Defining Requirements for *Perishable Goods Management Systems (SAFE_GOOD)*

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Abstract. Context: Logistics management of perishable products in Brazil requires aligning complex supply chain operations from production and storage to final delivery to consumers. In Brazil, the management of perishable inventories must be complied with regulations established by the National Health Surveillance Agency (ANVISA) and the Ministry of Agriculture and Livestock (MAPA). Hence, the supporting information systems are required not only to manage the relevant information but ensure that all regulatory requirements are fulfilled. Objective: Our goal is to propose the *Perishable Goods Management Requirements Catalog (SAFE_GOOD)* to guide the development or the selection of supporting management systems for logistics of perishable goods. Method: Regulatory standards issued by ANVISA and MAPA were collected and analyzed alongside a review of relevant literature. The identified regulatory and operational requirements were systematically extracted, and a Requirements Catalogue for the domain of perishable goods management was proposed. Finally, we will discuss how the catalog will be evaluated. Results: We proposed the *SAFE_GOOD Requirements Catalog* comprising 21 functional, and 5 non-functional requirements. The Functional Requirements description was based on the VOLERE template, while Non-Functional Requirement relied on an adapted version of the iNFR template. Some points for future improvement were also identified. Conclusion: The *SAFE_GOOD Requirements Catalog* constitutes a reusable requirement engineering artifact that supports the development of management systems aligned with regulatory standards in the perishable products sector.

Keywords: Requirements Engineering, Regulatory Compliance, Perishable Products, Inventory Management Systems, Logistics Systems

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1 Introduction

The logistics of perishable goods (Food Products & Groceries, Pharmaceuticals & Health products, and Beauty & Toiletries) represents one of the most sensitive and strategic segments of the Brazilian productive sector. Given its criticality, it is imperative to prevent losses which, according to data from the Food and Agriculture Organization (FAO) cited by governmental agencies, can reach up to 30% in the post-harvest phase of fruits and vegetables [1]. The strict control of transportation and storage conditions is essential to preserve product integrity and commercial value, as well as to ensure consumer safety [2].

According to Ballou [2], logistics efficiency is directly associated with the ability to plan, implement, and control material flows in an economically sustainable manner. In this context, operational effectiveness depends on the implementation of robust software systems, capable of integrating operational flows within a regulatory environment. Hence, the development of appropriate supporting software systems is key to reducing waste and ensuring regulatory compliance.

This domain is heavily regulated to ensure goods safety and quality, primarily overseen by ANVISA (National Health Surveillance Agency) for processed goods and MAPA (Ministry of Agriculture and Livestock) for animal and plant-based products. However, software developers may be unaware of all the regulatory requirements that the perishable goods management systems must comply with. Consequently, regulatory compliance is quite challenging.

According to Robertson and Robertson [4], effective elicitation ensures that specifications remain consistent with organizational contexts and stakeholder expectations. In the domain of perishable goods, this step becomes particularly critical, as non-functional requirements such as reliability, traceability, and auditability become decisive factors for system feasibility [5]. In this sense, the use of requirements catalogs emerges as a systematic approach to domain engineering, consolidating normative evidence into reusable artifacts that promote consistency and reduce rework in regulated software projects [6].

Given the absence of such artifacts, this research proposes the *Perishable Goods Management Requirements Catalog (SAFE_GOOD).* In addition to supporting the development of new systems, the catalog can also be used as an instrument for evaluating existing software systems in terms of their compliance with regulatory standards.

The remaining of this paper is structured as follows: Section 2 outlines the methodology used, and Section 3 discusses some Brazilian regulatory frameworks related to of domain of interest. Section 4 explains the *Perishable Goods Management Requirements Catalog (SAFE_GOOD).* Whereas Section 5 states how we intend to validate it. Then Section 6 describes some of the results obtained, and last but not least Section 7 concludes the paper and points to some future work to be done.

2 Methodology

The construction of a *Requirements Catalog for Perishable Goods Management Systems* follows a process that consists of 6 activities, spanning two main *phases*, namely 1) Elicitation and 2) Development, as illustrated in Figure 1, which models the workflow using Business Process Model and Notation (BPMN) [13]. In the sequel we describe the activities.

