DOI: https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166
ISSN - 1983-716X

FRAMEWORK FOR INFORMATION QUALITY ASSESSMENT IN INTELLIGENCE AND DECISION SUPPORT SYSTEMS

FRAMEWORK PARA AVALIAÇÃO DE QUALIDADE DA INFORMAÇÃO EM SISTEMAS DE INTELIGÊNCIA E APOIO A DECISÃO

MARCO PARA LA EVALUACIÓN DE LA CALIDAD DE LA INFORMACIÓN EN LOS SISTEMAS DE INTELIGENCIA Y APOYO A LA TOMA DE DECISIONES

ABSTRACT

Objective: To propose a framework for evaluating the quality of normative information in decision support systems, focusing on identifying the gap between the quality expected and perceived by public managers.

Context: Digital transformation has intensified the use of intelligence and decision support systems, demanding high-quality information. Despite the technical advance, few studies contemplate the perception of users about the information quality in the context of public management.

Diagnosis: The literature and applied tools favor technical and objective approaches to the information quality, neglecting subjective and contextual aspects. A gap was identified regarding the measurement of the discrepancy between expectation and perception of the quality of normative information, from the perspective of decision makers.

Limitations/implications of the research: The study is restricted to application in a public military organization, analyzing only four main attributes of quality (accuracy, accessibility, relevance and opportunity). Other dimensions can be developed based on different organizational contexts.

Practical implications: The developed tool allows managers to diagnose and monitor the quality of normative information, contributing to the efficiency of administrative practices and better targeting of resources.

Theoretical implications: The study contributes by incorporating the perceptual approach in the evaluation of information quality, based on the gap between expectation and perception, expanding the understanding of the role of IQ in decision-making environments.

Originality/value: Presents a practical framework, built with scientific rigor based on empirically validated Design Science Research, which offers a practical, adaptable and low-cost solution for information quality management in the public sector.

Keywords: Information quality; Decision making; Information systems.

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Submitted on: 07/31/2025
Approved in: 10/29/2025

How to cite: Santana, S. L. T., Santos, A. M. (2025). Framework for Information Quality Assessment in Intelligence and Decision Support Systems. Alcance (online), 32(3), 130-166. https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166

Chamada Especial da Revista Alcance: 10 anos PMPGIL – Artigos Tecnológicos

DOI: https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166

RESUMO

Objetivo: Propor um framework de avaliação da qualidade da informação normativa em sistemas de apoio à decisão, com foco na identificação do gap entre a qualidade esperada e percebida por gestores públicos.

Contexto: A transformação digital intensificou o uso de sistemas de inteligência e apoio à decisão, demandando informações de alta qualidade. Apesar do avanço técnico, poucos estudos contemplam a percepção dos usuários sobre a qualidade da informação no contexto da gestão pública.

Diagnóstico: A literatura e ferramentas aplicadas privilegiam abordagens técnicas e objetivas da qualidade da informação, negligenciando aspectos subjetivos e contextuais. Identificou-se uma lacuna no que tange à mensuração da discrepância entre expectativa e percepção da qualidade da informação normativa, sob a ótica dos tomadores de decisão.

Limitações / implicações da pesquisa: O estudo restringe-se à aplicação em uma organização pública militar, analisando apenas quatro atributos principais de qualidade (acurácia, acessibilidade, relevância e oportunidade). Outras dimensões podem ser desenvolvidas com base em diferentes contextos organizacionais.

Implicações práticas: A ferramenta desenvolvida permite aos gestores diagnosticarem e monitorar a qualidade da informação normativa, contribuindo para a eficiência das práticas administrativas e melhor direcionamento de recursos.

Implicações teóricas: O estudo contribui ao incorporar a abordagem perceptual na avaliação da qualidade da informação, com base no gap entre expectativa e percepção, ampliando a compreensão do papel da QI em ambientes decisórios.

Originalidade / valor: Apresenta um framework prático, construído com rigor científico. baseado em Design Science Research, validado empiricamente, que oferece uma solução prática, adaptável e de baixo custo para a gestão da qualidade da informação no setor público.

Palavras chave: Qualidade da informação; Tomada de decisão; Sistemas de informação.

RESUMEN

Objetivo: Proponer un marco para evaluar la calidad de la información normativa en los sistemas de apoyo a la decisión, centrándose en identificar la brecha entre la calidad esperada y percibida por los gestores públicos.

Contexto: La transformación digital ha intensificado el uso de sistemas de inteligencia y apoyo a la decisión, exigiendo información de alta calidad. A pesar del avance técnico, pocos estudios contemplan la percepción de los usuarios sobre la calidad de la información en el contexto de la gestión pública.

Diagnóstico: La literatura y las herramientas aplicadas favorecen los enfoques técnicos y objetivos de la calidad de la información, descuidando los aspectos subjetivos y contextuales. Se identificó una brecha en cuanto a la medición de la discrepancia entre la expectativa y la percepción de la calidad de la información normativa, desde la perspectiva de los tomadores de decisiones.

Limitaciones/implicaciones de la investigación: El estudio se restringe a la aplicación en una organización militar pública, analizando solo cuatro atributos principales de calidad (precisión, accesibilidad, relevancia y oportunidad). Se pueden desarrollar otras dimensiones en función de diferentes contextos organizacionales.

Implicaciones prácticas: La herramienta desarrollada permite a los administradores diagnosticar y monitorear la calidad de la información normativa, contribuyendo a la eficiencia de las prácticas administrativas y una mejor orientación de los recursos.

Implicaciones teóricas: El estudio contribuye incorporando el enfoque perceptual en la evaluación de la calidad de la información, basado en la brecha entre la expectativa y la percepción, ampliando la comprensión del papel del CI en los entornos de toma de decisiones.

Originalidad/valor: Presenta un marco práctico, construido con rigor científico basado en Design Science Research empíricamente validado, que ofrece una solución práctica, adaptable y de bajo costo para la gestión de la calidad de la información en el sector público.

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Palabras clave: Calidad de la información; Toma de decisiones; Sistemas de información.

INTRODUCTION

Recent digital transformation technologies, such as artificial intelligence, big data, data mining, and intelligent decision support systems, require better quality information to feed the processes supported by these technologies. Low-quality information can generate negative results that propagate and accumulate in information systems (Liu et al., 2020). Information quality can affect operational performance, decision-making, resource utilization, and relationships with external stakeholders of organizations (Houhamdi & Athamena, 2019) and is therefore a critical success factor for both public and private organizations (Saini et al., 2022).

In the context of digital transformation, information quality has received greater attention for its objective characteristics, that is, data sources. The data are verified and processed so that their formats and technical characteristics make them suitable for analytical processing in information systems, big data and artificial intelligence (Baabdullah, 2024). This process is known as data acquisition, extraction, and transformation (ETL—extract, transform, load) and is applied in identification systems (Becerra et al., 2020), Big Data systems (Chirkova et al., 2021), artificial intelligence (Bertossi & Geerts, 2020), and business intelligence systems. Most models for measuring information quality focus on the technical aspects of its representation and accuracy as data stored in computerized systems, neglecting the people-centered aspects and usage contexts (Li et al., 2025). Many studies have been applied in specific sectors or for specific purposes, such as logistics (Li & Lin, 2006), finance (Widyaningsih, 2016), and strategy (Pusparani, 2019). The domain of the problem is largely technical or aimed at ensuring the equivalence between the digitized data and what it represents, underestimating the subjective nature and value of information in the context of use by the decision-maker.

In a complex decision-making environment, the subjective nature of information needs to be assessed and is linked to the value it holds within the decision maker's context, which includes their way of thinking and decision-making requirements. However, the information quality in its actual context of use remains underexplored in the literature (Torres & Sidorova, 2019; Mensah & Mwakapesa, 2025). Although there has been concern regarding the needs and characteristics of the decision maker, as the user and consumer of information, for at least two decades (Wang & Strong, 1996), the relevance of information quality in the context of its application remains an issue for researchers and professionals in the field of information systems (Nagle et al., 2020). Many tools and methodologies found in the literature are aimed at technically measuring IQ with regard to the origin and source of the data, which shows their academic and practical importance (Conque Filho & Favaretto, 2009; Greef, 2019; Saini et al., 2022). However, this research identified a gap in the literature by observing that only a small portion of the literature focuses on discussing information quality in the context of its practical use by organizational managers (Nagle et al., 2022). An even smaller proportion of studies analyze the IQ in public management (De Araújo & Callado, 2017). According to Wang and Teo (2020), information quality in the public sector increases user satisfaction and enhances the perceived value of the service. The authors also emphasize that the public sector differs from the private sector in terms of the priorities of information attributes. While companies prioritize quality elements aimed at profit, governments pursue objectives such as equity, transparency, and public value. Therefore, evaluation metrics should capture the benefits perceived and expected by the end user, not just technical performance indicators. Recent studies by Nasution et al. (2025) and Mensah and Mwakapesa (2025) also support this view by revealing that evaluation frameworks for IQ in public management should focus on verifying the perceived and expected utility for the user as the central criterion, since it is this perception that turns technical attributes into practical value and satisfaction at work. Both studies highlight the need for research into applicable models to fa-

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cilitate the evaluation of IQ in public institutions to enable better management of IQ in relation to the user, whether they are public managers, civil servants, or citizens. Therefore, there is a gap in studies on practical frameworks for evaluating information quality, as they do not attribute managers' expectations to the perceived information quality in use. Likewise, managers lack applied frameworks or tools that allow them to assess and diagnose users' and decision-makers' perceived information quality. An accurate diagnosis can enable managers to better allocate resources and align technological and management areas to offer higher quality and value to the users.

The present study seeks to contribute to both theoretical and practical foundations. From a theoretical perspective, this study aims to present a model proposal for assessing information quality that considers the context in which the information is used, applying the theory of the gap between expectation and perceived quality (Teas, 1993). It is considered that there is heterogeneity in managers' expectations regarding various aspects of information quality. This source of diversity can also lead to different levels of perception and satisfaction with quality, even when they are based on the same information.

Based on the proposed theoretical model, this study also seeks to contribute to managerial practice by proposing a business intelligence system that focuses on information quality. The Design Science methodology was used to build an application that provides a strategic view of users' expectations and perceptions regarding information. Thus, for example, organizational managers can optimize the use and allocation of resources to improve information quality in line with users' expectations and needs.

