterns." SSRN Electron. J. https://doi.org/10.2139/ssrn.2309313

[17] Yu, P., Zhao, D. (2014) "Effect of Website Quality Factors on the Success of Agricultural Products B2C E-commerce" in: Li, D., Chen, Y. (Eds.), Computer and Computing Technologies in Agriculture VII, IFIP Advances in Information and Communication Technology. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 98–113.

[18] Carrer, M.J., de Souza Filho, H.M., Batalha, M.O. (2017) "Factors influencing the adoption of Farm Management Information Systems (FMIS) by Brazilian citrus farmers." Comput. Electron. Agric. **138**, 11–19.

[19] Ninsiima, D. (2015) "Factors Affecting Adoption of An Information Communications Technology System For Agriculture In Uganda" 150.

[20] 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." Inf. Process. Agric. **6**: 26–46.

[21] Bachhav, Nitin Bhagachand. (2012) "Information Needs of the Rural Farmers: A Study from Maharashtra, India: A Survey" Library Philosophy and Practice (e-journal). **866**.

[22] Nigel Bevan. (1995) "Human-Computer Interaction standards". In: Anzai & Ogawa (eds). Proceedings of the 6th International Conference on Human Computer Interaction, Elsevier. **20**: 885-890

[23] Lew, P., Olsina, L., Zhang, L. (2010). "Quality, Quality in Use, Actual Usability and User Experience as Key Drivers for Web Application Evaluation,". in: Benatallah, B., Casati, F., Kappel, G., Rossi, G. (Eds.), Web Engineering, Lecture Notes in Computer Science. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 218–232.

[24] William H. DeLone and Ephraim R. McLean. (2003) "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update" J. Manag. Inf. Syst. **19**, 9–30.

[25] ISO DIS 9241-11: Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts (2015)

[26] Raikar, K., Gawade, S., Chopade, S. (2017) "Usability Evaluation of Agricultural Websites" Proceedings of the 11th INDIACom; INDIACom-2017; IEEE Conference ID: 40353. **7**, 136-141.

[27] DeLone, W.H. and McLean, E.R. (1992). "Information systems success: The quest for the dependent variable.". Information Systems Research. **3(1)**: 60-95.

[28] Ndiege, J.R.A., Wayi, N., Herselman, M.E., (2012) "Quality Assessment of Information Systems in SMEs: A Study of Eldoret, Kenya." Electron. J. Inf. Syst. Dev. Ctries. **51**, 1–23.

[29] Petter, S., DeLone, W., McLean, E. (2008) "Measuring information systems success: models, dimensions, measures, and interrelationships." Eur. J. Inf. Syst. **17**, 236–263.

[30] Wahyudi, F., Respati, H., Ardianto, Y.T. (2017) "Study on DAPODIK Information System: User Satisfaction as Mediation of System Quality and Information Quality on Net Benefit" Information and Knowledge Management. **7(7):** 53 - 62.

[31] 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." Eur. J. Inf. Syst. **26**, 333–360.

[32] Wang, R.Y., Strong, D.M., (1996) "Beyond Accuracy: What Data Quality Means to Data Consumers." J. Manag. Inf. Syst. **12**, 5–33.

[33] Mouzhi Ge. and Markus Helfert. (2007) "A review of information quality research" Proceedings of the 2007 International Conference on Information Quality: 76-91.

[34] Naumann F. and Rolker C. (2000) "Assessment Methods for Information Quality Criteria" Proceedings of the fifth International Conference on Information Quality.

[35] Kante, M., Oboko, R., Chepken, C. (2017) "Influence of Perception and Quality of ICT-Based Agricultural Input Information on Use of ICTs by Farmers in Developing Countries: Case of Sikasso in Mali." Electron. J. Inf. Syst. Dev. Ctries. **83**, 1–21.