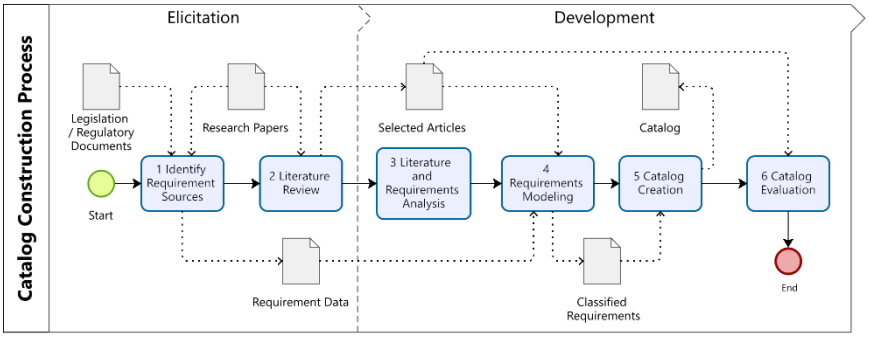

Fig. 1. BPMN model of the *Perishable Goods Management Requirements Catalog (SAFE_GOOD)* construction process, detailing the Elicitation and Development phases.

1. Identify Requirements Sources activity (finished) was focused on collecting Regulatory Requirements from Brazilian federal agencies, specifically ANVISA and MAPA. The scope was deliberately restricted to these institutions, as they define the primary regulatory constraints for perishable goods in Brazil. A document-driven elicitation approach was adopted, treating regulatory texts as formal sources of requirements.

2. Literature Review activity (finished), aimed to identify relevant approaches in Requirements Engineering, particularly regarding Requirements Modeling, Requirements Catalogs, and Regulatory Compliance. To map the state of the art and to identify scientific gaps at the intersection of Requirements Engineering and Perishable Goods Logistics, a systematic search was conducted in the Scopus and Web of Science databases. The search strategy employed search strings which included terms related to requirements catalogs/specification, perishable supply chains (good supply chain/cold chain), and regulatory compliance.

The results revealed a critical lack of technical literature: while Web of Science returned no records, Scopus identified only the work of Smit et al. [8], which addresses the traceability of legal requirements in the context of the Dutch government, without focusing on perishable goods or Brazilian regulatory agencies. It is observed that the prevailing literature [9, 10] still approaches the topic from purely logistical, accounting, or legal perspectives. Such studies operate within a pre-digital paradigm and do not advance toward the systematization of requirements capable of leveraging technologies such as the Internet of Things (IoT) and Artificial Intelligence for compliance automation [6, 11].

This second activity also included the analysis of domain-related studies, such as Anjos Neto et al. [7], which provides a structured proposal for requirements cataloging in a related context. The review supports both the theoretical grounding and the identification of limitations in existing approaches.

We also followed a systematic process of requirement extraction and refinement based on ANVISA and MAPA guidelines, ensuring that domain constraints are considered.

3. Literature and Requirements Analysis activity (finished) involved comparing the extracted Regulatory Requirements with structures and elements found in the literature. This comparison enabled the identification of missing requirements, refinement opportunities, and structural improvements. The process focused on transforming normative content into Structured Requirements, aligning legal constraints with RE practices.

4. Requirements Modeling activity (finished), expressed the identified requirements using established RE techniques. Functional Requirements (FRs) were specified using a template inspired in the VOLERE Requirements Template [4], ensuring structured and testable specifications. Non-Functional Requirements (NFRs) were modeled using the iNFR template [14], enabling a more precise representation of quality attributes. This combination ensures Clarity, Consistency, and Traceability across the catalog.

5. Catalog Creation activity (finished) consisted of consolidating the modeled requirements into a structured and publicly accessible *SAFE_GOOD Requirements Catalog.* The artifact was designed not only as a scientific output but also as a technical reference document, allowing stakeholders to interact with, evaluate, and provide feedback on the catalog. This approach supports continuous refinement and increases the practical relevance of the artifact.

