



Transparency in the Food Supply Chain: Conceptual Clarification and Identification of Key Dimensions Based on a Systematic Review

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ABSTRACT

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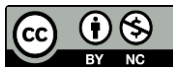
Objective: The increasing complexity and globalization of food supply chains, along with challenges such as food safety incidents, price volatility, difficulties in tracing product origins, and widespread food loss and waste, have further highlighted the necessity of enhancing transparency.

Methodology: This study aims to clarify the concept of transparency in this domain and to identify its key dimensions through a systematic literature review based on the PRISMA guidelines. A systematic search was conducted in the Scopus, Web of Science, and Google Scholar databases, and after applying inclusion and exclusion criteria, 164 articles were selected for final analysis.

Results: In the first step, by analyzing the definitions and approaches presented in the supply chain management literature, the concept of transparency in food supply chains was coherently articulated, and a comprehensive definition was proposed. In the second step, related and overlapping concepts were identified, and their conceptual distinctions were examined. Finally, in the third step, using inductive qualitative content analysis, the components and dimensions discussed in the literature were extracted and coded. Through open coding and iterative back-and-forth review between data and themes, 32 key transparency dimensions were ultimately identified.

Conclusion: Transparency in the food supply chain is not just an ethical or regulatory obligation, but a strategic process that balances stakeholder trust with commercial confidentiality. It involves carefully distinguishing between information that stakeholders have a right to know and proprietary data that should remain protected.

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Introduction

Providing food of appropriate quality and at the right time for the growing global population—projected to reach 8.5 billion by 2030 and 9.7 billion by 2050 is the primary objective of the food supply chain (Addouu et al., 2023). However, in practice, food supply chains face serious issues and challenges that disrupt their efficiency and effectiveness. Examples of current problems in food production include delayed responses, inadequate detection during outbreaks of foodborne diseases, and instances of food fraud, such as the addition of undeclared substances to meat products and fraud in seafood (Astill et al., 2019), the resale of waste oils as edible oils, aquaculture products containing heavy metals and toxin levels exceeding European Union and United States standards, high hormone levels in meat, and high concentrations of chemical toxins in fresh vegetables (Mol, 2014). In addition to these issues, food supply chains are plagued by inefficiencies that can result in the wastage of large quantities of food (Ben-Daya et al., 2020). Food waste can occur in various ways, including improper storage conditions throughout the supply chain (Astill et al., 2019), inadequate logistics, unsuitable packaging, and underdeveloped cold chains, which lead to food losses and resource depletion, as well as losses that occur during food processing (Singh & Akoijam, 2020; Mor et al., 2021; Sackmann & Mardenli, 2024). In this context, Ben-Daya et al. (2020) reported that food loss and waste in the supply chain prevent nearly one-third of global food production from reaching end consumers. This issue removes approximately 1.6 billion tons of food from the consumption cycle annually, with an estimated economic value of more than \$1.2 trillion. Given the rising trend in waste, this amount is expected to increase to 2.1 billion tons by 2030, equivalent to \$1.5 trillion.

In response to the aforementioned challenges and to facilitate the achievement of more sustainable goals and the development of agri-food systems, the supply chains in this industry must become more transparent (Gardner et al., 2019; Otter et al., 2024). Transparency enables various actors in the supply chain to gain complete visibility into the data, services, and products that are introduced and exchanged (Palocci et al., 2022; Kumar et al., 2023). It also helps them identify and mitigate risks, improve on-site conditions, and determine whether and where progress is being made (Gardner et al., 2019). Through greater transparency, sustainability efforts can be monitored and managed across all stages of complex global supply chains, while reducing common market failures (Gardner et al., 2019; Otter et al., 2024). Furthermore, transparency is associated with strengthening consumer and investor trust, facilitating supplier monitoring, meeting legal requirements, and reducing reputational risks for organizations (Sodhi & Tang, 2019). On the other hand, effective collaboration among various stakeholders requires a supply chain with a high degree of transparency. Ultimately, increased transparency can help customers evaluate a product's attributes more accurately (Gazzola et al., 2023).

Trienekens et al. (2012) categorize the motivations of an industry (or a supply chain) regarding transparency into four groups: responding to consumer requirements and expectations; preparedness for crisis management and rapid product recalls; business process optimization through the development of information flows in integrated information systems; and finally, interest in product labeling based on distinctive product attributes, whether intrinsic or extrinsic.

In recent years, as supply chain transparency has emerged as a significant issue in supply chain management, modern technologies such as blockchain technology (Chen et al., 2019; Baralla et al., 2021; Tayal et al., 2021; Kumar et al., 2023; Gazzola et al., 2023; Hasan et al., 2024; Xu et al., 2024; Elahi et al., 2024), the Internet of Things (IoT) (Corallo et al., 2018; Baralla et al., 2021; Karimi et al., 2022; Addou et al., 2023), Radio Frequency Identification (RFID) (Wognum et al., 2011), digital twin technology (Cirullies and Schwede, 2021; Guidani et al., 2024), artificial intelligence-based technologies (e.g., machine learning; Addou et al., 2023), and digital platforms such as IBM Food Trust (Köhler and Pizzol, 2020) have been used as effective tools to support supply chains and the firms operating within them—particularly in the food industry—in areas such as information assessment and exchange, logistics, sustainability, and supply chain transparency. Nevertheless, to understand what information should be shared through these technologies and who should participate in the information-sharing process, a deeper understanding of supply chain transparency is required (Schafer, 2023).

Despite the significant growth of research on food supply chain transparency and the strong emphasis on the role of emerging technologies in achieving it, the existing literature still faces a fundamental gap. Specifically, previous studies have mostly examined transparency either implicitly and in a fragmented manner, or within the context of applying a particular technology, and have paid less attention to providing a coherent conceptualization of transparency and a systematic identification of its key dimensions within food supply chains. As a result, there is still no shared and comprehensive understanding of what “food supply chain transparency” precisely means, which dimensions or core elements it encompasses, and how these dimensions have been conceptualized in the research literature. The absence of such an integrated conceptual framework has not only made it difficult to compare and accumulate knowledge in this field, but has also posed challenges for the design, implementation, and evaluation of technological and managerial solutions aimed at enhancing transparency. Therefore, conducting a systematic review that structurally clarifies the concept of transparency in food supply chains and identifies its key dimensions within the existing literature is an undeniable necessity. In response to this need, the present study seeks to provide a comprehensive, coherent, and evidence-based understanding of the concept and dimensions of transparency in food supply chains. In doing so, it aims to establish a theoretical foundation for future research and to offer practical guidance for policymakers and

practitioners in this field. Accordingly, the central research questions that this study seeks to address are articulated as follows:

RQ1: What definitions of transparency have been proposed in the supply chain management literature, and how can the concept of transparency be specifically conceptualized and defined for the “food supply chain” based on this body of literature?

RQ2: What terms and expressions have been used in this field as equivalents or synonyms for “transparency,” and what are the conceptual distinctions or differences between these terms and the notion of transparency?

RQ3: What are the key dimensions and components of transparency in the food supply chain that should be disclosed by companies to stakeholders?

Materials and Methods

This article adopts a Systematic Literature Review (SLR) approach, following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). In this regard, the methodological guidance provided by Page et al. (2021), as well as the frameworks used in recent and successful review studies in the field of supply chain management—such as Budler et al. (2024), Mühl et al. (2025), and Schafer (2023)—have been followed. The purpose of employing this framework was to ensure transparency, reproducibility, and comprehensiveness in the literature review process. Figure 1 illustrates the design of this study.

The search and selection process was carried out in accordance with the stages of the PRISMA protocol (identification, screening, eligibility, and inclusion) and based on the steps illustrated in Figure 2. In this regard, a systematic search was conducted in two major databases, Scopus and Web of Science, to capture the diversity of research on “transparency” across all fields of business and economics. These databases were selected due to their broad coverage of reputable academic journals in the areas of management, operations, and supply chain management. To complement the search scope and identify highly cited studies that might not have been indexed in the primary databases, Google Scholar was also used as a supplementary search tool. The search was not restricted to a specific starting date (i.e., the review began with the earliest appearance of “supply chain transparency” in the selected journals) and included articles published up to 2025.

