IEEE Access
Multidisciplinary ⋮ Rapid Review ⋮ Open Access Journal

Received 26 October 2023, accepted 18 November 2023, date of publication 27 November 2023,
date of current version 4 December 2023.

Digital Object Identifier 10.1109/ACCESS.2023.3337159

STANDARDS

Understanding How Intelligent Process Automation Impacts Business Continuity: Mapping IEEE/2755:2020 and ISO/22301:2019

JOSÉ CASCAIS BRÁS[1,2], RUBEN FILIPE PEREIRA[3], SÉRGIO MORO[4], ISAIAS SCALABRIN BIANCHI[5], AND RUI RIBEIRO[1]

[1]COPELABS, Universidade Lusófona, 1749-024 Lisboa, Portugal
[2]CGI Innovation Hub Lisbon, 1198-028 Lisboa, Portugal
[3]Instituto de Telecomunicações, Instituto Universitário de Lisboa (ISCTE-IUL), 1649-026 Lisboa, Portugal
[4]ISTAR, Instituto Universitário de Lisboa (ISCTE-IUL), 1649-026 Lisboa, Portugal
[5]Department of University Management, Federal University of Santa Catarina, Florianópolis 88040-900, Brazil

Corresponding author: José Cascais Brás (jose_manuel_bras@iscte-iul.pt)

This work was supported by COPELABS, Universidade Lusófona, Lisboa, Portugal.

ABSTRACT Organizations have been responding to possible disruptions in the organization and, at the same time, trying to increase customer satisfaction through digitising their processes. Thus, Intelligent Process Automation has been catching the latest trends in intelligent process automation due to the ease of use associated with data and requirements compliance; intelligent process automation is a step above regular automation as it mimics human behaviours and thought patterns to automate intelligently streamlines workflows and business processes. However, the constant introduction of technology via process automation in organizations can have positive and negative impacts on business continuity that need to be addressed. Although there are recent best practices, frameworks, guidelines, and standards, few studies focus on the relationship between these realms. The relationship between two sets of requirements, one for implementation practice and management methodology for intelligent software-based process automation, found in IEEE 2755.2-2020 and the other, ISO 22301-2019, about the business, to implement, maintain, and improve a management system to protect, reduce the likelihood of occurrence, prepare, respond, and recover from outages when they arise. This research is integrated into forthcoming areas for investigating the interplay between intelligent process automation and the continuity of business operations. Both are analysed and explained so that users can develop intelligent software-based process automation that complies with both frameworks in a way to embed continuity practices in an organization while optimizing business processes using Intelligent Process Automation. The study provides a bi-directional mapping for IEEE 2755.2:2020 and ISO 22301:2019, along with introducing a visual model to enhance their utility. It offers versatile applications, benefiting a wide range of stakeholders.

INDEX TERMS IEEE 2755.2:2020, ISO 22301:2019, business continuity, robotic process automation, intelligent process automation.

I. INTRODUCTION

It is unquestionable that in recent years' technological evolution has had vital effects on the operational processes of companies [1]. Recently, the COVID-19 pandemic brought this to the fore because, regardless of the organization's size, the continuous technological evolution allowed organizations to overcome this crisis with benefits that allowed companies to improve processes, train teams, offer better products to their customers, and find ways to protect organizations from

The associate editor coordinating the review of this manuscript and approving it for publication was Chih-Yu Hsu.

data breaches [2], [3]. One of the most adopted technologies was process automation which still evolving in the adoption curve [4].

Due to ever-increasing pressure to deliver value to the customer, and companies seeking to be competitive, simultaneously reducing costs and achieving efficiency gains, there has been a successive transformation in the search for alternative ways to the traditional ones to support the evaluation, planning, and decision-making of strategic decisions. From a certain point, these measures are only possible using technology, and it is at this point that the digital transformation represented by Robotic Process Automation (RPA) and Intelligent Process Automation (IPA) enters the equation [5]. This is because organizations have realized that tasks such as processing, settling, and managing transactions do not create much-added value, which due to their simplicity are potentially eligible to be automated [6], [7].

The changes related to process automation come along with proven benefits related to business efficiency, improved productivity, data security [3], [8] and effectiveness, reduced cycle time, and improved accuracy while relieving employees from repetitive and tedious tasks, but also, at the same time, contributing to a more and more complex technological environment, while still needing to ensure that their business continuity (BC) and resiliency efforts are effective [9], [10].

This brought augmented challenges to the organizations related to BC [8] and also how to find the adequate methodology of the practice for implementation and management of Software-Based Intelligent Process Automation (SBIPA).

Given the vital technology-based innovation and the progressive automation and digitization of operational, commercial, and management processes, Business Continuity Management (BCM) assumes an increased preponderance, particularly regarding the technological component. As demonstrated by the COVID-19 pandemic, which forced institutions to quickly adapt their mode of interaction with customers and employees, BCM capabilities, in operational, human, and technological aspects, are critical to avoid disruptions in the activity developed [1]. To ensure that their BC and resiliency efforts are effective in such complex environments, organizations rely on standards with IEEE/2755:2020 and ISO/22301:2019 leading [11], [12], [13].

The research question is to explore the importance of the connection between ISO 22301:2019 and IEEE 2755.2:2020 frameworks due to their relevance in the domains of BC and IPA respectively. ISO 22301:2019 is an internationally recognized standard that provides guidelines for establishing and maintaining a business continuity management system (BCMS) to ensure an organization's resilience in the face of disruptions. On the other hand, IEEE 2755.2:2020 focuses on IPA, providing a framework for organizations to leverage technologies like artificial intelligence, machine learning, and RPA to enhance their operational efficiency and decision-making capabilities.

Relating these two frameworks can bring about substantial benefits. Firstly, by integrating BC practices with IPA, organizations can strengthen their ability to respond to and recover from disruptive incidents more efficiently. IPA technologies can automate critical processes and data analysis, enabling faster decision-making during crisis situations. Secondly, incorporating BC considerations into IPA implementation ensures that automation processes are robust, secure, and capable of maintaining critical functions even during adverse events. This synergy reinforces the overall resilience of the organization's operations.

However, it's important to recognize the potential differences between these two frameworks. ISO 22301:2019 primarily focuses on risk assessment, disaster recovery, and continuity planning, while IEEE 2755.2:2020 places its emphasis on the technical aspects of implementing IPA. Understanding these distinctions lays the foundation for exploring how these standards can complement each other.

Identifying areas of convergence and divergence between ISO 22301:2019 and IEEE 2755.2:2020 is vital. This allows organizations to leverage the strengths of both standards effectively. As technology plays an increasingly vital role in business operations, aligning these two frameworks becomes pivotal for organizations aiming to enhance their resilience, maintain operational efficiency, and adapt to the ever-evolving business landscape.

In essence, investigating the relationship between ISO 22301:2019 and IEEE 2755.2:2020 is not only of academic interest but also holds practical value for organizations striving to adopt a comprehensive and forward-looking approach to BC and IPA [14].

While some best practices and standards have been proposed to guide organizations in managing these realms individually, there has been limited exploration into how they can complement and enhance each other. This research endeavors to uncover how IEEE/2755:2020 and ISO/22301:2019 can synergize, providing decision-makers with a consolidated approach that leverages understand both standards' strengths and understanding of how they can mutually support and enhance organizational resilience and IPA.

The remaining of this paper is comprised as follows. Section II presents the theoretical background. Section III describes the Method of Design Science Research (DSR). Section IV presents the design and development of the artefact. Section V presents the artefact evaluation. Finally, section VI describes the discussion and Section VII presents the conclusion and limitations of this study and future research.

II. BACKGROUND

This section defines the scope, helping to better understand the main topics of this investigation. First, an overview of the standard that supports BC activity and its evolution over time is provided. Next, the standard that supports the development of SBIPA is discussed. The last one, the section that refers

to the most used cycle in terms of quality control, is already used in the BC Standard.

A. BUSINESS CONTINUITY STANDARDS

ISO 22301:2012 was published in 2012 and replaced the British Standard for BCM BS 25999-2 [15]. It was the first internationally recognized BCM standard, and the first International Standards Organization (ISO) standard to adopt Annex L (previously Annex SL), a list of controls dedicated to management system specifications that provides a framework now common to all new management system standards published by ISO, the International Organization for Standardization.

The ISO 223XX series and its latest addendums, like all other relevant documents and other resiliency standards, are the International Organization for Standardization standards for BC and resiliency. Notwithstanding that some of these standards are applicable around the globe, many countries have their own resilience, and BC and Disaster Recovery standards, regulations, and practices [16]. Standards created by the ISO are the most widely used and have become firmly established in the U.S. Normally, ISO updates standards every 5 years. ISO 22301:2019 Security and Resilience - Business continuity management systems – Requirements [17], is the global BC standard.

Updated by ISO in 2019, this standard provides additional information to plan and execute a BCMS. It can also serve as a tool to audit business continuity programs. Table 1 summarizes the standards used to support BC.

TABLE 1. Standards to support business continuity.

Release Date	Designation	What it addresses
2003	PAS56	Business Continuity Management [18]
2005	ISO 27001 / 27002	The Information Security Standard & Information Security Management System [19]
2006	BS 25999 (1 & 2)	BSI BS25999 BS 25999 - Business Continuity [20]–[22] 1: code of practice 2: specification for BCM
2007	SI 24001:2007	Security and continuity management systems – Requirements and guidance for use of the Standards Institution of Israel (SII) [23]
2007	ISO/PAS 22399:2007	Societal security - Guideline for incident preparedness and operational continuity management [24]
2008	SS540	Singapore Standard - Singapore (SPRING) launches a new certifiable standard SS540:2008 which replaces TR 19:2004 [25].
2009	NFPA 1600	Standard on Disaster & Emergency Management and Business Continuity Programs [26].
2010	AS/NZS 5050:2010	Australian and New Zealand Business Continuity Management standard [27].
2010	ANSI/ASIS/BSI BCM.1-2010	Business Continuity Management Standard Business Continuity Management Systems: Requirements with Guidance for Use [28].
2012	ISO 223xx	Standards for BCMS Business Continuity Management [12], [15], [17], [29]–[30].
2020	NIST 800-34	Contingency Planning Guide for Information Technology Systems [31].

B. INTELLIGENT PROCESS AUTOMATION STANDARDS/FRAMEWORKS

IEEE 2755.2:2020 is a standard that provides guidelines for the development and implementation of IPA systems. The standard, titled ''IEEE Standard for Intelligent Process Automation Systems - Part 2: Guidelines for the Implementation of IPA Systems,'' is intended to help organizations design and implement IPA systems that are efficient, effective, and secure.

The standard covers various aspects of IPA system implementation, including system architecture, data management, security, performance, and scalability. It also provides guidance on the selection and integration of different IPA technologies, such as RPA, AI, and machine learning. IEEE 2755.2:2020 is specifically designed to provide guidelines for the development and implementation of IPA systems.

IEEE 2755.2 was approved in 2020, utilising the terminology and technology taxonomy established in IEEE 2755 and IEEE 2755.1, respectively. IEEE 2755.2 provides a comprehensive self-help methodology for technology domain exploration, strategy development, technology evaluation, implementation, management, governance, operations, program optimization, and successful enterprise scaling for SBIPA programs [32], [33].

Table 2 shows some of the standards that might support the implementation of IPA. Nevertheless, IEEE 2755.2:2020 is specifically designed to provide guidelines for developing and implementing IPA systems. As such, it can be said that this standard applies to and supports the use of IPA.

C. PDCA

One of the key features of ISO 22301 is the use of the Plan-Do-Check-Act (PDCA) cycle. The PDCA cycle is a four-step management method commonly used in quality management and other fields. It is a continuous improvement approach that helps organizations to identify and address issues and continually improve their processes and systems. PDCA is also called the ''Deming cycle'', which is a classic quality management model promoted and practiced in Japan by W. Edwards Deming, who is considered by many to be the father of modern quality control [39]. However, he always refers to it as the ''Shewhart cycle''. IS0900 I: 2000 stated in its introduction that the PDCA method is available for all processes [40].

ISO 22301 uses the PDCA cycle because it is an effective way to manage BC's complex and dynamic nature. The cycle allows organizations to plan and prepare for potential disruptions, implement and test their plans, monitor and evaluate their performance, and make improvements based

TABLE 2. Standards to support process automation.

