Universidade de Évora - Instituto de Investigação e Formação Avançada
Universidade de Trás-os-Montes e Alto Douro

Programa de Doutoramento em Agronegócios e Sustentabilidade

Tese de Doutoramento

Assessment of trust in agrifood supply chains with a focus on sustainability

Michel Tavares Quinteiro Milcent Assis

Orientador(es) | Maria Raquel Lucas
Maria José Matos Rainho

Évora 2024

Universidade de Évora - Instituto de Investigação e Formação Avançada
Universidade de Trás-os-Montes e Alto Douro

Programa de Doutoramento em Agronegócios e Sustentabilidade

Tese de Doutoramento

Assessment of trust in agrifood supply chains with a focus on sustainability

Michel Tavares Quinteiro Milcent Assis

Orientador(es) | Maria Raquel Lucas
Maria José Matos Rainho

Évora 2024

A tese de doutoramento foi objeto de apreciação e discussão pública pelo seguinte júri nomeado pelo Diretor do Instituto de Investigação e Formação Avançada:

Presidente	Andreia Teixeira Basílio (Universidade de Évora)
Vogais	Ana Alexandra Vilela Marta Rio Costa (Universidade de Trás-os-Montes e Alto Douro) Estela Alves de Medeiros (Ministério da Agricultura, Pecuária e Abastecimento, Brasil) Humberto Nuno Rito Ribeiro (Universidade de Aveiro) Maria Raquel Lucas (Universidade de Évora) (Orientador) Pedro Damião Henriques (Universidade de Évora) Susana Maria Palavra Garrido Azevedo (Universidade da Beira Interior)

Évora 2024

This work was produced as original thesis for the degree of Doctor in Agribusiness and Sustainability at the University of Évora and University of Trás-os-Montes and Alto Douro.

This work was supported by the Brazilian Ministry of Agriculture and Livestock and by the Portuguese Foundation for Science and Technology – FCT, under the grants UIDB/04007/2020 of the CEFAGE – UÉ, UIDB/04011/2020 of the CETRAD – UTAD and UIDB/05183/2020 of the MED and Change.

Dedicatória

À minha mãe e ao meu pai (*in memoriam*),

Às minhas filhas,

À mãe das minhas filhas,

Ao meu irmão e à minha família,

Aos meus amigos e colegas de trabalho,

Às minhas orientadoras.

ACKNOWLEDGEMENTS

It is necessary to express my sincere thanks to some people who contributed to the realization of this important project.

First, I would like to thank my beautiful mother, Angela Maria Tavares Quinteiro Milcent Assis, who always motivated me to be better and evolve in every way. I would also like to express my deep gratitude to my brother, Marcel Tavares Quinteiro Milcent Assis, who, in addition to always believing in me, helped me with the translation of articles for publication.

I am also very grateful for the support from my advisor, Professor Maria Raquel Lucas, and from my co-advisor, Professor Maria José Matos Rainho. You were very sensitive, believed in my potential, were patient with my shortcomings and knew how to guide me through the course. Thank you for your professionalism and also for your friendship.

I would like to thank the professors of the course for their commitment and willingness to teach and for their providential advices as well. The CETRAD and the CEFAGE gave us the necessary structure for the proper execution of the project, without the support of these renowned centres my path would certainly be more difficult. Thanks for the support.

I also thank Technische Universität Chemnitz - TUC for welcoming me to the Erasmus+ Mobility Programme, especially Ms. Nadja Hüller for all the support provided and Mr. Makus Tümpel for his guidance and advice.

And finally, I cannot fail to acknowledge the support of the Agricultural Defence Secretariat, of the Brazilian Ministry of Agriculture and Livestock, for encouraging my personal and professional development. I am very grateful to the Secretary of Agricultural Defence at the time, José Guilherme Tollstadius Leal, and to the Director of DEGES/SDA, Estela Alves de Medeiros, for trusting in my ability and effort.

Avaliação da confiança em cadeias de abastecimento agroalimentares com foco na sustentabilidade

Resumo

Para alcançar sistemas agroalimentares mais sustentáveis, as partes interessadas devem construir alianças e coalizões políticas além da alimentação e da agricultura. A natureza integrada e transformadora da Agenda 2030 para o Desenvolvimento Sustentável das Nações Unidas requer políticas que considerem sistematicamente os vínculos intersetoriais e apoiem a boa governança, relações comerciais justas, comunicação eficiente e a colaboração. A partir daí, a confiança foi identificada como um fator potencial na construção e na manutenção das boas relações, assim como da governança e da colaboração.

Sendo assim, o objetivo geral desta pesquisa foi avaliar as relações de confiança em cadeias agroalimentares com foco em sustentabilidade. Para compor a pesquisa, os objetivos específicos definidos foram: Identificar a agenda de investigação sobre confiança especificamente nas cadeias de abastecimento agroalimentares; estabelecer as principais variáveis para construir confiança nestas cadeias; descobrir como a confiança entre os stakeholders influencia a sustentabilidade tanto dos empreendimentos quanto das cadeias como um todo; avaliar e comparar a relação entre confiança e sustentabilidade considerando momentos de crise e não crise; e fornecer subsídios gerenciais, na forma de aportes teóricos e práticos contribuições, para melhorar a governança e a sustentabilidade dos sistemas agroalimentares.

