Alternative Representations of Business Process Models for Enhanced Understanding by People: A Systematic Mapping Study

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Abstract

Context: Business process models are essential resources in business process management approaches that allow people to understand how an organization works. With business process models, organizations can reflect on process improvements and bring innovation to their services and products. In this context, it is fundamental for the people involved in the organization to understand how the process is performed to avoid misunderstandings and losses. **Problem:** Although there are several ways to represent a business process model, it is challenging to find alternative representations apart from traditional approaches (graphical and textual) and identify non-traditional approaches, goals, advantages, disadvantages, audiences, etc. **Solution:** Therefore, in this paper, we explored how alternative representations of business process models are used to enhance people's understanding. **Method:** We planned, described, and performed a systematic mapping of the literature (SML) for that. **Summary Results:** In the search step, we found 322 primary studies, but after a careful evaluation criteria analysis by peer review, we accepted only 23. The results point to several alternative business process model representations, highlighting the potential for enhancing people's understanding. Additionally, we presented the advantages and disadvantages of alternative model representations related to specified audiences. **Contributions to IS:** Thus, this study brings contributions to the IS field by identifying aspects of alternative representations of business process models, which bring new ideas and reflections to explore new technological approaches to make organizational contexts more understandable and accessible for people. In addition, this research is aligned with the GranDSI-BR 2016-2026, once they approach innovative themes related to IS in an open and connected world.

CCS Concepts

• **Applied computing** → **Business process modeling**; • **Information systems** → Process control systems; Multimedia information systems.

Keywords

Business process model, Alternative representation, Understanding, People, Alternative process model.

1 Introduction

In a world increasingly connected and dependent on digital technologies, organizations look for greater business process efficiency and effectiveness [51]. In this scenario, organizations can improve and innovate their business process by considering and collaborating with people in high-quality digital approaches [44]. Thus, organizations implementing business process management (BPM) approaches must constantly review and improve their process models continually [20, 53].

BPM foresees business process modeling as an essential step that allows people to understand how an organization performs its activities, identify processes and resources, and look for improvements, resulting in business process model representations [20, 37]. These process models are presented by specific model languages such as the BPMN (Business Process Model and Notation), graphical models, or even in natural languages such as texts [41, 48], or other notations. The representation format does not matter, but every business process model aims to make itself understandable for people involved in the organizational context [2, 35].

For an organization to keep the success of its business, everyone should understand how to perform the business process and what the process model represents [20, 35, 46, 54]. However, traditional business process models (BPMN and others) might not be accessible or clear enough for ordinary people (staff, performers, clients, users, trainees, students, and others) [2, 13]. The lack of a good understanding of a business process model can bring risks regarding organizational productivity. For instance, users may perform tasks with the right equipment or resources or do not understand completely the process rule, which can compromise production or result in different hazards (injuries, time-consuming, high costs, etc.) [52].

According to Gallik et al., [24], there may be several ways to define a business process model, but it is challenging to determine characteristics such as user-friendly and easy-to-comprehend in a model representation. However, each kind of representation is designed for a particular purpose related to its target audience, bringing challenges related to the model's correctness, complexity, high costs, and others [41].

Therefore, in this study, apart from traditional business process models, we execute a systematic mapping of the literature (SML) aiming to identify primary studies that could help us answer the question: How are alternative representations of process models used to enhance people's understanding of business processes? In the search step, we identified 322 studies, but after careful analysis and peer review, we accepted 23 studies to help us answer research questions. As a result, we observe different alternative business process model representations, their proposals, advantages and

disadvantages, and whether they were assessed. We found evidence that alternative representations could bring innovations to understanding the business process, presenting new technological approaches that help people comprehend and collaborate with organizations.

Thus, we organized this article in the following sections: Section 2, we presented some concepts and definitions of business process management, modeling, and model understanding. Section 3 brings some related works. Section 4 presents the SML protocol and execution. We presented the results in Section 5, and we did a quick discussion in Section 6. Finally, Section 7 presents the final remarks.

2 Backgrounds

2.1 Business Process Management

A possible definition of Business Process Management (BPM) is a set of events, activities, rules, and decisions carried out by computational systems or humans that utilize resources to achieve specific objectives, aiming to create an artifact, deliver a service, or complete tasks for customers to enhance organizational value [20]. Additionally, BPM is a critical organizational process that examines how organizations perform their work and improve business performance and quality [50].

In general, several steps support the BPM approach, collectively referred to as the BPM life cycle [20]. This cycle includes: 1) process identification, 2) process discovery, 3) process analysis, 4) process redesign, 5) process implementation, and 6) process monitoring and control. Specific steps, such as process discovery and process redesign, generate BPM models, which serve as inputs for process analysis (as-is models) and process implementation (to-be models). Regardless of the specific steps that require a BPM model, the models must be understandable to all individuals within the organizational context [15, 20]. The success of any process-oriented initiative depends on a thorough understanding of the process, as this precedes effective execution and improvement [45]. Consequently, process modeling is a critical task in the BPM life cycle [20].