Release Date	Designation	What it addresses
2003	ISO/IEC 15504-2:2003	ISO/IEC 15504-2:2003 defines the requirements for performing process assessment as a basis for use in process improvement and capability determination [34].
2010	ISO/IEC TR 18018:2010	Information technology — Systems and software engineering — Guide for configuration management tool capabilities [35].
2015	ISO/IEC 33020:2015	This ISO/IEC standard defines a process measurement framework that supports the assessment of process capability, in accordance with the requirements of ISO/IEC 33003 [36].
2017	2755-2017	IEEE Guide for Terms and Concepts in Intelligent Process [33], [37].
2019	IEEE 2755.1-2019	IEEE Standard for Intelligent Process Automation Systems - Part 1: Framework and Concepts [38].
2020	IEEE 2755.2-2020	IEEE Standard for Intelligent Process Automation Systems - Part 2 [11].

on the results. By following the PDCA cycle, organizations can ensure that they constantly improve their BCM processes and stay prepared for future disruptions.

Järveläinen suggested that one way to incorporate good BC practices into an organization is to adopt an international standard or framework that comprehensively integrates it into existing processes [41]. The suggestion is in line with the scope of this study, which adopted ISO 22301 standards in the BC component as part of its effort to increase BCM competency and improve operational stability [22].

IEEE 2755.2:2020 [42] and ISO 22301 [17] are already robust frameworks that integrate well with other established management systems. However, they were developed as autonomous parts and, which need to be analysed to combine both in a process that can make the most of their potential.

III. RESEARCH METHODOLOGY

To pursue this research objective, the DSR methodology was chosen to build an artefact, as DSR aims to solve problems by constructing a new reality rather than explaining an existing fact or trying to help understand it.

The main elements of DSR in information systems investigations are the possibility of new research fields, the construction of new theories, or testing and validating theories. This work aims to develop a model to solve a specific problem; in this case, to understand how the IEEE and ISO standards can be combined. Therefore, DSR, widely used in information systems research to solve complex problems, may be a suitable approach for this study.

Using the DSR method was then followed for model development DSR is not only suitable for solving organizational problems in specific domains but also suitable for producing artefacts, as in the case of this model. Figure 1 presents a description of the research strategy using a DSR process and summarizes the design and development of mapping the standards under analysis.

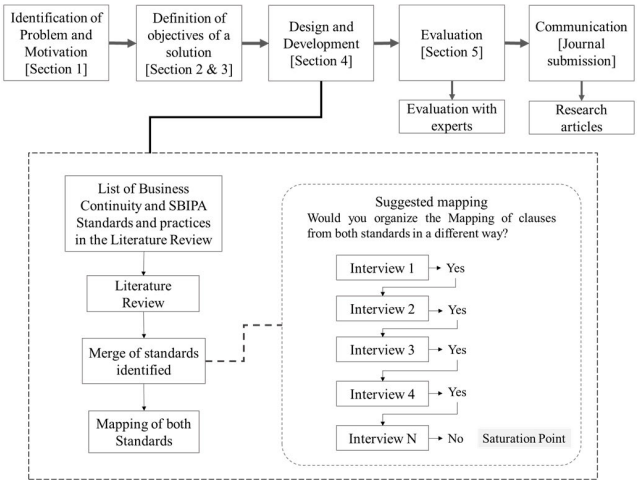

FIGURE 1. Design science research (DSR): Design and development of the mapping of both standards (adapted from [59]).

Both standards were analised to collect all data related to each clause (ISO/22301:2019) or Stage (IEEE/2755:2020).

ISO 22301:2019 applies the PDCA cycle - Plan (establish), Do (implement and operate), Check (monitor and review), and Act (maintain and improve) to implement, support, and continually improve the effectiveness of an organization's BCMS.

Following the PDCA cycle, Clauses 4 to 10 cover the following components:

- Clause 4 introduces the requirements necessary to establish the context of the BCMS applicable to the organization, as well as needs, requirements, and scope.
- Clause 5 summarizes the requirements specific to top management's role in the BCMS and how leadership articulates its expectations to the organization via a policy statement.
- Clause 6 describes the requirements for establishing strategic objectives and guiding principles for the BCMS.
- Clause 7 supports BCMS operations related to establishing competence and communication with interested parties on a recurring/as-needed basis while documenting, controlling, maintaining, and retaining required documented information.
- Clause 8 defines BC needs, determines how to address them, and develops procedures to manage the organization during a disruption.
- Clause 9 summarizes the requirements necessary to measure BC performance, BCMS conformity with this document, and to conduct a management review.
- Clause 10 identifies and acts on BCMS nonconformity and continual improvement through corrective action.

IEEE Std 2755.2–2020, IEEE Recommended Practice for Implementation and Management Methodology for Software-Based IPA, sets forth a structured methodology from inception through full adoption to establish proper programs in IPA initiatives that is broken into the following stages (later called ''Clauses''):

- Stage 3 - Exploration: In this stage, stakeholders explore the organizational readiness for IPA and identify the processes that are good candidates for automation. This stage helps stakeholders understand IPA's potential benefits and risks and identify the processes that will provide the most value.
- Stage 4 - Strategy: This stage is to develop a strategy for IPA adoption, which includes defining the business case, identifying the technology solutions, and establishing a roadmap for implementation.
- Stage 5 - Evaluation: Here, stakeholders evaluate the effectiveness of the IPA solution, including the impact on business processes, employee productivity, and customer satisfaction.
- Stage 6 - Implementation: In this stage, stakeholders implement the IPA solution, which includes designing, developing, testing, and deploying the automation solution.
- Stage 7 - Management and Operations: In this stage, stakeholders manage and operate the IPA solution, which includes monitoring the solution, providing ongoing support, and ensuring that it continues to meet the organisation's needs.
- Stage 8 - Optimization and Scaling: In this stage, stakeholders optimize and scale the IPA solution, which includes identifying opportunities for improvement, implementing changes to the solution, and expanding the use of IPA across the organization.

This standard also provides an initial Clause, ''General Overview.'': In this stage, stakeholders provide a general overview of the IPA initiative, including the goals, scope, and desired outcomes. This stage helps establish a common understanding of the initiative across all stakeholders.

Overall, the clauses of the IEEE Recommended Practice for IPA provide a comprehensive framework for planning, implementing, and managing an IPA initiative. Each stage builds on the previous one, and all stages are designed to work together to ensure the success of the IPA initiative. This recommended practice identifies six distinct but interrelated stages in that methodology, as outlined in Clause 3 through Clause 8. These stages should be executed in sequence for an IPA initiative that is starting, but various stages are appropriate to revisit throughout the life of an IPA program.

For each stage, this standard has a structured approach including five sections (Objective, Participation, Methodology, Activities, and Outcomes) that are part of the framework for each stage of the IEEE Recommended Practice for IPA. Here is a brief explanation of each section:

- Objective: The objective section defines the goals and objectives of the stage. This section sets the direction for the activities carried out in the stage and helps stakeholders understand what they are trying to achieve.
- Participation: The participation section describes the stakeholders involved in the stage and their roles and responsibilities. This section helps ensure that all relevant stakeholders are involved in the process and understand their roles.
- Methodology: The methodology section describes the approach and methods that will be used to achieve the objectives of the stage. This section helps ensure that the activities are carried out consistently and structured.
- Activities: The activities section describes the specific tasks and activities that will be carried out in the stage. This section provides a detailed plan for implementing the methodology and helps stakeholders understand what they need to do to achieve the objectives.
- Outcomes: The outcomes section describes the expected outcomes of the stage. This section helps stakeholders understand what they are trying to achieve and provides a basis for evaluating the success of the stage.

These five sections provide a structured approach for each stage of the IEEE Recommended Practice for IPA. They help stakeholders understand what they need to achieve, how they will achieve it, and the expected outcomes. By providing a consistent framework for each stage, the IEEE Recommended Practice for IPA helps ensure that the IPA initiative is implemented in a structured and effective manner.

IV. DESIGN AND DEVELOPMENT: MAPPING PROPOSAL

This section presents the steps to develop the mapping between the two standards. The purpose of this artifact is to propose the alignment of these two frameworks, establishing connection points between the two to allow them to use their potential when implementing either of them, together or individually. The effort is to identify the points of connection between both. For this, the next section presents the integration of the clauses of the two standards based on the literature review.

In the case of IEEE 2755.2:2020, analyse to incorporate and complement the requirements of ISO 22301:2019 that relate to planning, establishing, implementing, operating, monitoring, reviewing, maintaining, and continually improving a management system to protect, reduce the probability of occurrence, prepare for, respond to, and recover from outages when they arise. Regarding ISO 22301:2019, verify the recommendations in IEEE 2755.2:2020 concerning indications to support the optimal selection, evaluation, and adoption of rapidly expanding products and services of complementary technologies available to automate corporate operational processes. Its recommendations are based on the collective knowledge and experience of developers, consultants, system integrators, service providers, and end users. A business environment is now a place of continuous technological innovation, where IPA [43] is a dynamic activity. Likewise, the underlying business

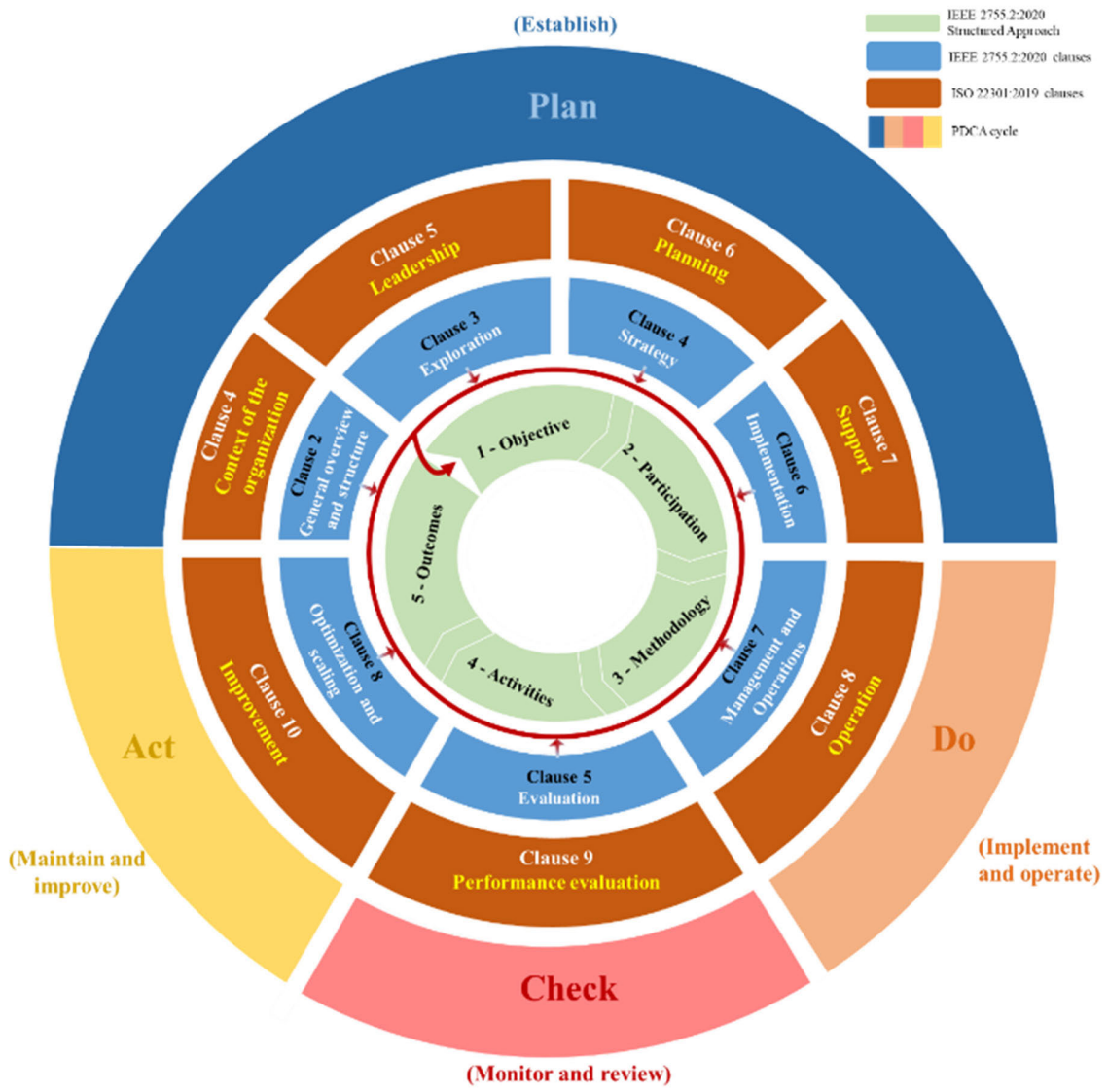

FIGURE 2. Merge of PDCA, ISO/22301:2019 and IEEE/2755:2020 clauses.

strategies and processes are constantly evolving to address new opportunities and at the same time, threats that can compromise BC, if all possibilities are not anticipated.