6. Preliminary Catalog evaluation activity (under way), it will consist of evaluating the approach through a *quasi-experiment* conducted with undergraduate students and graduate students from 2 Requirements Engineering courses. Participants will be divided into two groups: experimental and control. In the experimental group, participants will use *SAFE_GOOD Requirements Catalog,* while the control group will be unaware of it. The evaluation will consider metrics such as accuracy of regulatory compliance, completeness of requirements, and task completion time. In doing so, we hope to provide empirical evidence of the effectiveness of the *SAFE_GOOD Requirements Catalog* as a supporting artifact for RE activities.

3 Regulatory Framework

The definition of the regulatory scope of this study prioritized the Brazilian Health Regulatory Agency (Agência Nacional de Vigilância Sanitária – ANVISA) and the Ministry of Agriculture and Livestock (Ministério da Agricultura e Pecuária – MAPA), as they are federal institutions with nationwide authority and direct competence over critical aspects of production, storage, sanitary control, and traceability of perishable goods. ANVISA is responsible for regulating and supervising products and services that pose risks to public health, including goods safety and sanitary conditions, while MAPA oversees agricultural production chains, storage systems, and inspection

processes related to animal and plant products. In an international context, ANVISA performs a role comparable to the Food and Drug Administration (FDA) in the United States, as both agencies are responsible for establishing and enforcing regulatory standards related to food safety and public health within their respective territories.

Although other institutions operate within the broader regulatory ecosystem, they were not included in the scope of this study due to their limited jurisdiction or lack of direct normative authority at the federal level. For example, the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) focuses on environmental regulation, particularly licensing and environmental impact control, without defining operational requirements for storage and inventory systems. Similarly, the Agência Nacional de Transportes Terrestres (ANTT) regulates transportation infrastructure and logistics services but does not establish detailed requirements for storage or sanitary compliance of perishable goods. Additionally, state and municipal sanitary surveillance bodies (Vigilância Sanitária Estadual/Municipal) play an important role in enforcement and local inspection. However, they generally implement and operationalize federal regulations rather than define new normative frameworks. For these reasons, the present study focuses only on ANVISA and MAPA as the primary sources of regulatory requirements, given their comprehensive and authoritative role in defining nationwide standards applicable to perishable good smanagement.

The regulatory sources collected in this study include legislation and normative acts issued by ANVISA and MAPA. Among the main references are: Law No. 9,973/2000, which establishes the system for storage of agricultural products [15]; RDC No. 216/2004 [16] and Ordinance No. 326/1997 [17], which define best practices and hygienic-sanitary conditions for good services; RDC No. 18/2013 [18], related to herbal and medicinal products; Normative Instruction No. 5/2017 [19] and Normative Instruction No. 77/2018 [20], which define specific requirements for establishments and dairy production chains; Joint Normative Instruction No. 2/2018 [21] , focused on traceability of plant products; as well as RDC No. 752/2022 [22] and Regulatory Standard NR-31 [23], which addresses occupational health and safety in agricultural environments. This set of documents was selected due to its direct relevance to storage, operational control, and regulatory compliance in the domain of perishable goods.

During the document analysis phase, the main federal norms, instructions, and ordinances that directly or indirectly impact the storage and inventory control of perishable goods were identified. The extraction process focused on provisions that impose requirements related to traceability, environmental conditions (such as temperature and humidity), hygiene practices, equipment calibration and maintenance, segregation of incompatible products, labeling, and certification of storage units. These requirements were transcribed into a categorized repository, enabling their analysis by domain and their subsequent translation into software requirements — that is, into functionalities, data record constraints, and performance indicators that an information management system must support to ensure regulatory compliance.