Military public administration was chosen as the application context. Decision-making in military public organizations must be based on a set of normative information that seeks to guide and support the decision-making process to achieve greater efficiency and effectiveness in management actions and the use of public resources. In public organizations, executing and oversight bodies need to share high-quality information to carry out their functions and make decisions. Considering the user-centered view of information, each body may perceive the importance and quality of the same information differently, requiring detailed knowledge of these differences and priorities for an effective information quality management process. Thus, evaluating information quality becomes an important element in the systemic context of managerial public administration to support the formulation of strategies that aim to make service administration less costly and more efficient, oriented toward results and citizens (Bresser-Pereira, 1997).

Thus, this study proposes a method for evaluating the gap between the expected and perceived quality of normative information in management and internal control units within a public organization. The analysis highlights the perspective of information quality from the user's point of view in the context of their organizational routines. The theoretical relevance of understanding and assessing the quality of normative information is evident in the possibility of incorporating the dissonance between expectations and perceptions of information quality, as experienced by users and consumers. The practical relevance is also demonstrated regarding the management of information quality, contributing to the correct and timely use of information by public agents in their decisions and administrative actions. The goal is to contribute to improved management and value generation in the use of public resources for the benefit of society (Barzelay, Martins, Vilela & Marques, 2019). In the context of lean Public Administration, technological frameworks need to be built with a focus on simplicity, adaptability, and scalability, allowing for their extensive application in other institutional contexts, supported by routine management, with premises of reuse, low cost, and ease of maintenance (Lima et al., 2023).

The IQ assessment method was implemented using a low-cost business intelligence system. The use of technological tools and intelligent automation, such as an interactive dashboard, has proven to be viable and effective in the public

DOI: https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166

sector, especially in resource-constrained scenarios, as they are low-cost technological innovations (Lima et al., 2023). Their use offers significant improvements in operational capacity and promotes transparency, agility, reliability, and accountability in public management (Moura et al., 2025).

This article is structured into three sections. Next, the theoretical foundations used for the proposed model of information quality assessment and understanding the public military organizational structure are presented. The adopted methodological procedures are then detailed. Subsequently, the results and their respective analyses are presented. Finally, considerations are made regarding the findings, replicability, limitations, and future perspectives of this study are discussed. The developed framework is also offered as a simple technological tool that can be adapted and implemented in different organizations and contexts.

THEORETICAL FOUNDATION

The information quality has always been an academic and professional concern regarding the effectiveness of information systems. Advances in technologies such as big data, data science, and artificial intelligence are consistently marked by their dependence on the information quality that feeds into and is made available by these systems (Noshad et al., 2021; Baabdullah, 2024). This section presents the theoretical basis that justifies the proposed framework.

Information Quality (IQ)

Information can be understood as a contextualized version of data, to which meaning is assigned through the cognitive processes and mental models of the user who utilizes it (Ackoff, 1989). Information is the foundation of an organization's decision-making process, considered relevant in studies and research within a management context (Shankaranarayanan & Blake, 2017; Ndlovu et al., 2022), employed in processes, and of significant importance in the resulting outcomes (Guimarães & Evora, 2004). According to DeLone and McLean (1992), pioneers in studies on Information Quality (IQ), information can be measured at different levels, either as an integral part of a system or as a message in the communication process. It must conform to precise quality criteria, be impartial, reliable, and strictly related to its actual context and purpose, thus avoiding the risk of skewing correct interpretation between its emission and reception (Geraldo & Pinto, 2019, Lutfi, 2023). Therefore, managers must exercise caution when using data in practice and their interpretations, considering the impact of possible bias or even interpretation errors (Liu et al., 2020; Nagle et al., 2020; Baabdullah, 2024). Information must be properly managed, as it is the foundation for improving service quality and ensuring effective decision-making (Santos & Valentim, 2015; Greef, 2019; Nagle). There is an effective relationship between the relevance of information for the organization and its management: the greater the relevance of the information, the greater and more effective its management (Lobato et al., 2019, Noshad et al., 2021).

The quality of a manager's actions is directly related to the IQ that originated them, thus establishing a relationship between the original IQ and the resulting action, along with the practices executed by agents (Kleinsorge, 2015; Janssen, Van Der Voort, & Wahyudi, 2017). IQ, as a management support tool, achieves the organization's objectives more efficiently through the proper use of organizational resources up to the decision-making act because of the value (quality) present in the information (Greef; Günther et al., 2019).

Studies on IQ, which have accumulated more than two decades of research (Wang and Strong, 1996; Nagle et al., 2020), reveal various approaches to assessing information, such as technological factors and knowledge (Huang et al., 1999), benchmarking metrics (Lee, Strong, Khan & Wang, 2002), contextual factors (Stvilia, Gasser and Twidale, 2007), and the stakeholders' perspective (Mashoufi, Ayatollahi & Khorasani-Zavareh, 2019). From seminal studies in the IQ field, such as Ballou and Pazer (1985), DeLone

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and McLean (1992), Goodhue (1995), Wang et al. (1995), Wang and Strong (1996), Strong et al. (1997), Pipino et al. (2002), Lee, Strong, Khan and Wang (2002), it is possible to identify different IQ attributes, for example: (1) intrinsic dimension (accuracy, credibility, objectivity, precision, and reliability); (2) contextual dimension (relevance, timeliness, completeness, and convenience); (3) representational dimension (comprehensibility, interpretability, concise and consistent representation); and (4) accessibility dimension (accessibility, security, system availability, ease of use, and privileges).

Although more recent research highlights that there is no consensus on how to measure information quality (Shamala et al., 2017; Nagle et al., 2020), Cichy and Rass (2019) indicate that the choice of attributes for measuring IQ depends on the context of application, business area, organizational level, and strategic vision regarding IQ. On the other hand, relevant and highly impactful research in the IQ literature, such as the studies by Lee, Strong, Kahn, and Wang (2002), Pipino, Lee, and Wang (2002), Stvilia, Gasser, and Twidale (2007), and Mashoufi, Ayatollahi, and Khorasani-Zavareh (2019), present four attributes frequently cited as relevant in the organizational context: accuracy, accessibility, relevance, and timeliness (Baabdullah, 2024; Al-Okaily & Al-Okaily, 2025).

Accuracy is a characteristic that indicates how correct the information is, free of errors, faithfully representing reality, and recognized by users as legitimate. As it is an intrinsic trait of information, it is subject to interference when captured or processed (Lee et al., 2002). On its own, accuracy is not sufficient for a comprehensive evaluation of IQ, as it does not capture aspects relevant to the context of its use.

Another important attribute is accessibility, which assesses how readily information can be accessed by users (Stvilia et al., 2007). Information must be easily retrievable to be useful to the user. Difficulty in locating and accessing information can lead to poor decision-making and operations.

Finally, the context and timing of use determine two important attributes: relevance and time. Timeliness refers to information being available at the appropriate moment and updated according to the need at the time of use (Pipino et al., 2002). Relevance assesses how well the obtained information meets the needs of the receiver. In critical decision-making contexts with restrictions on time and resources, relevance becomes extremely necessary to reduce the overload of information that is not useful or pertinent (Mashoufi, Ayatollahi & Khorasani-Zavareh, 2019).

Aspects of Information Management in Public Administration

APublic Administration actions are guided by current legal regulations based on the Federal Constitution, in which the principle of legality is highlighted, meaning that public managers cannot perform actions not provided for by legal support. Public Administration systems also rely on the principle of efficiency, which has been analyzed in studies of different administrations in various countries (Narbón-Perpiñá & Witte, 2018), including Brazil (Siqueira, Souza, Farias & Bermejo, 2019).

The principle of efficiency goes beyond actions carried out by managers solely through legality, requiring the achievement of satisfactory results in meeting society's needs (Pérez, 2009). It emphasizes the organizational purpose (intention) of public entities to generate value for citizens' benefit (Barzelay et al., 2019).

Efficiency has been effectively applied, leading to a shift from inflexible and inefficient structures and starting to demand results from managers, similar to the private sector (Cavalcante, 2018). Through the use of efficient administrative practices and smart use of information, the goal is to achieve management results that include saving resources used in service delivery, offering what society needs at the lowest possible cost and with the best quality (De Alencar, Da Fonseca, 2016). In this process, high-quality information made available to managers contri-

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butes to decisions that are realized through properly carried out administrative practices (Beuren & Zonatto, 2014; Montenegro et al., 2018; Gattringer & Marinho, 2020).

METHODOLOGICAL PROCEDURES

To assess IQ, this research produced a usable artifact, consisting of a data collection instrument and business intelligence systems for analysis. This process was conducted using the Design Science method. Design Science has been used in the fields of information systems and management to design or develop systems that aim to solve real-world organizational problems (Dresch, Lacerda & Antunes Junior, 2015). When the problem involves the design and prototyping of information systems, the Design Science methodology has proven to be more appropriate due to the greater control and validity achieved with its results (Baskerville et al., 2018). Design Science research consists of four main stages, as shown in Table 1.

Table 1
DSR Stages

Design Science Stage	Operationalization in Research
1. Problem definition and context	Problem scope, study delimitation
2. Solution (artifact) development	Literature research, development of the instrument, data collection, construction of the quality panel.
3. Solution (artifact) evaluation	Research on managers' perception (or "Survey of managers' perception")
4. Communication of results	Documentation and publication

Source: autor.

Definition and context of the problem

For the development, the first step was to define the focus of this study by researching IQ in the environment of a military organization. Military organizations carry out tactical and strategic operations that require high quality information. In addition, they are important models of information systems, often serving as sources of innovation for the civilian sector. For this study, the context used was the information systems of rules and procedures involving managing units (UGV) and internal control units (UCI) of the Brazilian Army (De Alencar, Da Fonseca, 2016; Montenegro, De Oliveira & Lopes, 2018), focused on the oversight and control of 36 (thirty-six) managing units located in the states of Paraná (PR) and Santa Catarina (SC), as part of the structure that carries out CI activities in a decentralized manner.

Development

Sample

In the stage of validating the research instrument and identifying relevant information to be evaluated, qualitative interviews were conducted with 24 subjects: developers of UCI normative information (5 interviewees); implementing agents of the UGV (15 interviewees); and former UGV agents and former UCI members (4 interviewees). The UGs were classified by type and by the average volume of financial resources they manage, in order to serve as a criterion for prioritizing interviews, since it was not possible to interview all agents from the 36 units.