Both documents (IEEE 2755.2:2020 and ISO 22301:2019) have a similar word usage regarding verbs, thus, the word shall indicate mandatory requirements strictly to be followed to conform to the standard and from which no deviation is permitted (shall equals required to).

The word should indicate that among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others, or that a particular course of action is preferred but not necessarily required (should equals recommended that). The word may is used to indicate a course of action permissible within the limits of the standard (may equals permitted to). The term can is used for statements of possibility and capability, whether material, physical, or causal (can equals able to).

Figure 2 represents the mapping proposal of both standards, including the already mapped PDCA cycle with ISO 22301.

Figure 2 and **Appendix A** aggregate the pre-established mapping at ISO 22301:2019 with the PDCA cycle, with the clauses for IEEE 2755.2:2020.

In the IEEE 2755.2:2020 document, each clause (stage) is fully explained with a structured approach that includes: Objective(s), Participation, Methodologies, Activities, and Outcomes, and guidance on the activities needed to complete all of the objectives of a stage comprehensively and is represented at Figure 2 with the green doughnut. Each stage succeeds the previous one and builds on the results of the last stages, establishing a logical progression of capability.

In ISO 22301:2019, Clauses 4 to 10 contain the requirements to assess compliance and can be used to determine

an organization's ability to meet its own BC needs and obligations.

A. OUTCOME OF THE MAPPINGS

The information presented in **Appendix B** correlates process outcomes required in IEEE 2755.2:2020 to process outcomes required in ISO 22301:2019. The mapping indicates related outcomes that may help meet the requirements of IEEE 2755.2:2020 when developing automation projects. There is no assumption that all the required outcomes of IEEE 2755.2:2020 are necessary to fulfil the required outcomes of ISO 22301:2019.

1) PROCESS CORRELATION

BCM is a comprehensive and holistic approach to ensuring that an organization can continue to operate during and after a disruptive event. It has the following major process to support its objectives:

i Business Impact Analysis (BIA): This process involves identifying critical business functions and the potential impacts of disruptions to those functions. It helps organizations understand their most critical processes and prioritize their BCM efforts.

ii Risk Assessment: This process involves identifying and analysing the risks that could lead to a disruptive event. It helps organizations understand the likelihood and potential impact of various risks and prioritize their risk management efforts.

iii BC Strategy Development: Based on the results of the BIA and risk assessment, organizations develop a BC strategy that outlines the steps that will be taken to ensure the continuity of critical business functions during a disruptive event.

iv Plan Development and Implementation: This process involves developing and implementing detailed plans to ensure the continuity of critical business functions during and after a disruptive event. This includes developing plans for crisis management, emergency response, and business recovery.

v Testing, Training, and Exercising: Organizations should test their plans regularly to ensure they are effective and current. Testing should include table-top exercises, simulations, and full-scale exercises. Employees should also be trained to understand their roles and responsibilities during a disruptive event.

vi Program Management: Finally, BCM is an ongoing process that requires ongoing program management. This includes monitoring the BCM program's effectiveness, making necessary changes, and ensuring that the program remains up-to-date and effective.

These processes are designed to help organizations prepare for and respond to disruptive events, minimize the impact of those events, and ensure the continuity of critical business functions.

Both IEEE Std 2755.2:2020 and ISO 22301:2019 are two different frameworks that have other objectives, however, they use a process-oriented approach for some of their major processes: knowledge acquisition, assessment, evaluation, operation, maintenance, and continuous improvement. The two, however, differ in the names of the activities of the processes.

V. EVALUATION

This section presents an assessment of the artifact. Evaluating design artifacts and design theories is a significant undertaking and a critical aspect of DSR.

To assess the proposed mapping of the clauses of ISO 22301 and IEEE 2755.2, several interviews were carried out with specialists and professionals from both areas. Interviews hold a central position in the realm of social science research, with a plethora of research method publications delving into the practice of conducting interviews in this domain [44], [45]. These interviews aim to make inferences about a population by examining a sample from that population. This contrasts with a census, which aims to make observations drawn from an entire population and are methods used for artifact evaluation. Therefore, in this study, a semi-structured questionnaire was evaluated for the proposed mapping of the clauses of ISO 22301 and IEEE 2755.2.

In this study, the artifact was evaluated in terms of construct and model with the following principles: completeness, ease of use, fidelity with real-world phenomena, internal consistency, level of detail, simplicity, Understandability, importance, accessibility, and suitability were looked at, as proposed by March and Smith [46] and Rosemann and Vessey [47]. Based on the criteria in Table 3, a semi-structured questionnaire was created.

As previously stated, assessment plays a vital and significant role in the DSR. To appraise the artifact, professionals were chosen from both the realms of BC and IPA, possessing varying levels of experience and proficiency. This decision enables us to enhance the thoroughness of the evaluation, ensuring the practical viability of the artifact. Table 3 displays the participants' area, industry, function, country, academic degree, and origin source. Table 4 shows the duration of work experience, tenure in the current position, level of responsibility, years of involvement in BC, and years of involvement in RPA/IPA.

VI. POPULATION AND SAMPLE

This study focused on integrating ISO 22301 and IEEE 2755.2 frameworks, so understanding the perspectives and experiences of experts and practitioners in the field is paramount. The population under consideration comprises professionals with expertise in BCM and IPA, from IT Business Consulting organisations, banks, and insurance companies. This includes individuals actively involved in implementing, assessing, or governance of BCM and IPA practices within their respective organizations. A purposive sampling approach will be employed to ensure comprehensive and representative insight. This will involve

TABLE 3. Semi-structured questionnaire for evaluation of the proposed clauses mapping.

	Criterion	Statement
1	Completeness	The mapping contains all the clauses of the standards of both standards.
2	Ease of use	The mapping is well-described and easy to verify and implemented in both contexts.
3	Fidelity with real-world phenomena	The proposed mapping corresponds to a possible solution to the suitable choice of practice to incorporate both standards.
4	Internal consistency	The proposed mapping uses adequate terminology, is well-written, and is justified by the theory.
5	Level of Detail	The proposed mapping contains a sufficient level of detail in each mechanism for each standard.
6	Simplicity	The proposed mapping contains the exact number of clauses for both practices and they it is easy to implement.
7	Understandability	The proposed mapping is easily understood as a model for BC and IPA and the meaning of each clause mapping is easily understandable.
8	Importance	The proposed mapping is important for both practitioners and academics.
9	Accessibility	The proposed mapping has an understandable terminology with a practice perspective, not only a theoretical one.
10	Suitability	The proposed mapping of practices is applicable in the practice to assist with BC and IPA practitioners.

identifying and selecting participants based on their demonstrable expertise and experience in ISO 22301 and IEEE 2755.2 domains. Table 5 presents the results achieved with the interviews regarding work experience, current position, responsibility, and work experience in both areas. Through semi-structured interviews, we aim to glean valuable insights that will contribute significantly to the discourse surrounding the harmonious integration of these critical frameworks.

These tables provide an overview of the characteristics of the sampled population for the study focused on integrating ISO 22301 and IEEE 2755.2 frameworks. The population consists of professionals with expertise in BCM and IPA, with select participants being extended invitations through pertinent LinkedIn reference groups [48], [49], [50], [51], [52], [53], [54], [55], [56].

Interviews are the most well-known method to collect data in qualitative research and can be used in all kinds of philosophy paradigms whether positivist, interpretive or critical [57]. The qualitative interview is an excellent way of gathering data [57]. According to Myers and Newman the interview allows collecting valuable data from people in different roles and situations [58]. Thus, interviews can be an appropriate method to develop and evaluate an artifact. Therefore, in this article, using semi-structured interviews to collect data will be used. The interviews were conducted to assess the completed artifact rather than its initial construction. The artifact under consideration was evaluated rigorously by a diverse panel of experts from various geographic, cultural, and industrial backgrounds. Notably, the interactions were limited to a single iteration, yielding no additional models or refinements as an outcome of these interviews.

Regarding the number of interviews necessary in qualitative research, Myers and Newman argues that there is a nonspecific number. It depends on the research question and what answers are being looked for. A saturation point is reached when a new insight for your research question is not found [57], [58].

In this study, we are evaluating a model with an appropriate number of clauses for BC and IPA. The proposed model is being sought, and the saturation point was reached in the fifth interview. From the fifth to twenty-two interviews, no new insights were added to the mapping model proposed.

A. WORK EXPERIENCE

A significant portion (40.9%) of the participants has over 20 years of work experience, indicating a substantial level of expertise in the field, but the same (40.9%) for the level with less expertise. No one in the range 10 – 15 years (0%), and the remaining participants fall into the categories of 5 to 10 years and 15 to 20 years, each representing 9.1% of the population.

B. CURRENT POSITION

The majority (81.8%) of the participants hold positions with 0 to 5 years of experience, indicating a relatively young workforce in their current positions. 9.1% are in positions with 5 to 10 years of experience. Only a small percentage (4.5%) are in positions with 15 to 20 years of experience, and an equal share (4.5%) have positions with over 20 years of experience.

C. RESPONSIBILITY

The responsibilities of the participants are distributed across various levels, with no particular level dominating. The highest percentage (40.9%) falls under the ''Other'' category, indicating diverse roles within the sampled population. This is followed by ''Manager'' (22.7%), ''D-Level'' (27.3%), and ''C-Level'' (9.1%).

TABLE 4. Details about the participants.

#	Area	Industry	Function	Country	Academic degree	Source
1	IT & Business Consulting	Bank	RPA Team Leader	Portugal	Bachelor	1
2	IT & Business Consulting	Insurance	RPA Developer	Portugal	Bachelor	1
3	BC	Bank	BC Analyst	Portugal	Master's degree	1
4	IT & Business Consulting	Services	VP Business Consulting	Finland	Master's degree	2
5	IT & Business Consulting	Services	Director Consulting	England	Bachelor	3
6	BC	Bank	Director Consulting	Portugal	Bachelor	1
7	IT & Business Consulting	Services	RPA Developer	Portugal	Bachelor	3
8	IT & Business Consulting	Services	VP Business Consulting	Portugal	MsC	2
9	IT & Business Consulting	Services	RPA Developer	Portugal	BsC	2
10	IT & Business Consulting	Services	RPA Developer	Portugal	Bachelor	3
11	BC and Risk	Bank	Audit Manager	Portugal	Master's degree	4
12	BC	Portuguese Road Rail Network	BC Analyst	Portugal	Bachelor	4
13	IT & Business Innovation	Insurance	Director of Organization, Innovation and Products	Portugal	Executive Master	4
14	IT & Business Consulting	Services	BC Analyst	EUA	Bachelor	1
15	IT & Business Consulting	Services	RPA Business Consultant	India	PhD	1
16	IT & Business Consulting	Services	BC Manager	Portugal	Bachelor	3
17	IT & Business Consulting for Bank & Insurance	Services	Director Consulting Services	Sweden	Master's degree	3
18	IT & Business Consulting	Services	Director Consulting	Germany	PhD Student	3
19	IT & Business Consulting	Services	Business Manager	EUA	Master's degree	1
20	IT & Business Consulting	Bank & Insurance	RPA Team Leader	Portugal	Master's degree	5
21	IT & Business Consulting	Insurance	Director Consulting	Portugal	Master's degree	3
22	IT, Business & Governance	Education	Professor	Brazil	PhD	5

Legend: [1] LinkedIn | [2] Industry Reference connection | [3] Industry Connection | [4] Client related | [5] University Link

TABLE 5. Details about the semi-structured questionnaire in the evaluation.