A estratégia de pesquisa foi, após revisão da literatura, realizar uma abordagem mista sobre o tema. O método qualitativo escolhido foi de entrevistas semi-estruturadas e a amostra utilizada foram 15 produtores que fazem parte de uma cadeia de maricultura localizada no sul do Brasil. A amostra da pesquisa quantitativa correspondeu a 208 profissionais de cadeias produtivas agroalimentares brasileiras, que atuam tanto em órgãos públicos quanto vinculados a empresas privadas, e a metodologia aplicada foi o modelo de equações estruturais através da regressão por mínimos quadrados parciais (PLS-SEM).

As principais conclusões obtidas foram que a revisão bibliométrica utilizando o software R se mostrou muito útil para confirmar a linha de pesquisa, assim como para identificar as principais publicações da área. Após as entrevistas, foi possível identificar diversos constructos e consequências da confiança, inclusive aqueles relacionados à Teoria das Trocas Sociais e à colaboração. A confiança se mostrou relacionada à sustentabilidade das cadeias de abastecimento estudadas, tanto de forma direta, na abordagem qualitativa, como indireta na abordagem quantitativa. Nesta última, a confiança através da governança foi mais representativa em detrimento do caminho através da colaboração.

Este trabalho é de grande importância para gestores, formuladores de políticas e outros stakeholders, objetivando melhorias na gestão, no desenvolvimento e na governança das cadeias de abastecimento agroalimentares e contribuindo de forma bastante representativa para o conhecimento sobre a sustentabilidade dessas estruturas.

Palavras-chave: sustentabilidade; desenvolvimento sustentável; governança; colaboração; confiança; agroalimentar; cadeia de suprimentos, agricultura; alimento.

Abstract

To achieve more sustainable agri-food systems, stakeholders must build alliances and political coalitions beyond food and agriculture. The integrated and transformative nature of the United Nations 2030 Agenda for Sustainable Development requires policies that systematically consider inter sectoral linkages and support good governance, fair trade relations, efficient communication and collaboration. From there, trust was identified as a potential factor in building and maintaining good relationships, as well as governance and collaboration.

Therefore, the general objective of this research was to evaluate trust relationships in agri-food chains with a focus on sustainability. To compose the research, the specific objectives defined were: Identify the research agenda on trust specifically in agri-food supply chains; establish the main variables to build trust in these chains; discover how trust between stakeholders influences the sustainability of both the enterprises and the chains as a whole; evaluate and compare the relationship between trust and sustainability considering moments of crisis and non-crisis; and provide managerial subsidies, in the form of theoretical and practical contributions, to improve the governance and sustainability of agri-food systems.

The research strategy was, after reviewing the literature, to carry out a mixed approach on the subject. The qualitative method chosen were semi-structured interviews and the sample used were 15 producers who are part of a mariculture chain located in southern Brazil. The quantitative research sample corresponded to 208 professionals from Brazilian agri-food supply chains, who work both in public bodies and in private companies, and the applied methodology was the structural equation modelling through partial least squares (PLS-SEM).

The main conclusions reached were that the bibliometric review using the R software proved to be very useful to confirm our field of research, as well as to identify the main publications in the area. After the interviews, it was possible to identify several trust constructs and outcomes, including those related to Social Exchange Theory and collaboration.
Trust proved to be related to the sustainability of the studied supply chains, both directly, in the qualitative approach, and indirectly in the quantitative approach. In the latter, trust through governance was more representative comparing the path through collaboration.

This work is of great importance for managers, policy makers and other stakeholders, aiming at improvements in the management, development and governance of agrifood supply chains, and contributing in a very representative way to knowledge about the sustainability of these structures.

Keywords: sustainability; sustainable development; governance; collaboration; trust; agri-food; supply chain, agriculture; food.

INDEX

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

AFSCQ	Agri-Food Supply Chain Quality
AVE	Averaged Variance Extracted
CFA	Confirmatory factor analysis
DHA	Descending Hierarchical Analysis
DHC	Descending Hierarchical Classification
EFA	Exploratory Factor Analysis
EPAGRI	Agricultural Research and Rural Extension Company of Santa Catarina
ESG	Environmental, Social, and Governance
FAO	Food and Agriculture Organization
FSCM	Food Supply Chain Management
GVA	Gross Value Added
HTMT	Heterotrait-Monotrait Indicator
IDE	Integrated Development Environment
ILO	International Labour Organization
KMO	Keiser-Meyer-Okin
LV	Latent Variable
MANOVA	Multivariate analysis of variance
MCP	Multiple Country Publication
PLS	Partial Least Squares
SCP	Single Country Publication
SCI	Supply Chain Integration
SDG	Sustainable Development Goal
SDPI	Sustainable Development Performance Indicators
SEM	Structural Equation Modelling
SI	Sustainable Intensification
SSCG	Sustainable Supply Chain Governance
UFSC	Federal University of Santa Catarina
VIF	Variance Inflation Factor

Chapter 1
Introduction

1 Introduction

This work is part of the Plan for People Development of the Brazilian Ministry of Agriculture and Livestock (PDP-MAPA), conducted by the National School of Agricultural Management - ENAGRO, subordinated to the Department of People Management and Knowledge Management - DGP/SE, from the Executive Secretariat – SE. This program seeks to offer excellent development opportunities, as well as provide conditions for continuous and effective learning that prepares all those involved in the productive and social arrangements of agribusiness. Enagro's target audience includes internal and external participants in the Brazilian Agricultural System and its beneficiaries, related to MAPA strategies and the demands of Brazilian agribusiness.