In the IQ evaluation stage, this research used a quantitative method, employing the Survey technique and interviewing 155 subjects: top management and section heads of the UCI (6 respondents); UGV agents (149 respondents). In addition to the internal perspective (from the UCI) in measuring the normative IQ of the UCI 5th ICFEx, the sample included managers and implementers from the UGs, in order to obtain external perceptions, identifying how the normative IQ requirements of the 5th ICFEx compare to what the clients of this information perceive as satisfactory or not.

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Thus, all 36 UGs were included in the sample, comprising the managers and all implementing agents, as a way to ensure the involvement of those engaged in the administrative practices of the UGs was well represented. The interview scripts (Appendix A), along with the questionnaires, were structured to seek answers regarding the importance and influence of IQ attributes in administrative practices, as variables of the study and part of the normative IQ constructs issued by the UCI 5th ICFEx and administrative practices.

Respondents

The interviews sought the participation of the actors who issue the normative information under study, who work directly in the production of this information, in order to obtain a more robust internal perception of which normative information is most important for a UG. For the interviews with external agents, the criterion used for selecting the UGs was their expressiveness in terms of carrying out administrative activities, while still including some units with a lower volume of resource management. The interviews with the agents responsible for decisions and implementation were intended to address the need to obtain answers to qualitative aspects of the UCI's normative information from an external point of view.

Aiming to qualitatively enrich the research, three (3) retired military personnel were located, who, throughout their careers in various UGs, held administrative roles, ranging from those of implementers to those in decision-making positions in administrative areas, culminating in activities within the UCI under study. The expectation was that the experiences lived by these former UG agents and former UCI members would enrich the study.

The surveys conducted allowed for the analysis of data collected from a sample of managers and implementers in the areas of budgeting, finance, assets, and payroll across all UGs. In total, 185 questionnaires were sent out between October 15 and 30, 2020, with a response rate of 83%.

Instrument

The questionnaires (Appendix B, C, and D) consisted of questions related to the expectation and perception of IQ in four dimensions: accuracy, accessibility, relevance, and timeliness. The subject of the evaluation was the set of UCI normative instructions in relation to the practices of the UGs, within their administrative areas of operation. For the application, a 5-point Likert scale was defined as the evaluation method for the items proposed as variables under study. The respondents' familiarity with using scales from 1 to 5 became a determining factor for its use in this study, supported by the scale's reliability validation already established in previous research (Lee, Strong, Kahn & Wang, 2002). All the instruments and their questions are included in the appendices of this work.

Analysis

For the qualitative stage, the interviews conducted were analyzed using exploratory textual techniques. According to Peräkylä and Ruusuvuori (2008), exploratory techniques do not attempt to follow a rigid protocol for analysis. On the contrary, researchers read and reread the empirical material to identify key themes, verify assumptions, and describe underlying findings and meanings that constitute the cultural universe of which the text is a sample. For Denzin and Lincoln (2017), in research projects where qualitative text analysis is secondary or complementary to the main objective, and not the central focus, simple and flexible exploratory analytical methods are most appropriate.

In the quantitative stage, the data were compiled into tables using electronic spreadsheets, aiming at organization (Bettis, Gambardella, Helfat & Mitchell, 2014) for the subsequent stages. The aim was to achieve the specific objectives through strategies to obtain answers to the research question and understand the relationship between the variables (Creswell, 2010), focusing on the following proposition: Do the attributes of UCI's normative IQ influence the efficiency of UG's administrative practices?

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To this end, analyses of the collected data were performed using Microsoft Excel spreadsheets and the data analysis software Microsoft Power BI and IBM SPSS, which assisted in interpretation.

Table 2 presents the objectives, strategies, variables, constructs, and participants used in the development of the method.

Table 2

Methodological Matrix

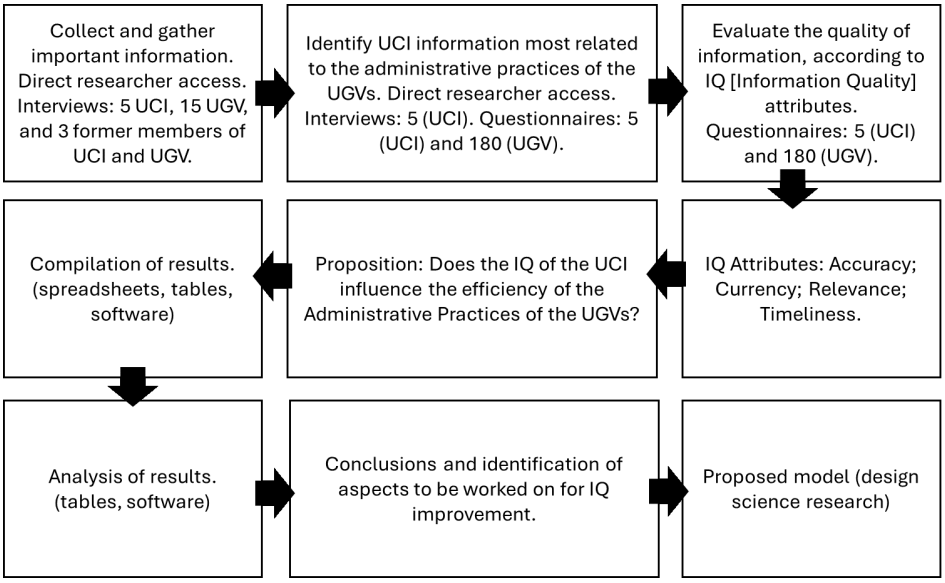
Specific Objectives	Strategies	Variables and Constructs	Invited Participants
1. Identify the set of normative information most important for administrative practices.	Direct data access: SPED System; SIAFI System; Internal UCI surveys (2019 and 2020).	Normative information; Administrative practices.	UCI: Researcher and members of the 3 involved Sections.
	Semi-structured interview (UCI, UG, and former agents of the UG and UCI).		Interview Group: UCI: Chief, Deputy Chief, Chiefs, and members of the 3 Sections that prepare normative information.
	Survey (UCI and UG).		Also: 3 reserve military personnel, former agents of various UGs, and former members of the UCI. Survey Group: UCI: Chiefs of 3 Sections. UG: Expense Authorizers and the 4 main administrative agents of the 36 UGs.
2. Measure the IQ of normative information.	Survey (UCI and UG).	Normative information; IQ Attributes: Accuracy, Accessibility, Currency, Relevance, Timeliness.	UCI: Chiefs of 3 Sections. UG: Expense Authorizers and the 4 main administrative agents of the 36 UGs.
3. Presentation of the measurement method for IQ analysis.	Method prototype.	IQ; Administrative practices.	UCI: Researcher and model development staff (IT).
4. Pre-test of the proposed method.	Initial sample environment.	IQ; Administrative practices.	UCI: Chief, Deputy Chief, Chiefs of 3 Sections, and model development staff. UG: Sample of Expense Authorizers and administrative agents of the 36 UGs.
5. Final presentation of the method.	Method for normative IQ analysis.	IQ; Administrative practices.	UCI: Chief, Deputy Chief, Chiefs of 3 Sections, and model development staff. UG: Expense Authorizers and the 4 main administrative agents of the 36 UGs.

Source: Prepared by the author

Given the objectives to be achieved, the research followed the process shown in Figure 1.

Figure 1

Research Process



Source: Prepared by the author

DOI: https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166

RESULTS

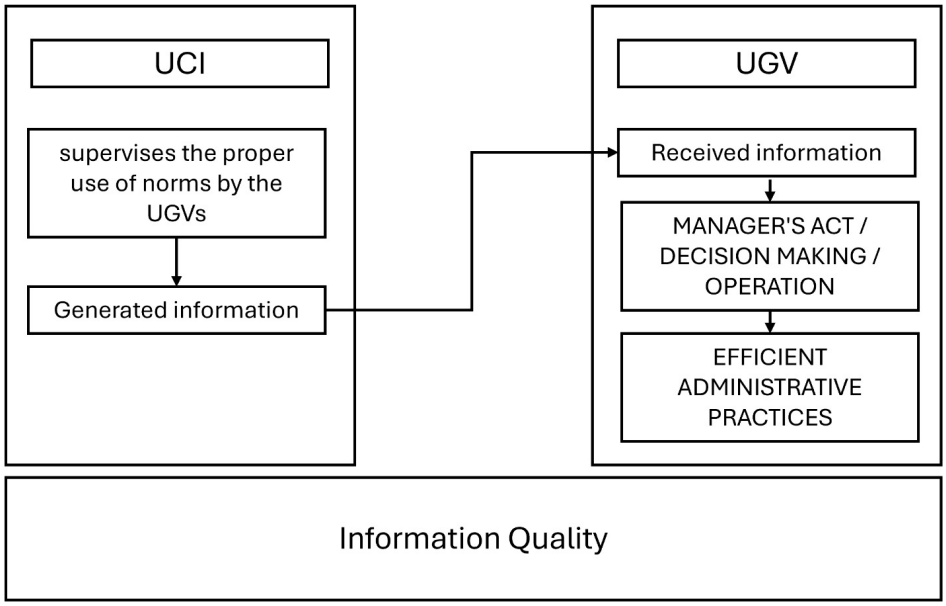
The development of the method was carried out using the strategies listed in Table 1, fulfilling the specific objectives defined in order to achieve the overall objective of the work.

Information Flow UCI x UG

Through the observation and review of the internal normative documentation of the ICU under study, corroborated by the respondents' answers, the model of the information flow between the ICU and the UG was mapped, as shown in Figure 2.

Figure 2

Information flow model Source: Prepared by the author, based on research data.



Source: Prepared by the author, based on research data.

Identification of the most important set of normative information for administrative practices

Documentary research through direct access, interviews, and the use of secondary sources allowed for the identification of the most important normative information from both internal and external perspectives. The information was identified and classified into groups to facilitate the study, as presented in Table 3.

Table 3

Normative information issued by the UCI

Normative Information	Descrição
Diligence	Document with observations on specific aspects regarding the execution of accounting, fiscal, and audit procedures of the UGs.
Informative Note	Document gathering a selection of the main subjects from administrative, accounting, and asset management areas, consolidated in an annual periodical.
Information Bulletin	Monthly document containing the main changes in legal interpretations and updates on administrative, accounting, and asset management procedures.
Opinion	Document generated by the UCI to clarify doubts raised by the UGs regarding procedures.
Message	Document that disseminates, in a general and specific manner, information on norms or procedures to be followed with urgency.