Rational	Indicators					
Your Work Experience	0 – 5 years	5 – 10 years	10 – 15 years	15 – 20 years	> 20 years	
	40,9%	9,1%	0%	9,1%	40,9%	
Your current position	0 – 5 years	5 – 10 years	10 – 15 years	15 – 20 years	> 20 years	
	81,8%	9,1%	0%	4,5%	4,5%	
Responsibility	C-Level	D-Level	Manager	Other		
	9,1%	27,3%	22,7%	40,9%		
Work experience in business continuity	None	1 – 5 years	5 – 10 years	10 – 15 years	15 – 20 years	> 20 years
	27,3%	45,5%	13,7%	4,5%	4,5%	4,5%
Work experience in RPA / IPA	None	1 – 5 years	5 – 10 years	> 10 years		
	22,7%	63,6%	4,5%	9,2%		

D. WORK EXPERIENCE IN BUSINESS CONTINUITY

Most participants (45.5%) have 1 to 5 years of experience in BC. 27.3% have yet to specify work experience in this area. 13.7% have 5 to 10 years of experience, while 4.5% each have 10 to 15 years and 15 to 20 years of experience.

E. WORK EXPERIENCE IN RPA/IPA

The highest percentage of participants (63.6%) have 1 to 5 years of experience in RPA/IPA, indicating a relatively high level of familiarity with this domain. 22.7% have yet to specify work experience in this area. 9.2% have more than ten years of experience in RPA/IPA, indicating a group of highly experienced individuals in this field.

In summary, the sampled population represents a diverse group of professionals with varying expertise and experience in BCM and IPA. The majority have substantial experience in their respective fields, and a significant portion also have considerable expertise in RPA/IPA. This diverse range of perspectives and experiences is expected to contribute significantly to the study's insights.

VII. DATA COLLECTION

A multi-faceted data collection approach was employed to gather comprehensive insights into integrating ISO 22301 and IEEE 2755.2 frameworks. The method involved semi-structured interviews with selected experts and practitioners. These interviews have been conducted one-on-one,

TABLE 6. Details the closed questions done to the participants and their results.

Rational	Indicators				
1. On a scale of 1 to 5, how compatible do you consider the possible combination of the "Context of the organization" clause from ISO 22301 with the "General overview and structure" clause from IEEE 2755.2?	0%	4,5%	13,6%	50%	31,8%
2. In your opinion, what level of alignment exists between the "Leadership" clause from ISO 22301 and the "Exploration" clause from IEEE 2755.2? Please rate it on a scale of 1 to 5	0%	13,6%	18,2%	59,1%	9,1%
3. Considering the combination of the "Planning" clause from ISO 22301 and the "Strategy" clause from IEEE 2755.2, how well do you perceive their synergy? Please rate it from 1 to 5	0%	0%	13,5%	50%	36,4%
4. On a scale of 1 to 5, how well do you believe the "Support" clause from ISO 22301 fits with the "Implementation" clause from IEEE 2755.2?	0%	0%	40,9%	36,4%	22,7%
5. By combining the "Management and Operations" clause from ISO 22301 and the "Operations" clause from IEEE 2755.2, how effective do you perceive this combination to be? Please rate it on a scale of 1 to 5.	0%	4,5%	18,2%	31,8%	45,5%

allowing for an in-depth exploration of their experiences, challenges, and successes in implementing these frameworks within their organizations.

Data Collection Process: The interview process started by requesting consent and an introduction to the study's objectives. Closed questions with a rating scale of 1 to 5 (1 being the lowest, five being the highest) with optional comments to each question have been used to encourage participants to share their perspectives freely regarding the combination of each clause. Their results are expressed in Table 6. The analysis involved a systematic review to extract key information on how well each clause combines or fits together relating BCM and IPA. An additional question was posed for the participants to share any insights, concerns, or potential advantages they might foresee in implementing this integrated approach.

Data Interpretation: The collected data aimed at identifying recurring patterns, themes, and significant points raised by the participants. Through this process, commonalities and differences in perspectives have been identified, providing valuable insights into the challenges, successes, and potential synergies between ISO 22301 and IEEE 2755.2, involving triangulating the findings from both interview transcripts and proposal analysis, ensuring a comprehensive understanding of the integration landscape.

VIII. RESULTS AND DISCUSSION

This section discusses the results of the optional comment requested for each question. **Appendix C** presents all the information related to the comments made by the participants for each question presented (Q1 to Q8).

Q1. "Context of the organization" clause from ISO 22301 with the "General overview and structure"

Respondents generally perceive a high level of compatibility between the ''Context of the organization'' clause from ISO 22301 and the ''General overview and structure'' clause from IEEE 2755.2. The majority (81%) rated the combination as a 4 or 5, indicating a solid alignment.

As seen in **Appendix C - Q1**, the feedback emphasizes that aligning the organizational context with the general structure provides a solid foundation for BCM and IPA initiatives.

This understanding is crucial for effective planning and automation efforts. The combination supports risk mitigation by allowing for a nuanced assessment of potential risks and vulnerabilities based on the organizational context.

This enables more targeted and effective selection and implementation of automation solutions to enhance BC. The integration of these clauses aids in optimizing resource allocation for automation projects. It ensures that automation efforts are directed towards functions and processes foremost vital to the organization's overall structure and objectives. The integration establishes a foundation for the long-term alignment of automation efforts with organizational goals.

This ensures that automation strategies evolve in sync with organizational structure and objectives changes, providing sustained support for BC initiatives. Combining these clauses leads to a comprehensive understanding of the organizational landscape, enabling a more informed and strategic approach to BC and automation initiatives. This alignment ensures that automation efforts are closely aligned with the overall structure and objectives of the organization.

Overall, the responses suggest a strong consensus among the respondents regarding the compatibility and adequacy of combining these clauses. The alignment between the organizational context and the general structure is critical in facilitating effective planning and automation efforts for BCM and IPA initiatives.

Q2. "Leadership" clause from ISO 22301 and the "Exploration" clause from IEEE 2755.2

Respondents broadly recognize a substantial degree of alignment between the ''Leadership'' clause from ISO 22301 and the ''Exploration'' clause from IEEE 2755.2. The majority (68.2%) rated the alignment as either a 4 or 5, indicating a strong perceived alignment.

Some respondents expressed a degree of uncertainty or suggested that, based solely on the wording and context, they did not see an immediate fit between the clauses. This indicates that a deeper understanding of the specific clauses may be needed to appreciate the alignment. There is a viewpoint that the ''Exploration'' clause is a vast subset of what ISO 22301 describes. However, it's noted that if the intent is to use ISO as a tie-breaker between implied frameworks, this alignment could be appropriate. It suggests that there may be a hierarchical relationship where one standard complements or supplements the other. Feedback emphasizes that effective leadership, as outlined in ISO 22301, is pivotal

in driving informed decisions regarding IPA initiatives. The ''Exploration'' clause complements this by emphasizing the need for comprehensive documentation, including motivations, dependencies, and competitive analysis. This ensures that leadership is well-informed and equipped to drive IPA initiatives forward. The combination of ''Leadership'' and ''Exploration'' is seen as providing a solid foundation for turning strategic vision into actionable plans. This alignment ensures that the vision is supported by a detailed roadmap, incorporating documentation of motivations, dependencies, and competitive analysis. The feedback highlights the pivotal role of leadership in driving the adoption of automation technologies. A forward-thinking approach to exploration can uncover opportunities for utilizing automation to enhance BCM strategies, allowing organizations to respond more effectively to unforeseen events. It's suggested that there may also be a match between the ''Leadership'' clause and Clause #7 (''Management & Operations''). This indicates recognition of potential interrelationships between multiple clauses.

Overall, as presented in **Appendix C - Q2**, the responses indicate a perceived strong alignment between the ''Leadership'' clause from ISO 22301 and the ''Exploration'' clause from IEEE 2755.2. This alignment is seen as providing a solid foundation for driving informed decisions and exploring opportunities for automation within the context of BC.

Q3. "Planning" clause from ISO 22301 and the "Strategy" clause from IEEE 2755.2

Respondents generally acknowledge a high level of synergy between the ''Planning'' clause from ISO 22301 and the ''Strategy'' clause from IEEE 2755.2. The majority (86.4%) rated the synergy as either a 4 or 5, indicating a strong perceived alignment.

The feedback emphasizes that both clauses focus on actions to address risks and opportunities. ''Planning'' within the BCMS context emphasizes risk assessment and mitigation, while ''Strategy'' in the IPA context involves controlling deployment risks managing. This alignment ensures that risk management is integrated into BCMS planning and IPA strategy development. ''Planning'' and ''Strategy'' are fundamentally aligned in their focus on strategic thinking. ''Planning'' encompasses the development of a structured approach to BC, while ''Strategy'' guides formulating a broader organizational strategy that may include automation initiatives. This alignment ensures that planning efforts are integrated into the larger strategic framework. Measurable objectives are highlighted as crucial for both BCMS and IPA initiatives. The ''Planning'' clause's emphasis on measurable objectives aligns with the ''Strategy'' clause's aim to assess how IPA can support and enhance the enterprise's strategic plan. This alignment ensures progress can be effectively tracked, monitored, and communicated in line with the sustainability concept. Automation is viewed as a significant augmentation to the effectiveness of BCM plans, contributing to both efficiency and environmental sustainability. It can streamline processes related to continuity planning, enabling faster response times and reducing human error in critical scenarios. This suggests that integrating automation into the planning process enhances the overall effectiveness of BCM while aligning with the sustainability concept. The integration ensures that automation efforts are not viewed in isolation but are considered an integral part of the overall BC strategy. This emphasizes that automation is a strategic component of BC planning, emphasizing its role within the sustainability concept rather than as a separate initiative.

Overall, as shown in **Appendix C - Q3**, the responses indicate a perceived strong synergy between the ''Planning'' clause from ISO 22301 and the ''Strategy'' clause from IEEE 2755.2. This alignment is seen as providing a solid foundation for integrating automation into the broader BC planning process, ultimately enhancing the effectiveness of BCM plans.

Q4."Support" clause from ISO 22301 with the "Implementation" clause from IEEE 2755.2

Respondents generally perceive a high level of compatibility between the ''Support'' clause from ISO 22301 and the ''Implementation'' clause from IEEE 2755.2. The majority (59.1%) rated the fit as either a 4 or 5, indicating a strong perceived alignment.

The feedback emphasizes that support is crucial during the implementation stage. With adequate support, the success of the implementation may be better. This highlights the importance of having resources and expertise available to ensure a smooth implementation process. Both clauses are seen as complementing each other. The ''Support'' clause addresses potential challenges, such as skill gaps or resource constraints, which can be critical to the success of the implementation. This synergistic approach increases the likelihood of a successful automation deployment. Integrating ''Support'' from ISO 22301 with ''Implementation'' from IEEE 2755.2 is viewed as leading to enhanced operational efficiency. Adequate support regarding skilled personnel, technology infrastructure, and training ensures that automation initiatives directly contribute to the resilience of critical business functions. The combination of ''Support'' and ''Implementation'' underscores the critical need for resource allocation and training. ''Support'' ensures that the right resources, including personnel and technology, are allocated for the successful ''Implementation'' of automation solutions. This alignment is seen as vital for achieving BC and efficiency goals.

Overall, as illustrated in **Appendix C - Q4**, the responses suggest a strong consensus among the respondents regarding the compatibility and adequacy of combining the ''Support'' clause from ISO 22301 with the ''Implementation'' clause from IEEE 2755.2. This alignment is essential for ensuring a smooth and successful implementation of automation technologies within the context of BC.

Q5." Management and Operations" clause from ISO 22301 and the "Operations" clause from IEEE 2755.2

Respondents generally perceive a high level of effectiveness in combining the ''Management and Operations''

TABLE 7. Relationship between the PDCA Cycle, clauses of ISO 22301:2019 and IEEE 2755.2:2020 addressing PDCA component.