In addition to the courses completed at the University of Évora and UTAD, the student attended a mobility period in the second half of 2021/2022. Mobility was promoted by the Erasmus+ Program at Technische Universität Chemnitz – TUC, where 19 ECTS were completed.

1.1 Problem statement and justification of the study

The value chain is a key concept in the development of sustainable agri-food systems, which must improve aiming to be economically, socially, and environmentally sustainable: the so-called triple bottom line of profit, people, and planet. Value chains, as engines of growth, create added value such as salaries for workers, a return on assets (profits) to entrepreneurs and asset owners, tax revenues to the government, a better food supply to consumers, and a net impact on the environment, positive or negative (Neven, 2014).

Supply chain management is complex in many aspects and refers to information transfer and relationships. When partners find a way to understand and recognize the positive side of complexity, there are more opportunities in the sense of pounding and resource sharing. However, achieving this collaborative environment requires confidence and commitment (Manfredi & Capik, 2022). Although dependence on customers/suppliers has no direct effect on supply chain integration (SCI), it improves SCI indirectly through trust with customers/suppliers. Both supplier integration and customer integration significantly improve financial performance.

Despite improvements in the study and dissemination of sustainability processes over the last decades, current indicators and methodologies do not yet provide an appropriate basis for assessing the impacts related to socioeconomic, governance, and environmental dimensions of sustainable development. In addition, as current structures and indicators are designed mainly for for-profit entities, sustainability reports often ignore public, non-profit, and social economy

institutions that seek social and environmental goals aside from economic objectives (Yi et al., 2022).

Agri-food supply chains deserve to be studied because agricultural production is essential for human survival, especially in a context of world population growth. However, they are production chains that present risks of unsustainability, such as high levels of informality and vulnerabilities to different types of crises caused by health emergencies, adverse weather conditions, discontinuity of supply, among others, depending on their location. In addition, the agri-food sector has great responsibility for environmental and social issues and there is no doubt that agri-food systems need to be more sustainable (Assis et al., 2022; Trigo et al., 2021.). Research in the field of food supply chain management (FSCM) has gained momentum in the 15 years. However, compared to other FSCM sub-areas, few authors have addressed issues and challenges related to agri-food supply chains in developing countries (Patidar et al., 2022).

Sustainability has been identified by scholars and practitioners as an ideology or a set of objectives, while others describe it as a set of management strategies. However, sustainable agriculture is increasingly related to its impact on the environmental, economic and social pillars of sustainability (Bathaei & Štreimikienė, 2023; Zhang et al., 2021). An agri-food value chain is sustainable when it is profitable in all its stages (economic sustainability), offers consistent benefits to society (social sustainability) and has a positive or neutral impact on the environment (environmental sustainability) (FAO, 2018).

Sustainable development can be defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition consists of three main ideas relevant to companies and institutions: development should not be strictly defined in economic terms, more broad objectives related to human well-being and planetary health should be sought; a company or institution should seek an integrated approach that meets these wider goals simultaneously; and a company or insight should be guided not only by short-term but also long-term goals, designed to ensure future health and longevity of the organization itself and the well-being of the base of resources on which current and future generations to depend (WCED, 1987).

The United Nations explain that a successful sustainable development agenda requires partnerships between governments, private sector, and civil society. These inclusive partnerships built on principles and values, a shared view and shared objectives that place people and the planet in the centre are necessary at the global, regional, national, and local level (UN, 2015). Sustainable Development Goal 17 (Partnerships for the goals) encourages and promotes effective

public, public-private, and civil society partnerships, building on the experience and resourcing strategies of cooperation, data monitoring and accountability.

In this same direction, to achieve more sustainable agri-food systems, stakeholders must have good relationships and build political alliances and coalitions. The integrating foundations of the 2030 agenda for the sustainable development of the United Nations consider it systematically the promotion of inter sectoral connections through good communication and collaboration. The food and agriculture sector should address sustainability in an integrated manner, mapping and analysing synergies and compensations between economic, social, and environmental spheres, and reducing key issues, their causes, and determining factors (FAO 2018).

An agri-food supply chain is considered a stable system if no chain member breaks their contracts during processes and transactions and if they are optimistic about their relationship. In addition, the stability of a supply chain refers to its sustainability. Organizations that have high levels of trust are more comfortable building good relationships, creating more opportunities to benefit through collaboration and striving to ensure the stability of their relationships than those who operate with lower levels of trust (Nyaga et al., 2010; Ostrovsky, 2008.).

Good relationships require trust, because this driver is one of the factors that positively affects the stability of a partnership. Forming as a bridge mechanism, trust helps to connect us to people who are different, from a critical condition and necessary to build strong relationships. Others consider trust as a stable personality feature, a rational choice strategy, or a social capital factor. On the other hand, weaknesses in trust, in various ways such as distrust, mistrust, and nontrust among different actors and institutions, limit progress to solving collective problems, and these weaknesses reverberate for the future (Uslaner, 2018).

Trust influences the entire supply chain integration and it is important for supply chain managers to consider and show more focus on their main partners through reliable communication, which can improve their performance. Companies should also diversify the means to achieve trust, as this promotes greater effects to influence their partners since trust plays a prominent role in shaping the perceptions and attitudes of partners (Alshurideh et al., 2022; Baah et al., 2022).

1.2 Background

Trust is an abstract concept that, while difficult to observe, is a constant feature of human experience. It is a phenomenon that can be deeply incorporated and shaped by individual experiences and expectations. Trust manifests itself in relationships and interactions between and among individuals and groups (Beck, 2012).