The article search was conducted using a combination of the following keywords: “supply chain,” “food supply chain,” “agriculture supply chain,” “agri-food supply chain,” “transparent,” “transparency,” “traceability,” “visibility,” “disclosure,” “information disclosure,” and “information sharing.” These terms were searched within the title, abstract, and keywords of

publications. The primary focus of the review was on articles published in peer-reviewed academic journals related to supply chain management and the agri-food sector. This scope included leading specialized journals (such as Journal of Supply Chain Management, Journal of Operations Management, Production and Operations Management, Decision Sciences, The International Journal of Logistics Management, Frontiers in Sustainable Food Systems, and Agribusiness), as well as other reputable interdisciplinary journals in the fields of business and economics.

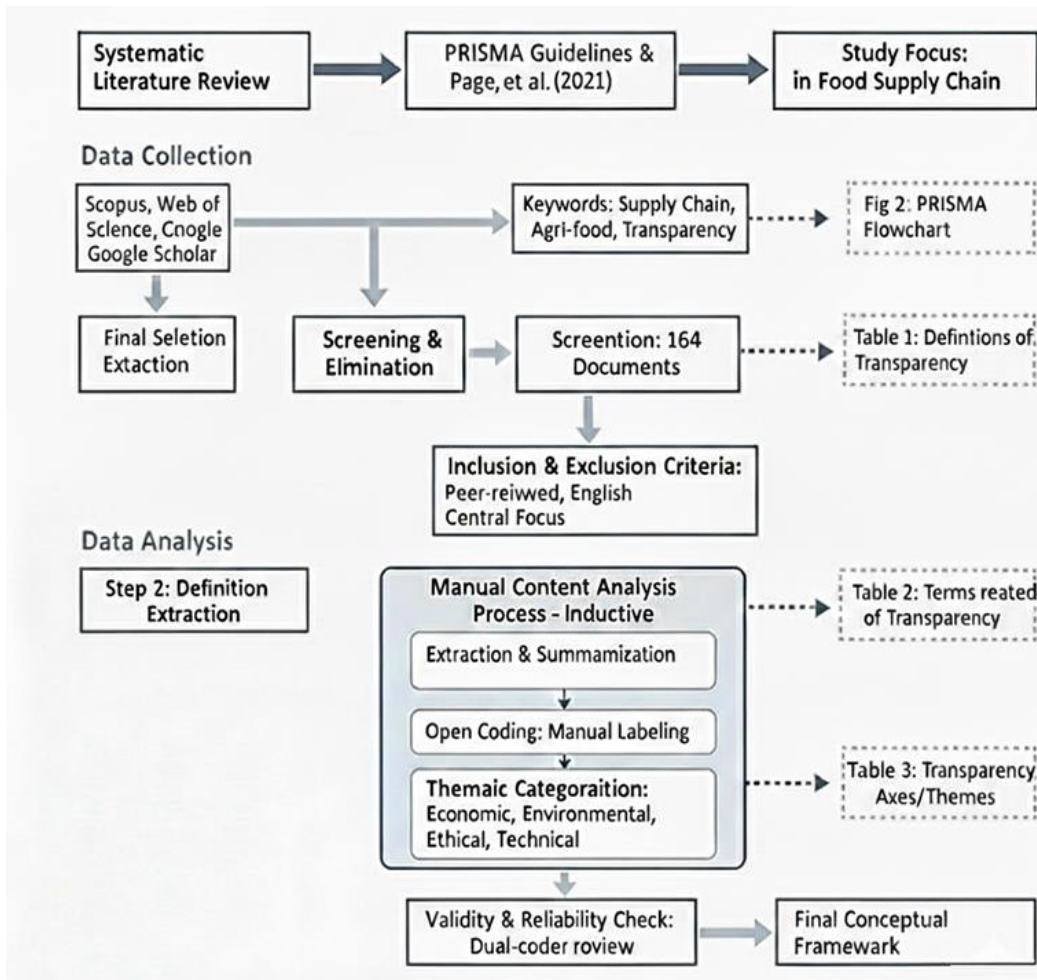


Figure 1. Schematic of the Research Design

To maintain scientific quality and focus on the research objectives, specific inclusion and exclusion criteria were applied for study selection. The inclusion criteria were as follows: 1) Articles published in peer-reviewed scientific journals; 2) Articles in English; 3) Studies that examine “transparency” (or its synonyms) as a central topic in supply chains; 4) Conceptual, empirical, and modeling studies. The exclusion criteria included: 1) Books and organizational reports (except for limited use in providing classic definitions); 2) Articles that only briefly mention

transparency without in-depth conceptual analysis; 3) Non-English sources; 4) Studies outside the fields of management, business, accounting, and decision sciences.

The initial search identified 514 articles in Scopus, 419 articles in Web of Science, and 650 articles in Google Scholar. All extracted records were imported into the reference management software Zotero. Using Zotero's automatic duplicate detection feature combined with manual review, duplicates were removed, leaving 545 unique articles eligible for the screening stage. Figure 3 illustrates the chronological distribution of the references cited in this study based on their year of publication.

In the first screening stage, the titles and abstracts of the articles were reviewed, resulting in the selection of 208 articles for full-text evaluation. In the second stage (eligibility assessment), after thoroughly reading the full texts, an additional 44 articles were excluded due to misalignment with the study's objectives (either lacking sufficient in-depth focus on transparency and its components, or addressing broader systems such as the food-water-energy nexus). Consequently, 164 documents that directly addressed transparency in supply chains—particularly in the food product supply chain—were selected for the final analysis.

To enhance the accuracy of study selection and minimize potential bias, following the full-text review stage, the selected articles were further evaluated based on their level of focus on the concept of transparency. In this phase, the articles were graded according to their conceptual relevance to supply chain transparency (ranging from implicit mention to central focus), and only those that treated transparency as one of their core concepts remained in the final set. These articles were identified as works that addressed supply chain transparency—and particularly food supply chain transparency—as a central aspect. As a result of the first phase of the research, 31 articles containing definitions of supply chain transparency were identified (4 definitions in the first part of the findings and 27 additional definitions in Table 1). The articles with definitions included those that either provided the authors' own definitions or cited existing definitions of transparency from other sources. All identified definitions of transparency were analyzed to: first, enable the formulation and presentation of a coherent and contextually appropriate definition for the agri-food supply chain (addressing RQ1); and second, identify synonymous or alternative terms for transparency, along with their conceptual distinctions (RQ2).

- Extraction and summarization: In this stage, all text segments related to the dimensions/components of transparency in the 164 selected articles were examined. The primary focus was on identifying the components that food supply chain companies are required to disclose to stakeholders (e.g., product origin, production methods, safety certifications, etc.).

- Open coding: In this step, the extracted features and dimensions were manually coded. Each aspect of transparency that was repeatedly emphasized in the literature was recorded as an “initial code.”
- Categorization and development of core themes: In the final stage, the preliminary codes were reviewed based on conceptual similarities and the thematic nature of the subjects, and were subsequently organized into “key axes.” The main criterion for grouping the codes into a particular theme was the alignment between the type of disclosed information and its intended function or purpose. In other words, issues that contributed to similar disclosure objectives for stakeholders (e.g., informing about safety, source, environmental impacts, or social responsibility) were placed within the same overarching theme. This iterative process of moving between codes and themes continued until the final categories (such as economic, environmental, ethical, and technical axes) reached theoretical saturation and comprehensively covered all the dimensions identified in the literature.

To enhance the trustworthiness and credibility of the qualitative content analysis, this study relied on three main mechanisms.

First, auditability and transparency of the analytical process were taken into consideration. All stages of extraction, coding, and categorization of concepts were conducted through a systematic procedure, and the supporting references for each final transparency dimension were explicitly reported in Table 3. This linkage between codes, themes, and supporting studies provides an audit trail for tracing and reviewing the development of the conceptual framework and helps reduce subjective interpretations.

Second, to improve inter-coder reliability and minimize researcher bias, the coding process was independently reviewed by two researchers. In cases of disagreement, the codes and categorizations were revisited through discussion and consensus meetings in order to achieve a shared understanding of the concepts and the boundaries of each theme. This iterative process contributed to greater consistency and coherence in the extracted conceptual structure.

Third, the content validity of the framework was strengthened through the diversity and multiplicity of the reviewed sources. The final transparency dimensions emerged from the synthesis and integration of evidence extracted from 164 selected studies, and each theme was developed based on the recurrence and convergence of concepts across the literature. Accordingly, the proposed framework is not grounded in a single study, but rather represents a systematic synthesis of the perspectives and dimensions identified in the existing literature.