PDCA component	ISO 22301:2019	IEEE 2755.2:2020
Plan (Establish)	**Clause 4** ("Context of the organization") **sets out** what the organization **should do** to make sure that the BCMS meets its requirements, taking into account all relevant external and internal factors, including: — the needs and expectations of interested parties; — its legal and regulatory obligations; — the required scope of the BCMS.	**Clause 2** ("General overview and structure") The objective is to **investigate** the suitability of an IPA initiative for a business unit or business before **setting out** any strategic directives. The investigation is completed by leveraging a variety of people, tools, and methodologies along with defined industry practices to understand the relevant pros and cons of IPA adoption.
	Clause 5 ("Leadership") **sets out** management's role in demonstrating commitment, defining policy, and establishing roles, responsibilities and authorities.	**Clause 3** ("Exploration") The objective is to **investigate** the suitability of an IPA initiative for a business unit or business before **setting out** any strategic directives. The investigation is completed by leveraging a variety of people, tools, and methodologies along with defined industry practices to understand the relevant pros and cons to IPA adoption
	Clause 6 ("Planning") describes the actions for **establishing strategic** objectives and guiding principles for implementing the BCMS.	**Clause 4** ("Strategy") Based on the findings and insights gained from the Exploration stage, the Strategy stage aims to **assess** how IPA can support and enhance the enterprise strategic business plan and technology environment in ways that maximize opportunities and benefits while controlling risks.
	Clause 7 ("Support") **identifies** the BCMS elements that should be in place, namely resources, competence, awareness, communication and documented information.	**Clause 6** ("Implementation") The purpose is to **design**, **configure**, **build**, **test**, and **deploy** automation that will deliver the targeted business outcomes identified in the Strategy stage using the architectures and technologies selected for deployment in the Evaluation stage.
Do (Implement and operate)	**Clause 8** ("Operation") identifies the processes for **establishing** and maintaining BC.	**Clause 7** ("Management and operations") The objectives are to assure the reliable performance of automations in production and to **identify new** deployment opportunities for current automation tools and new IPA tools that can enhance capability, performance, and value.
Check (Monitor and review)	**Clause 9** ("Performance evaluation") **provides the basis** for improving the BCMS through measurement and evaluation its performance.	**Clause 5** ("Evaluation") The objective is to **select** the most appropriate technologies and product architectures to deliver the outcomes and benefits identified in the Strategy workstream. NOTE—IEEE Std 2755.1–2019 provides a comprehensive technology evaluation guide
Act (Maintain and improve)	**Clause 10** ("Improvement") covers the corrective action for **addressing** nonconformity identified through performance evaluation.	**Clause 8** ("Optimization and scaling") Aims to **support** the sustainable growth of IPA programs while mitigating risks. When scaled, IPA technologies create additional value by improving productivity, expanding enterprise capacity, and supporting the expansion of new products, solutions, and business models.

clause from ISO 22301 and the ''Operations'' clause from IEEE 2755.2. The majority (77.3%) rated the combination as either a 4 or 5, indicating a strong perceived alignment.

The feedback emphasizes that operation and management are closely intertwined. Even though operations may have a routine nature, effective leadership is crucial. This highlights the importance of vigilant oversight and collaboration between operations and management. The need for continuous assessment of BCM and IPA performance metrics is recognised. Automation processes are considered integral to the overall assessment of BC effectiveness, indicating that automation can enhance the measurement and evaluation of BCM initiatives. Both clauses are viewed as emphasizing the importance of operational planning and control. ''Management and Operations'' focuses on planning and controlling BCM support processes, while ''Operations'' in the context of IPA aims to sustain and expand automation programs. This alignment ensures that operational processes are well-planned and effectively executed in BCM and IPA initiatives. Combining ''Operation'' and ''Management and Operations'' is seen as seamlessly integrating automation processes into day-to-day operations. This optimization of routine tasks enhances the organization's overall resilience by ensuring that critical processes are consistently maintained. Both clauses are seen as highlighting the preparation of plans and procedures. In BCM, this ensures readiness to respond to disruptions. In the context of IPA, it supports the sustainable growth of automation programs. This alignment underscores the importance of well-defined plans and procedures in both initiatives. The alignment between the two clauses is emphasized as supporting risk mitigation in both BCM operations and IPA initiatives. This highlights the critical role of risk management in operational activities for both BCM and IPA. The combination is described as a perfect match, indicating a strong compatibility and complementarity between the ''Management and Operations'' clause and the ''Operations'' clauses.

Overall, as displayed in **Appendix C - Q5**, the responses suggest a strong consensus among the respondents regarding the effectiveness of combining these clauses. Integrating management and operations with operational processes is seen as a powerful approach to enhancing the organization's resilience and effectiveness in both BCM and IPA initiatives.

TABLE 8. PDCA, ISO 22301:2019 & IEEE 2755.2:2020 outcomes.

PDCA component	ISO 22301:2019	Outcomes	IEEE 2755.2:2020	Outcomes
Plan (Establish)	**Clause 4** ("context of the organization")	- Determine external and internal issues that are relevant to his purpose and affect your ability to achieve their BCMS results(s); - which stakeholders and requirements are relevant to BCMS; - Legal and regulatory requirements (for this must have a process to have the ability to identify, access, and evaluate the continuity of their products and services, activities, and resources); - Scope of Business Continuity Management Systems (Internal and External Issues; Requirements, Mission, Objectives, and Internal and External Obligations); - Implement a BCMS	**Clause 2** ("General overview and structure")	- Overall, the outcomes are intended to provide stakeholders with a clear understanding of the standard', as well as the key concepts and definitions used throughout the document. This sets the foundation for applying the standard to an IPA initiative and helps ensure that all stakeholders are on the same page
	Clause 5 ("leadership")	- High Management must demonstrate leadership and commitment by ensuring that the policy of continuing the predefined business is communicated, as well as who are the interveners and their responsibilities and which objectives are established, providing all the necessary resources and promoting continuous improvement.	**Clause 3** ("Exploration")	- Documented and clearly defined business-focused vision; - Documented identification and categorization of the instant motivations for exploring the potential of an IPA initiative; - Documented identification of dependencies of an IPA initiative or factors that conflict; - Documented competitive analysis to understand existing supplier; - Documented review with conclusions and considerations collected through the Exploration stage that support the recommendation to proceed or not.
	Clause 6 ("planning")	By planning BCMS to determine which objectives to be achieved, the actions to face risks and opportunities to ensure that BCMS achieves the intended results, preventing or reducing unwanted effects and achieving continuous improvement. These should be measurable, monitored, communicated, and tied as appropriate, incorporating change management techniques whenever necessary.	**Clause 4** ("Strategy")	- Maybe a new or significantly revised enterprise strategic plan, including prospective outcomes, benefits, and risks associated with deploying IPA, along with a high-level timetable and operating budget for the IPA initiative
	Clause 7 ("support")	The organization must determine and provide all the necessary resources to establish, implement, maintain and improve the BCMS. These resources must have the necessary skills and capabilities and be aware of the policies in force and the implications for not being in accordance. The organization must determine internal and external communications relevant to BCMs, creating and maintaining records in a controlled manner and allowing their distribution only to those who are authorized.	**Clause 6** ("Implementation")	- The deliverables from the implementation stage of work consist of fully tested and validated automation, including software, complete documentation, instructional materials, policies, procedures, and performance monitoring methods—all information, training, and practice guides required for controllers to run the automated processes safely and reliably at enterprise scale during the Management and Operations stage of work.

Q6. "Evaluation" clause from ISO 22301 and the "Performance Evaluation" clause from IEEE 2755.2

Respondents overwhelmingly perceive a high level of compatibility between the ''Evaluation'' clause from ISO 22301 and the ''Performance evaluation'' clause from IEEE 2755.2. The majority (95%) rated the compatibility as either a 4 or 5, indicating a strong perceived alignment.

There's a view that ''Evaluation'' and ''Performance evaluation'' look similar. Unless the word ''performance'' refers explicitly to evaluating the performance of the evaluation process itself, the objectives appear to be expected. This suggests a natural overlap in their focus on measurement and assessment. The adequacy of the integration is seen as 100%, indicating a high level of confidence in the compatibility and effectiveness of combining these clauses. Both clauses are seen as highlighting the need for measurement and assessment. ''Evaluation'' in ISO 22301 focuses on BCMS performance, while ''Performance evaluation'' in IEEE 2755.2 addresses the review of IPA programs. This alignment ensures that performance is systematically measured in both BCM and IPA initiatives to support growth while mitigating associated risks. While the integrated approach holds tremendous promise, there may be challenges in harmonizing certain aspects of BCM with automation. This includes ensuring that automated processes align with BC objectives without compromising security, which requires careful consideration. The integration is seen as an opportunity for improvement in both BCM and automation. It can lead to optimizing and scaling automation processes, ultimately resulting in more resilient and efficient BC strategies. Integrating ''Performance Evaluation'' and ''Evaluation'' is viewed as making performance evaluation more comprehensive. Automation of performance metrics allows for real-time monitoring of key indicators, enabling proactive adjustments

TABLE 8. *(Continued.)* **ISO 22301:2019 & IEEE 2755.2:2020 outcomes.**

PDCA component	ISO 22301:2019	Outcomes	IEEE 2755.2:2020	Outcomes
Do (Implement and operate)	**Clause 8** ("operation")	The organization must operationally plan and control BCM support processes to meet all requirements, implementing the processes and actions required to meet all criteria. It should perform business impact analysis and risk assessment over time, determining its order, and the types and impact criteria relevant to the context of the organization, to identify and elaborate BC strategies and solutions. The risk assessment process is addressed in ISO 31000. Other outcomes are preparing the BC's plan and procedures and allocating resources to implement the solutions and strategies to the risks raised, allowing you to alert and communicate effectively.	**Clause 7** ("Management and Operations")	- Cost/benefit analysis of automation in production—including hours returned to the business, improvement in quality or audit performance, enhanced throughput, and others—guides where further optimization or scale potential is possible.
Check (Monitor and review)	**Clause 9** ("performance evaluation")	An organization will be able to evaluate the performance and effectiveness of its BCMS and verify if it ensures that its intended outcomes are achieved by auditing: • whether the BCMS meets the needs of the organization • conforms to the requirement of ISO 22301:2019 • how consistently processes and procedures are being applied • whether processes and procedures achieve the intended results.	**Clause 5** ("Evaluation")	- Specific measurements [in the form of critical success factors (CSFs)] and deliverables that should be documented for evaluation, decision-making, and post-decision planning for the Implementation stage of work (Demonstration with key attributes and requirements, Proof of concept and pilot). The deliverables from the PoC stage should be a working automation.
Act (Maintain and improve)	**Clause 10** ("improvement")	The main purpose for implementing a BCMS is to ensure an organization can respond to a disruptive incident promptly on time, and to continue delivering its key products and services at a pre-defined level until return to normal operations can be affected. For this, need to determine opportunities for improvement and implement actions to achieve its intended outcomes of its BCMS, react to nonconformities, take action to control and correct the non-conformities, deal with the consequences, find the root cause, and investigate nonconformities. Any corrective actions identified to address nonconformities will be implemented without delay. The corrective action implemented is to be reviewed to determine its effectiveness.	**Clause 8** ("Optimization and Scaling")	- Measurements and deliverables in the optimizing and scaling stage include a set of metrics, KPIs, decisions, and action items that contribute to the program's overall growth and value generation. Programs should tailor the metrics and KPIs to meet their needs, and then use them to drive decisions and activities required to continue to optimize and scale the program.

to both automation processes and BCM strategies as needed.

Overall, as exposed in **Appendix C - Q6**, the responses suggest a strong consensus among the respondents regarding the compatibility and adequacy of combining the ''Evaluation'' clause from ISO 22301 with the ''Performance evaluation'' clause from IEEE 2755.2. This alignment is viewed as crucial for systematically measuring and assessing performance in both BCM and IPA initiatives, supporting growth while mitigating associated risks.

Q7. "Optimization and scaling" clause from ISO 22301 and the "Improvement" clause from IEEE 2755.2

Respondents overwhelmingly perceive a high level of compatibility between the ''Optimization and scaling'' clause from ISO 22301 and the ''Improvement'' clause from IEEE 2755.2. The majority (86.4%) rated the compatibility as either a 4 or 5, indicating a strong perceived alignment.