4 Perishable Goods Requirements Catalogue (SAFE_GOOD)

The catalog proposed in this study is structured into two main categories: Functional Requirements (FRs) and Non-Functional Requirements (NFRs). This distinction follows established practices in Requirements Engineering, enabling a clearer separation between system behaviors and quality attributes. Functional Requirements were elicited, structured, and modeled using a use case–oriented approach based on the VOLERE Requirements Template [4]. This template was chosen primarily for its simplicity of understanding, ensuring clarity, traceability, and consistency in the specification of system functionalities. Non-Functional Requirements, in turn, were modeled using the iNFR framework [14]. This template was selected because it aligns closely with industrial practices, making complex quality attributes, such as reliability, traceability, and compliance, more easily understandable for the domain experts and stakeholders involved in this work. This combined modeling and specification approach allows the catalog to represent both operational and regulatory aspects in a systematic and reusable manner.

In addition to the regulatory sources analyzed in this work, a complementary analysis was conducted based on the study by Anjos Neto et al. [7]. While their work organized requirements derived from normative evidence, it proposed an approach that remained unstructured from a strict Requirements Engineering perspective. To address this gap, the catalog proposed in this study serves as a formalized baseline specifically tailored for the management and control of perishable goods. Rather than merely replicating the previously proposed artifact, the present study extends it by incorporating additional fields. This update is necessary to ensure better fluidity and integration among the requirements, while also aligning the catalog with current industry practices based on active legislation. Ultimately, this process enables the transformation of previously unstructured identified requirements into a more structured requirements specification and tool-oriented representation, significantly improving their applicability in software development and analysis contexts.

The proposed *SAFE_GOOD* Requirements Catalog aims to serve as a Requirements Engineering artifact to support both the development and evaluation of software systems in the domain of perishable goods logistics. It provides a structured set of regulatory-driven requirements that can guide system design while also serving as a reference baseline for assessing compliance in existing systems. In this sense, the *SAFE_GOOD Requirements Catalog* contributes to bridging the gap between regulatory demands and software specification.

4.1 Functional Requirements and Baseline Expansion

The specification of systems for the logistical management of perishable goods requires the translation of complex regulations into testable and actionable elements. For the specification of *Functional Requirements (FRs),* we tried to address some limitations of the previous work of Anjos Neto et al. [7], notably its lack of structure.

In our work we adapted the VOLERE Requirements Template [4]. It was selected because it is well known and used by many organizations, thus reducing learning time.

It also promotes traceability information. Furthermore, the rational field can be used to capture regulatory justification, while the fit criteria field can be used for acceptance criteria definition.

We also identified several new requirements, such as the base registry for perishable products (RF-CAD-01) and critical assets (RF-CAD-02), digital sanitation checklists (RF-HIG-01), allocation and segregation rules (RF-WMS-01), calibration management (RF-CAL-01), quality control (RF-QUA-01), and storage unit certification management (RF-ADM-01).

Due to space limitation, we only illustrate one of the new requirements (see Figure 2) is *RF-WMS-01 (Product Allocation and Segregation Rules)*.

Rather than simply declaring the need to store items correctly, this *Functional Requirement* specifies that the Warehouse Management System (WMS) must support and automatically apply certain allocation rules (check Detailed Description of Figure 2). *Its Justification Standard* field (see Figure 2) rests on two interconnected regulations: Administrative Rule (Portaria) No. 326/1997 [17], which requires the prevention of cross-contamination, and Normative Instruction No. 05/2017 [19], which categorically prohibits the joint storage of chemicals and goods products.

The *Fit Criterion field* (see Figure 2) establishes that the system must systemically block any attempt to move a chemical product into a zone mapped for goods items.

According *to Interdependencies field* (see Figure 2) it possesses a *strong interdependence* with the new registry requirement (RF_EST-03), creating a data validation chain from product entry to its physical allocation.

Specification Card: RF-WMS-01	
Requirement No.	RF-WMS-01
Name	Product Allocation and Segregation Rules
Classification	Functional
Detailed Description	The Warehouse Management System (WMS) must support and automatically apply allocation rules preventing the joint storage of incompatible products (such as cleaning materials and food) or those requiring specific isolation.
Justification (Standard)	Ensure food is stored in a way that prevents contamination, according to ANVISA Portaria 326/97 **[5]**, as will as to ensure chemical products are kept isolated from production areas, following MAPA IN No. 05/2017, § 5 **[6]**.
Fit Criterion	The system must block any attempt to move a chemical product into a storage zone defined as "Food" or "Perishables".
Dependencies	RF-CAD-01 (Base Product Registration) and RF-CAD-02 (Asset Registration).
Interdependencies	Related to RF-EST-03 (Multiple Warehouse Management) to define physical constraints for each location.
Priority	Essential.
History	2026-03-19

Fig 2. Detailing of the RF-WMS-01 Specification Card modeled in the Volere pattern.