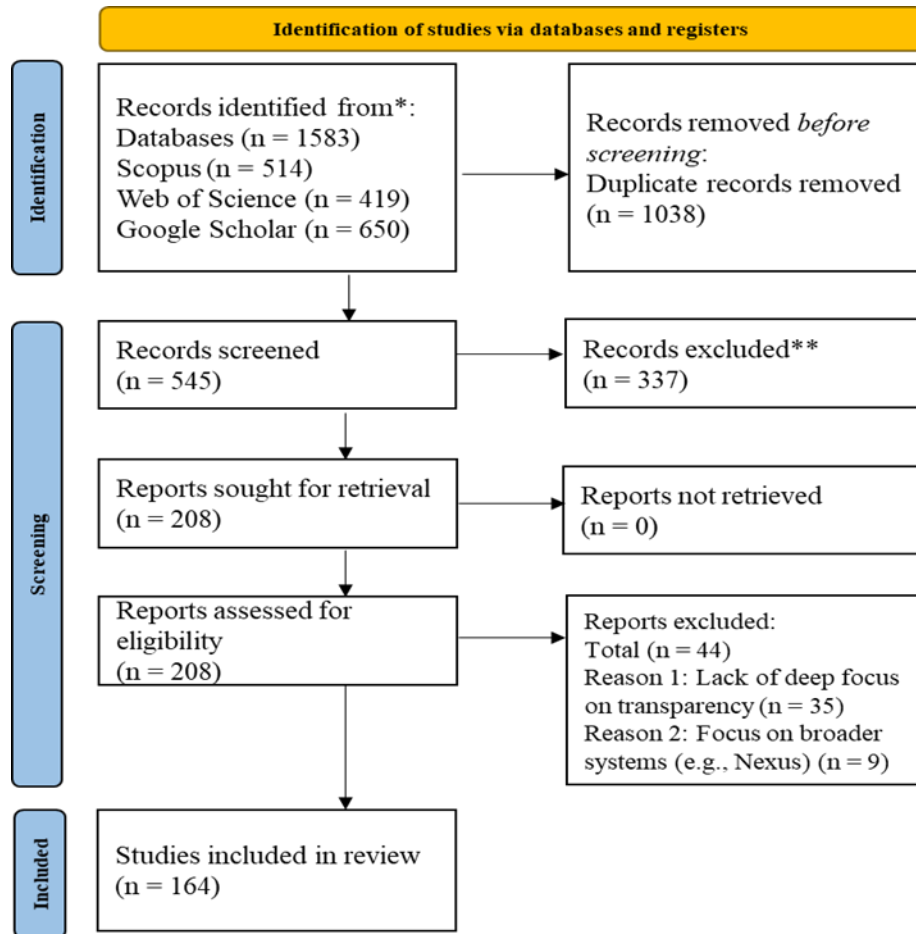


Figure 2. PRISMA Flow Diagram of the Study Selection Process

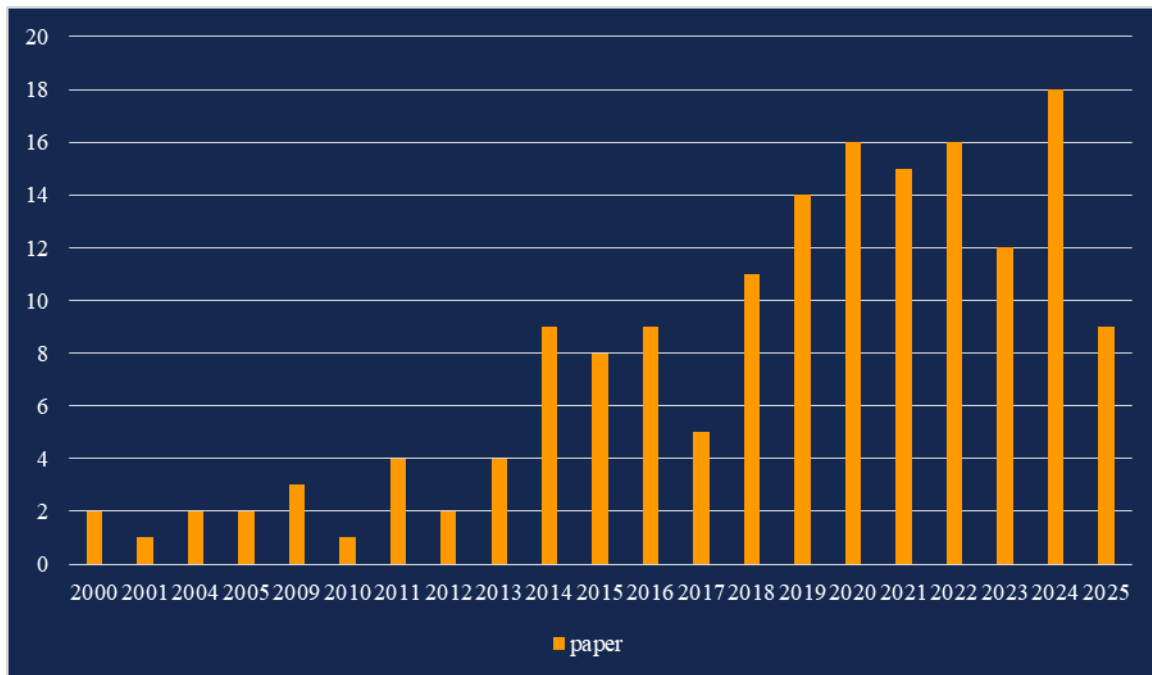


Figure 3. Distribution of Cited References by Publication Year

Results

Section One: The Concept of Transparency in Supply Chain Management Literature

One of the objectives of this article was to clarify the existing understanding of “supply chain transparency.” To this end, definitions of supply chain transparency were analyzed (Table 1).

From popular discourse to politics, the term “transparency” has entered everyday language (Morgan et al., 2023) and is regarded as a prerequisite for democratic participation, trust in government, a barrier against corruption, informed decision-making, and the provision of information to the public, companies, and other societal actors (Ada et al., 2021).

The meaning of transparency may vary across different groups and can be significant from multiple perspectives (Williams, 2015). Accordingly, it can be interpreted as the extent to which relevant, timely, and reliable information—both written and verbal—is provided by an organization to investors, regulators, and market intermediaries (Williams, 2005). Stiglitz (2000) offers a description in which transparency is essentially another term for information. From this perspective, increasing transparency is necessary to reduce and minimize information asymmetry in the market. Florini (2000) presents a broader understanding of the concept. According to this view, transparency refers to the dissemination of information by organizations that is necessary for

evaluating those organizations. Since these entities—whether public or private—are considered legitimate and accountable, this definition provides a suitable starting point for conceptualizing transparency.

To gain a clearer understanding of transparency in supply chain management, the definition proposed by Hofstede et al. (2004, p. 290) can be considered. They define supply chain transparency as “the extent of shared understanding and access of all stakeholders to product-related information requested, without loss, noise, delay, and distortion. Building on this definition, Beulens et al. (2005, p. 482) expanded the concept beyond product transparency to also include process transparency and capital flows. They define supply chain transparency as “the degree to which a supply chain actor has access to product-, process-, and capital flow-related information without loss, noise, delay, and distortion”. Other studies, inspired by these two definitions, conceptualize transparency in supply chains as access to undistorted, accurate, relevant, and timely information regarding operations and products, such as origin and sourcing, production processes, costs, and logistics (e.g., Bai and Sarkis, 2020). Similarly, Awaysheh and Klassen (2010, p. 6) define transparency as “the extent to which information is readily available to end users and other firms in the supply chain.” In line with this and earlier definitions, transparent supply chains are characterized by simple and rapid access to information. In such chains, information can be disclosed to key supply chain stakeholders—such as customers, regulators, or shareholders—in a comprehensible, comprehensive, credible, and timely manner (Wognum et al., 2011; Trienekens et al., 2012; Bastian and Zentes, 2013).

As James and Montgomery (2017) have pointed out, there is no single, stable understanding of supply chain transparency; that is, different authors have adopted different approaches and perspectives when using this concept. The lack of consensus regarding supply chain transparency in the current body of knowledge is evident from the various definitions presented above and in Table 1. The absence of a consistent definition and the ambiguity surrounding the term “supply chain transparency” have also been noted by other authors (e.g., Egels-Zandén et al., 2015; James & Montgomery, 2017).