Trust is dynamic, relational and difficult to define – there are many definitions, each highlighting different aspects depending on the context (Fleming et al., 2020). Most definitions convey something about: positive expectations regarding the actions and/or intentions of partners; vulnerabilities in relation to a partner; as well as making a 'choice' and weighing risks rationally and/or emotionally and making judgments about character and potential risks and benefits from granting trust (Boschetti et al., 2016; Rousseau et al., 1998.). According to Kale et al. (2000), trust is built between individuals working in organizations and is based on personal interactions and ties.

There is trust between institutions at the inter organizational level, which can be defined as "the extent of trust in the organization by members of another organization". This form of trust reflects the expectations of an organization that the partner organization will not act opportunistically and that there is predictability in the behaviour of the partner organization. Trusting behaviours lead to a predisposition to cooperate and collaborate towards a mutual goal. (Gulati & Nickerson, 2008; Jones et al., 2018; Roehrich, et al., 2020).

The agri-food literature suggests that trust is one of the most important supply chain drivers in order to reach collaboration (Dania et al., 2018). In this sense, trust is the most prominent and critical aspect for not only the effectiveness of a collaboration, but also improving sustainability performance (Chen et al., 2017; Touboulic & Walker, 2015). Azevedo et al. (2018) point out some controversial studies on the relationship between collaboration and sustainability, such as Hubeau et al. (2017), León-Bravo et al. (2017) and Walker et al. (2014), but they suggest that trust is fundamental to understand individuals' behaviours in the social network and how social actors are related to each other to implement collaboration initiatives to improve supply chain sustainability.

Trading partners are willing to rely on exchange of information with other partners in whom it trusts. As trust enables the exchange of large amounts of information among trading partners, it facilitates the implementation of collaboration. As a governance mechanism, trust plays a crucial role in sharing information among business partners. Important to remind that information is one of the main drivers in supply chain management, being the basis upon which to make decisions regarding the other supply chain drivers. It is the connection between all the activities and operations in a supply chain (Ghosh & Fedorowicz, 2008; Hugos, 2018; Panahifar et al., 2018).

Trust was recognised as being hard to obtain, but nevertheless an essential, and unavoidable process for the range of actors involved to start to develop further. Additionally, the lack of trust among supply chain partners often results in inefficient and ineffective performance as the

transaction costs (verification, inspections and certifications of their trading partners) mount. This is another important point to consider, as it directly involves companies' profits (Fleming et al., 2020; Kwon & Suh, 2004).

Both affective trust and trust in competency have a significant impact on benefit/risk sharing and partners with high-trust relationships are more inclined to take risks than low-trust partners. In crisis situations, when the risks increase considerably, the confidence to take risks can be a key element in decision making (Ha et al., 2011; Kwon & Suh, 2004).

Among the main factors that build trust, there is benevolence, effective communication, partner's reputation, competence, lasting relationship, dedicated investment, information sharing, integrity, planning, and sharing of values (Cerri, 2012; Dlamini-Mazibuko et al., 2019; Gosh & Fedorowicz, 2008; Kwon & Suh, 2005; Mayer et al., 1995; Nyaga et al., 2010; Paiva et al., 2014; Panahifar et al., 2018; Tejpal et al., 2013; Wu et al., 2012). Regarding the main outcomes of a trustworthy relationship, we find collaboration, commitment, cooperation, information sharing, innovation, integration, operational efficiency, performance, stability, satisfaction, and cost reduction (Delbufalo, 2012; Dlamini-Mazibuko et al., 2019; Kwon & Suh, 2005; Nyaga et al., 2010; Paiva et al., 2014; Panahifar et al., 2018; Revilla & Knoppen, 2015; Wu et al., 2012; Wu et al., 2014; Yang et al., 2008)

Since trust is a key driver and directly influences collaboration, performance, and sustainability of supply chains, we consider that understanding how trust works in local agri-food supply chains is essential to find better paths to improve the functioning of those structures. Azevedo et al. (2018), Dania et al. (2018), Newell et al. (2019) and Roy et al. (2017) are some authors who suggest new researches on the subject.

1.3 Objectives and research questions

Through the literature review, it was identified that complementary studies are needed to understand how the relationship among trust, governance, collaboration and sustainability in agri-food supply chains works. Some gaps have been found in this field of investigation, such as: which are the most important variables, and its impacts, for building trust between stakeholders in local agri-food supply chains; how trust influences governance, collaboration and sustainability of these value chains; and what is the effect of trust in crisis moments and non-crisis periods. Therefore, the main research question of this project is:

How is trust among stakeholders built and how it influences the governance, collaboration and sustainability of local agri-food supply chains?

In view of this, the general objective of this research is to assess the relationships of trust in local agri-food supply chains with focus on sustainability.

To compose the research, the specific objectives (O) are listed below:

1- Identify the research agenda on trust in agri-food supply chains (**O1**);

2- Establish the main variables to build trust in local agri-food value chains (**O2**);

3- Discover how trust between stakeholders influences the sustainability of local agri-food supply chains, addressing economic, social and environmental aspects (**O3**);

4- Evaluate and compare the relationship between trust and sustainability in local agri-food supply chains, considering crisis and non-crisis times (**O4**);

5- Based on the results, provide management subsidies, in the form of theoretical and practical contributions, to improve governance and sustainability in agri-food systems (**O5**).