2.2 Business Process Modelling

Business process modeling is essential in every business process management initiative [3, 20, 47]. Its purpose is to represent an existing business process within an organization (as-is) or to redesign and propose a new process (to-be) aimed at fostering organizational innovation and improvement [20].

Process modeling involves describing and representing an organizational process in terms of objectives, actors, rules, activities, flows, resources, products, and other relevant elements [20]. A business process model is an abstraction of an existing or hypothetical process, derived through process discovery and comprehension [20]. These models are often simplified visual representations of process execution, offering a general overview of organizational rules and their interrelationships [1].

Business process models can be presented in various formats (graphical, textual, and others), often using standardized notations with symbols to represent processes [8]. BPMN (Business Process Model and Notation) is the most widely used business process modeling language. As an international standard, BPMN represents graphical elements with semantic meanings specific to business process contexts [20, 40]. Alternatively, textual or natural language models are often easier to understand, as they align with natural modes of human communication [2].

Regardless of the representation type, business process models must be understandable to all organizational staff (managers, performers, etc.). Business processes are "living entities" that require continual change and redesign for organizations seeking to maintain a competitive edge [20].

2.3 Business Process Models Understanding

A business process model is designed to capture and represent the execution of sequences of activities that constitute a general organizational process, along with the information and resources associated with these activities [4, 5]. However, understanding such a model can be cognitively demanding, as its components are often complex. Challenges arise due to hidden dependencies among tasks, gateways, and business rules, which are difficult to discern within the model and to infer from overarching process knowledge [25, 42].

When a model is overly complex and requires in-depth comprehension, the cognitive load increases, which can diminish learning effectiveness. Various approaches — known as "secondary notations" or "support notations" — can add information or enhance model visualization [23] to alleviate this cognitive load associated with business process models. Providing methods to enhance process model comprehension, reduce cognitive load, and improve organizational efficacy is essential for organizations aiming to meet their objectives [4, 41].

3 Related Works

Including similar secondary studies in the related works section of systematic literature reviews is a common practice [34]. This approach helps highlight the relevance of the research and emphasizes its significant differences from previous studies.

In related works, we identified several studies with similarities and differences compared to our investigative purpose. For instance, Bitencourt et al. [9] and Karras and Papademetriou [32] conducted literature reviews to identify approaches for using various models to support business process requirements, focusing on BPMN extensions, variations, or techniques for implementing BPM projects.

Fernandez et al. [19] conducted a systematic literature review to explore tools to improve the efficacy and quality of business process models. Their findings revealed approaches utilizing variations of the BPMN language that enhanced the organizational team's understanding of the models.

Similarly, Ferreira and Classe [21] performed a systematic mapping of the literature to identify studies incorporating narratives and storytelling elements in business process models. However, they found no studies that combined these themes. Instead, they conducted separate research, identifying 14 studies that contributed to their investigation.

Previous related works have contributed to understanding the state-of-the-art of various business process model approaches, their applications, and the stages of the BPM lifecycle in which they were utilized. However, while these studies proposed alternatives

to traditional model-based notation languages, they predominantly focused on variations or extensions of conventional models. In contrast, our study emphasizes creating alternative business process model representations to improve people's understanding.

This perspective allows us to explore how alternative representations enhance comprehension purposes, identify their target audience, understand their goals, and address potential challenges. Consequently, our study is valuable to advancing business process management and enhancing people's understanding of business models and their representations.

4 Systematic Mapping of the Literature

In this article, we conducted a systematic mapping of the literature based on the research guidelines provided by Kitchenham et al. [34]. According to these authors, systematic mapping allows for a broader review of primary studies on a given research subject. This approach also enables researchers to identify, analyze, and interpret studies relevant to a specific research topic. Developing a research protocol is essential to maintaining research rigor, as it provides the structural foundation for documenting our research decisions and supports the study's reproducibility by scientific peers.

Therefore, following the SEGRESS (Software Engineering Guidelines for REporting Secondary Studies) guidelines by Kitchenham et al. [34], we structured our study around the following steps: 1) method (protocol), 2) execution, and 3) discussion (Figure 1).

Figure 1: SML steps based on SEGRESS guidelines.

4.1 Protocol

The protocol is a component of SML planning, which includes (i) goal definition, (ii) formulation of research questions, (iii) development of selection criteria, (iv) design of search strategies and sources, and (v) definition of study phases.

In light of the main research question (RQ: How are alternative representations of process models used to enhance people's understanding of business processes?), we structured the study definition using the Goal-Question-Metric (GQM) approach [7], as follows: **analyzing** the presence of primary studies; **with the purpose of** identifying alternative representations; **related to** business process models; **from the perspective of** researchers; **in the context of** business process understanding.