Table 1. Definitions of Transparency in Supply Chain Management Literature

Source	Definition of Transparency	Focus Area
Lamming et al. (2001); Van Der Zee & Van Der Vorst (2005); Skilton & Robinson (2009)	It refers to the extent to which information related to sources, processes, and relationships is readily accessible to transaction partners as well as external observers (in both organizational and environmental contexts).	Access to information (within organizational and environmental contexts)
Fiala (2005)	Defines transparency as a system for sharing supply chain information among participants, through which information asymmetry within the supply chain is reduced.	Information sharing
Turilli & Floridi (2009)	Defined transparency based on the visibility and accessibility of information; a capability that increases through the reduction or elimination of barriers.	Visibility and accessibility of information
Svensson (2009)	Firms must consider the ethical aspects of corporate actions and behavior in business operations beyond their own immediate scope, even if they are not in direct business interaction with them.	Transparency of professional ethics
Pirson & Malhotra (2011)	The perceived willingness to share “trust-relevant” information with vulnerable stakeholders is considered a distinct and critical dimension of trustworthiness.	Sharing trust-relevant information
Steinfeld et al. (2011)	The uninterrupted and integrated flow of information across various levels of the supply chain.	Integrated information flow across the supply chain
Morgan et al. (2015)	Defined as a firm's capability to proactively engage with stakeholders to achieve visibility and traceability in upstream and downstream supply chain operations.	Stakeholder engagement
Egels-Zandén et al. (2015)	They define this concept as “disclosure of information about supplier names, sustainability conditions at suppliers, and buying practices of purchasers.”	Information disclosure (specifically regarding suppliers)
Egels-Zandén & Hansson (2016)	Supply chain transparency is introduced as a tool for transferring power from the disclosing firm to the stakeholders.	A tool for power transfer
Schnackenberg & Tomlinson (2016)	Transparency consists of three main dimensions: disclosure, clarity, and accuracy. They argued that these dimensions encompass pivotal aspects of information quality, ensuring information appears accessible, reliable, honest, understandable, correct, and consistent.	Quality of shared information
Buell et al. (2017)	Operational transparency refers to the disclosure of a firm's work processes to customers. Specifically, it entails disclosing the “behind-the-scenes” activities that the firm performs during its operational processes.	Visibility of behind-the-scenes processes
Morgan et al. (2018)	Consists of reporting to and communicating with key stakeholders to provide “traceability” regarding product history and “visibility” into current activities across the supply chain, while integrating stakeholder feedback for improvement.	Traceability and Visibility
Gold & Heikkurinen (2018)	Transparency means acting in a way that allows others (both internal and external stakeholders) to understand and observe what the firm does; it also includes high-quality disclosure of the information required for this. In other words, transparency is not just about sharing information, but about acting transparently.	Transparent performance
Kraft et al. (2018); Bateman & Bonanni	Transparency at the supply chain level includes “visibility (accurate identification and data collection from all nodes of	Visibility and Disclosure

(2019); Searcy et al. (2022)	a supply chain) [and] disclosure (the exchange of that information, both internally and externally, with the required or desired level of detail).”	
Sodhi & Tang (2019); Viridin et al. (2022); Gligor et al. (2022)	A concept referring to the communication and disclosure of supply chain information regarding a firm's products and operations.	Communication and information disclosure
Bai & Sarkis (2020)	The extent of access by contracting parties and external observers to information within organizational and environmental platforms.	Access to information by contracting parties
Pournader et al. (2020)	Transparency focuses on the “how” aspect; for example, how a product was sourced, processed, and moved during transportation.	Logistics processes and execution methods
Shafiq et al. (2020)	Covers the extent of access for end-users and other firms to information regarding suppliers, sourcing locations, raw materials used, and associated risks and concerns.	Access to information regarding suppliers, sourcing locations, raw materials, and risks
Gualandris et al. (2021)	The aggregate of environmental, social, and governance (ESG) information made available to the public.	Disclosure of ESG indicators
Montecchi et al. (2021)	The act of disclosing detailed information regarding the origin, sourcing, manufacturing processes, costs, and logistics of goods.	Disclosure of operational functions and cost details
Duan et al. (2022)	Informing stakeholders about the sustainability of the organization's products and the underlying sourcing and production activities.	Sustainability in production
Mir et al. (2022)	Sharing the procedures governing buyer-supplier transactions for their uniform execution.	Operational transparency in transactional procedures
Saeed et al. (2022)	Transparency is a public value that requires citizens to be aware of the “how” and “why” of decision-making; this includes procedures, criteria used by public decision-makers, evidence used to reach decisions, and the resulting outcomes. Often, transparency is viewed as “access to information.”	Access to information for decision-making
Ko et al. (2023)	Can be defined as the extent to which a firm discloses its supply chain information to consumers.	Information disclosure
Münch & Hartmann (2023)	Transparency and visibility mean the ability to see into the supply chain to prepare for and recover from disruptions.	Resilience and crisis management
Schäfer (2023)	Understanding transparency requires attention to three dimensions: supply chain information, involved stakeholders, and the overall landscape. From the information perspective, it means access to data about firms, suppliers, locations, and processes. From the stakeholder perspective, it involves disclosure and communication to enhance consumer awareness. From the landscape perspective, it includes disclosing supplier names, processing conditions, and purchasing practices to enable traceability.	Sustainability
Budler et al. (2024)	The amount of information voluntarily provided within a supply chain regarding matters such as operations, product authenticity, and cost analysis to stakeholders within or beyond the chain (e.g., suppliers, third parties, manufacturers, distributors, governments, NGOs, or customers).	Stakeholder access to information regarding supply chain operations

Explaining the Concept of Transparency in the Agri-Food Supply Chain

Previous studies in the food and agricultural supply chain sector have primarily relied on existing definitions to provide a clear and understandable conceptualization of “transparency.” For instance, Wognum et al. (2011), Trienekens et al. (2012), Manning (2018), and Chan et al. (2019) refer to Hofstede et al. (2004, p. 5); Kraft & Kellner (2022) and Sunny et al. (2020) refer to Hofstede et al. (2004, p. 290); Bastian & Zentes (2013) refer to Beulens et al. (2005, p. 482); Manning (2018) refers to Turilli & Floridi (2009, p. 105); and Nguyen & Nguyen (2025) refer to Schnackenberg & Tomlinson (2016, p. 1788) (refer to Table 1 to view the aforementioned definitions).

Wognum et al. (2011, p. 66), emphasizing sustainability in the food supply chain, state that “supply chain transparency has both horizontal and vertical dimensions. The vertical dimension encompasses knowledge about all companies and the inflows and outflows within the supply chain. The horizontal dimension refers to the conditions, policies, and processes within individual companies at specific levels of the supply chain, as well as information flows to specific corporate stakeholders.” Mol (2015, p. 1) explains transparency in sustainable food systems as “information disclosure” that was previously held privately by public and/or private organizations, noting that transparency also incorporates quality and sustainability characteristics to enhance public accountability. Nilsson et al. (2019) and John et al. (2025) support this definition in their studies. On the other hand, Gardner et al. (2019, p. 165) argue that “the term transparency in sustainable product supply chains carries both normative and substantive connotations. From a normative perspective, transparency serves as a tool for democracy, participation, accountability, and reducing information access inequalities, positively influencing environmental policies and civil society activities. From a substantive perspective, transparency involves objective criteria such as monitoring, disclosure, reporting, and verification of information, which are essential for improving performance and sustainability standards.”

Faisal (2015, p. 1300) defines transparency in the food supply chain as “the amount of information available to the final consumer for tracing the history of the transformation of raw materials into the final product.” Farnsworth et al. (2019, p. 106), emphasizing “good food” in food supply chains, define transparency as “the open disclosure of work and production procedures, ingredients, and product origin (i.e., where the product was produced and processed).”

Drawing on the existing definitions and taking into account the specific characteristics and requirements of agri-food supply chains, the concept of transparency is defined in this study as follows:

“Transparency in the agri-food supply chain refers to the extent and quality of access, disclosure, and integrated flow of accurate, timely, relevant, and undistorted information regarding the origin, processes, relationships, and decisions related to food products across all upstream and downstream links of the supply chain. It enables the visibility and traceability of activities, accountability of actors, and the strengthening of trust among various stakeholders in the supply chain, including suppliers, producers, assemblers, distributors, retailers, governments, customers/consumers, and non-governmental organizations (NGOs).