4.2 Non-Functional Requirements: The iNFR Approach

The management of the perishable supply chain depends not only on what the system does but also on how it performs under severe operational conditions. *Non-Functional Requirements (NFRs)*, such as usability, availability, security, and interoperability [5], had already been identified as critical attributes in this domain

Note that our focus is not the elicitation of new non-functional requirements, but rather the restructuring and details specification of the previously mapped ones using the **iNFR** framework [14].

The motivation for adopting the ***iNFR*** template lies in its empirical foundation. Note that it was developed iteratively with industry practitioners to address real-world specification challenges. Historically, NFRs descriptions tend to be provided only at an abstract (high) level and are not detailed; as such, they have little use as a software requirement. This lack of precision may cause project failures and compliance risks.

The **iNFR** template transforms these generic attributes into measurable and testable "Fit Criteria", strictly delineating architectural constraints.-Furthermore, it allows for explicit documentation of legal and regulatory sources, tracing them directly to the functional modules they impact.

The *RNF-DIS-01 requirement* (Availability and Reliability) perfectly illustrates the advantages of the iNFR model. In logistical systems serving rural producers and extractivists, connectivity is an inherent technological constraint (see Fig. 3). The definition of this requirement improves reliability measurement by stipulating a dual and objective acceptance criterion. First, the systemic uptime must be at least 99.9%. Second, the software must operate in an offline mode for field records, requiring an automatic data synchronization process initiated within 10 seconds after network restoration. Through the **iNFR** modeling, the software developer understands exactly the technical constraint, the regulatory compliance required (e.g., traceability laws), and the impacts on other affected functional modules, such as RF-EST and RF-RAS

ID: RNF-DIS-01			
Priority level: 1 (Essential)			
System (component): Inventory and Storage Management System			
Source *(choose one)*	O Stakeholder: ...	O Own organization: ...	X Legal entity: INC ANVISA/MAPA Nº 02/2018
Type *(choose one per column)*	O Desire, user-oriented X Desire, technology-oriented		O Usability O Efficiency O Maintainability O Portability X Reliability O Security O Other: ...
	X Constraint		O Cultural O Environmental O Implementation & design O Interface X Legal O Other: ...
Description *The system shall ...* ensure high availability and include an offline operation mode for rural areas with automatic synchronization, complying with traceability regulations.			
Fit criteria 1. Uptime must be at least 99.9%. 2. Automatic synchronization must start within 10 seconds after connectivity is restored.			
Validation *(choose one)*	X Run-time online	O Run-time offline	O Compile-time
Testing *(choose one)*	X Continuous	O Periodical	O Single test
Conflicting NFR(s) *(mandatory in case of constraint)* n/a			
Impacted functional requirement(s) *(mandatory in case of constraint)* All field registration modules (RF-EST, RF-RAS)			

Fig 3. Specification Card of RNF-DIS-01 detailed through the iNFR template.

4.3 Catalog Availability and Traceability Matrix

With the aim of fostering open innovation, standardization, and the development of a more cohesive digital ecosystem for the logistical and agro-industrial sector, the entire requirements engineering effort was consolidated and made available to the general public. The complete and structured artifact can be accessed anonymously and freely through the online repository at https://anonymous.4open.science/r/perishablegoodsle-galcatalog-EDB5 The public availability of the catalog promotes the reuse of technical knowledge and substantially reduces engineering costs and risks.

Table 1 was elaborated to indicate the traceability between the extracted legal framework, general logistics principles, and the suggested software implementations. It

directly correlates the normative and technical references to all functional (FR) and non-functional (NFR) requirements present in the catalog.