Considering the definition, we proposed 5 secondary questions:

SQ1: What business process model representations were used in the studies?

SQ2: What were the primary goals and advantages of using alternative process model representations?

SQ3: What were the main challenges and disadvantages of using an alternative process model representation?

SQ4: Who was the target audience of business process models?

SQ5: Were there any assessments about the alternative representation?

In secondary studies, such as SMLs, search results often include several studies that do not align with the research purpose, even when a well-defined research strategy is in place. Therefore, it is essential to establish selection criteria closely aligned with the research goal to filter out irrelevant results. In this paper, Table 1 outlines the inclusion (IC) and exclusion (EC) criteria used to evaluate the studies.

Table 1: Selection studies criteria

Criteria type	Code	Description
Inclusion (IC)	IC01	Studies that approach alternative representation of business process models and that are not related to traditional representations (BPMN, EEPC, UML, I*, etc.)
Exclusion (EC)	EC01	Duplicated studies
	EC02	Studies that are not fully available.
	EC03	Studies that present only variations or extensions of traditional business process modeling languages.
	EC04	Studies that are not using English language.
	EC05	Studies that are not full papers (less than 4 pages)
	EC06	Studies that are book prefaces, book chapters, full books, posters, lectures, keynotes, tutorials, or similar formats.
	EC07	Studies that do not meet the inclusion criteria.

We organized our search process after planning the research questions and selection strategy. Following the SEGRESS guidelines, we employed a grouping keywords strategy to construct the research string[1]. This approach involves grouping keywords and their synonyms or variations into logical groups used in research databases. Thus, we structured the research string as follows:

("business process model" OR "business process modeling" OR "bpm model" OR "bpm modeling" OR "business process design" OR "designing business process")
AND
("representation" OR "present" OR "presentation" OR "visualization" OR "view" OR "display" OR "deliver" OR "receive")
AND
("user" OR "stakeholder" OR "collaborator" OR "worker" OR "experts" OR "manager" OR "team" OR "people")
AND
("understand" OR "understanding" OR "comprehend" OR "know")

We selected research databases based on the availability of logical search mechanisms and specific search fields, such as title, keywords, and abstract. For this study, we considered the most commonly used databases in computer science: *ACM DL, EI Compendex, IEEEXplore, ScienceDirect, Scopus, ISI Web of Science, and SBC Open Library.*

For execution of the SML, we planned 3 steps: 1) **Search** (step 1): we searched within scientific databases, retrieving results and removing duplicate studies; 2) **Selection** (step 2): we reviewed the

[1]According to Kitchenham et al. [34], PICOC-based strings do not make sense in the computer field, being more beneficial for the health field. Therefore, we opted not to use the approach in this SML.

title, abstract, and keywords of each study, applying the selection criteria; and 3) **Acceptance** (step 3): we performed a full-text reading of each study, applying the selection criteria and extracting data to support responses to the research questions.

Finally, to support the execution of the SML protocol, we used the *Parsif.al* system for organizing references. We then used *Google Sheets* to support the selection process and data summarization and *Atlas.ti* to analyze and correlate information.

4.2 Execution

We established the SML protocol and conducted all searches in October 2024. The search step returned a total of **322 studies** (Table 2 - search), from which we removed 80 duplicate studies (25%), leaving 242 studies (75%) for the next step. In the selection step (step 2 - Table 2 - selection), applying the selection criteria led to the rejection of 212 studies (66%), resulting in over 30 studies (9%) for detailed analysis in the acceptance step. Finally, in the acceptance step (Table 2 - acceptance), more than 7 studies (2%) were excluded. Consequently, **23 studies** (7%) were accepted to address our research questions, indicating a precision rate of 7% for our search string.

Table 2: Primary studies numbers by research base and execution steps

Research Base	Search	Duplicated		Selection		Acceptance	
		Removed	Remnants	Rejected	Remnants	Rejected	Accepted
ACM DL	2	1	1	1	0	0	0
EI Compendex	68	32	36	27	9	4	5
IEEE Xplore	18	7	11	11	0	0	0
Scopus	182	38	144	131	13	3	10
Web of Science	15	2	13	11	2	0	2
SBC Open Library	37	0	37	31	6	0	6
Total	**322**	**80**	**242**	**212**	**30**	**7**	**23**

It is important to note that the selection step involved a peer review process conducted by **two researchers**. To ensure research quality and fairness, each researcher performed the study selection independently (each researcher read all papers wholly and separately). At the end of this process, we agreed to reach a consensus through joint discussion in cases of differing opinions. We assessed the individual selections using the *Kappa Test* [33] to ensure reliability. The test yielded a coefficient of 83.7, indicating a **strong agreement** between researchers.

Finally, Table 3 presents the result of the SML execution after the selection and acceptance steps. This table shows the publication year, the study title, and a code that references the distinct study across the SML.