There's a view that while ''Improvement'' is a broader concept than ''optimization and scaling,'' their objectives are fully compatible. This suggests a natural overlap in their focus on driving enhancements and expansions in processes and initiatives. The integration is seen as key to efficient resource utilization for automation projects. It ensures that resources are allocated in a way that enhances current processes and allows for scaling automation initiatives. This targeted approach maximizes the impact of automation on BC. It is emphasized that the integration of 'Optimization and scaling' with 'Improvement' is crucial for maximizing the return on investments in automation. Improvements are seen as contributing not only to the current state but also to the scalability and optimization of automation solutions, enhancing their overall value in BC. Respondents specifically highlight that both clauses are compatible, indicating a strong consensus on their alignment. The combination is

TABLE 9. Summary of the main comments regarding questions 1 to 3 (these comments were optional to the closed questions).

Question	Comments
Q1.	"Alignment enables standardization, which enables easier awareness and understanding"
	"In my opinion, as a whole, the identified clauses make a very solid and pertinent match. However, and in a paradigmatic way, clause 7 (Management and Operations) presents a very strong and unequivocal connection."
	"I highlight that aligning the organizational context with the general structure provides a solid foundation for BCM and IPA initiatives. Both permit the understanding of the organization's structure that is crucial for effective planning and automation."
	"The 'Context of the Organization' clause emphasizes the importance of understanding the internal and external factors that influence an organization. Combined with the 'General overview and structure,' it ensures that automation is integrated seamlessly within the existing organizational framework. This alignment is crucial for achieving continuity objectives while leveraging automation technologies."
	"This integration can support risk mitigation, as by understanding the organizational context allows for a more nuanced assessment of potential risks and vulnerabilities. This contextual awareness guides the selection and implementation of automation solutions in a way that enhances business continuity efforts.
	"The integration of 'Context of the Organization' and 'General overview and structure' aids in optimizing resource allocation for automation projects. It ensures that automation efforts are prioritized and directed towards functions and processes foremost vital to the organization's overall structure and objectives. This targeted approach maximizes the impact of automation on business continuity."
	"It can establish a foundation for long-term alignment of automation efforts with organizational goals. This ensures that automation strategies evolve in sync with organizational structure and objectives changes, providing sustained support for business continuity initiatives."
	If we integrate 'Context of the Organization' with 'General overview and structure,' we establish a comprehensive understanding of the organizational landscape. This enables a more informed and strategic approach to both business continuity and automation initiatives. The 'Context' clause ensures that automation efforts are aligned with the overall structure and objectives of the organization."
Q2.	"Have doubts about the relation between Leadership (ISO) and Exploration (IEEE)"
	"The 'Leadership' clause, emphasizing clear communication of predefined business policies and objectives, aligns seamlessly with the 'Exploration' focus on a documented and business-focused vision. When high management effectively communicates the strategic vision, it provides a foundation for the detailed exploration of an IPA initiative's potential motivations and dependencies."
	"Not knowing in detail the clauses, looking only at the words and the context of them, it doesn't seem to have a fit."
	"It's an appropriate mapping, but as a mapping, the exploration clause is a vast subset of what 22301 describes. If the intent, though, is that by this mapping that, ISO is the tie-breaker between what is the implied framework of each (each inherits the strengths and weaknesses of the other, as a result), then ok, but otherwise (if no implied inheritance), it should be noted as separated."
	"Both can emphasize the importance of leadership in driving BCM and IPA efforts and how an exploratory approach to automation can uncover opportunities for improving business continuity strategies."
	"Effective leadership, as outlined in ISO 22301, empowers high management to make informed decisions regarding IPA initiatives. The 'Exploration' clause complements this by emphasizing the need for comprehensive documentation, including motivations, dependencies, and competitive analysis. This ensures that leadership has the necessary insights to drive the initiative forward."
	"The 'Leadership' clause, emphasizing the communication of predefined business policies and objectives, provides the foundation for turning the strategic vision into actionable plans. This aligns with the 'Exploration' clause's focus on documenting motivations, dependencies, and competitive analysis, ensuring that a detailed roadmap supports the vision."
	"Highlights the pivotal role of leadership in driving the adoption of automation technologies. A forward-thinking approach to exploration can uncover opportunities for utilizing automation to enhance BCM strategies, allowing organizations to respond more effectively to unforeseen events."
	"Leadership's role in providing resources aligns with the 'Exploration' clause's focus on identifying dependencies and conflicts. This combination might ensure that leadership is equipped to proactively manage risks and resolve conflicts that may arise while exploring an IPA initiative."
	"It should be considered to find also a match between Clause #7 (Management & Operations)."
Q3.	"Planning must follow a strategy direction and definition, so I believe they have high compatibility."
	"Clauses match Perfectly."
	"Both 'Planning' and 'Strategy' clauses emphasize actions to face risks and opportunities. 'Planning' within the BCMS context focuses on risk assessment and mitigation, while 'Strategy' in the IPA context involves controlling deployment risks. This alignment ensures that risk management is integral to BCMS planning and IPA strategy development."
	"From my point of view, the 'Planning' clause from ISO 22301 and the 'Strategy' clause from IEEE 2755.2 are fundamentally aligned in their focus on strategic thinking. 'Planning' encompasses the development of a structured approach to business continuity, while 'Strategy' guides formulating a broader organizational strategy that may include automation initiatives. This alignment ensures that planning efforts are integrated into the larger strategic framework."
	"The match that was perceived is completely accurate and needed."
	"The 'Planning' clause emphasizes that objectives should be measurable and tied appropriately. This aligns with the 'Strategy' clause, which aims to assess how IPA can support and enhance the enterprise's strategic plan. Measurable objectives are crucial for BCMS and IPA initiatives, ensuring that progress can be tracked, monitored, and communicated effectively."
	"A well-supported automation strategy can significantly augment the effectiveness of BCM plans. Automation can streamline processes related to continuity planning, enabling faster response times and reducing human error in critical scenarios.
	"The 'Planning' clause emphasizes the need for structured business continuity plans. When integrated with the 'Strategy' clause, it ensures that automation initiatives are included as a strategic component of these plans. This alignment ensures that automation efforts are not viewed in isolation but are integral to the overall business continuity strategy."
	"Improvement in BCM and automation can go hand-in-hand to optimizing and scaling automation processes and lead to more resilient and efficient business continuity strategies."
	"Evaluating performance becomes more comprehensive with the integration of 'Performance Evaluation' and 'Evaluation', as the automation of performance metrics allows for real-time monitoring of key indicators, enabling proactive adjustments to both automation processes and BCM strategies as needed."

viewed as a way to future-proof automation initiatives. This integration ensures that automation solutions are effective today and designed to adapt and grow with the organization. It provides a strategic advantage in maintaining BC in a constantly evolving business landscape. The combination establishes a framework for iterative enhancement. It ensures

TABLE 9. *(Continued.)* **Summary of the main comments regarding questions 4 to 6 (these comments were optional to the closed questions).**

Question	Comments
Q4.	"During an implementation stage, support must be included or at least it must follow the implementation; without support the success of the implementation is questionable, to say the least."
	"Both complement each other."
	"It can mitigate the risks associated with implementing automation technologies. The 'Support' clause from ISO 22301 ensures that potential challenges such as skill gaps or resource constraints are addressed proactively, minimizing the likelihood of implementation setbacks. This synergistic approach increases the likelihood of successful automation deployment."
	"The integration of 'Support' from ISO 22301 with 'Implementation' from IEEE 2755.2 can lead to enhanced operational efficiency. The 'Support' clause emphasizes the importance of resources and competence, directly contributing to the effective 'Implementation' of automation processes. Adequate support ensures that the implementation is seamless and optimized for maximum impact."
	"The 'Support' clause from ISO 22301 complements the 'Implementation' clause from IEEE 2755.2 by ensuring that the implementation of automation technologies aligns seamlessly with the organization's business continuity goals. Adequate support regarding skilled personnel, technology infrastructure, and training ensures that automation initiatives contribute directly to the resilience of critical business functions."
	"The integration of 'Support' and 'Implementation' highlights the critical need for resource allocation and training. 'Support' ensures that the right resources, including personnel and technology, are allocated for successful 'Implementation' of automation solutions. This can help in achieving the intended business continuity and efficiency goals."
Q5.	"Operation and management go hand-by-hand, even though the perceived routine nature of operations, management must be watchful and work closely."
	"See my comments from #2 above."
	"There is a need for continuous assessment of BCM and IPA performance metrics. Therefore, automation processes can be integrated into the overall assessment of business continuity effectiveness."
	"Both 'Management and Operations' and 'Operations' clauses emphasize the importance of operational planning and control. 'Management and Operations' focuses on planning and controlling BCM support processes, while 'Operations' in the context of IPA aims to sustain and expand automation programs. This alignment ensures that operational processes are well-planned and effectively executed in BCM and IPA initiatives."
	"Direct connection"
	"From my point of view ', Management and Operations' and 'Operations' clauses highlight the preparation of plans and procedures. In BCM, this ensures readiness to respond to disruptions. In the context of IPA, it supports the sustainable growth of automation programs. This alignment underscores the importance of well-defined plans and procedures in both initiatives."
	"The combination of 'Operation' and 'Management and Operations' ensures that automation processes are seamlessly integrated into day-to-day operations. This also optimises routine tasks and enhances the organization's overall resilience by ensuring that critical processes are consistently maintained."
	"The 'Management and Operations' clause in ISO 22301 emphasizes mitigating risks in BCM operations. This aligns with the objective of the 'Operations' clause in IEEE 2755.2, which seeks to mitigate risks while expanding enterprise capacity through IPA. Both clauses highlight the importance of risk management in operational activities."
	"Nevertheless, we find a perfect match on this; we are upon a strong compatibility and complement related."
Q6.	"Again, not knowing the details of the clauses evaluation and performance evaluation look similar and unless the word performance if specific of looking at how the 'performance' of the evaluation itself I would say the objectives are common."
	"Adequacy is 100%"
	"Having the wide scope related with the 'Evaluation' concept, we cover all the key areas related, namely auditing, risk impacts, reporting, ... So, the 'marriage' between both is very natural and strong."
	"Both 'Evaluation' and 'Performance evaluation' clauses highlight the need for measurement and assessment. 'Evaluation' in ISO 22301 focuses on BCMS performance, while 'Performance evaluation' in IEEE 2755.2 addresses the assessment of IPA programs. This alignment ensures that performance is systematically measured in both BCM and IPA initiatives to support growth while mitigating associated risks."
	"While this integrated approach holds tremendous promise, there may be challenges in harmonizing certain aspects of BCM with automation. For instance, ensuring that automated processes align with business continuity objectives without compromising security is a critical concern that requires careful consideration."
	"Improvement in BCM and automation can go hand-in-hand to optimizing and scaling automation processes and lead to more resilient and efficient business continuity strategies."
	"Evaluating performance becomes more comprehensive with the integration of 'Performance Evaluation' and 'Evaluation', as the automation of performance metrics allows for real-time monitoring of key indicators, enabling proactive adjustments to both automation processes and BCM strategies as needed."

that automation solutions are also optimized for current operations and scalable to accommodate future needs. This promotes a culture of continuous improvement, driving sustained benefits for BC.

Overall, as exhibited in **Appendix C - Q7**, there is a recognition of the significant potential in reshaping the intersection of BCM and IPA through integrating clauses from ISO 22301 and IEEE 2755.2. This integrated approach is seen as revolutionizing how organizations approach BC and automation, leading to a more resilient and efficient operational model. However, it's noted that robust change management processes, stakeholder buy-in, and training are crucial for successful implementation and maximizing the benefits of this integrated approach.

Q8. "In your expert opinion, considering the integration of clauses from ISO 22301 and IEEE 2755.2, how do you envision this combined framework influencing the intersection of Business Continuity Management (BCM) and Intelligent Process Automation (IPA)? Please share any insights, concerns, or potential advantages you foresee in implementing this integrated approach".