Source: Prepared by the author

DOI: https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166

In the qualitative interviews conducted, the importance of the tool was also exemplified as necessary in the response to Question 3: "What is missing, what is needed, and what is currently absent regarding IQ to improve UG practices?"

One of the responses from a UCI agent demonstrated this clearly:

> "Due to the excess of legislation we possess and the frequent updates, which demand time for reading and upskilling for those of us working with this. [...] As for difficulties, I see we have two. The biggest one is making this information accessible and understandable for the users. Another difficulty I see is ensuring that the agent who is going to execute the activities receives this information in a timely manner [...] so he needs support and guidance that is timely and legally viable" (Interviewee 02 / UCI).

Measurement of normative IQ

With the aim of understanding which attributes are most important for measuring normative IQ, an effort was made to identify the most frequently cited IQ attributes in the scientific literature. These attributes were categorized according to similar conceptual characteristics to facilitate the development of this work (Lee, Strong, Kahn & Wang, 2002; Pipino, Lee & Wang, 2002; Stvilia, Gasser, Twidale & Smith, 2007; Lee & Haider, 2013; Carretero et al., 2016; Niemi & Laine, 2016; Zárraga-Rodríguez & Álvarez, 2016; Ayyash, 2017; Arazy, Kopak & Hadar, 2017; Fidler & Lavbic, 2017; Gustaffson, 2017; Laumer, Maier & Wwitzel, 2017; Alshikhi & Abdullah, 2018; Rasool & Warraich, 2018; Mashoufi, Ayatollahi & Khorasani-Zavareh, 2019; Dewi, Azam & Yusoff, 2019; Filieri, Hofacker & Alguezaui, 2018; Saffar & Obeidat, 2020; Wilson & Campbell, 2020).

Based on the frequency of studies on IQ attributes, it was possible to identify those with the highest incidence in academic research (accuracy, relevance, accessibility, and timeliness). These attributes were corroborated by documentary searches and secondary data obtained in two surveys conducted by UCI 5th ICFEx itself, which aimed to identify improvements in IQ in the internal context, conducted in the years 2019 and 2020.

In addition, the interviews listed the same attributes as being the most important for the administrative practices of the Management Units (UG). Thus, the approach by Günther et al. (2019) was adopted regarding the use of dimensions and attributes in research, in which, according to the author, the relevance lies in knowing how to apply what best fits the model under study, regardless of the number of IQ attributes or dimensions, in line with the thinking of Lee et al. (2002) and Ladhari (2010), who also argue that the choice of dimensions in measuring IQ will depend on the type of organization, the objectives pursued, among other factors, which will determine which dimensions are most coherent for the analysis, taking into account their utility (Günther et al., 2019).

Thus, the attributes, as variables of the normative IQ construct (accuracy, relevance, accessibility, and timeliness), together with the construct administrative practices (categorization of administrative execution acts by agents in the Management Units, in the areas of application of practices: budgetary, financial, asset-related, and personnel payment) are presented in Table 4.

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Table 4
Study Variables

IQ Construct Variables (at UCI)	Description
Accuracy	Correct and error-free information.
Accessibility	Information that is easy to find.
Relevance	The information must be related to the receiver's needs.
Timeliness	Updated information available at the appropriate moment.
Administrative Practices Construct Variables (at UG)	**Description**
Budgetary acts	Execution acts related to bidding (tenders) and contracts.
Financial acts	Accounting execution acts.
Asset management acts	Control acts for movable and immovable assets.
Personnel payment acts	Execution acts for the payment of active personnel, retirees, and pensioners.
Descriptive Variables (Normative Information Types)	**Description**
Diligence	Document with observations on specific aspects regarding the execution of accounting, fiscal, and audit procedures of the UGs.
Informative Note	Document gathering a selection of the main subjects from administrative, accounting, and asset management areas, consolidated in an annual periodical.
Information Bulletin	Monthly document containing the main changes in legal interpretations and updates on administrative, accounting, and asset management procedures.
Opinion	Document generated by the UCI to clarify doubts raised by the UGs regarding procedures.
Message	Document that disseminates, in a general and specific manner, information on norms or procedures to be followed with urgency.

Source: Prepared by the author

Once the attributes had been identified and the questionnaire data collected, the results that allowed for the measurement of the IQ of the normative information of the UCI under study were extracted using Microsoft PowerBI software. The pursuit of quantitative results in IQ measurement led to the use of a graphical solution that enabled the comparison of average perception values regarding normative IQ among agents of the operational units, as gathered from the questionnaires, as well as the expectation values concerning IQ. The next section details and explains these solutions.

Presentation of the IQ management model of an ICU

Aiming to create a practical application tool (toolkit), which is expected to assist in the management of IQ involving the parties in this study (ICU and UG), it was designed to be easy for users to read and interpret. It was also established that the IQ attributes, normative information, and areas of administrative practices should be considered, not only in terms of points for improvement, but also by highlighting aspects that are already at levels of excellence, to serve as examples of best practices in IQ management.

The artifact, developed in the form of a dashboard with all the features already described, took into account the difference between expected and perceived evaluation values of the attributes (Gap) (Parasuraman, Zeithaml & Berry, 1985, 1988). The process is simple and can be implemented using free or low-cost tools, which is important for its adoption in public organizations and in emerging countries, where costs are significant barriers to technological applications.

The process, represented in Figure 3, begins with defining the area and scope of the information whose quality is to be assessed and monitored. Next, it is necessary to adapt the questionnaires to properly reference the information being evaluated. This adaptation is merely textual, to inform the user about which information and context are being assessed. The questionnaire is administered electronically, automatically integrating the collected responses into a database that will serve as a historical quality record. The calculation of indicators is performed using features of the visualization tools themselves, such as spreadsheets or BI systems. Finally, a pre-formatted model with dashboards and graphical visualizations simply receives the updated data and makes them available to managers.

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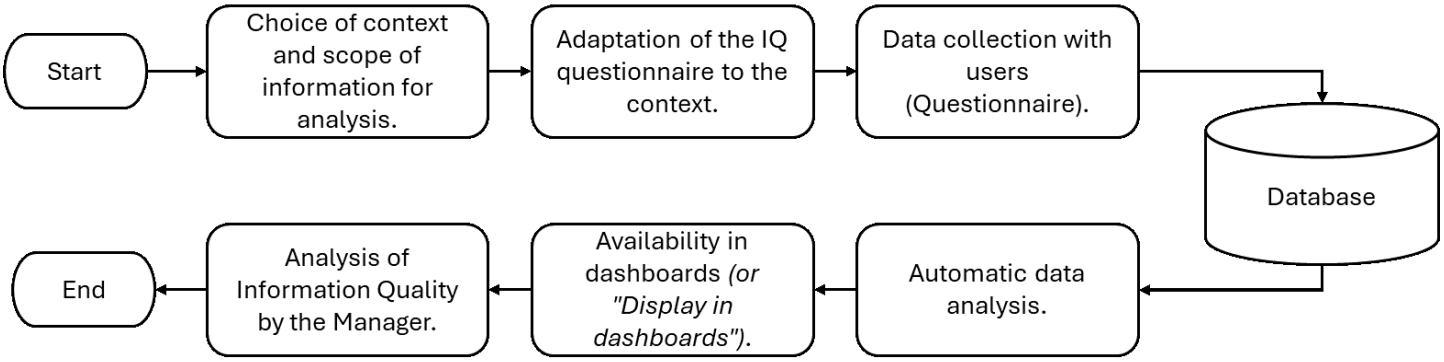
Figure 3

Stages of the information quality assessment framework (toolkit).



Source: Prepared by the author

With the use of Microsoft Power BI, three main forms of presenting the method for measuring IQ were identified, allowing for the identification of critical values and the comparison of values between different units and dimensions of perception and expectations of IQ, as shown in Figure 4, as an example to assist managers in their analysis.

Figure 4

Dashboard for IQ assessment – example

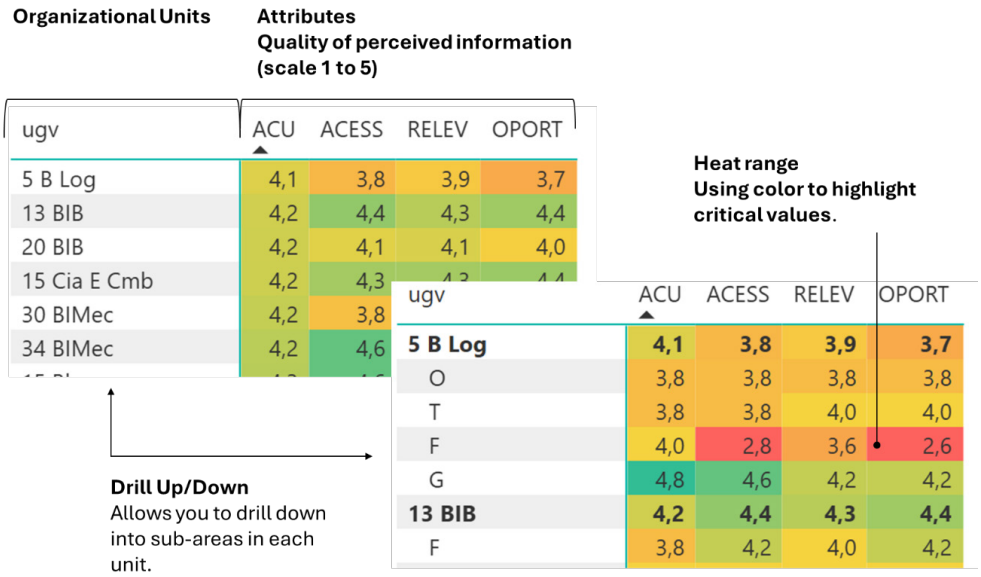
Source: Prepared by the author, based on research data.