1.4 Research strategy

After reviewing the literature, we were able to identify the main methodologies used in this type of research, as well as the most important variables to be applied. The research strategy was, after the literature review, to perform a qualitative assessment and, subsequently, the quantitative analysis. It is a common strategy and widely followed by researchers. The qualitative approach provides a deeper understanding of social phenomena that would not be obtained from purely quantitative methods, such as questionnaires. In a purely quantitative analysis, there is often a previous notion of what is happening, but not why and how it is happening, which does not happen in qualitative research, since it presents the causes and reasons for a particular phenomenon (Patton, 2014; Silverman, 2013). Moreover, initial qualitative research can help the design of later quantitative research. The outline of the research strategy is in figure 1.1.

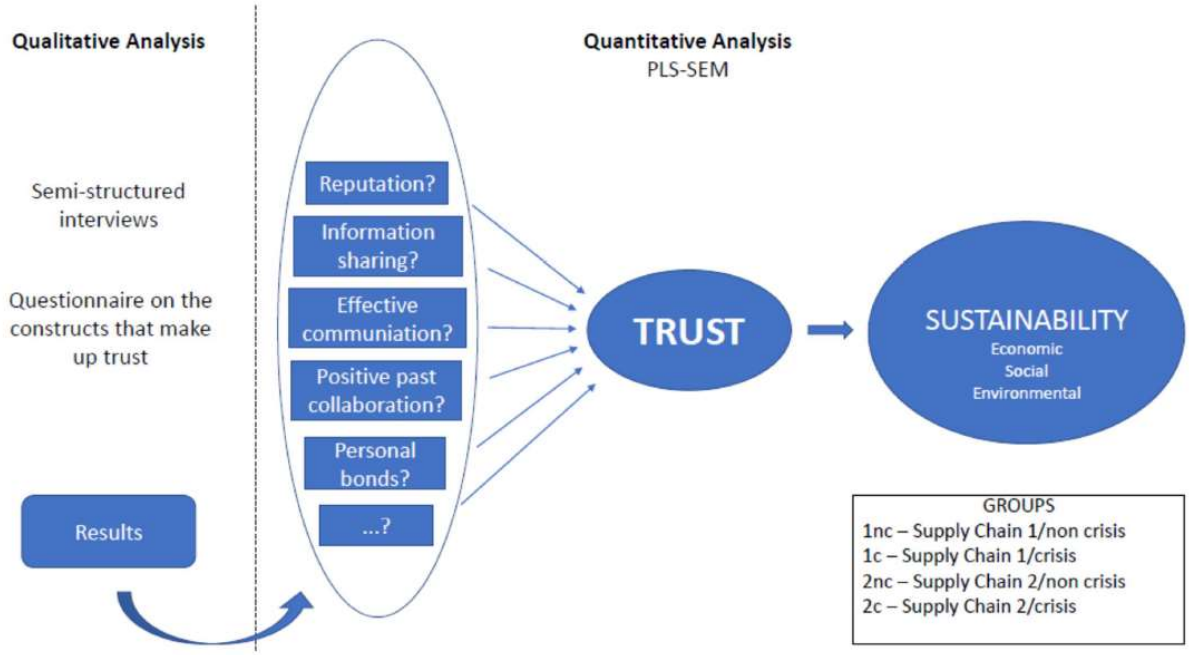


Figure 1.1 – Research strategy.

1.4.1 Qualitative assessment

The qualitative method chosen was the interview, as in our review we observed that it was the most used method for qualitative research on trust in the agri-food area. The purpose of the research interview is to explore individuals' opinions, experiences, beliefs and/or motivations on specific issues, and interviews are appropriate when little is known about the phenomenon being studied or when detailed insights from individual participants are needed. This type of qualitative method is also well suited to exploring sensitive topics that participants may not want to talk about in groups (Gill et al., 2008).

In this way, the interviews were individual so that it was possible to collect more detailed information and to allow the interviewer to probe and expand the interviewee's answers. The questions were asked according to a previously defined guide for the search for data on the role of trust among stakeholders. The interview guide started with a brief introduction and then sought information about the stakeholder role in the studied supply chain. During the in-depth interview process, we addressed the following sub-topics: creating and maintaining business relationships; company and supply chain performance; the sustainability of the company and the supply chain; and trust relationships in times of crisis.

The sample used were 15 producers that are part of the mariculture chain of the Metropolitan Region of Florianópolis, state of Santa Catarina - Brazil. Initially, we identified some of the main stakeholders of the local chain through professional networks, whom we proposed to interview.

The first interviewees were asked to indicate other people they considered relevant (snowball technique). We tried to interview professionals from different categories to address different points of view, both local and systemic. The interviews were previously scheduled and carried out both in person and remotely via video call.

1.4.2 Quantitative assessments

For the elaboration of the questionnaire, constructed specifically for the present study, the previous qualitative study and the researched references were used. 29 questions were proposed for respondents to assess their degree of agreement with the statements, according to a 7-point Likert scale. We used scales already validated in previous works, translated and adapted to meet the needs of the research. In addition, we created three new scales based on indicators already validated in the literature. The proposed hypotheses of our study were analysed using the structural equation modelling method using partial least squares (PLS-SEM) with the help of Smart-PLS 4 software (version 4.0.9.1).

The research sample corresponded to 208 professionals from Brazilian agri-food supply chains, who work both in public bodies and linked to private companies. The questionnaires were applied from November 2022 to January 2023 through Google Forms. After due verification, four participants were excluded, and the sample was reduced to 204 respondents. This sample reached three times the number of respondents required to apply the chosen method (Hair et al., 2021).