Based on the feedback provided, as demonstrated in **Appendix C - Q8**, there is a strong consensus among participants that integrating ISO 22301 and IEEE 2755.2 holds

TABLE 9. *(Continued.)* **Summary of the main comments regarding questions 7 to 8 (these comments were optional to the closed questions).**

Question	Comments
Q7.	"Improvement is again a concept larger than "optimization and scaling" but forgetting the specifics of the wordings I say they are fully compatible."
	"Integrating 'Optimization and scaling' with 'Improvement' leads to efficient resource utilization for automation projects. It ensures that resources are allocated in a way that enhances current processes and allows for scaling automation initiatives. This targeted approach maximizes the impact of automation on business continuity."
	"The integration of 'Optimization and scaling' with 'Improvement' is key to maximizing the return on investments in automation. It ensures that improvements are not isolated but contribute to the overall scalability and optimization of automation solutions. This holistic approach enhances the value derived from automation in terms of business continuity."
	"Both clauses are compatible."
	"By combining 'Optimization and Scaling' with 'Improvement,' we future-proof automation initiatives. This integration ensures that automation solutions are effective today and designed to adapt and grow with the organization. It provides a strategic advantage in maintaining business continuity in a constantly evolving business landscape."
	"This is a key area of the broad diagram presented. Besides linking both rules, the ISO 22301 clause expands the scope by introducing the scaling area. Nonetheless, both converge in fighting (e.g.), Non-Conformities."
	"If 'Optimization and scaling' are aligned with 'Improvement,' it will support the strategic evolution of automation capabilities. This integration enables organizations to also refine existing processes and scale automation efforts to cover broader areas. It ensures that improvements in automation contribute directly to enhancing business continuity strategies."
	"It establishes a framework for iterative enhancement. This combination ensures that automation solutions are optimized for current operations and scalable to accommodate future needs. It promotes a culture of continuous improvement, driving sustained benefits for business continuity."
Q8.	"This approach ensures a robust and holistic understanding of the integration of ISO 22301 and IEEE 2755.2, drawing on the expertise of practitioners and leveraging existing organizational documentation for added context and validation".
	"As I had the opportunity to cover previously (above), the match identified between the ISO 22301 Clauses and the IEEE 2755.2is indeed very strong and, most importantly, extremely relevant. Taking that and to conclude, in my opinion, the design of this framework should constitute a very useful and powerful tool for, mainly, to have the right management tool to obtain success in complex projects."
	"In my view, the main advantage is the ease of understanding the process and reading the ISO clauses and stages. This model makes it easier for business specialists to have a clearer model."
	"One notable advantage is the seamless alignment of organizational context with operational structures. This provides a solid foundation for BCM and IPA initiatives, ensuring that automation efforts are strategically deployed in areas with the highest impact on business continuity."
	"The combination of framework ISO 22301 and IEEE 2755.2 has the potential to revolutionize the way organizations approach business continuity and automation. By leveraging the strengths of both frameworks, organizations can achieve a more resilient and efficient operational model that enhances their ability to navigate disruptions and drive sustainable growth. But in terms of implementation, it's imperative to have a robust change management process in place to ensure a smooth transition. Stakeholders buy-in and training will play a crucial role in maximizing the benefits of this integrated approach."
	"The integration of clauses from ISO 22301 and IEEE 2755.2 holds significant potential in reshaping the intersection of Business Continuity Management (BCM) and Intelligent Process Automation (IPA). By combining these frameworks, we create a comprehensive approach that safeguards critical business functions during disruptions and not leverages automation to enhance operational efficiency."

significant potential in reshaping the intersection of BCM and IPA. The combined framework is a powerful tool that can revolutionize how organizations approach BC and automation. Four of these six responses express positive views regarding the integration of ISO 22301 and IEEE 2755.2, highlighting advantages such as enhanced understanding, strong relevance, ease of comprehension, and potential for revolutionizing BC and automation. One response emphasizes the importance of change management for successful implementation. One provides a practical insight into how the combined framework can be a powerful management tool for complex projects.

Please note that this analysis is based on a qualitative evaluation of the responses, as the provided answers are not quantifiable in a traditional percentage format.

Overall, the feedback reflects a positive outlook on integrating ISO 22301 and IEEE 2755.2. Practitioners and experts see this combined framework as a valuable approach that has the potential to significantly impact the intersection of BCM and IPA positively. They recognize its potential to enhance organizational resilience and efficiency in the face of disruptions. However, they also acknowledge the importance of careful implementation, particularly in terms of change management and stakeholder buy-in

IX. CONCLUSION

This research provides an approach to a bi-directional mapping for IEEE 2755.2:2020 and ISO 22301:2019 on their clauses and sub-clauses (stages regarding the IEEE 2755.2:2020 standard). In addition to the mapping exercise, our objective is to augment the utility of IEEE 2755.2:2020 and ISO 22301:2019 by introducing visual models as a complementary aid to their existing textual representation.

This document offers versatile applications, serving organizations, projects, acquirers, and suppliers in diverse capacities. For academia, this research provides an instrumental resource for studying and advancing the integration of IPA and BCMS. Professionals stand to benefit from the practical insights and guidelines offered for implementing these frameworks in real-world scenarios.

However, it's important to acknowledge the limitations of this study. Contextual variations among organizations may require tailored approaches not covered in this analysis. Additionally, evolving industry standards and technologies could necessitate ongoing adaptation.

Looking ahead and charting a course for future research, a critical area of exploration involves the development of a comprehensive Maturity Model for both IEEE 2755.2:2020

and ISO 22301:2019, connected to essential domains including cybersecurity, data breach prevention, governance, risk, and compliance. The aim is to gain insights into the comprehensive impact on people, technology, and processes. Such a model would capture the nuances of individual and organizational contexts and provide a nuanced evaluation of the maturity of implementing SBIPA under the purview of BCMS. This framework becomes pivotal in offering organizations a structured approach to gauge their maturity levels, fostering continuous improvement and resilience in the face of evolving challenges.

Moreover, pursuing a sustainable combination of IEEE 2755:2020 and ISO 22301:2019 demands a multifaceted approach. Beyond the technical integration, prioritizing energy efficiency, actively reducing the carbon footprint, and promoting inclusivity within the framework emerge as integral components. A meticulous cost-benefit analysis, coupled with a commitment to adaptability in the face of future technological advancements, forms the basis for a resilient and sustainable merged framework.

Compliance with stringent environmental standards becomes very important, and ongoing stakeholder engagement, transparent communication, and a culture of continuous improvement further solidifies the alignment with sustainable practices in business continuity and intelligent process automation.

APPENDIX A

See Table 7.

APPENDIX B

See Table 8.

APPENDIX C

See Table 9.

REFERENCES

[1] S. Chatterjee, R. Chaudhari, and R. Shams, "Applications of industry 4.0 for pandemic responses and business Continuity: A TOE-DCV integrated approach," *IEEE Trans. Eng. Manag.*, early access, Mar. 17, 2023, doi: 10.1109/TEM.2023.3250587.

[2] M. Röglinger, R. Plattfaut, V. Borghoff, G. Kerpedzhiev, J. Becker, D. Beverungen, J. vom Brocke, A. Van Looy, A. del-Río-Ortega, S. Rinderle-Ma, M. Rosemann, F. M. Santoro, and P. Trkman, "Exogenous shocks and business process management: A scholars' perspective on challenges and opportunities," *Bus. Inf. Syst. Eng.*, vol. 64, no. 5, pp. 669–687, Oct. 2022, doi: 10.1007/s12599-021-00740-w.

[3] M. Greve, S. Hengstler, and S. T. N. Trang. (2020). *Overcoming Digital Challenges: A Cross-Cultural Experimental Investigation of Recovering From Data Breaches*. Accessed: Nov. 19, 2023. [Online]. Available: https://www.researchgate.net/publication/344367508

[4] D. A. da Silva Costa, H. São Mamede, and M. M. da Silva, "Robotic process automation (RPA) adoption: A systematic literature review," *Eng. Manage. Prod. Services*, vol. 14, no. 2, pp. 1–12, Jun. 2022, doi: 10.2478/emj-2022-0012.

[5] R. Uskenbayeva, Z. Kalpeyeva, R. Satybaldiyeva, A. Moldagulova, and A. Kassymova, "Applying of RPA in administrative processes of public administration," in *Proc. IEEE 21st Conf. Bus. Informat. (CBI)*, vol. 2, Jul. 2019, pp. 9–12, doi: 10.1109/CBI.2019.10089.

[6] S. Sutipitakwong and P. Jamsri, "The effectiveness of RPA in fine-tuning tedious tasks," in *Proc. 6th Int. Conf. Eng., Appl. Sci. Technol. (ICEAST)*, Jul. 2020, pp. 1–4, doi: 10.1109/ICEAST50382.2020.9165452.

[7] T. Chakraborti, *From Robotic Process Automation to Intelligent Process Automation: Emerging Trends*. Cham, Switzerland: Springer, 2020, doi: 10.1007/978-3-030-58779-6.

[8] Angraini, R. A. Alias, and Okfalisa, "Information security policy compliance: Systematic literature review," *Proc. Comput. Sci.*, vol. 161, pp. 1216–1224, Jan. 2019, doi: 10.1016/j.procs.2019.11.235.

[9] S. E. A. Ali, F.-W. Lai, P. D. D. Dominic, N. J. Brown, P. B. B. Lowry, and R. F. Ali, "Stock market reactions to favorable and unfavorable information security events: A systematic literature review," *Comput. Secur.*, vol. 110, Nov. 2021, Art. no. 102451, doi: 10.1016/j.cose.2021.102451.

[10] S. Rasoulian, Y. Grégoire, R. Legoux, and S. Sénécal, "Service crisis recovery and firm performance: Insights from information breach announcements," *J. Acad. Marketing Sci.*, vol. 45, no. 6, pp. 789–806, Nov. 2017, doi: 10.1007/s11747-017-0543-8.

[11] *2755.2-2020—IEEE Recommended Practice for Implementation and Management Methodology for Software-Based Intelligent Process Automation | IEEE Standard | IEEE Xplore*. Accessed: Apr. 7, 2023. [Online]. Available: https://ieeexplore.ieee.org/document/9404959

[12] (2020). *ISO 22313:2020(en) Security and Resilience—Business Continuity Management Systems—Guidance on the Use of ISO 22301*. Accessed: Feb. 25, 2023. [Online]. Available: https://www.iso.org/obp/ui/#iso:std:iso:22313:ed-2:v1:en

[13] N. C. Suresh, G. L. Sanders, and M. J. Braunscheidel, "Business continuity management for supply chains facing catastrophic events," *IEEE Eng. Manag. Rev.*, vol. 48, no. 3, pp. 129–138, 3rd Quart., 2020, doi: 10.1109/EMR.2020.3005506.

[14] J. Brás, R. Pereira, and S. Moro, "Intelligent process automation and business continuity: Areas for future research," *Information*, vol. 14, no. 2, p. 122, Feb. 2023, doi: 10.3390/info14020122.