DOI: https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166

The chart presented in Figure 5 is a Heatmap Table with Conditional Formatting, a type of hybrid visualization that is essential in Business Intelligence (BI) systems (Few, 2006). Its structure allows for assessing information quality across various organizational areas and sub-areas (rows) using four predefined quality dimensions (columns: ACU, ACESS, RELEV, OPORT). Through a graduated color scheme (heatmap) ranging from green (high/excellent values) to red/orange (low/critical values), the chart eliminates the need to read each numeric cell individually. Additionally, the hierarchical matrix format (as seen in the main rows and sub-areas) often supports Drill-Up and Drill-Down functionality, allowing users to expand or collapse data groups, observing units or drilling down into sub-areas within each unit. This gives managers the ability to instantly identify performance patterns and, more importantly, the critical values or failure points that require immediate attention (for example, the scores 2.8 and 2.6), thus facilitating agile, data-driven decision-making.

Figura 5

Heatmap table para avaliação da QI – exemplo



Source: Prepared by the author, based on research data.

The filter and cross-referencing system enables possibilities for relating data for managerial use, serving as an important facilitating tool for Information Quality (IQ) management. It allows the analysis of a single Organizational Unit (OU), all units, or a selection of them, as well as the type of normative information, and even the selection of one or more attributes for analysis. The chart shown in Figure 6 is a Radar Chart (Knaflic, 2015). In this chart, each radial axis represents an organizational unit or subarea (the categories at the perimeter, such as "13 BIB" or "5 RCC"), while the four colored lines represent the average scores of the Information Quality (IQ) dimensions for each unit: the Green line indicates Accuracy, the Black line represents Accessibility, the Red line expresses Relevance, and the Yellow line shows Timeliness. The main advantage of this visualization is the simultaneous and immediate comparison of the IQ profile of multiple units across all dimensions, transforming a complex set of metrics into an easily perceptible polygon. This benefits management by facilitating the visual identification of strengths (peaks) and, especially, weaknesses (contracted areas), such as the visibly low performance of the red and yellow lines in certain units, thereby guiding improvement actions in a strategic and efficient manner.

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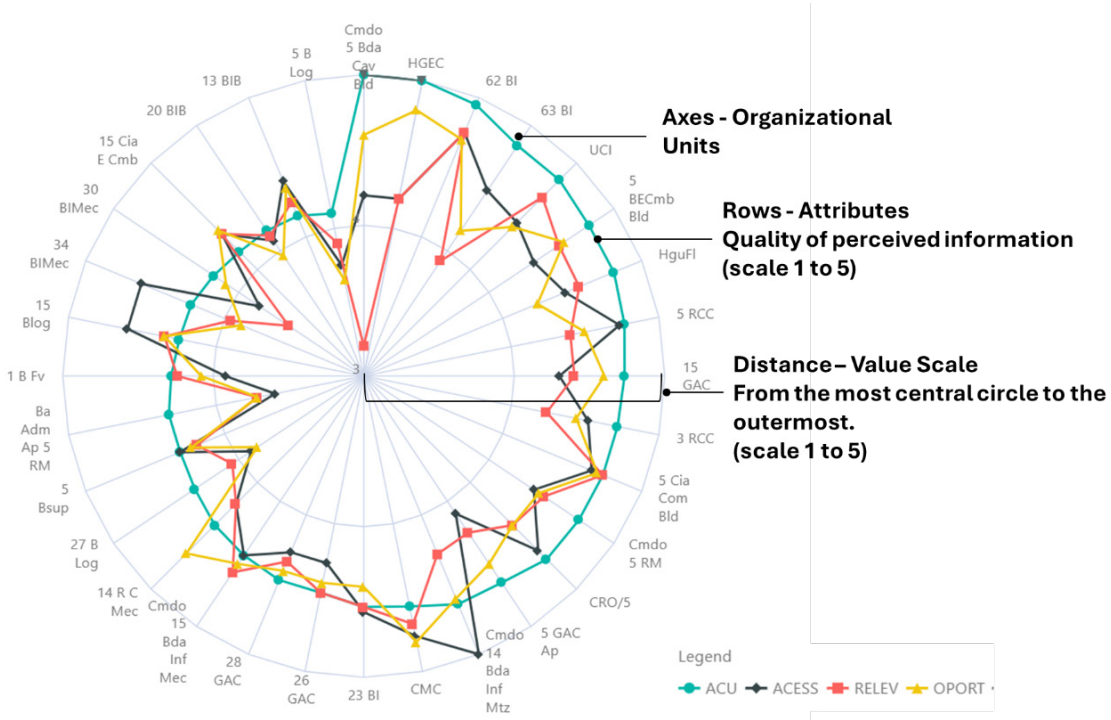
Figure 6

IQ assessment radar – example



Source: Prepared by the author, based on research data.

The chart presented in Figure 7 is a Radial Gauge Chart, a Business Intelligence (BI) dashboard visualization designed to monitor the performance of a single metric against a predefined target (Few, 2006). In this example, it was used to assess the Information Quality (IQ) of the "Informative Notes," specifically in the Accuracy attribute. The key detail lies in the comparison between the observed and expected values: the dark mark (at 4.76) indicates the expected Accuracy score for the Informative Notes, while the filled bar (cyan/aqua green), which points to 4.52, represents the observed Accuracy value. This visualization instantly communicates that the accuracy of the Informative Notes (4.52) falls short of the organization's expectation (4.76), signaling the need for managerial attention.

Figure 7

Dashboard highlighting the Gauge Chart for IQ assessment – example

Source: Prepared by the author, based on research data.

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It is important to note that other software may be used, taking into account the same criteria defined during the development of the method, such as the identification of the most important attributes, the information to be analyzed, and the use of data collected through the administered questionnaires. The literature points to several low-cost or free options, which can be chosen according to the technical capabilities and specific needs of each organization (Mgbame et al., 2022). It is expected that, in the form of this dashboard example and its possible uses, it will be useful in the proposal to manage the ICU's IQ and will have a positive impact on the practices of the UGs. However, it should be emphasized that the aspects observed at this time may not be the same in the future, thus requiring IQ management that takes these observations into account. Additionally, it is considered relevant to conduct a pre-test on a smaller scale prior to the use of the method.

Validation of the IQ assessment method

Aiming to create a practical application tool, the method underwent validation through a pre-test of the indicator panel, the phases and methodologies of which are detailed in Table 5.

Table 5

Application and validation of the prototype method for the analysis of normative IQ

Phase	Methodology	Participants
Dashboard refinement	Refinement of the indicator panel	UCI: Researcher and model development staff (IT)
Pre-test of the proposed method	Application of the panel in an initial sample environment	UCI: Chief, Deputy Chief, Chiefs of 3 Sections, and model development staff. UGV: Sample of Expense Authorizers and administrative agents of the 36 UGVs
Final presentation of the dashboard	Presentation of all developed material and panel tests	UCI: Chief, Deputy Chief, Chiefs of 3 Sections, and model development staff. UGV: Expense Authorizers and the 4 main administrative agents of the 36 UGVs

Fonte: Elaborado pelo autor.

The practical validation tests of the tool were carried out at three levels. Even before this validation, five additional internal tests were conducted, aiming for a preliminary informal critical assessment by two Section Chiefs of the UCI—one with a background in Accounting and Administration, and the other in Statistics. The feedback provided by these two Section Chiefs regarding the functioning of the Framework during the initial tests was extremely important for making improvements to certain aspects of the dashboard presentation, as well as for a better interpretation of some of the criteria within the tool's dimensions in its practical application with the UGV. Next, the practical validation initially took place at the UCI's Chief level. After approval at this level, the validation moved to the execution level within the UCI itself, which, upon its approval, submitted it to the units that receive regulatory information. The managers of these units were formally requested, through a circular letter, to evaluate the use of the Framework. The evaluation was unanimously positive, with the most common reasons cited being the increased clarity and objectivity in administrative information.

During the validation of the method, as a contribution resulting from the dashboard presentation, it was possible to observe from the participants the possibility of identifying feedback from the UGV agents regarding their perceptions about the normative IQ of the UCI:

> "what's interesting is that, with this material, we can see that we can find out what the units think about our newsletters" (MJC – Participant 03 / UCI)

Participants also highlighted their satisfaction with the graphical presentation of the indicators, combined with the various breakdown

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options provided by the dashboard, which offers important insights and assists in the qualitative analysis of the IQ:

> "some observations drawn from the panel pointed to the need for an investigation by us, from internal control, in order to understand what is happening in that unit" (WSA - Participant 02 / UCI)

DISCUSSION

The development of the Information Quality (IQ) assessment framework took into account the processes and technologies necessary for a practical implementation of a business intelligence system to monitor IQ. The framework was developed based on two main theoretical perspectives. The first is the Gap Theory between expectation and perception, developed by authors such as Teas (1993), Parasuraman, Zeithaml, and Berry (1985, 1988), who proposed models to measure quality from the user's point of view. Applying this theory enables the framework to diagnose the discrepancy between the quality expected and the perceived quality by managers, expanding the understanding of the role of IQ in decision-making environments. The second strand is Information Quality Management and Assessment, which defines the dimensions and attributes of the concept. The artifact is based on seminal studies by Wang and Strong (1996), Strong et al. (1997), Lee, Strong, Kahn, and Wang (2002), and Pipino, Lee, and Wang (2002), using as its pillars the four attributes frequently cited: accuracy (intrinsic dimension), accessibility (accessibility dimension), relevance, and timeliness (contextual dimensions). The combination of these perspectives (user perception and IQ attributes) lends scientific rigor to the framework, which was constructed using the Design Science Research methodology. All the aspects raised, the attributes identified as most relevant, as well as the results obtained after the application and analysis of the data, were considered for the proposition of the tool (Günther et al., 2019) and in the development of the method. In the end, a dashboard was suggested, capable of providing the ICU manager with a technical, objective presentation, yet with a user-friendly and easily interpreted visual interface, allowing observations of perceptions on IQ aspects, offering the necessary support to control the quality levels that normative information in an ICU must have (Chiamenti & Santos, 2013).