1.5 PH.D. Thesis structure

This thesis begins with an introduction, is followed by a sequence of articles and culminates in the conclusion. Each article is described in accordance with the guidelines established by each publisher, including citations and references. Although four papers are present, we decided to group those related to qualitative analysis in the same chapter, so that the thesis is presented with five chapters in total (table 1.1).

Table 1.1 - Ph.D. Thesis structure.

Ph.D. Thesis	
Chapter 1 - Introduction	1.1 Problem statement and justification of the study
	1.2 Background
	1.3 Objectives and research questions
	1.4 Research strategy

	1.5 Ph.D. Thesis structure	
Chapter 2 – A meta-analysis on the trust in agri-food supply chains	2 A meta-analysis on the trust in agri-food supply chains	REVIEW
Chapter 3 – The influence of trust for sustainable agri-food production	3 The influence of trust for sustainable agri-food production: Empirical evidence of a mariculturist supply chain in Southern Brazil	RESEARCH PAPER
Chapter 4 – The influence of informality in a local agri-food supply chain in Brazil	4 The influence of informality in a local agri-food supply chain in Brazil	RESEARCH PAPER
Chapter 5 - Trust, governance, collaboration, and sustainability within the Brazilian agri-food sector	5 Assessment of the relationships among trust, governance, collaboration, and sustainability within the Brazilian agri-food sector	RESEARCH PAPER
Chapter 6 - Conclusions	5.1 Main Conclusions	
	5.2 Limitations and Future Research	

Chapter 1 – Introduction:

Chapter 1 consists of a general introduction on how the PhD was possible, exposes the problem and justification for studying the subject, as well as its antecedents. It then presents the objectives and corresponding research questions, the research strategy and, finally, the structure of this thesis.

Chapter 2 - A meta-analysis on the trust in agri-food supply chains:

This chapter coincides with the review paper "A meta-analysis on the trust in agri-food supply chains".

Purpose: The purpose of this article was to carry out a literature review on the relationships of trust in agri-food supply chains, to obtain data on previous publications as well as to justify future research on the search topics.

Methodology: For the bibliometric study, it was used the R software in RStudio and the R packages *bibliometrix* and *biblioshiny* for data analysis. Documents from the Scopus and Web of Science databases were extracted. Documents related to the researched topics, published in the last ten years, were collected to the following systematic review. Of 277 documents published from 1995 to 2021, seven review articles and 67 papers were analysed.

Paper framework in the thesis: This first work was a useful step towards the development of the project. In addition to using up-to-date tools for a good bibliographic review, we were able to identify the most used methodologies, as well as detect research trends related to the subject. The low density of studies on trust in agri-food supply chains confirmed the review we made previously, in the sense of the importance of carrying out researches in this research field.

Chapter 3 – The influence of trust for sustainable agri-food production

This chapter coincides with the research paper "The influence of trust for sustainable agri-food production: Empirical evidence of a mariculturist supply chain in Southern Brazil".

Purpose: This chapter aims to study the relationships of trust in a local agri-food supply chain in Southern Brazil. In an unsustainable context, where the number of mariculturists is decreasing, we seek to identify what the factors are and how they contribute to this problem, as well as find solutions aimed at the sustainability of that chain.

Methodology: Qualitative research was carried out with 15 semi-structured interviews that took place in the year 2021. The thematic analysis of the results applied the IRAMUTEQ software and the assessment of the narratives was guided by prior thematic analysis.

Paper framework in the thesis: We consider that the qualitative research was very relevant in order to achieving the project's objectives, as it allowed us to know more deeply about the relationships between the stakeholders of a local agri-food supply chain. In addition to showing interesting solutions for the disorganization of that chain, the work provided key information for the development of the quantitative study.

Chapter 4 - The influence of informality in a local agri-food supply chain in Brazil

This chapter coincides with the research paper "The Influence of Informality in a Local Agri-food Supply Chain in Brazil".

Purpose: The objective of this short paper was to study the influence of informality in the supply chain researched in the previous chapter. The theme of informality came up spontaneously during the interviews, so we found it interesting to go deeper into this subject and carry out a specific work for this subject, which is present worldwide.

Methodology: The methodology used was the same as the qualitative research in Chapter 3. The topic of informality emerged spontaneously in 9 of the 15 in-depth interviews. Through the thematic analysis in IRAMUTEQ, the content was categorised into four classes, in which class

2, with 84 text segments (19.13% of the total text segments), was related to the inspection of products and the control bodies that carry out inspections.

Paper framework in the thesis: This work greatly enriched our research, as it brought very relevant information on a delicate and little-studied topic. The research allowed us to address relationships between the public and private sectors that directly influence the sustainability of supply chains.

Chapter 5 - Trust, governance, collaboration, and sustainability within the Brazilian agri-food sector:

This chapter coincides with the research paper "Assessment of the relationships among trust, governance, collaboration, and sustainability within the Brazilian agri-food sector".

Purpose: The purpose of this research was to study the relationship between trust and sustainability (environmental, economic, and social), whose path passed through two different variables, governance and collaboration.

Methodology: For this quantitative research, questionnaires were distributed to professionals linked to agri-food supply chains in Brazil. Data were analysed using the structural equation modelling method using partial least squares (PLS-SEM) with the support of the Smart-PLS software. A final model, contemplating the chosen variables, was proposed.