5 Results

In this section, we present the SML results, including a preliminary analysis summarizing the demographic data of the studies and information addressing each research question.

5.1 Preliminary

Analyzing the countries of origin of the publications (Figure 2, we observe that Germany leads with the most studies (7 - 2%), followed by Brazil (6 studies - 1.8%), Australia (2 studies - 0.6%), and the Netherlands, Austria, and Pakistan, with 1 study each (0.03%). Although the exact reasons are unclear, Germany hosts several BPM research centers focused on organizational process improvements and innovation. In Brazil, there is an interest in business research, along with efforts to help citizens and society better understand processes. For fairness, it is important to say that we excluded studies from the SBC Open Library from this world map because it is a Brazilian base. We included only studies sourced from international research databases. If we included them, Brazil would have 11 studies (3.4%). Other countries have conducted occasional research on this theme.

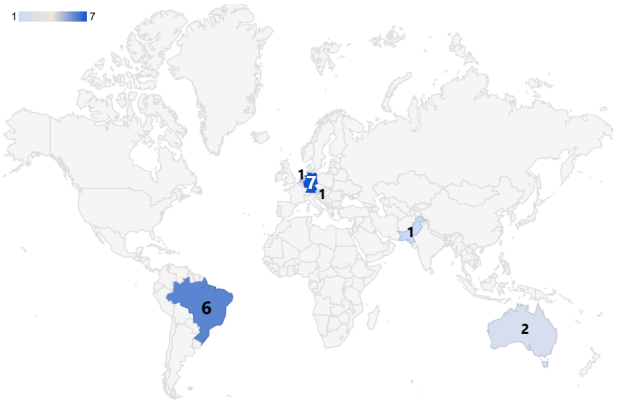

Figure 2: Amount of studies by country.

About the publication type and vehicles, in Figure 3, we observed that most studies were published in conferences or symposiums (69.6%), while only 7 studies (30%) appeared in journals. Among the journals, *Advanced Information Systems Engineering* published 2 studies. The conferences *Business Process Management Workshops* and the *Brazilian Symposium on Information Systems* included 2 studies.

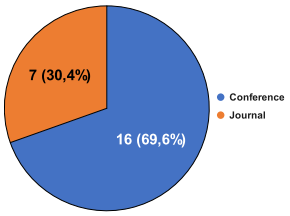

Figure 3: Publication types.

Examining the temporal distribution of publication years (Figure 4), we observed an increase in studies starting in 2008, with peaks in selected and accepted studies occurring in 2016, 2018, and 2020. This trend may indicate a growing interest in alternative representations of business process models as organizations have recognized the link between process comprehension and improvement. While traditional model representations are valuable within an organizational context, they may not be sufficiently simple or clear for non-specialists to understand and actively contribute to process improvements. However, we could not confirm the reason for this gain of interest.

Table 3: Accepted primary studies

Code	Year	Title
S01	2013	Back to origin: Transformation of business process models to business rules [35]
S02	2015	Business processes to touch: Engaging domain experts in process modelling [31]
S03	2020	Play Your Process - A Digital Game Design Method Based on Business Process Models [16]
S04	2018	Empirical Analysis of Sentence Templates and Ambiguity Issues forBusiness Process Descriptions [46]
S05	2021	DyVProMo - A Lightweight Web-Based Tool for the Dynamic Visualization of Additional Information in Business Process Models [24]
S06	2016	Process Modelling as Serious Game: Design of a Role-Playing Game for a Corporate Training [49]
S07	2018	From business processes to digital games: A mapping proposal [17]
S08	2015	Virtual business role-play: Leveraging familiar environments to prime stakeholder memory during process elicitation [27]
S09	2016	Augmenting process elicitation with visual priming: An empirical exploration of user behaviour and modelling outcomes [28]
S10	2024	Web-based Interactive Narratives to Present Business Processes Models [22]
S11	2018	BPMN model and text instructions automatic synchronization [6]
S12	2022	Learning by gaming: Improvement of User Experience of a Simulation Game for Teaching the Digital Transformation and its Administration Cockpit [10]
S13	2022	Narration as a Technique to Improve Process Model Comprehension: Tell Me What I Cannot See [4]
S14	2020	Immersive Process Model Exploration in Virtual Reality [55]
S15	2022	BPMN pra GERAL: a framework to translate BPMN to a citizen language [13]
S16	2010	Tangible Business Process Modeling - Methodology and Experiment Design [26]
S17	2023	Alternative and Interactive Representations of Public Service Process Models [36]
S18	2020	BPMN pra GERAL, Business Process Models in a Citizen Language [12]
S19	2024	Business Process Modeling Concepts Using Paper Folding in the Organizational Aspects of Information Systems Course [14]
S20	2023	Integrating BPMN and AIML to build dialog flows for Chatbots [39]
S21	2016	BPM2Text: A language independent framework for Business Process Models to Natural Language Text [43]
S22	2012	Supporting end-user articulations in evolving business processes: A case study to explore intuitive notations and interaction designs [29]
S23	2012	Timeline visualization for documenting process model change [30]