Table 1. Traceability of Normative and Technical References to the Catalog Requirements.

Reference / Legal Source	Regulatory Focus	Modeled Requirements (IDs)
Law No. 9.973/2000 [15]	Mandatory certification, storage management, and systemic scalability	RF-EST-03, RF-EST-04, RF-FOR-02, RF-REL-01, RF-ADM-01, RNF-ESC-01
ANVISA RDC No. 216/2004 [16]	Goods practices, validity control, maintenance logs, and system reliability	RF-EST-02, RF-FOR-02, RF-CAD-02, RF-HIG-01, RF-CAL-01, RF-REL-02, RL-002, RNF-USA-01, RNF-DIS-01
ANVISA Ordinance No. 326/1997 [17]	Segregation of incompatible goods products and sanitation records	RF-CAD-01, RF-WMS-01, RF-REL-02
ANVISA RDC No. 18/2013 [18]	Process control, quality assurance, and conservation of sensible products	RF-EST-05, RF-QUA-01
MAPA Normative Instruction No. 5/2017 [19]	Strict physical and logical isolation of chemical products	RF-WMS-01
Joint Normative Instruction No. 2/2018 [21]	End-to-end traceability, data integrity, and interoperability	RF-EST-01, RF-RAS-01, RF-RAS-02, RF-RAS-03, RF-RAS-04, RF-FOR-01, RNF-SEG-01, RNF-INT-01

5 Preliminary Evaluation

We are currently defining how the catalogue will be evaluated. It is planned to be carried out within the next three months. The evaluation of the *SAFE_GOOD Requirements Catalog* is a critical step to assess its applicability, completeness, and usefulness in real-world scenarios. Previous studies have demonstrated the efficacy of qualitative methods for validating regulatory and requirements engineering artifacts, employing complementary approaches. For instance, Smit et al. [8] relied on a combination of exploratory case studies across multiple governmental agencies followed by three iterative rounds of Focus Groups to achieve saturation and cross-organizational consensus for a traceability framework. In contrast, Anjos Neto et al. [7] emphasize a validation approach specifically tailored to a targeted domain, utilizing Focus Groups that integrate stakeholders from logistics, regulatory agencies, and software engineering. While Smit et al. [8] focus on achieving generalization across different institutions, Anjos Neto et al. [7] prioritize deep, domain-specific evaluation to assess completeness, correctness, clarity, and relevance. Together, these complementary methods highlight how

rich qualitative insights can support the iterative refinement of an artifact based on expert feedback.

While the Focus Group approach provides valuable domain-driven validation, it is inherently subjective and dependent on the experience and perspective of the selected participants. In this sense, this study complements the existing approach by proposing an alternative validation strategy based on controlled experimental evaluation. The objective of this complementary method is to provide a more objective assessment of the effectiveness of the *SAFE_GOOD Requirements Catalog* when used as a support artifact in Requirements Engineering (RE) activities.

The proposed experimental design consists of a quasi-experiment conducted in an academic environment with participants who have prior experience in requirements elicitation and analysis. The participants will be divided into two groups. Both groups will be assigned the same task: to analyze and refine a given set of requirements for a perishable food management system, ensuring its compliance with applicable regulatory standards (ANVISA and MAPA).

The first group will perform the task with access to the proposed *SAFE_GOOD Requirements Catalog*, using it as a reference to adapt, add, or remove requirements in order to achieve regulatory compliance. The second group will perform the same task without access to the catalog and is additionally required to identify the applicable regulatory norms and laws, as well as adapt the requirements to ensure compliance based on their own interpretation and research.

The evaluation will focus on comparing the performance of both groups based on predefined criteria. These include: (i) accuracy, measured by the degree to which the resulting requirements align with regulatory standards; (ii) completeness, considering whether relevant requirements were correctly identified or omitted; and (iii) efficiency, assessed through the time required to complete the task. The comparison of results allows the identification of differences in performance, as well as the extent to which the catalog contributes to improving the quality and speed of Requirements Engineering activities.