Chapter 6 - Conclusions:

Chapter 6 brings the main conclusions of the thesis and evaluates the fulfilment of the proposed objectives in the project. This section also addresses the limitations found during the course, as well as suggestions for future research on the subjects studied.

The table 1.2 shows the relationship between the works produced and the objectives proposed in the project.

Table 1.2 – Linking research papers with the objectives of the thesis.

Papers	Objectives
A meta-analysis on the trust in agri-food supply chains	O1
The influence of trust for sustainable agri-food production: Empirical evidence of a mariculturist supply chain in Southern Brazil	O2, O3, O4, O5

The Influence of Informality in a Local Agri-food Supply Chain in Brazil	O2, O5
Assessment of the relationships among trust, governance, collaboration, and sustainability within the Brazilian agri-food sector	O3, O5

References

Alshurideh, M., Kurdi, B., Alzoubi, H., Obeidat, B., Hamadneh, S., and Ahmad, A. (2022). The influence of supply chain partners' integrations on organizational performance: The moderating role of trust. *Uncertain Supply Chain Management*, *10*(4), 1191-1202. http://dx.doi.org/10.5267/j.uscm.2022.8.009

Assis, M. T., Lucas, M. R., & Rainho, M. J. M. (2022). A meta-analysis on the trust in agrifood supply chains. *Food Frontiers*, *3*(3), 413-427. https://doi.org/10.1002/fft2.137

Azevedo, S. G., Silva, M. E., Matias, J. C., & Dias, G. P. (2018). The Influence of collaboration initiatives on the sustainability of the cashew supply chain. *Sustainability*, *10*(6), 2075. https://doi.org/10.3390/su10062075

Baah, C., Acquah, I. S. K., & Ofori, D. (2022). Exploring the influence of supply chain collaboration on supply chain visibility, stakeholder trust, environmental and financial performances: a partial least square approach. *Benchmarking: An International Journal*, *29*(1), 172-193. https://doi.org/10.1108/BIJ-10-2020-0519

Bathaei, A., & Štreimikienė, D. (2023). A Systematic Review of Agricultural Sustainability Indicators. *Agriculture*, *13*(2), 241. https://doi.org/10.3390/agriculture13020241

Beck, S. (2012). Between tribalism and trust: the IPCC under the" public microscope". *Nature and Culture*, *7*(2), 151-173. https://doi.org/10.3167/nc.2012.070203

Boschetti, F., Cvitanovic, C., Fleming, A., & Fulton, E. (2016). A call for empirically based guidelines for building trust among stakeholders in environmental sustainability projects. *Sustainability Science*, *11*(5), 855-859. https://doi.org/10.1007/s11625-016-0382-4

Cerri, S. (2012). Exploring factor affecting trust and relationship quality in a supply chain context. *Journal of Business Studies Quarterly*, *4*(1), 74.

Chen, L., Zhao, X., Tang, O., Price, L., Zhang, S., & Zhu, W. (2017). Supply chain collaboration for sustainability: A literature review and future research agenda. *International Journal of Production Economics*, *194*, 73-87. https://doi.org/10.1016/j.ijpe.2017.04.005

Dania, W. A. P., Xing, K., & Amer, Y. (2018). Collaboration behavioural factors for sustainable agri-food supply chains: A systematic review. *Journal of cleaner production*, *186*, 851-864. https://doi.org/10.1016/j.jclepro.2018.03.148

Delbufalo, E. (2012). Outcomes of inter-organizational trust in supply chain relationships: a systematic literature review and a meta-analysis of the empirical evidence. *Supply Chain Management: An International Journal*, *17*(4), 377-402. https://doi.org/10.1108/13598541211246549

Dlamini-Mazibuko, B. P., Ferrer, S., & Ortmann, G. (2019). Examining the farmer-buyer relationships in vegetable marketing channels in Eswatini. *Agrekon*, *58*(3), 369-386. https://hdl.handle.net/10520/EJC-178a73092d

FAO. (2018). Transforming food and agriculture to achieve the SDGs: 20 interconnected actions to guide decision-makers. *Technical Reference Document*.

Fischer, C. (2013). Trust and communication in European agri-food chains. *Supply Chain Management: An International Journal*, *18*(2), 208-218. https://doi.org/10.1108/13598541311318836

Fleming, A., Ogier, E., Hobday, A. J., Thomas, L., Hartog, J. R., & Haas, B. (2020). Stakeholder trust and holistic fishery sustainability assessments. *Marine Policy*, *111*, 103719. https://doi.org/10.1016/j.marpol.2019.103719

FAO. (2018). Transforming food and agriculture to achieve the SDGs: 20 interconnected actions to guide decision-makers. *Technical Reference Document*.

Fritz, M., & Fischer, C. (2007). The role of trust in European food chains: theory and empirical findings. *International Food and Agribusiness Management Review*, *10*(2), 141-163. https://hdl.handle.net/10863/5969

Ghosh, A., & Fedorowicz, J. (2008). The role of trust in supply chain governance. *Business Process Management Journal*, *14*(4), 453-470. https://doi.org/10.1108/14637150810888019

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *British dental journal*, *204*(6), 291-295. https://doi.org/10.1038/bdj.2008.192

Gulati, R., & Nickerson, J. A. (2008). Interorganizational trust, governance choice, and exchange performance. *Organization science*, *19*(5), 688-708. https://doi.org/10.1287/orsc.1070.0345

Ha, B. C., Park, Y. K., & Cho, S. (2011). Suppliers' affective trust and trust in competency in buyers: Its effect on collaboration and logistics efficiency. *International Journal of Operations & Production Management*, *31*(1), 56-77. https://doi.org/10.1108/01443571111098744

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook* (p. 197). Springer Nature (eBook). http://doi.org/10.1007/978-3-030-80519-7

Hubeau, M., Marchand, F., & Van Huylenbroeck, G. (2017). Sustainability experiments in the agri-food system: Uncovering the factors of new governance and collaboration success. *Sustainability*, *9*(6), 1027. https://doi.org/10.3390/su9061027

Hugos, M. H. (2018). *Essentials of supply chain management*. John Wiley & Sons (eBook).