[15] (2012). *ISO 22301:2012(en), Societal Security—Business Continuity Management Systems—Requirements*. Accessed: Feb. 23, 2023. [Online]. Available: https://www.iso.org/obp/ui/#iso: std: iso:22301:ed-1:v2:en

[16] *Standards—BCMpedia. A Wiki Glossary for Business Continuity Management (BCM) and Disaster Recovery (DR)*. Accessed: Feb. 23, 2023. [Online]. Available: https://www.bcmpedia.org/wiki/Standards

[17] ISO. (2019). *ISO 22301:2019 Security and Resilience—Business Continuity Management Systems—Requirements*. Accessed: Dec. 26, 2020. [Online]. Available: https://www.iso.org/obp/ui/#iso: std: iso:22301:ed-2:v1:en

[18] *PAS56, PAS 56 and BS25999 Business Continuity Management*. Accessed: Feb. 23, 2023. [Online]. Available: https://web.archive.org/web/20061015195120/http://www.pas56.com/

[19] *ISO/IEC 27001:2022—Information Security, Cybersecurity and Privacy Protection—Information Security Management Systems—Requirements*. Accessed: Apr. 2, 2023. [Online]. Available: https://www.iso.org/standard/82875.html

[20] *BS25999, BS 25999*. Accessed: Apr. 4, 2023. [Online]. Available: https://web.archive.org/web/20061015195123/http://www.pas56.com/support.htm

[21] *BS 25999 and Its Contribution to Business Continuity Management | BSI Middle East and Africa*. Accessed: Apr. 4, 2023. [Online]. Available: https://www.bsigroup.com/en-AE/About-BSI/Media-Center/Press-releases/2011/6/BS-25999-and-its-Contribution-to-Business-Continuity-Management/

[22] *Moving From BS 25999-2 to ISO 22301*. Accessed: Apr. 4, 2023. [Online]. Available: https://www.bsigroup.com/documents/iso-22301/resources/bsi-bs25999-to-iso22301-transition-uk-en.pdf

[23] *SI 24001: Organizational Resilience Management System (ORMS)—Requirements and Guidance for Use—Standards Institution of Israel*. Accessed: Apr. 2, 2023. [Online]. Available: https://www.sii.org.il/en/24001

[24] *ISO/PAS 22399:2007—Societal Security—Guideline for Incident Preparedness and Operational Continuity Management*. Accessed: Apr. 2, 2023. [Online]. Available: https://www.iso.org/standard/50295.html

[25] *Singapore Standards*. Accessed: Apr. 2, 2023. [Online]. Available: https://www.singaporestandardseshop.sg/Product/SSPdtDetail/235b31c7-7d39-4282-9205-6e4a5a3f7805

[26] NFPA. (Dec. 17, 2012). *NFPA ® 1600 Standard on Disaster/Emergency Management and Business Continuity Programs 2013 Edition An International Codes and Standards Organization*. Accessed: Feb. 22, 2023. [Online]. Available: http://www.nfpa.org

[27] *Business Continuity-Managing Disruption-Related Risk*. Accessed: Apr. 4, 2023. [Online]. Available: http://www.saiglobal.com.au

[28] *ASIS International and BSI Release Joint Business Continuity Management ANSI Standard*. Accessed: Apr. 2, 2023. [Online]. Available: https://www.continuitycentral.com/news05526.html

[29] *Business Continuity Management: Understanding the Requirements of ISO 22301:2012 and ISO 22301:2019*, BSI Org., Standard ISO 22301, 2019.

[30] *ISO 22301, The Business Continuity Management Standard*. Accessed: Apr. 2, 2023. [Online]. Available: https://www.isms.online/iso-22301/

[31] *NIST SP 800-34 | NIST*. Accessed: Apr. 4, 2023. [Online]. Available: https://www.nist.gov/privacy-framework/nist-sp-800-34

[32] *IEEE Recommended Practice for Implementation and Management Methodology for Software-Based Intelligent Process Automation*, Ted Burse, Bursa, Türkiye, 2020.

[33] (Jan. 2017). *P2755/D1, IEEE Approved Draft Guide to Terms and Concepts in Intelligent Process Automation*. [Online]. Available: https://ieeexplore.ieee.org/document/7891875/keywords#keywords

[34] *ISO/IEC 15504-2:2003—Information Technology—Process Assessment—Part 2: Performing an Assessment*. Accessed: Apr. 7, 2023. [Online]. Available: https://www.iso.org/standard/37458.html

[35] *ISO/IEC TR 18018:2010—Information Technology—Systems and Software Engineering—Guide for Iguration Management Tool Capabilities*. Accessed: Apr. 7, 2023. [Online]. Available: https://www.iso.org/standard/51042.html

[36] *ISO/IEC 33020:2015—Information Technology—Process Assessment—Process Measurement Framework for Assessment of Process Capability*. Accessed: Apr. 7, 2023. [Online]. Available: https://www.iso.org/standard/54195.html

[37] *IEEE Guide for Terms and Concepts in Intelligent Process Automation*, Standard IEE 2755-2017, 2017.

[38] *2755.1-2019—IEEE Guide for Taxonomy for Intelligent Process Automation Product Features and Functionality | IEEE Standard | IEEE Xplore*. Accessed: Apr. 7, 2023. [Online]. Available: https://ieeexplore.ieee.org/document/8764094

[39] *PDSA Cycle—The W. Edwards Deming Institute*. Accessed: Feb. 21, 2023. [Online]. Available: https://deming.org/explore/pdsa/

[40] J. Ning, Z. Chen, and G. Liu, "PDCA process application in the continuous improvement of software quality," in *Proc. Int. Conf. Comput., Mechatronics, Control Electron. Eng.*, vol. 1, Aug. 2010, pp. 61–65. Accessed: Feb. 21, 2023. [Online]. Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5609635

[41] J. Järveläinen, "IT incidents and business impacts: Validating a framework for continuity management in information systems," *Int. J. Inf. Manage.*, vol. 33, no. 3, pp. 583–590, Jun. 2013, doi: 10.1016/j.ijinfomgt.2013.03.001.

[42] *P2755.2/D2, Sept_2020-IEEE Approved Draft Recommended Practice for Implementation and Management Methodology for Software Based Intelligent Process Automation (SBIPA)*, Standard IEEE P2755.2/D2, Sep. 2020, pp. 1–58. Accessed: Mar. 17, 2021. [Online]. Available: https://ieeexplore.ieee.org/document/9199584

[43] *IEEE Guide for Terms and Concepts in Intelligent Process Automation*, IEEE Standard 2755-2017, 2017, pp. 1–16, doi: 10.1109/IEEESTD.2017.8070671.

[44] T. Hollweck, "Robert K. Yin. (2014). Case study research design and methods (5th ed.)," *Can. J. Program Eval.*, vol. 30, no. 1, pp. 108–110, Mar. 2015, doi: 10.3138/cjpe.30.1.108.

[45] K. M. Eisenhardt, "Building theories from case study research," *Acad. Manage. Rev.*, vol. 14, no. 4, pp. 532–550, Oct. 1989. [Online]. Available: https://www.jstor.org/stable/258557

[46] S. T. March and G. F. Smith, "Design and natural science research on information technology," *Decis. Support Syst.*, vol. 15, no. 4, pp. 251–266, Dec. 1995, doi: 10.1016/0167-9236(94)00041-2.

[47] M. Rosemann and I. Vessey, "Toward improving the relevance of information systems research to practice: The role of applicability checks," *MIS Quart.*, vol. 32, no. 1, p. 1, 2008, doi: 10.2307/25148826.

[48] *ISO 22301: Business Continuity Management System, Implementation and Audit | Groups | LinkedIn*. Accessed: Aug. 19, 2023. [Online]. Available: https://www.linkedin.com/groups/8347186/

[49] *Institute of Business Continuity Management | Groups | LinkedIn*. Accessed: Jul. 7, 2023. [Online]. Available: https://www.linkedin.com/groups/4699159/

[50] *Business Continuity | Groups | LinkedIn*. Accessed: Oct. 7, 2023. [Online]. Available: https://www.linkedin.com/groups/60416/

[51] *Institute of Business Continuity Management | Groups | LinkedIn*. Accessed: May 22, 2023. [Online]. Available: https://awww.linkedin.com/groups/4699159/

[52] *Business Continuity & Disaster Recovery Consultants | Groups | LinkedIn*. Accessed: Jun. 17, 2023. [Online]. Available: https://www.linkedin.com/groups/126477/

[53] *ISO 22301: Business Continuity Management System, Implementation and Audit | Groups | LinkedIn*. Accessed: Sep. 5, 2023. [Online]. Available: https://awww.linkedin.com/groups/8347186/

[54] *Disaster Recovery Journal (DRJ) Dedicated to Business Continuity Since 1987 | Groups | LinkedIn*. Accessed: Jun. 5, 2023. [Online]. Available: https://www.linkedin.com/groups/117659/

[55] *RPA & IPA / AI+ML / IDP / BPM ? Consultants Group | Groups | LinkedIn*. Accessed: Oct. 7, 2023. [Online]. Available: https://www.linkedin.com/groups/7045359/

[56] *Robotic Process Automation (RPA) / IPA / Artificial Intelligence / Machine Learning / Analytics | Groups | LinkedIn*. Accessed: Oct. 7, 2023. [Online]. Available: https://www.linkedin.com/groups/8604621/

[57] M. D. Myers and M. Newman, "The qualitative interview in IS research: Examining the craft," *Inf. Org.*, vol. 17, no. 1, pp. 2–26, Jan. 2007, doi: 10.1016/j.infoandorg.2006.11.001.

[58] M. D. Myers, *Qualitative Research in Business and Management*, 2nd ed. Newbury Park, CA, USA: Sage, 2013.

[59] I. S. Bianchi, R. D. Sousa, and R. Pereira, "Information technology governance for higher education institutions: A multi-country study," *Information*, vol. 8, no. 2, p. 26, 2021, doi: 10.3390/informatics8020026.

JOSÉ CASCAIS BRÁS received the B.S. degree in information technology management and the master's degree in software engineering from Universidade Lusófona, Lisbon, Portugal, in 2010 and 2017, respectively. He is currently pursuing the Ph.D. degree in information science and technology with the ISCTE University of Lisbon, Portugal.

He is also a Research Assistant Professor with ISTAR-IUL—Information Sciences, Technologies and Architecture Research Center (ISTA), ISCTE University of Lisbon, and a Research Assistant Professor with COPELABS, Universidade Lusófona. He is also the Consulting Director of CGI, Portugal. His research interests include business continuity, governance, risk, compliance, the intersection between business process management, business process automation, intelligent process automation, and business continuity. More specifically, his research seeks to understand the state of awareness of RPA/IPA within the business continuity management lifecycle.

RUBEN FILIPE PEREIRA received the master's degree in computer engineering and in computer science and the Ph.D. degree in computer science and information systems from Instituto Superior Técnico. He is currently an Assistant Professor with ISCTE. With extensive experience as a consultant in various sectors, including services, banking, telecommunications, healthcare, and e-commerce. Currently, he is an Advisor to several prominent organizations. He is also a Researcher with the Institute of Telecommunications and leads a research group with INOV. With over 2000 citations, he is a recognized author of numerous scientific articles in areas, such as IT risk, IT strategy, IT value, IT governance, business process management, innovation, digital transformation, DevOps, and robotic process automation.

SÉRGIO MORO is currently a Full Professor with ISCTE, where he is also the Vice-President of the Scientific Council. He is also the former Deputy Director of the ISTAR Research Center, where he coordinated the Information Systems Group. He is also an Interdisciplinary Data Scientist that envisions the development of innovative predictive systems through data science approaches in distinct domains, such as marketing, management, tourism, and education. His work has received more than 2600 Scopus (H-index=25) and more than 4800 Google Scholar (H-index=33) citations. He is also the Deputy Director of the Department of Information Science and Technology. He is also the Director of the Master in Data Science.

ISAIAS SCALABRIN BIANCHI received the Ph.D. degree in technology and systems information from the University of Minho, Portugal. He is currently a Civil Servant with the Federal University of Santa Catarina, where he has been working, since 2010, holding several management positions. He investigates IT governance, information technology services management, business process management, business intelligence, and digital transformation and innovation, in particular for public organizations and higher education institutions. His research has been published in leading IS conferences and international journals. He is also an Assistant Coordinator with the Open University of Brazil—UAB and Federal University of Santa Catarina, where he is also a Professor with the Master Program in Management. He is also a Visiting Professor with Al-Farabi Kazakh National University teaching and supervising Ph.D. students in the topics of digital transformation, digital marketing, and supply chain management. He also co-supervises master's students with the University of Minho and Instituto Universitário de Lisboa. He has achieved the Moodle Educator Competence in the Moodle Educator Certification Program.

RUI RIBEIRO received the Ph.D. degree in applied business management and in information systems from ISCTE/IUL, the M.B.A. degree from Universidade Católica Portuguesa, and the degree in computer engineering from IST. In academia, he is currently the Executive Director of the Lusofona Information Systems School—LISS and a Professor with Universidade Lusófona. At a business level, he is also the Head of Consulting and Technology with Auren Portugal, having previously been the General Director of IPTelecom, the Commercial Director of Infraestruturas de Portugal S.A., the Director of Information Systems with EP—Estradas de Portugal S.A., and the Professional Services Manager of Sybase Inc., Portugal. He is the coauthor of the book *Digital Transformation: The Challenges, Thinking and Doing* and several scientific articles, including *Digital Transformation: The Evolution of the Enterprise Value Chain* Series on Advances in Intelligent Systems and Computing (2020), pp. 290-302.