In the agri-food industry, transparency can address various needs. Increasing transparency by improving information exchange across the supply chain not only enhances market efficiency but also helps maintain uniform food quality, supports product differentiation, and optimizes processes and logistics, thereby aligning with operations management objectives. This positions food industry companies, alongside consumers and governments, as one of the primary claimants demanding transparency in food supply chains (Trienekens et al., 2012). Furthermore, a transparent food supply chain not only strengthens consumer trust but also bolsters the competitiveness of the agricultural sector on a global scale. It ensures that products are traceable, safe, and produced under fair conditions—an issue that aligns with the growing global demand for ethical and transparent production practices (Hasan et al., 2024).

Section 2: Section Two: Concepts Related to Transparency

In the literature on transparency and supply chains, concepts such as visibility (Awaysheh & Klassen, 2010; Kassahun et al., 2014; Morgan et al., 2015, 2018; Sodhi & Tang, 2019; Duan et al., 2022), disclosure (Birkey et al., 2018; Kraft et al., 2018; Sodhi & Tang, 2019; Guan et al., 2020; Montecchi et al., 2021; Budler et al., 2024), traceability/tracking (Kassahun et al., 2014; Francisco & Swanson, 2018; Morgan et al., 2015, 2018; Duan et al., 2022; Gazzola et al., 2023; Montecchi et al., 2021; Budler et al., 2024), and openness (Montecchi et al., 2021; Budler et al., 2024) are, in some cases, treated as synonymous with transparency; at other times, they are viewed as entirely independent concepts, as components of transparency, or as prerequisites for achieving transparency. However, there are varying perspectives regarding the relationship between transparency and these related terms.

Table 2 introduces some of the most commonly used adjacent concepts along with their definitions, drawn from key articles in the field. In the following section, we relate transparency to other concepts in the supply chain management (SCM) literature and demonstrate how they connect to transparency in the food supply chain. This set of related terms allows us to link them to transparency while also distinguishing them from it.

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- Information Sharing as Transparency: Gardner et al. (2019), by posing the key question “Transparency of what?” (p. 3), emphasize the central importance of “supply chain information.” They also state that the effectiveness of supply chain transparency depends on the type of information being shared. While “information sharing” refers to the active deed of making information available to specific individuals or groups, “transparency” represents the extent of information availability. Information sharing is always the result of a conscious corporate decision, meaning that organizations determine what information is shared, at what time, and with which audience. The consequences or effects of this sharing can be estimated for each specific case (Budler et al., 2024).

Gold and Heikkurinen (2018) emphasize that transparency is not merely about information sharing, but rather about acting transparently. Consequently, transparency is a concept that extends beyond the mere sharing of information, encompassing the organization, flow, and function of information at the supply chain level (Budler et al., 2024).

- Visibility as Transparency: Several researchers have provided various definitions of supply chain visibility; however, to date, no universally agreed-upon definition exists. Early definitions of this concept placed special emphasis on information shared across the supply chain. From their perspective, visibility means the ability to access and share information throughout the supply chain and utilize it in real time (Busse et al., 2017; Swift et al., 2019; Singh et al., 2020). Others have expanded this definition, viewing it as the capability to share timely and accurate data regarding customer demand, inventory quantities and locations, transportation costs, and other logistical dimensions across the entire supply chain (Nooraie & Parast, 2015; Somapa et al., 2018).

In the definition by Swink et al. (2024, p. 1), “visibility refers to the extent to which a company can easily access accurate, timely, complete, and usefully formatted data provided by the company’s internal systems, its partners, and other market sources.” Subsequent definitions of visibility, emphasizing internal supply chain operations, define it as “making information related to various aspects of the supply chain available to stakeholders, as well as utilizing that information within the firm” (Morgan, 2018, pp. 960-961). Similarly, Sodhi and Tang (2019, p. 2946) define this concept as “the efforts of an organization to collect information about upstream and downstream operations in supply chains, primarily for internal use.” On the other hand, some researchers focus on the characteristics of the exchanged information, defining it as access to high-quality information that describes various supply and demand factors (Williams et al., 2013; Kalaiarasan et al., 2022).

Other researchers and practitioners advocate for a specific type of supply chain visibility known as end-to-end visibility, termed “End-to-End Visibility” (KPMG, 2016; Somapa et al., 2018; Messina et al., 2023). End-to-end visibility, which represents visibility from the “supplier's supplier” to the “customer's customer” (Somapa et al., 2018; Messina et al., 2023), enables supply chain partners to achieve a higher level of market responsiveness and mitigate the risk of disruptions in the flow of materials and products (Somapa et al., 2018).

The concept of supply chain visibility is highly related to and intertwined with the two concepts of traceability and transparency (Zhang & Su, 2020; Nnabueze et al., 2021). For instance, Tse and Tan (2012, p. 51) define supply chain visibility as the “traceability and transparency of the supply chain process.” Nevertheless, these concepts remain distinct from one another in practice.

Roy (2021), by utilizing a deep conceptual synthesis of conflicting research emphases and theoretical foundations, clarifies these two concepts across five key axes. First, traceability primarily focuses on the “logistical unit of analysis” and the details of product movement, whereas visibility is defined at the macro level of the “entire chain.” Second, the goal of traceability is to map information links between the product and its components, while visibility seeks to integrate chain actors to enhance performance and coordination. Third, from a managerial perspective, traceability leads to “logistical control” of material flows, whereas visibility provides “supply chain governance” to strengthen integration. Fourth, regarding provenance, traceability is a technical tool for proving authenticity, which is integrated into the broader concept of visibility to achieve transparency. Finally, while traceability deals with operational challenges such as “product safety and recalls,” visibility adopts a strategic approach aimed at addressing “major disruptions and building resilience” within complex geographical environments.

Supply chain visibility is considered to address the information needs of internal supply chain stakeholders and is primarily conceptualized from the perspective of the “information user.” In contrast, “supply chain transparency” is framed from the perspective of the “information provider” and only manifests when supply chain firms share or disclose that visibility to external stakeholders (Zhang & Su, 2020).

Overall, while superior traceability in the supply chain is a prerequisite for superior visibility, superior visibility itself is considered a prerequisite for coordinating contemporary complex supply chains to achieve competitive advantage (Roy, 2021). Significantly, visibility is equal to or greater than supply chain transparency; in other words, visibility provides an upper bound for supply chain transparency (Budler et al., 2024).

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- Traceability as Transparency: The Codex Alimentarius Commission and the International Organization for Standardization (ISO) have defined traceability as follows: "...the ability to trace the history, application, or location of an entity by means of recorded identifiers" (as cited in Gui et al., 2009, p. 972). This definition was subsequently expanded in the UNI EN ISO 9000 standard as "the ability to trace back the history, application, or location of that which is under consideration." Accordingly, this concept was redefined within the agri-food context in the UNI 10939 standard, which defines supply chain traceability as: "the ability to reconstruct the history and follow the path of a product's use through documented identifiers in relation to material flows and supply chain operators" (Corallo et al., 2018, p. 2).

The definitions of traceability and traceability systems provided by Karlsen et al. (2013) and Dabbene et al. (2014) refer to the ability to ensure that products moving along the food supply chain can be monitored both forward (Tracking/Tracked) and backward (Traced/Traceability/Tracing). Although these two terms are often used interchangeably, they represent two symmetrical (mirror) processes (Corallo et al., 2018). Tracking (forward traceability) refers to the ability to follow a product's path downstream (from origin to destination) along the supply chain. In contrast, tracing (backward traceability) refers to the ability to identify the origin and characteristics of a specific product by referring to records maintained upstream in the supply chain (Dabbene et al., 2014; Corallo et al., 2018). Therefore, both processes follow the logic of accurate and systematic information collection throughout the activities (tasks) that lead to the intermediate or final realization of a product (Corallo et al., 2018).

More precisely, traceability can be defined in terms of the what, how, where, why, and when aspects of the underlying product throughout the supply chain (Razmi et al., 2010; Aung & Chang, 2014). In summary, traceability enables transparency through tracking and tracing (Roy, 2021; Sunny et al., 2020). However, the relationship between supply chain transparency and traceability is not direct and linear. While having more information available (i.e., being transparent) may lead to increased traceability, greater traceability does not necessarily result in greater transparency if the supply chain consists of a few participants with weak interdependencies (Francisco & Swanson, 2018). Previous literature has also shown that although transparency and traceability are related concepts, they represent distinct characteristics (Francisco & Swanson, 2018; Roy, 2021; Hellani et al., 2021).