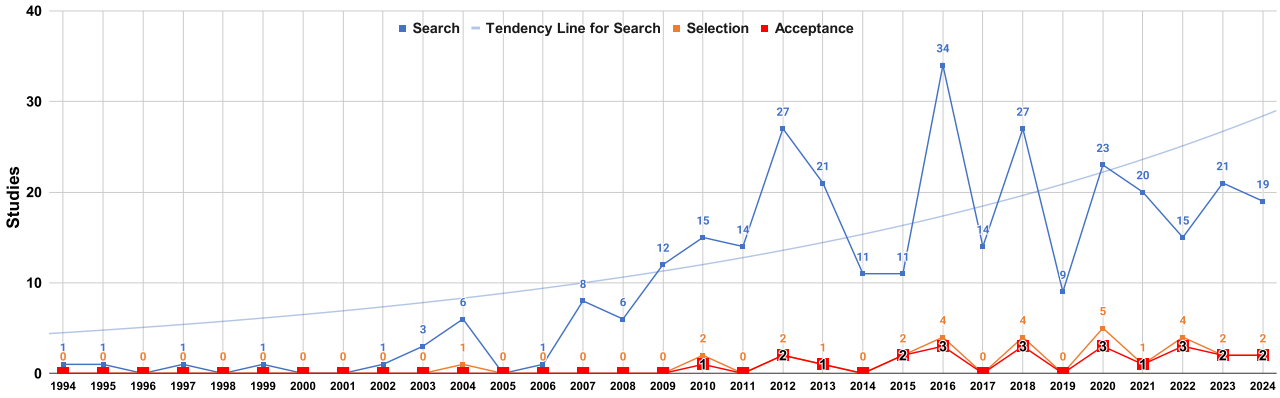

Figure 4: Amount of studies by publication year.

At last, considering the authors of the studies (Figure 5), we identified several names associated with research on alternative representations, such as *Udo Kannengiesser (Austria)*, *Tadeu Moreira de Classe (Brazil)*, *Joel Harman (Australia)*, *Renata Mendes de Araujo (Brazil)*, and *Geraldo Bonorino Xexéo (Brazil)*. This highlights these authors' sustained interest in the topic, suggesting they could be references in future reviews.

Figure 5: Main authors.

5.2 Research Questions

SQ1) What business process model representations were used in the studies?

The first question aims to identify the types of alternative business process model representations that researchers are proposing as substitutes for traditional models, such as BPMN.

Analyzing each accepted study, we identified 11 approaches to representing business processes. As shown in Figure 6, 5 studies (22% - S03, S06, S07, S12, and S17) focused on using digital games to represent models. These studies incorporated process elements

such as activities, tasks, rules, resources, gateways, and roles within a gamified environment, illustrating how processes are performed. The second most common alternative representation was natural language (text), with 4 studies (17% - S01, S04, S11, and S21)translating models into textual formats to facilitate readability.

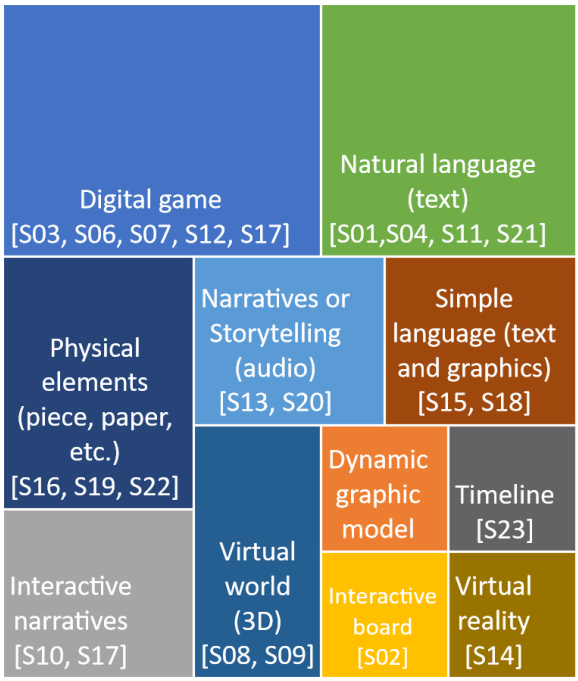

Figure 6: Types of alternative business process models representations.

Next, process representations using physical elements (e.g., pieces, paper) were addressed in 3 studies (13%). In studies S16 and S22, the authors utilized tools such as paper, pen, transparent cards, and boards to draw as-is business process models. In study S19, business process models were represented through paper folding techniques.