[36] Alenezi, H., Tarhini, A., Sharma, S.K., (2015) "Development of quantitative model to investigate the strategic relationship between information quality and e-government benefits." Transform. Gov. People Process Policy **9**, 324–351.

[37] Alshikhi, O.A., Abdullah, B.M. (2018) "Information quality: definitions, measurement, dimensions, and relationship with decision making" European Journal of Business and Innovation Research 6(5): 36-42.

[38] Miller, H., (1996) "The multiple dimensions of information quality." Inf. Syst. Manag. **13**, 79–82.

[39] Lee Y.W, Strong D.M, Kahn B.K. and Wang R.Y. (2002) "AIMQ: a methodology for information quality assessment. Information & Management" **40(2):** 133–146.

[40] Nelson R. and Todd, Peter and Wixom, Barb. (2005) "Antecedents of Information and System Quality: An Empirical Examination Within the Context of Data Warehousing" J. of Management Information Systems 21(4):199-236.

[41] Hsiu-Fen Lin (2007) "The Impact of Website Quality Dimensions on Customer Satisfaction in the B2C E-commerce Context" Total Quality Management & Business Excellence, **18(4):** 363-378.

[42] Gorla, N., Somers, T.M., Wong, B. (2010) "Organizational impact of system quality, information quality, and service quality." J. Strateg. Inf. Syst. **19**, 207–228.

[43] Petter, S., DeLone, W., McLean, E. (2013) "Information systems success: the quest for the independent variables." J. Manage. Inf. Syst. **29(4)**, 7–62.

[44] Vancauwenbergh, S., (2019) "Data Quality Management." Scientometr. Recent Adv. https://doi.org/10.5772/intechopen.86819.

[45] Fadahunsi, K.P., Akinlua, J.T., O'Connor, S., Wark, P.A., Gallagher, J., Carroll, C., Majeed, A., O'Donoghue, J., (2019) "Protocol for a systematic review and qualitative synthesis of information quality frameworks in eHealth." BMJ Open 9.

[46] Zina Houhamdi and Belkacem Athamena (2019) "Impacts of information quality on decision-making," Global Business and Economics Review, **21(1):** 26-42.

[47] Jarke, M., Vassiliou, Y. (1997) "Data warehouse quality: a review of the DWQ project" Proceedings of the Conference on Information Quality, Cambridge, MA: 299–313.

[48] Sedera, D., Gable, G., & Chan, T. (2004) "A Factor and Structural Equation analysis of the Enterprise Systems Success Measurement Model." AMCIS 2004 Proceedings 94.

[49] Wilson, R.S.I., Ginige, A., Goonetillake, J.S., Indika, W.A. (2019) "User Needs-driven Enrichment of Ontology: A case study in Sri Lankan Agriculture" in: Proceedings of the 2019 7th International Conference on Information Technology: IoT and Smart City. Presented at the ICIT 2019: IoT and Smart City, ACM, Shanghai China: 581–586.

[50] Tegegne A. K., and Alemu T.A. (2019) "SMS-Based Agricultural Information System for Rural Farmers in Ethiopia": JUS **15 (1):** 47-62.

[51] Zhang, Y., Wang, L., Duan, Y., (2016) "Agricultural information dissemination using ICTs: A review and analysis of information dissemination models in China." Inf. Process. Agric. **3**, 17–29.

[52] Dhayal, B.L. and Bochalya, B.C. (2015) "Credibility of different sources and channels of agriculture information as perceived by the ber growers" Agric. Update **10(1):** 17-22.

[53] Alexa J. Lamm, Courtney T. Owens, Ricky Telg. (2016) "Influence of Source Credibility on Agricultural Water Use Influence of Source Credibility on Agricultural Water Use Communication." Journal of Applied Communications **100(3)**: 121+.

[54] Sidi, J and Junaini, S.N, (2007) "Credibility Review of The Malaysian States E-Government Web Sites" Public Sector ICT Management Review **1 (1),** 41-45.