By combining qualitative validation through expert evaluation, with an experimental approach, we plan to provide a more comprehensive initial validation strategy. This dual approach not only supports the refinement of the catalog but also will generate empirical evidence regarding its effectiveness as a reusable Requirements Engineering artifact for regulatory compliance in perishable goods systems.

6 Results

This study produced 21 *Functional Requirements (FRs)* modeled using an adapted version of the VOLERE template and 05 *Non-Functional Requirements (NFRs)* formalized via the iNFR framework. To foster open innovation and reduce engineering costs for the agro-industrial sector, the entire artifact was consolidated into a publicly accessible repository, serving as a reusable knowledge base for both developers and auditors.

This artifact represents a significant technical evolution from previous exploratory baselines by incorporating essential new modules required for modern, compliance-driven system development.

Specifically, the catalog expands upon previous work of Anjos Neto et al. [7] by not only implementing new functionalities such as the base registry for perishable products and critical assets (RF-CAD-01, RF-CAD-02), digital sanitation checklists (RF-HIG-01), automated allocation and segregation rules (RF-WMS-01), calibration management (RF-CAL-01), and storage unit certification management (RF-ADM-01). These additions ensure a more fluid integration among system modules, addressing the critical interdependencies between storage rules, equipment calibration, and baseline registries. But also providing a structured way of specifying the requirements based on the VOLERE Template.

A central component of these results is the Traceability Matrix, which directly correlates specific legal sources to the modeled technical requirements. For instance, the requirement RF-WMS-01 (Product Allocation and Segregation Rules) aligning with the provisions of ANVISA Administrative Ruling (Portaria) 326/1997 and MAPA Normative Instruction 05/2017. This mapping reduces non-compliance risks by transforming dense legal texts into measurable acceptance criteria, such as blocking the movement of chemical products into designated goods storage zones.

Furthermore, early results highlight the effectiveness of the iNFR template in defining measurable quality attributes for the logistics domain. Under this framework, ambiguous quality goals are transformed into testable "fit criteria," as seen in requirement RNF-DIS-01 (Availability and Reliability). This requirement stipulates a 99.9% uptime and an offline operation mode with automatic synchronization within 10 seconds, specifically addressing the connectivity constraints inherent to rural producers and extractivists while ensuring compliance with federal traceability laws.

7 Conclusion and Future Work

This research has undertaken an investigative journey to map, synthesize, and structure the requirements for perishable goods management systems. By contextualizing the importance of perishable logistics and identifying the previous lack of a structured catalog grounded in the Brazilian regulatory framework—specifically the norms of ANVISA and MAPA—this study extracted mandatory compliance requirements for legal and safe operations. An initial and limited *SAFE_GOOD Requirements Catalog* was made available. It is organized into functional and non-functional requirements.

The primary contribution of this work is the delivery of a reusable *SAFE_GOOD Requirements Catalog,* By translating complex operational needs and dense legal requirements into a structured Requirements Catalog, this study provides not only a solid foundation for software development in a highly regulated domain, but it can also serve as the basis for the selection of alternative software system proposals.

Despite its contributions, this study has inherent limitations. A proper evaluation of *SAFE_GOOD Requirements Catalog*, while recognized as critical, was not fully

executed within the current scope of this work. It is under way and should be concluded by July 2026. It will include a quasi-experiment and survey with specialists. We also would like to conduct comprehensive static and dynamic validation with professional stakeholders. It could help continue to refine the *SAFE_GOOD Requirements Catalog* and foster technical competence, providing the technological unlock needed for one of the most promising sectors of the Brazilian economy

Because the SAFE_*GOOD Requirements Catalog* reflects the technological and regulatory scenario of its creation, the fluid nature of laws and market demands will require a continuous process of maintenance and updating.

Future research should focus on deepening and expanding the knowledge generated by this study. The next logical step is the development of a high-fidelity software prototype to validate the applicability of the catalog in real-world operational contexts, such as within cooperatives or logistics firms. Furthermore, there is a clear opportunity to expand the catalog to include specific requirements for other vital value chains in the Brazilian bioeconomy, such as essential oils, medicinal plants, and sustainable fisheries.

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