Process model representations through interactive narratives, storytelling, simple language (text and graphics), and virtual 3D worlds appeared in 2 studies (9%) each. Regarding interactive narratives, studies S10 and S17 explored representing business process elements and their execution sequence using interactive stories for users. Studies S13 and S20 employed audio narratives, utilizing storytelling techniques to present business processes. In studies S15 and S18, the authors proposed using simple text and visual forms to represent business process models to enhance citizen understanding in public service contexts. Finally, authors of studies S08 and S09 envisioned process representations using virtual 3D worlds.

Finally, 4 studies introduced unique alternative process models, including dynamic graphic representation (S05), interactive boards (S02), virtual reality (S14), and timelines (S23).

SQ2) What were the primary goals and advantages of using alternative process model representations?

After identifying the types of alternative business process model representations used in research, the next step was to investigate their goals and advantages. Thus, the primary objective of this research question is to establish a clear connection between alternative representations and their intended purposes.

In the initial analysis, we aimed to identify the main goals and advantages of employing alternative representations in each study. We identified 14 reasons for using alternative representations (Table 4. The most frequently cited reason was that alternative representations enable easier comprehension of process models compared to traditional models (19 studies - 83%). Additionally, several studies highlighted other advantages, such as the ability to simplify representations (4 studies - 17%), create interactive business process models (6 studies - 26%), and ensure process model consistency (3 studies - 13%), among others.

Table 4: Goal and advantages of alternative representations.

Advantages	Studies	Amout
Accessibility	S15, S18	2
Collaboration	S02	2
Concistency	S11, S21, S18	3
Decrease Ambiguity	S04	1
Engagement	S16, S22	2
Facilitate understanding	S01, S02, S03, S04, S05, S06, S07, S08, S09, S10, S12, S13, S14, S15, S19, S17, S18, S20, S22	19
Gamify the process	S03, S07	2
Improve process elicitation	S08, S09	2
Improve vizualization	S06	1
Interactivity	S03, S06, S07, S10, S12, S17	6
Learning	S12, S22	2
Simplify the representation	S03, S13, S15, S18	4
Traininng	S06	1
Understanding changes	S23	1

Building on these goals and advantages, we conducted further analyses by correlating them with alternative representations. Figure 7 presents a bubble graph illustrating the matrix of "alternative representation × goal," where the bubble size indicates the number of studies associated with each relationship. As shown in the graph and detailed in Table 4, "Facilitate understanding" appears as a goal in almost all studies, with the highest representation in digital games (5 studies), natural language representations (4 studies), and physical approaches (3 studies). Conversely, "Understanding changes" was mentioned in only one study, which used timelines for process representation, or for "training", only a digital game representation.

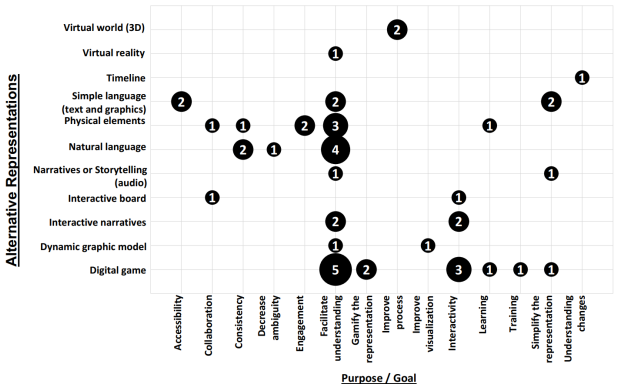

Figure 7: Primary goals by alternative representations.

This figure indicates possible goals related to unique representations. It could suggest that each alternative form representing a business process model focuses on different purposes related to different people, contexts, and BPM lifecycle.

SQ3) What were the main challenges and disadvantages of using an alternative process model representation?

On the other hand, alternative representations of business process models also present challenges and disadvantages. While analyzing the studies for goals and advantages, we identified several negative aspects related to creating or applying alternative representations. Figure 8 highlights the main disadvantages and their corresponding representations.

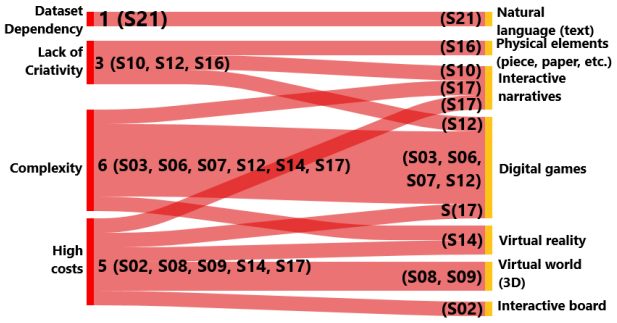

Figure 8: Disadvantages of alternative representations.

The figure reveals that the most frequently cited disadvantage is related to model complexity. For example, our analysis of the studies indicates that transforming business process elements into game aspects is far from straightforward. Additionally, some studies highlighted the high costs of creating alternative representations, particularly when employing virtual reality technologies. Alternative techniques also demand significant creativity. Professionals tasked with developing these representations are no longer just process modelers; they must also take on roles such as artists, programmers, and screenwriters. Consequently, a lack of creativity challenges the designing of effective alternative model representations.