Replicability

Using the Design Science Research method, replicability of the proposed artifact was also sought, since the conception, solution-seeking, and evaluation followed an iterative process between theory and practical application. The process articulated between theory and practice allows for instantiations based on general (theoretical) principles that can be used in other contexts, mainly due to the theoretical and methodological foundation focused on the user and the context of use, rather than the specific nature of the organization or the data. The core of the method lies in measuring the discrepancy (Gap) between the information quality expected and that perceived by managers. This methodology, based on the theory of the difference between expectation and perception of quality, is universal, applying to any situation where there is an "information consumer" and a "producer." User perception and satisfaction depend on the value the information presents in their decision-making context. In this way, it is possible to replicate the method in different types of organizations and users, both internal and external to the organizations, at different levels. Thus, it is possible to evaluate, for example, the information quality perceived by suppliers, clients, citizens, executives, frontline employees, vendors, or any other actor who has a relationship as an information user. The study also used four IQ attributes widely recognized and cited in the academic literature: accuracy, accessibility, relevance, and timeliness. These attributes have been studied in the literature and considered relevant in various organizational contexts (logistics, finance, retail, public administration, government agencies, associations, etc.) and are applicable to virtually any type of information that supports decision-making, whether normative (as in this study), technical, operational, tactical, or strategic. It is also possible to expand the set of attributes according to the existing literature or that yet to be produced,

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allowing the adaptation, updating, and modernization of the framework. In other contexts, such as artificial intelligence systems, attributes such as understandability, interpretability, or the reliability of the data source may be relevant, allowing the development of new dimensions. The successful implementation of the IQ framework required, beyond methodological aspects, effective structural and functional support. Large public organizations, such as the Brazilian Army and the Federal Court of Accounts at the federal level, or corresponding structures at the state and municipal spheres, generally have internal sectors dedicated to training and developing human resources. Such structures become crucial allies in change management, facilitating the transition to new systems and methodologies with lower costs and impact during transformation. In the context of this study in a military organization, visible and ongoing support from top management and the active involvement of management and functional areas (UCI and UGV) were critical factors for acceptance and practical validation of the assessment method, overcoming cultural barriers and ensuring that the framework was perceived as a management tool and not just a technical performance indicator. Finally, the article demonstrated how the framework is implemented as a toolkit (practical application tool) and a low-cost business intelligence system, built with a focus on simplicity, adaptability, and scalability. The replication process requires only textual adaptation of the questionnaires to reference the new context and the new information. These questionnaires are available in Appendices B, C, and D. The article also offers a guide for replication, which can be found in Appendix F, covering everything from adapting the questions to calculating indicators and graph suggestions.

Technical limitations

The most practical and technical limitations in replicating the framework stem primarily from the restriction of IQ attributes. The study focused on four dimensions (accuracy, accessibility, relevance, and timeliness), which may be insufficient for more complex or technical contexts, such as raw sensor data or information that is ambiguous and highly dependent on the context of interpretation, such as informal market information. Another operational issue is the need for pre-testing and calibration. Before large-scale adoption, it is essential to carry out a pilot test in a limited setting to ensure that the data collection instrument is finely tuned to the new information and the specificities of the new organization. Finally, although the method is adaptable, the specific nature of the information requires managers to carefully adapt the questions among users to maintain the validity and relevance of the results in the new context of application.

From a managerial standpoint, the barriers to the framework's success are associated with the classic variables of change related to organizational culture and user engagement. The effectiveness of the method depends on agents' perceptions and feedback, making it vulnerable to cultures with low adherence to internal surveys or resistance to change. To mitigate this risk, top management support is non-negotiable; leadership must actively demonstrate the value of the initiative and use the results to make concrete decisions about resource allocation and continuous improvement. It is also vital to promote active user involvement in the development and communication of the results, going beyond mere data collection. Clear and effective communication of the evaluation's objectives must convey the practical benefits of the framework for the daily work of managers and staff, ensuring they understand how improving IQ benefits them, and not just the system or top management. Failure in these aspects of leadership and change management undermines the validity of the data and, consequently, the sustainability of the artifact.

Recommendations for Future Research

The recommendations for future research suggest including performance measures and verifying the relationship between IQ and performance. It is also suggested to observe and analyze the application of the method presented in this study in order to attest to its effectiveness after being put into use. Future research should focus on expanding and integrating the IQ framework with Artificial Intelligence (AI) and intelligent agents. Investigating how the application

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of AI can automate continuous IQ monitoring, predict failures, and integrate the assessment of user-centered IQ attributes (such as relevance and accessibility) with the technical requirements of AI systems, like interpretability and reliability. This intelligence cycle aims to establish a more robust, timely IQ management cycle that maximizes the value of information in the decision-making process.

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APPENDIX A

Interview Script (UCI perception and UGV perception)

Objective: Identify the normative information from the UCI that is most important for the UGVs.

Interview aimed at collecting data to support research on the Quality of Normative Information from the 5th ICFEX, considering the pursuit of improved administrative practices of the UGVs (in the budgetary, financial, patrimonial, and personnel payment areas).

Target audience for application:

UCI: Chief and Deputy Chief of the 5th ICFEx; Chiefs of the 1st, 2nd, and 3rd Sections of the UCI.

UGV: Sample of Expenditure Authorizing Officers from the 36 UGVs, selected according to unit type and similarity of administrative functions.

Respondent information (UGV):

- Full name:
- Current position:
- Time in position:
- Length of service:
- Education level:

Questions

1. Do you consider the UCI's normative information important for the UGV manager?

2. Which normative information do you consider most important to support the administrative acts of the UGVs in the budgetary, patrimonial, financial, and personnel payment dimensions?

3. Do you believe that the UGV manager uses normative information to support administrative acts? How frequently?

4. Do you adopt, as a standardized model, the use of UCI-issued guidance regarding an administrative practice, for similar future administrative practices in the UGV?

5. Do you consider that when a UGV manager performs a practice that is not compliant with normative guidelines, this is related to missing or inaccessible normative information?

6. How do you assess the current situation of the information quality (IQ) in documents issued by the UCI for administrative use by the UGVs?

7. Which aspects of UCI normative IQ do you consider most important for UGV administrative practices?

8. Do you believe any UCI normative information is not transmitted to the UGV but should be, due to its importance for administrative acts?

9. Do you suggest any improvement opportunities, criticisms, or comments about UCI normative information for the UGVs?

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APPENDIX B
Questionnaire 1 (UGV perception)

Objective: Identify the normative information from the UCI that is most important for the UGVs.

This questionnaire aims to collect data supporting research on the Quality of Normative Information from the 5th ICFEX, considering improvements in the administrative practices of the UGVs (budgetary, financial, patrimonial, and personnel payment areas).

Target audience:

UGV: Expenditure Authorizing Officer, Administrative Inspector, Chief of the Procurement and Contracts Section, Head of the Financial Sector, and Chief of the Personnel Payment Section of the 36 UGVs.

Respondent Data:

Full name:
Current position:
Time in position: ___ years
Length of service: ___ years
Age: ___ years
Education level:
a. High School
b. Higher Education
c. Postgraduate

Normative information issued by the UCI to the UGVs

Normative Information	Description
Diligences	Document (MSG SIAFI or DIEx) with individualized observations to the UGVs regarding specific aspects of accounting, inspection, and auditing procedures
Informative Note	Typically annual document compiling major topics in administrative, accounting, and patrimonial areas
Informative Bulletin (B Info)	Monthly document with major changes in legal interpretations and updates in administrative, accounting, and patrimonial procedures
Opinion	Document generated by the ICFEx responding to UGV queries in memorandum format, with appraisal by the Expenditure Authorizing Officer
Message	Circular document (MSG SIAFI or DIEx) disseminating general information on norms or procedures to be followed

Questions:

1. In the normative information issued to the UGV, considered most important for supporting administrative actions in terms of budget, assets, finances, and personnel payments, indicate for each one its level of importance for UGV actions, using a scale from 1 to 5:

Five-point Likert scale for importance

1 - Unimportant: The lowest level of importance.

2 - Somewhat unimportant: A low level of importance, but not the lowest.

3 - Important: The neutral middle point.

4 - Very important: A high level of importance.

5 - Extremely important: The highest level of importance.

Q1: For the actions of my UGV, the information contained in the Notices of Inquiry issued to the UGV regarding accounting, oversight, and auditing matters is:

Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
○	○	○	○	○

Q2: For the actions of my UGV, the information from Informative Notes issued and made available for access by the UGV is:

Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
○	○	○	○	○

Q3: For the acts of my UGV, the information from Information Bulletins issued and made available for access by the UGVs is

Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
○	○	○	○	○

Q4: For the acts of my UGV, the information from Opinions on specific inquiries made by the UGVs [is of]:

Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
○	○	○	○	○

Q5: For the acts of my UGV, the information from Messages disseminating norms and interpretations issued and made available for access by the UGVs [is of]:

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Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
○	○	○	○	○

2. . In addition to these, please cite (if any) up to 3 other pieces of **Normative Information** sent by the 5th ICFEx considered important to substantiate the administrative practices of the UG.

Normative Information	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
	○	○	○	○	○
	○	○	○	○	○
	○	○	○	○	○

3. Is there any **Normative Information** that you believe is necessary and important for the administrative acts of the UGV that is **not** made available by the 5th ICFEx?

_____

_____

Is there any **Normative Information** that you believe is necessary and important for the administrative acts of the UGV that is **not** made available by the 5th ICFEx?

Budgetary Area (Acquisitions, Bidding, and Contracts Section)

Normative Information	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
Q6: Diligences issued to the UGV on accounting, inspection, and auditing aspects.	○	○	○	○	○
Q7: Informative Notes issued and made available for UGV access.	○	○	○	○	○
Q8: Information Bulletins issued and made available for UGV access.	○	○	○	○	○
Q9: Opinions on specific inquiries made by the UGVs.	○	○	○	○	○
Q10: Messages disseminating norms and interpretations issued and made available for access by the UGVs.	○	○	○	○	○

Financial Area (Financial Sector / Treasury)

Normative Information	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
Q11: Diligences issued to the UGV on accounting, inspection, and auditing aspects.	○	○	○	○	○
Q12: Informative Notes issued and made available for UGV access.	○	○	○	○	○
Q13: Information Bulletins issued and made available for UGV access.	○	○	○	○	○
Q14: Opinions on specific inquiries made by the UGVs.	○	○	○	○	○
Q15: Messages disseminating norms and interpretations issued and made available for access by the UGVs.	○	○	○	○	○

Asset Management Area (Administrative Inspection)

Normative Information	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
Q16: Diligences issued to the UGV on accounting, inspection, and auditing aspects.	○	○	○	○	○
Q17: Informative Notes issued and made available for UGV access.	○	○	○	○	○
Q18: Information Bulletins issued and made available for UGV access.	○	○	○	○	○
Q19: Opinions on specific inquiries made by the UGVs.	○	○	○	○	○
Q20: Messages disseminating norms and interpretations issued and made available for access by the UGVs.	○	○	○	○	○

Personnel Payment Area (Active Personnel, Retirees, and Pensioners Payment Section)

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Normative Information	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
Q21: Diligences issued to the UGV on accounting, inspection, and auditing aspects.	○	○	○	○	○
Q22: Informative Notes issued and made available for UGV access.	○	○	○	○	○
Q23: Information Bulletins issued and made available for UGV access.	○	○	○	○	○
Q24: Opinions on specific inquiries made by the UGVs.	○	○	○	○	○
Q25: Messages disseminating norms and interpretations issued and made available for access by the UGVs.	○	○	○	○	○

5. Regarding the importance of the normative information of the 5th ICFEx in the decisions of the OD and its importance in administrative practices, do you have any considerations to add that are not addressed in this questionnaire?