- Disclosure as Transparency: Companies typically adopt one of four disclosure strategies: 1) Transparency, in which data are fully and openly disclosed; 2) Secrecy, in which supply chain information is concealed for commercial reasons; 3) Distracting attention, where excessive reporting is used to obscure the lack of meaningful content; and 4) Withholding, in which companies neither seek out information nor report it (Marshall et al., 2016).

Disclosure is the process of sharing organizational information with internal stakeholders (e.g., upstream and downstream supply chain partners, employees, etc.) and external stakeholders (e.g., customers, investors, governments, etc.) (Schnackenberg et al., 2020). This approach defines transparency not merely as traceability, but as an information disclosure strategy aimed at reducing information asymmetry and increasing consumer trust (Mol, 2015). According to Koo et al. (2023, p. 1), supply chain transparency can be defined as “the disclosure of supply chain information, such as sourcing, production processes, and logistics, to other supply chain participants or consumers.” Similarly, Gardner et al. (2019) argue that for companies operating within a sustainable food supply chain, information disclosure means that the impacts of their actions can be evaluated and judged by external parties. In some cases, disclosure is a matter of compliance with laws and regulations; in contrast, it can also provide an opportunity for companies to voluntarily report on initiatives or strategies that are considered important by stakeholders.

- Openness as Transparency: According to Gold and Heikkurinen (2018, p. 4), “transparency means openness and information exchange in a way that allows others to easily see what actions are being taken and what actions are not being taken.” Similarly, Commandré et al. (2021, p. 4) describe transparency as a two-dimensional concept in which the two components of openness and monitoring are combined. Moreover, Fantazy et al. (2016, p. 1268) define supply chain openness as “the extent to which supply chain partners are willing to demonstrate joint agility, collective flexibility, integration of their business operations, two-way communication and information sharing, collaboration and mutual learning, and knowledge creation.”

Budler et al. (2024) emphasize that openness, understood as the willingness to make information available, is a fundamental prerequisite for achieving supply chain transparency. In their definition, “openness is the orientation of a supply chain or company that relates to the overall attitude and willingness of stakeholders to enable and facilitate the availability of information within and outside the supply chain” (Budler et al., 2024, p. 6).

Table 2. Terms Related to Transparency

Related Term	Concept	Key Difference from Transparency
Information Sharing	A deliberate act of exchanging information with a selected stakeholder at a specific point in time, either within or outside the supply chain (Shang et al., 2015).	“Information sharing” refers to the active act of making information available to specific individuals or groups, whereas “transparency” refers to the degree to which information is available (Budler et al., 2024).
Visibility	The capability to share timely and accurate data regarding customer demand, inventory quantity and location, transportation costs, and other logistical dimensions across an entire supply chain (Noorai & Parast, 2015; Somapa et al., 2018).	Visibility caters to the needs of stakeholders internal to the company (or its supply chain), like managers, immediate suppliers, or customers. In contrast, transparency targets a broader set of external stakeholders, including consumers and consumer rights’ advocacy groups, NGOs, as well as investors and monitoring agencies (Sodhi & Tang, 2019).

Traceability	The ability to access some or all information related to products and to track the movement of products at specific stages, such as production, processing, and distribution (Aung & Chang, 2014; Óskarsdóttir & Oddsson, 2019; Ringsberg, 2014).	According to Mol (2015), traceability refers to limited transparency for a small number of economic actors in value chains, primarily driven by economic interests. This limited “managerial transparency” originates from management and logistics sciences and does not address or involve citizen-consumers or public authorities.
Disclosure	Disclosure is the process of releasing information and may include supply chain transparency, information sharing, quality disclosure (Zhou et al., 2022), environmental disclosure (Khosroshahi et al., 2021), or technology disclosure (Zhou et al., 2018).	Disclosure is a formal action or report that may include data related to due diligence practices, corporate responsibility, or organizational performance, even when there is no legal or practical obligation to implement such actions (She, 2021). In contrast, transparency reflects the quality and extent of disclosure and is typically associated with goals such as reducing information asymmetry, increasing trust, and enhancing stakeholder accountability (Mol, 2015).
Openness	The orientation of a supply chain or company relates to the overall attitude and willingness of stakeholders to enable and facilitate the availability of information within and outside the supply chain (Budler et al., 2024).	Openness reflects the organizational willingness and attitude to provide information, whereas transparency can be the practical outcome of openness (openness is a prerequisite for transparency; Budler et al., 2024). That is, when openness becomes an operational reality and information is actually visible to stakeholders, transparency is achieved. Despite the fact that transparency or supply chain visibility contributes to our understanding of supply chain openness, it does not fully explain the complete dynamics of interconnections among supply chain partners (Tipu et al., 2019).

Section Three: Dimensions of Transparency in the Food Supply Chain

Achieving transparency in the supply chain goes beyond a mere ethical obligation; it involves managing the delicate boundaries between “building trust” and “commercial confidentiality.” In practice, attaining transparency within supply networks requires balancing ethical responsibilities with the protection of competitive advantages. Accordingly, disclosure matrices distinguish, for example, between non-critical, voluntary, strategic, and critical disclosures, as well as among different disclosure strategies. Importantly, transparency does not require companies to reveal “everything” about their activities. Rather, it necessitates difficult decisions to differentiate between issues that other parties have a “right to know” and those for which no such right can reasonably be assumed (Searcy et al., 2022).

The content of supply chain transparency now encompasses a wide range of dimensions/components. These include, for example: actual production costs (Huang & Yang, 2016; Montecchi et al., 2021); ESG information (Sodhi & Tang, 2019; Fraser et al., 2020); the environmental, social, and economic impacts of products (Duan et al., 2022; Gold & Heikkurinen,

2018; Schafer, 2023; Jia et al., 2025); human trafficking and modern slavery (Schafer, 2023); the environmental and social conditions of suppliers (Schafer, 2023; Searcy et al., 2022); carbon emissions (Villena & Dhanorkar, 2020; Onyeaka et al., 2024); production and sourcing processes (Čuš-Babič et al., 2014; Ko et al., 2023); inventory and warehousing status of materials (Čuš-Babič et al., 2014); logistics information (Čuš-Babič et al., 2014; Saeed et al., 2022; Ko et al., 2023); employees' working conditions (e.g., occupational health and safety, equal treatment and non-discrimination, wages and leave) (Doorey, 2011; Ma et al., 2016; Venkatesh et al., 2020; Montecchi et al., 2021; Fraser et al., 2020); the identity of all stakeholders within multilayer supply chains (Doorey, 2011; Venkatesh et al., 2020); certification and standards status (Ahmed & Omar, 2019); disclosure of negative incidents (reporting errors, accidents, and weaknesses—not only successes) (Gold & Heikkurinen, 2018); child labor (Ma et al., 2016); product authenticity (Montecchi et al., 2021); product history and origin (Morgan et al., 2018); intangible assets and business collaborations (Su et al., 2013); and financial transactions and payments (Bai & Sarkis, 2020).

Although the broader supply chain transparency literature encompasses diverse dimensions ranging from carbon emissions to working conditions, food supply chains require a more specialized interpretation of transparency due to the “essential” and “perishable” nature of food products and their direct connection to human physiology. Accordingly, Table 3 represents the outcome of an analytical synthesis of studies specifically focused on agri-food supply chains. By integrating prior findings, the table redefines the substantive dimensions of transparency from the perspective of the actual needs of stakeholders within this industry.

In fact, each of the 32 identified dimensions presented in the table reflects a response to industry-specific challenges in relation to stakeholders. For example, while “traceability” may represent a strategic option in many industries, in food supply chains, it is considered a fundamental principle of transparency due to the necessity of controlling biological and chemical hazards. Likewise, the “Food Quality and Safety” category in our framework directly addresses standards and concerns that are uniquely critical in the food sector and may not constitute a comparable priority in non-food industries. Therefore, the proposed framework reflects the operational and ethical concerns of food supply chain actors and, through the integration of industry-specific findings, provides a more precise understanding of the actual transparency requirements within this sector.