SQ4) Who was the target audience of business process models?

This question aims to analyze the target audience for which the alternative business model representations were designed. Table 5 lists the roles identified in each study. Most studies (6 - 26%) focused on processes aimed at stakeholders. Following this, roles such as organizational managers, users or customers, and citizens were each addressed in 5 studies (22%). Other identified audiences include domain specialists, students, and trainees who engage with process models in various ways.

Table 5: Alternative process model audience.

Audience	Studies	Amout
Domain specialist	S02, S11, S21	3
Citizens	S03, S07, S15, S18, S17	5
Managers	S04, S10, S16, S17, S23	5
Stakehouders	S04, S10, S13, S16, S17, S23	6
Trainees	S06, S14	2
Users or customers	S10, S13, S14, S17, S22	5
Students	S12, S14, S19	3

SQ5) Were there any assessments about the alternative representation?

In the last question, we would want to understand whether alternative representations were assessed in some way. We could identify that some papers used research assessment methods, as described in Table 6. The most used evaluation method was experimental approaches (8 studies - 35%), but most of them only verified perceptions about the use and the comprehenssion of the alternative model, but they did not compare to traditional approaches.

Table 6: Methods used to compare traditional with alternative business process model

Type of evaluation	Studies	Amount
Survey	S01, S12	2
Proof of concept	S01, S05	2
Quasi-experiment	S03, S07, S10, S17	4
Observation	S06	1
Experiment	S08, S09, S11, S13, S14, S16, S21, S22	8
Case study	S15, S18, S19, S20	4

However, study S17 conducted a preliminary evaluation using a quasi-experimental approach, comparing users' understanding and perception of clarity across three representations: a BPMN model, an interactive narrative, and a digital game. The results were inconclusive, as the perceptions were very similar. Consequently, it was impossible to determine whether the alternative representations were superior to the traditional approach in this context.

6 Discussion

This study aimed to explore how alternative representations of business process models enhance the understanding of business processes. Through our research, we identified various ways to present business process models, with the majority of studies emphasizing the facilitation of process understanding as their primary purpose. This aligns with findings from several authors

([24, 31, 38, 52, 55]), who noted that improving business processes relies heavily on clear understanding and straightforward visualization/representation.

As demonstrated in the results, different process model representations serve specific purposes, each offering unique advantages. For instance, timeline representations (S23) are effective for illustrating changes in business processes, while simple language representations (S15, S18) enhance accessibility and simplify complex models. Digital games (S03, S06, S07, S12, S17) and interactive narratives (S13, S20) provide engaging, ludic representations that promote interaction, training, and a sense of belonging.

However, despite their advantages, alternative representations also present challenges. These include high costs, complexity in transforming traditional models into alternative formats, and, in some cases, a lack of creativity in developing more dynamic or ludic representations. These challenges raise an important question: in organizational contexts where "time is money", how essential or justifiable is the investment in alternative representations of business process models? This remains unanswered. As observed in the results, few studies compared alternative representations with traditional ones, and those that did were unable to conclude that alternative representations were superior.

In conclusion, Figure 9 summarises our main discoveries during the study analysis, trying to answer the research questions "How are alternative representations of process models used to enhance people's understanding of business processes"? The analysis revealed a variety of alternative representations, including digital games, natural language, interactive narratives and storytelling, virtual worlds and reality, interactive boards, simple language, dynamic models, timelines, and physical materials. These representations are applied to different models, such as As-Is and To-Be, and serve diverse purposes.

The representations are designed for varied audiences, including managers, stakeholders, users, students, trainees, specialists, and citizens. Each is tailored to specific goals such as accessibility, collaboration, learning, training, interactivity, improved communication, visualization, elicitation, and, most importantly, facilitating understanding [41].

However, challenges remain, including high costs, complexity, dependency on datasets, and, in some cases, a lack of creativity in their development. Furthermore, while alternative models are evaluated using various methods, few studies compare their effectiveness directly against traditional modeling approaches.

6.1 Threats and Limitations

We rigorously followed the SEGRESS guidelines to ensure that this SML was as precise and clear as possible. However, we can identify some possible points that could threaten research.

Firstly, there is an inherent limitation related to search mechanisms and the process of conducting searches within scientific databases. To address this, we selected major databases commonly used in computer science reviews, which allow searches with logical operators within specific fields such as title, abstract, and keywords.

Additionally, another limitation concerns the potential for missing relevant studies. To mitigate this, we defined a search strategy within the SML protocol, aiming for databases that could retrieve the most significant number of studies matching the research string. However, this also represents the primary limitation of this article: we acknowledge that many studies may exist in local databases that are not indexed internationally. Furthermore, we did not employ snowballing techniques in this study, though we recognize that such approaches could identify additional relevant studies.