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APPENDIX C
Questionnaire 2 (UCI perception and UGV perception)

Objective: Identify the attributes that most affect the Quality of Normative Information of the 5th ICFEx transmitted to the UGVs.
This questionnaire aims to conduct data collection to support research on the Quality of Normative Information of the 5th ICFEx, considering the pursuit of improvement in the administrative practices of the UGVs (in the budgetary, financial, asset management, and personnel payment areas).
Invited Participants: UCI: Chiefs of the 1st, 2nd, and 3rd Sections of the UCI. UGV: Expense Authorizers, Administrative Inspectors, Chiefs of the Bidding and Contracts Section, Heads of the Financial Sector, and Chiefs of the Personnel Payment Section of the 36 UGVs.

Respondent Data

UGV:|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|
_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|
Full name:
Current position:
Time in position: ___ years
Length of service: ___ years
Age: ___ years
Education level:
a. High School
b. Higher Education
c. Postgraduate

Quality Attributes of UCI Normative Information defined for the study

Attribute	Correct and error-free information.
Accuracy	Information that is easy to find.
Accessibility	The information must be related to the receiver's needs.
Timeliness	Updated information available at the appropriate moment.

1. Questions:

1. Regarding these attributes of the quality of the information, evaluate how you consider them to be, if more absent or more present, in the following normative information listed, considering the application under the budgetary, patrimonial, financial and personnel payment aspects. Check option 1 to 5 for each of the attributes in each type of normative information issued by the 5th ICFEx (1 strongly disagree and 5 strongly agree).

[Regarding Diligences issued to the UGV...]*:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qa1: The information is correct and free of errors.	○	○	○	○	○
Qa2: The information is easy to find.	○	○	○	○	○
Qa3: The information is related to the receiver's needs.	○	○	○	○	○
Qa4: The information is up-to-date and available at the appropriate time.	○	○	○	○	○

Regarding the Informative Notes issued and made available for UGV access:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qb1: The information is correct and free of errors.	○	○	○	○	○
Qb2: The information is easy to find.	○	○	○	○	○
Qb3: The information is related to the receiver's needs.	○	○	○	○	○
Qb4: The information is up-to-date and available at the appropriate time.	○	○	○	○	○

Regarding the Information Bulletins issued and made available for UGV access:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qc1: The information is correct and free of errors.	○	○	○	○	○
Qc2: The information is easy to find.	○	○	○	○	○
Qc3: The information is related to the receiver's needs.	○	○	○	○	○
Qc4: The information is up-to-date and available at the appropriate time.	○	○	○	○	○

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Regarding the Opinions on specific inquiries made by the UGVs:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qd1: The information is correct and free of errors.	○	○	○	○	○
Qd2: The information is easy to find.	○	○	○	○	○
Qd3: The information is related to the receiver's needs.	○	○	○	○	○
Qd4: The information is up-to--date and available at the appropriate time.	○	○	○	○	○

Regarding Messages disseminating norms and interpretations issued and made available for access by the UGVs:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qe1: The information is correct and free of errors.	○	○	○	○	○
Qe2: The information is easy to find.	○	○	○	○	○
Qe3: The information is related to the receiver's needs.	○	○	○	○	○
Qe4: The information is up-to-date and available at the appropriate time.	○	○	○	○	○

2. In general, please indicate how you perceive the quality of normative information from the 5th ICFEx (where 1 is Strongly Disagree and 5 is Strongly Agree):

	Strongly Disagree 1	2	3	4	Strongly Agree 5
Statement: In general, the normative information from the 5th ICFEx is of maximum quality.	○	○	○	○	○

3. In the areas below, indicate your perception of the importance of the quality of normative information issued by the 5th ICFEX, considering a scale of 1 to 5 (where 1 is no importance and 5 is maximum importance in the administrative acts of the area).

Perception of importance for the Budgetary Area (Chief of Acquisitions, Bidding, and Contracts)	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
Qf1: ICFEX Information being correct and free of errors.	○	○	○	○	○
Qf2: ICFEX Information being easy to find.	○	○	○	○	○
Qf3: ICFEX Information being related to the receiver's needs.	○	○	○	○	○
Qf4: ICFEX Information being up-to-date and available at the appropriate time.	○	○	○	○	○

Perception of importance for the Asset Management Area (Administrative Inspector)	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
Qg1: ICFEX Information being correct and free of errors.	○	○	○	○	○
Qg2: ICFEX Information being easy to find.	○	○	○	○	○
Qg3: ICFEX Information being related to the receiver's needs.	○	○	○	○	○
Qg4: ICFEX Information being up-to-date and available at the appropriate time.	○	○	○	○	○

Perception of importance for the Financial Area (Head of Financial Sector / Treasurer)	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
Qh1: ICFEX Information being correct and free of errors.	○	○	○	○	○
Qh2: ICFEX Information being easy to find.	○	○	○	○	○
Qh3: ICFEX Information being related to the receiver's needs.	○	○	○	○	○
Qh4: ICFEX Information being up-to-date and available at the appropriate time.	○	○	○	○	○

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Perception of importance for the Personnel Payment Area (Chief of SPP / Chief of SIP)	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
Qi1: ICFEX Information being correct and free of errors.	◯	◯	◯	◯	◯
Qi2: ICFEX Information being easy to find.	◯	◯	◯	◯	◯
Qi3: ICFEX Information being related to the receiver's needs.	◯	◯	◯	◯	◯
Q4: A ICFEX information being updated and available at the appropriate time.	◯	◯	◯	◯	◯

4. Regarding the quality of the normative information of the 5th ICFEx and its importance in the acts of the OD and in the administrative practices of the UGV, do you have any considerations to add that are not addressed in this questionnaire?

DOI: https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166

APPENDIX D
Questionnaire 3 (UCI and UGV perception)

Objective: Identify the perception of the UCI and the UGVs regarding the ideal degree of the attributes that most affect the Quality of Normative Information of the 5th ICFEx.

This questionnaire aims to conduct data collection to support research on the Quality of Normative Information of the 5th ICFEx, considering the pursuit of improvement in the administrative practices of the UGVs (in the budgetary, financial, asset management, and personnel payment areas).

Invited Participants: UCI: Chiefs of the 1st, 2nd, and 3rd Sections of the UCI. UGV: Expense Authorizers, Administrative Inspectors, Chiefs of the Bidding and Contracts Section, Heads of the Financial Sector, and Chiefs of the Personnel Payment Section of the 36 UGVs.

Respondent Data

UGV:|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|
_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|
Full name:
Current position:
Time in position: ___ years
Length of service: ___ years
Age: ___ years
Education level:
a. High School
b. Higher Education
c. Postgraduate

Quality Attributes of UCI Normative Information defined for the study

Attribute	Description
Accuracy	Correct and error-free information.
Accessibility	Information that is easy to find.
Timeliness	Updated information available at the appropriate moment.

UCI Normative Information issued to the UGVs

Normative Information	Description
Diligences	Document (SIAFI MSG or DIEx) with individualized observations to the UGVs regarding specific aspects of the execution of accounting, inspection, and auditing procedures of the UGVs.
Informative Note	Document, normally with annual periodicity, gathering a selection of the main subjects from administrative, accounting, and asset management areas, consolidated in an annual periodical.
Information Bulletin (B Info)	Monthly document containing the main changes in legal interpretations and updates on administrative, accounting, and asset management procedures.
Opinion	Document generated by the ICFEx in response to doubts from the UGVs sent via consultation in memorandum format, with the appraisal of the Expense Authorizer (OD).
Message	Circular document (SIAFI MSG or DIEx) that disseminates, in a general manner, information on norms or procedures to be followed.

1. Questions:

1. Regarding these information quality attributes, considering your experience and expectation of use for the application areas in the administrative practices of the UGV, what is your perception regarding the minimum expected degree, considering 1 as Strongly Disagree and 5 as Strongly Agree.

Regarding Diligences issued to the UGV on accounting, inspection, and auditing aspects:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qp1: I expect the information to be correct and free of errors.	○	○	○	○	○
Qp2: I expect the information to be easy to find.	○	○	○	○	○
Qp3: I expect the information to be related to the receiver's needs.	○	○	○	○	○
Qp4: I expect the information to be up-to-date and available at the appropriate time.	○	○	○	○	○

Regarding Informative Notes issued and made available for UGV access:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qq1: I expect the information to be correct and free of errors.	○	○	○	○	○
Qq2: I expect the information to be easy to find.	○	○	○	○	○
Qq3: I expect the information to be related to the receiver's needs.	○	○	○	○	○
Qq4: I expect the information to be up-to-date and available at the appropriate time.	○	○	○	○	○

DOI: https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166

Regarding Information Bulletins issued and made available for UGV access:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qr1: I expect the information to be correct and free of errors.	◯	◯	◯	◯	◯
Qr2: I expect the information to be easy to find.	◯	◯	◯	◯	◯
Qr3: I expect the information to be related to the receiver's needs.	◯	◯	◯	◯	◯
Qr4: I expect the information to be up-to-date and available at the appropriate time.	◯	◯	◯	◯	◯

Regarding Opinions on specific inquiries made by the UGVs:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qs1: I expect the information to be correct and free of errors.	◯	◯	◯	◯	◯
Qs2: I expect the information to be easy to find.	◯	◯	◯	◯	◯
Qs3: I expect the information to be related to the receiver's needs.	◯	◯	◯	◯	◯
• Qs4: I expect the information to be up-to-date and available at the appropriate time.	◯	◯	◯	◯	◯

Regarding Messages disseminating norms and interpretations issued and made available for access by the UGVs:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Qt1: I expect the information to be correct and free of errors.	◯	◯	◯	◯	◯
Qt2: I expect the information to be easy to find.	◯	◯	◯	◯	◯
Qt3: I expect the information to be related to the receiver's needs.	◯	◯	◯	◯	◯
Qt4: I expect the information to be up-to-date and available at the appropriate time.	◯	◯	◯	◯	◯

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APPENDIX E
Termo de Consentimento Livre e Esclarecido

CONSENTIMENTO DE PARTICIPAÇÃO

INFORMED CONSENT FORM
CONSENT TO PARTICIPATION

I, _____ _____, the undersigned, agree to participate in the present study as a participant. The researcher informed me about everything that will happen in the research, what I will have to do, including the possible risks and benefits involved in my participation. The researcher assured me that I can leave the research at any time, without giving any explanation, and that this decision will not bring me any kind of penalty.