Table 3. Dimensions of Transparency in the Food Supply Chain

Main Theme	Transparency Dimensions (Sub-codes / Open Codes)	Supporting Sources
Supplier and Origin Information	Disclosure of supplier factory lists / supplier-related information	Chan et al. (2019); Fraser & Van der Ven (2022); Bai et al. (2022); Ehsan et al. (2022); Farooq et al. (2024)
	Product origin and authenticity	Wognum et al. (2011); Trienekens et al. (2012); Bastian & Zentes (2013); Mol (2014); Scholten et al. (2014); Kassahun et al. (2014); Faisal (2015); Yiannas (2018); Francisco & Swanson (2018); Astill et al. (2019); Bhat et al. (2021); Majdalawieh et al. (2021); Nyamah et al. (2022); Palocci et al. (2022); Bai et al. (2022); Ehsan et al. (2022); Pozelli Sabio & Spers (2022); Gazzola et al. (2023); Hurduzeu & Popescu (2023); Kansal et al. (2024); Nwariaku et al. (2024); Caputo & Reardon (2025); Mirikar et al. (2025)
	Geographic information (e.g., exact cultivation location)	Bonanni et al. (2010); Godar et al. (2016); Kos & Kloppenburg (2019); Gligor et al. (2022); Caputo & Reardon (2025); Mirikar et al. (2025)
	Source legitimacy (harvesting from authorized/legal lands)	Chan et al. (2019)
	Input-sector information (seed suppliers, machinery providers, agrochemicals, fertilizers)	Medina & Thomé (2021)
Supply Chain Process Information	Production process information (how the product is produced)	Beulens et al. (2005); Bonanni et al. (2010); Wognum et al. (2011); Bastian & Zentes (2013); Mol (2014); Xu et al. (2014); Francisco & Swanson (2018); Bhat et al. (2021); Tayal et al. (2021); Gligor et al. (2022); Gazzola et al. (2023); Caputo & Reardon (2025); Vandenhaute et al. (2025)
	Transportation and distribution process information	Beulens et al. (2005); Trienekens et al. (2012); Mol (2014); Bhat et al. (2021); Ehsan et al. (2022); Gazzola et al. (2023); Xu et al. (2024); Siddiqui et al. (2024)
	Controlled atmosphere variables (CO ₂ , O ₂ , ethylene, SO ₂)	Wang et al. (2017); Mirikar et al. (2025)
	Materials and inputs used	Beulens et al. (2005); Bonanni et al. (2010); Xu et al. (2014); Ehsan et al. (2022); Gazzola et al. (2023); Guidani et al. (2024)
	Chemical input information	Mol (2014); Majdalawieh et al. (2021)
	Authenticity and proof-of-work (verification of claimed activities)	David et al. (2022)
	Cultivation and farming methods	Siddiqui et al. (2024)
Food Quality and Safety	Product quality and safety	Beulens et al. (2005); Kassahun et al. (2014); Faisal (2015); Yiannas (2018); Bhat et al. (2021); Pozelli Sabio & Spers (2022); Hurduzeu & Popescu (2023); Steiner et al. (2024); Xu et al. (2024); Guidani et al. (2024); Farooq et al. (2024)
	Allergen risks (presence of allergens)	Kassahun et al. (2014)
	Specific attributes of food products	Trienekens et al. (2012); Bastian & Zentes (2013); Mol (2014); Bhat et al. (2021); Gazzola et al. (2023)

Environmental Impacts	Greenhouse gas (GHG / carbon footprint) reporting	Wognum et al. (2011); Bastian & Zentes (2013); Manning (2018); Fraser & Van der Ven (2022); Nyamah et al. (2022); Palocci et al. (2022); Martin et al. (2023); Gazzola et al. (2023); Guidani et al. (2024); Essien et al. (2024)
	Pollution from wastewater and waste effluents	Mol (2014)
	Waste and pollution management	Manning (2018); Essien et al. (2024)
	Deforestation status (deforestation-free sourcing)	Godar et al. (2016); Kashmanian (2017); Gardner et al. (2019)
	Natural resource management practices (temperature control, water consumption, etc.)	Brewer (2014); Godar et al. (2016); Majdalawieh et al. (2021); Essien et al. (2024); Mwewa et al. (2024); Siddiqui et al. (2024); Nwariaku et al. (2024); Mirikar et al. (2025)
	Environmental impacts (general)	Godar et al. (2016); Manning (2018); Gardner et al. (2019); Kos & Kloppenburg (2019); Tayal et al. (2021); Pozelli Sabio & Spers (2022); Gligor et al. (2025); Al-Khatib (2025); Samoggia et al. (2025)
Social and Ethical Impacts	Working conditions (e.g., occupational health and safety, equal treatment and non-discrimination, wages and leave)	Kashmanian (2017); Tayal et al. (2021); Essien et al. (2024); Nwariaku et al. (2024); Caputo & Reardon (2025)
	Forced labor (absence of modern slavery)	Kashmanian (2017)
	Fair payment to farmers	Kansal et al. (2024)
	Social impacts	Godar et al. (2016); Manning (2018); Gardner et al. (2019); Kos & Kloppenburg (2019); Tayal et al. (2021); Gligor et al. (2025); Al-Khatib (2025)
Economic and Financial Information	Sharing cost and profit margin information	Nyamah et al. (2022); Guidani et al. (2024); Igwe et al. (2024); Caputo & Reardon (2025); Mühl et al. (2025); Vandenhaute et al. (2025)
	Financial flows and investments	Medina & Thomé (2021); Farooq et al. (2024)
	Pricing structure	Brewer (2014); Pozelli Sabio & Spers (2022); Essien et al. (2024); Mwewa et al. (2024); Igwe et al. (2024); Samoggia et al. (2025)
	Inventory levels	David et al. (2022); Hasan et al. (2024); Al-Khatib (2025); Vandenhaute et al. (2025)
Regulations, Standards, and Certifications	Compliance with food laws and standards (ISO, HACCP, MSC, BRC)	Beulens et al. (2005); Trienekens et al. (2012); Scholten et al. (2014); Kassahun et al. (2014); Gardner et al. (2019); Majdalawieh et al. (2021); Pozelli Sabio & Spers (2022); Lorusso et al. (2024); Steiner et al. (2024); Essien et al. (2024); Nwariaku et al. (2024); Mwewa et al. (2024); Samoggia et al. (2025)
	Third-party certifications	Kashmanian (2017)
	Organic product certification	Majdalawieh et al. (2021); Gligor et al. (2025)

To enhance conceptual clarity and provide a visual representation of the findings from the systematic review, the identified dimensions of transparency are presented in Figure 4 below.



Figure 4. Conceptual framework of transparency dimensions in food supply chains

Discussion and Conclusion

This study attempted to clarify and define the concept of transparency specifically for the “food supply chain” (RQ1). In this regard, an in-depth focus was placed on the supply chain management literature (in general), and 31 existing definitions of transparency were extracted. Furthermore, by referring to the agri-food supply chain literature and presenting several highly-cited definitions in this field, all of which were, of course, inspired by previous definitions, we provided a specialized

definition for the concept of transparency within the agri-food supply chain domain. This definition is comprehensive and provides a clear understanding for both academic and organizational readers.

The next endeavor of this study was to identify which terms and vocabularies in the literature of this field are used as equivalents or synonyms for “transparency” (RQ2). Table 2 introduces some of the most frequently used adjacent concepts along with their definitions based on key articles in the field, as well as the conceptual distinctions or differences between these terms and the word “transparency.” Our review of the existing literature indicates a lack of clarity and consistency in the use of these terms, which has led to ambiguity among researchers and difficulty in determining appropriate indicators for organizations within supply chains. We considered resolving this ambiguity essential for the development of meaningful future research on “transparency” and related terminology. In doing so, we have attempted to guide managers, consultants, and regulatory bodies toward a stronger understanding of supply chain transparency and equip them with a roadmap for measuring transparency and its adjacent concepts.