Second, there is a potential bias in the selection and interpretation of studies. To minimize this threat, we implemented a peer review process in which researchers independently analyzed and selected studies. In cases of differing opinions, consensus was reached through discussion, and only studies unanimously selected were accepted.

Lastly, there is a risk of errors in the analysis. To address this, we applied peer review to the data extraction process. After data extraction, information was compiled into tables and plots, and other researchers verified that the extracted data was accurately represented.

7 Final Remarks

In this study, we presented a systematic mapping of the literature investigating how alternative representations of process models have been utilized to enhance people's understanding of business processes. Based on the analysis of the selected studies, various approaches have been employed to represent business process models differently, catering to diverse target audiences. Each representation demonstrated specific purposes and advantages, with most emphasizing the facilitation of model understanding as a primary goal. However, while alternative representations were highlighted as innovative ways to depict business process models, they also presented challenges and disadvantages compared to traditional representations.

This study contributes to the field by showcasing alternative business process models that aim to improve accessibility and comprehension for a wide range of audiences. We summarized the primary approaches, their advantages, disadvantages, and the audiences they target. By doing so, we encourage reflections on making business process models more accessible, which can drive process innovation, enhance organizational efficiency, and foster improvements in business practices. Additionally, we provide resources that help researchers and managers evaluate the necessity of alternative models, particularly in comparison to traditional models concerning complexity and cost.

From an information systems perspective, this study offers valuable insights for researchers and managers to apply in their research or organizational contexts. Specifically, we explore how various technological approaches and tools are used to make business process models within specific organizational contexts more understandable and accessible to people. In this regard, our study aligns closely with the major research challenges in information systems in Brazil (GranDSI-BR 2016-2026) [11], particularly the challenge of "Information Systems and the Open World" [18], as it addresses how ordinary individuals, with the aid of technology, can contribute to organizational improvement through enhanced process model understanding.

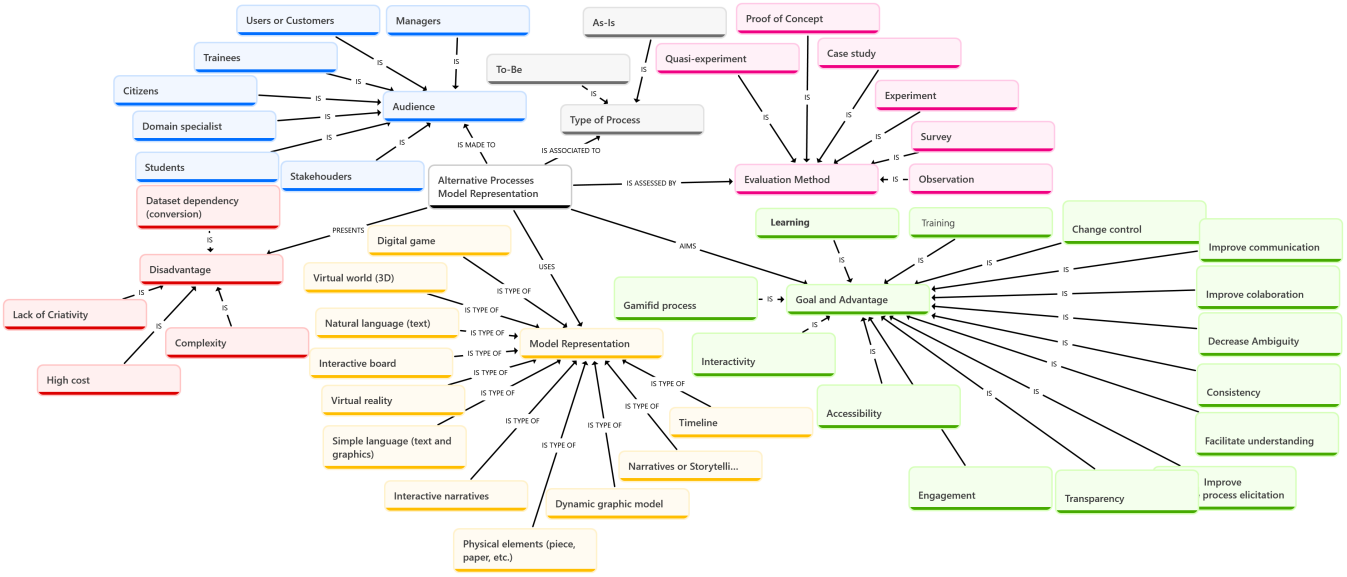

Figure 9: Primary goals by alternative representations.

For future work, we intend to advance this study by proposing a novel alternative representation. Acknowledging the lack of comparative literature, we aim to evaluate this representation alongside traditional techniques. Our goal is not to assert that alternative representations are superior but to demonstrate their potential utility for ordinary users, including customers, trainees, and citizens, in understanding business processes.

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