Place and date: _____ _____
Name:_____ _____
Participant's Signature: _____ _____
Contact phone/email: _____ _____
Name of Controller:
Contact:

DOI: https://doi.org/10.14210/alcance.v32n3(set/dez).p130-166

APPENDIX F

Guide to Artifact Replication

Step 1 – Definition of the information to be evaluated

Based on interviews and meetings with the user group, it is necessary to identify what types of information will be analyzed. Some types of information, for example: customer records, operational standards, tables of values or indexes, internal reports, external data from customers or suppliers. It is recommended to choose a maximum of five types of information. For each type, ten questions will be asked, four of which are about the evaluation of attributes, four about the importance of attributes and two about the importance of information. Therefore, a large number of types of information will generate a large set of questions, making it difficult for users to apply and accept.

PStep 2 – Adaptation of Questionnaire 1 - perception of the importance of information

This questionnaire evaluates the perception of the importance of information for the activities of a sector or area of the organization. In it, it is necessary to describe each type of information that will be evaluated and present questions to assess the importance of the information for the sector or user. The information will be rated on a scale of 1 to 5.

Example:

Q1: For my role, taxpayer information has:

Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
□	□	□	□	□

You must repeat this block for each type of information that you choose for evaluation.

Step 3 – Adaptation of Questionnaire 2 – perception of the quality of the information

Questionnaire 2 aims to evaluate each type of information chosen in the four attributes (Chart 1) and to identify the degree of importance of each attribute. It is made up of three sections.

Accuracy	Correct and error-free information.
Accessibility	Information that is easy to find.
Relevance	The information must be related to the receiver's needs.
Timeliness	IUpdated information available at the appropriate moment.

In the first section, it is necessary to indicate the type of information that will be evaluated in each block of attributes, as in the example below:

Regarding the information of taxpayers:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Q2.1: The information is correct and error-free	□	□	□	□	□
Q2.2: Information is easy to find	□	□	□	□	□
Q2.3: The information is related to the needs of the receiver/user.	□	□	□	□	□
Q2.4: The Information is updated and available at the appropriate time	□	□	□	□	□

It is not recommended to change the wording of the questions, as they come from scientifically validated instruments and were designed to capture the dimensions evaluated. Some adjustments can be made to specify a specific system or type of technology being used. For instance:

Q2.2: The Information is easy to find in the email system.

Neste caso, especifica-se um sistema onde está a informação que se deseja avaliar de forma mais específica.

In this case, a system is specified where the information that is to be evaluated more specifically is located.

In the second section there is a question (Q2.5) that evaluates the level of general quality, used as an additional indicator for the set of attributes. Adaptation must be made to the context and type of information chosen, maintaining the same nomenclature. For instance:

In general, mark how you perceive the quality of taxpayer information: (1 totally disagree and 5 totally agree):

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	Strongly Disagree 1	2	3	4	Strongly Agree 5
Q2.5In general, the information of taxpayers is of the highest quality.	□	□	□	□	□

In the third section, the importance of each information quality attribute is evaluated. This step is very important because its crossing with other information allows you to identify priority areas, helping the planning of quality actions. For instance:

In the quality dimensions below, indicate your perception of the importance of the quality of taxpayer information, considering a scale of 1 to 5 (1 of no importance and 5 of maximum importance in administrative acts in the area).

Perception of importance	Unimportant 1	Somewhat unimportant 2	Important 3	Very important 4	Extremely important 5
Q2.6: The Information being correct and free of errors.	□	□	□	□	□
Q2.7: The Information being easy to find.	□	□	□	□	□
Q2.8: The Information being related to the receiver's/user's needs.	□	□	□	□	□
Q2.9: The Information being up-to-date and available at the appropriate time.	□	□	□	□	□

Finally, it is recommended to display an open-ended question, to capture comments, suggestions, and other insights that users deem relevant.

Step 4 – Adaptation of Questionnaire 3 - expected perception of the quality of the information

Questionnaire 3 captures users' expectations regarding information quality attributes. The investigation of the expectation is important to weigh the level of perceived quality, allowing a more detailed view of the problems from the user's point of view. For instance:

Regarding these attributes of the quality of the information, considering your experience and expectation of use, what is your perception of the minimum degree expected, considering 1 as totally disagree and 5 as totally agree.

Regarding information on defaulting taxpayers:	Strongly Disagree 1	2	3	4	Strongly Agree 5
Q3.1: I expect the information to be correct and free of errors.	□	□	□	□	□
Q3.2: I expect the information to be easy to find.	□	□	□	□	□
Q3.3: I expect the information to be related to the receiver's/user's needs.	□	□	□	□	□
Q3.4: I expect the information to be up-to-date and available at the appropriate time.	□	□	□	□	□

Step 5 – Data collection

Adapted questionnaires must be sent to users so that they can be answered. It is recommended to use anonymity, without identifying the respondent, whenever possible. Anonymity protects privacy and tends to provide more honest answers in hierarchical power environments. It is also recommended to use online tools, whenever possible, to speed up the distribution, collection, and processing of responses. In the case of unidentified questionnaires, it is important that the three instruments are grouped into a single document or session, in order to maintain the connection of the respondent's data.

It is important that the data collected be stored in a reliable database for later retrieval and comparison with future studies. Precautions with privacy and legal aspects must be verified with the competent departments of the public or private organization.

Step 6 – Calculation of indicators

The data should be calculated using the averages of the values collected and calculating the weighted indicators of expectation, importance and quality. Below we detail each of these data for each type of information and area of the organization evaluated.

1. Level of **importance of information**:

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1. Calculation: average of Q1
2. Perceived information quality
    1. Average Calculation of Questions:
        1. Q2.1: The information is correct and error-free.
        2. Q2.2: The information is easy to find.
        3. Q2.3: The information is related to the needs of the receiver/user.
        4. Q2.4: The Information is updated and available at the appropriate time.
        5. Q2.5In general, the information is of the highest quality.
3. Importance of information quality
    1. Calculation: average of the questions:
        1. Q2.6: The Information is correct and error-free.
        2. Q2.7: The information is easy to be found.
        3. Q2.8: The information be related to the needs of the receiver/user.
        4. Q2.9: The Information is updated and available at the appropriate time.
4. Expected information quality
    1. Calculation: average of the questions:
        1. Q3.1: I hope the information is correct and error-free
        2. Q3.2: I hope the information is easy to be found
        3. Q3.3: I hope the information will be related to the needs of the receiver/user.
        4. Q3.4: I expect the Information to be updated and available at the appropriate time.
5. Expected vs Perceived Quality (GAP)
    1. Calculation: average of the differences between Expected Quality - Perceived Quality
        1. Q3.1 - Q2.1: The Information is correct and error-free.
        2. Q3.2 - Q2.2: Information is easy to find.
        3. Q3.3 - Q2.3: The information be related to the needs of the receiver/user.
        4. Q3.4 - Q2.4: The Information is updated and available at the appropriate time.
6. Importance of Expected vs Perceived Quality
    1. Calculation: average of the differences between Expected Quality - Perceived Quality, multiplied by Quality Importance
        1. (Q3.1 - Q2.1) * Q2.5: The Information is correct and error-free.
        2. (Q3.2 - Q2.2) * Q2.6: Information is easy to find.
        3. (Q3.3 - Q2.3) * Q2.7: The information be related to the needs of the receiver/user.
        4. (Q3.4 - Q2.4) * Q2.8: The Information will be updated and available at the appropriate time.
        5.

Step 7 – Visual presentation of the indicators

The large set of indicators can be better visualized using graphical elements, which simplify and focus attention on critical elements of analysis. One of the ways chosen by the managers surveyed was the use of gauge charts. This type of chart is a visual representation that uses a pointer marker to indicate how well a single metric is performing against a pre-defined goal or range. It mimics the appearance of a car speedometer, or industrial gauge, and can use colored stripes to signal different levels of performance, such as poor (red), regular (yellow), and good (green).
Below are some suggestions that can be used to represent the calculated indicators. The available options and formats may vary depending on the viewing tool used. The options demonstrated are available in Microsoft's PowerBI tool and in Google's Sheets tool.

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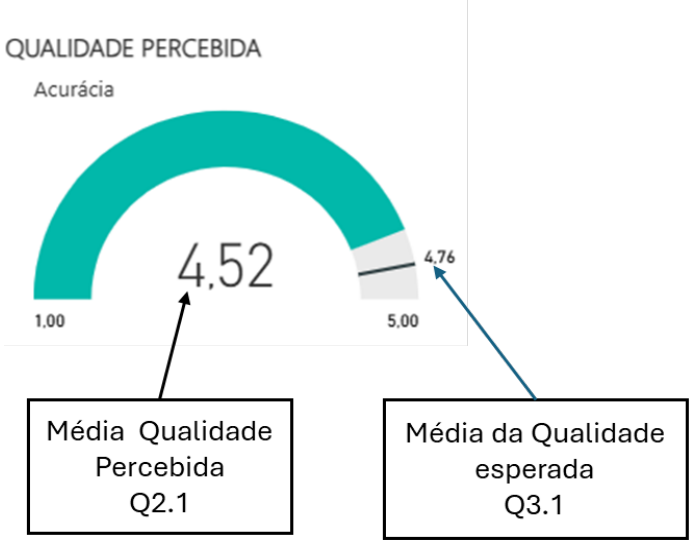
Gauge-style chart, available on Powe BI



Gauge-style chart, available in Google Sheets.

Example of a dashboard with several indicators, in PowerBI.