Our analysis also revealed that stakeholders in the food supply chain differ in their application of the adjacent concepts of “transparency” and that the scope and nature of these concepts vary depending on the term used. For example, within the framework of “information sharing,” the primary stakeholders are those actors in the food supply chain who are intentionally targeted by corporate decisions regarding information disclosure. This group includes suppliers, producers, distributors, retailers, and logistics partners in B2B relationships, as well as regulatory bodies, investors, and occasionally consumers in B2C relationships. Therefore, under this concept, stakeholders are mainly “specific information recipients” rather than all participants in the food ecosystem—something that manifests in contractual interactions, pricing, regulatory reporting, and product communication within the agri-food industry. In contrast to “supply chain visibility” and “traceability,” the concept of “transparency” shifts its focus from internal supply chain partners (such as managers, direct suppliers, or customers) toward external stakeholders, including consumers, governments, and non-governmental organizations (NGOs). Within the framework of the concept of “disclosure,” stakeholders are primarily external actors and evaluators of the food supply chain who play a regulatory, judgmental, or legitimizing role. This group includes consumers, regulatory bodies, NGOs, investors, and in some cases, the media and public opinion. Transparency, however, encompasses both internal and external stakeholder groups and also considers their interactions. Finally, the concept of “openness,” which emphasizes the willingness and overall orientation of companies and chain actors to facilitate access to information, collaboration, shared learning, and operational integration, pertains to a broader spectrum of stakeholders. Suppliers, manufacturers, distributors, retailers, and other operational partners are engaged in reciprocal relationships, and at a wider level, it also includes the internal stakeholders of the organization. Openness is more than a formal act of disclosure; it represents a culture of

interaction, readiness to act transparently, and the establishment of necessary behavioral and organizational infrastructures to achieve supply chain transparency.

Finally, our effort to identify the key dimensions and components of transparency in the food supply chain that should be disclosed by companies to stakeholders (RQ3) resulted in the discovery of 32 key transparency dimensions, which were organized into seven main conceptual categories. These seven categories are: (1) supplier and Origin Information, (2) supply chain processes information, (3) quality and safety of food products, (4) environmental impacts, (5) social and ethical impacts, (6) economic and financial information, and (7) regulations, standards, and certifications. The present study adopts a structured approach and, for the first time, organizes these dimensions into an integrated conceptual framework. Derived from a systematic synthesis of the existing literature, this framework addresses the fragmented treatment of transparency dimensions in prior studies, provides a theoretical foundation for future research, and offers a basis for the development of empirical models in this domain. Furthermore, it can assist various stakeholders—ranging from producers, processors, and retailers to consumers and regulatory bodies—in designing disclosure policies, reporting mechanisms, and transparency evaluation systems, thereby contributing to the development of more responsible and sustainable governance in food supply chains.

An important point regarding this finding, consistent with the perspective of Searcy et al. (2022), is that transparency does not require companies to disclose “everything” about their activities; rather, it entails difficult decisions to distinguish between issues that other stakeholders have a “right to know” and those for which no such right can reasonably be assumed. The recommendations of Gardner et al. (2019) can follow from this finding of ours. They stated that supply chain transparency in itself is “neither inherently good nor bad, and the impact of increasing transparency depends on what information is made transparent, how, for whom, and for what purpose.”

Most organizations operating in developed and developing countries are striving to increase supply chain transparency to improve their business, legal, financial, or procurement operations. Improved transparency contributes to stronger performance, as it drives organizations toward faster planning and better results stemming from the visibility of their impact on the supply chain. Furthermore, organizations and users gain trust from transparency through information disclosure, leading to better management, outstanding effort and performance, increased production efficiency, and improved organizational learning (Ada et al., 2021). Additionally, transparency can help reduce information asymmetry between suppliers and buyers/retailers, as well as stakeholders, by utilizing tools such as product information systems, codes of conduct, and certification programs

(Boström et al., 2015). Higher transparency in information increases the efficiency of supply chain partnerships and contributes to the growth of supply chain collaboration (Khan et al., 2019).

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Alongside these advantages, there are also disadvantages. To increase information transparency, partners generally must invest a significant amount in developing information systems and improving information flow. Furthermore, from the partners' perspective, some concerns regarding information transparency relate to the disclosure of confidential information, which could lead to attacks by competitors. Consequently, some partners may be unable to share their information (Ada et al., 2021). Increasing supply chain transparency can also have a negative impact on a company's sales. Excessive disclosure of information can expose it to public criticism. As consumers' ethical standards have risen in recent times, the risk that supply chain transparency might damage the company's brand image has also grown (Ko et al., 2023). Nevertheless, the general view is that transparency is inherently perceived as positive, as it reduces information inequality (information asymmetry) between companies and stakeholders (Egels-Zandén et al., 2015), builds trust and a positive reputation among stakeholders (Gardner et al., 2019), and improves organizational legitimacy (Gligor et al., 2022).

From the above, it can be inferred that achieving transparency in the food supply chain is not merely an ethical commitment or a regulatory requirement; rather, it is a strategic process that necessitates the intelligent management of the boundary between "building trust" and "maintaining commercial confidentiality." Achieving the positive outcomes of transparency depends on the precise identification of the type of information to be disclosed, the method of disclosure, the level of stakeholder access, and the purpose of clarification. The findings of this study provide a systematic framework for understanding the scope and boundaries of transparency within the agri-food supply chain.

Managerial Implications

The findings of this study indicate that effective transparency management in food supply chains extends beyond simply increasing the amount of disclosed information. Rather, it requires balancing information visibility, verification mechanisms, diverse stakeholder expectations, and concerns related to confidentiality and data governance. Accordingly, the following managerial implications are proposed.

First, instead of adopting a one-size-fits-all approach to information disclosure, organizations may benefit from implementing a layered transparency architecture. Within this approach, information related to standards, certifications, and baseline food quality and safety data can be disclosed publicly to strengthen consumer trust and organizational legitimacy. In contrast, operational and process-related information—such as production methods, transportation conditions, or storage data—may be shared selectively among supply chain partners to improve coordination and operational efficiency. Furthermore, more sensitive information, including pricing structures, inventory levels, or profit margins, should be managed through restricted-access mechanisms and formal data-sharing agreements in order to reduce the risk of competitive exploitation.

Second, the findings suggest that transparency without verification mechanisms is unlikely to foster sustainable stakeholder trust. Therefore, in addition to disclosing information, organizations should develop mechanisms for validating transparency-related claims. For example, information concerning environmental impacts, product origin, or production conditions can be supported through independent audits, credible certification schemes, or digital traceability systems. Such mechanisms may reduce the likelihood of unsubstantiated claims or misleading interpretations while enhancing the credibility of transparency initiatives.

Third, organizations should avoid attempting to implement all transparency dimensions simultaneously and with the same level of intensity. Instead, transparency priorities should be aligned with stakeholder expectations and the risk profile of each domain. For example, consumers are primarily concerned with information related to product quality, food safety, allergens, and product origin, whereas regulatory bodies and civil society organizations may place greater emphasis on environmental impacts, working conditions, and legal compliance. Likewise, supply chain partners may require greater visibility into process-related information, traceability, and operational stability. Aligning transparency strategies with stakeholder priorities may therefore improve the effectiveness of transparency-related investments.

Fourth, the findings indicate that enhancing transparency in food supply chains requires the establishment of clear data governance mechanisms. In this regard, organizations should clearly define data ownership responsibilities, access rights, data-sharing procedures, and verification-related responsibilities. Such mechanisms can facilitate information exchange while mitigating concerns associated with confidentiality, cybersecurity, and potential data misuse.

Limitations and Future Research Directions

Despite this study's significant contribution in providing a comprehensive conceptual framework for transparency in food supply chains, several limitations should be acknowledged, which open avenues for future research. First, this study is conceptual in nature, and the proposed framework has not yet been empirically validated. Although the model was developed through a rigorous systematic literature review, its validation through empirical methods—such as expert surveys, case studies, or statistical analysis—could be pursued in subsequent research stages to enhance its precision and practical applicability.

Second, given the exploratory and inclusive nature of this study in identifying transparency dimensions, we intentionally avoided a single-theory approach to ensure that all dimensions emerging from the literature were integrated without the constraints of a specific theoretical lens. In this regard, it is suggested that future studies analyze the relationships between these dimensions more deeply by applying various theoretical lenses (e.g., Stakeholder Theory or Information Asymmetry Theory). The proposed comprehensive conceptual framework can thus serve as a robust foundation for more nuanced theoretical testing in future research.

Finally, the dimensions presented are generalized across the entire food supply chain. Therefore, context-specific investigations aimed at adapting these dimensions to particular types of food products or diverse geographical regions would further enrich future studies.

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During the preparation of this work, the author(s) used ChatGPT and Gemini to translate texts. After using these tools, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Data Availability Statement

Data available on request from the authors.

Conflict of interest

The authors declare no conflict of interest related to the content, data, or results of this study.

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Ethical considerations

The authors declare compliance with all applicable ethical guidelines, including proper data handling, originality of content, and avoidance of duplicate submission.

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