Jones, T. M., Harrison, J. S., & Felps, W. (2018). How applying instrumental stakeholder theory can provide sustainable competitive advantage. *Academy of Management Review*, *43*(3), 371-391. https://doi.org/10.5465/amr.2016.0111

Kwon, I. W. G., & Suh, T. (2004). Factors affecting the level of trust and commitment in supply chain relationships. *Journal of supply chain management*, *40*(1), 4-14. https://doi.org/10.1111/j.1745-493X.2004.tb00165.x

León-Bravo, V., Caniato, F., Caridi, M., & Johnsen, T. (2017). Collaboration for sustainability in the food supply chain: A multi-stage study in Italy. *Sustainability*, *9*(7), 1253. https://doi.org/10.3390/su9071253

Manfredi, E., & Capik, P. (2022). A case of trust-building in the supply chain: Emerging economies perspective. *Strategic Change*, *31*(1), 147-160. https://doi.org/10.1002/jsc.2488

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of management review*, *20*(3), 709-734. https://doi.org/10.5465/amr.1995.9508080335

Neven, D. (2014). *Developing sustainable food value chains*. FAO.

Newell, W. J., Ellegaard, C., & Esbjerg, L. (2019). The effects of goodwill and competence trust on strategic information sharing in buyer–supplier relationships. *Journal of Business & Industrial Marketing*, *34*(2), 389-400. https://doi.org/10.1108/JBIM-02-2017-0035

Nyaga, G. N., Whipple, J. M., & Lynch, D. F. (2010). Examining supply chain relationships: do buyer and supplier perspectives on collaborative relationships differ?. *Journal of operations management*, *28*(2), 101-114. https://doi.org/10.1016/j.jom.2009.07.005

Ostrovsky, M. (2008). Stability in supply chain networks. *American Economic Review*, *98*(3), 897-923. http://doi.org/ 10.1257/aer.98.3.897

Paiva, E. L., Teixeira, R., Vieira, L. M., & Finger, A. B. (2014). Supply chain planning and trust: two sides of the same coin. *Industrial Management & Data Systems*, *114*(3), 405-420. https://doi.org/10.1108/IMDS-07-2013-0324

Panahifar, F., Byrne, P. J., Salam, M. A., & Heavey, C. (2018). Supply chain collaboration and firm's performance: the critical role of information sharing and trust. *Journal of Enterprise Information Management*, *31*(3), 358-379. https://doi.org/10.1108/JEIM-08-2017-0114

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice*. Sage publications.

Patidar, S., Shukla, A. C., & Sukhwani, V. K. (2022). Food supply chain management (FSCM): A structured literature review and future research agenda. *Journal of Advances in Management Research*, *19*(2), 272-299. https://doi.org/10.1108/JAMR-04-2021-0143

Revilla, E., & Knoppen, D. (2015). Building knowledge integration in buyer-supplier relationships: The critical role of strategic supply management and trust. *International Journal of Operations & Production Management*, *35*(10), 1408-1436. https://doi.org/10.1108/IJOPM-01-2014-0030

Roehrich, J. K., Selviaridis, K., Kalra, J., Van der Valk, W., & Fang, F. (2020). Inter-organizational governance: a review, conceptualisation and extension. *Production planning & control*, *31*(6), 453-469. https://doi.org/10.1080/09537287.2019.1647364

Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. *Academy of management review*, *23*(3), 393-404. https://doi.org/10.5465/amr.1998.926617

Roy, H., Hall, C. M., & Ballantine, P. W. (2017). Trust in local food networks: The role of trust among tourism stakeholders and their impacts in purchasing decisions. *Journal of Destination Marketing & Management*, *6*(4), 309-317. https://doi.org/10.1016/j.jdmm.2017.07.002

Silvermann, D. (2013). *Doing qualitative research: a practical handbook*. Verlag nicht ermittelbar.

Tejpal, G., Garg, R. K., & Sachdeva, A. (2013). Trust among supply chain partners: a review. *Measuring Business Excellence*, *17*(1), 51-71. https://doi.org/10.1108/13683041311311365

Trigo, A., Marta-Costa, A., & Fragoso, R. (2021). Principles of sustainable agriculture: Defining standardized reference points. *Sustainability*, *13*(8), 4086. https://doi.org/10.3390/su13084086

United Nations (UN), (2016), Transforming our world: The 2030 agenda for sustainable development", available at: https://documents-dds-ny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement (accessed February 24, 2023).

Uslaner, E. M. (Ed.). (2018). *The Oxford handbook of social and political trust*. Oxford University Press.

Walker, H., Seuring, S., Sarkis, J., Klassen, R., Roehrich, J. K., Grosvold, J., & Hoejmose, S. U. (2014). Reputational risks and sustainable supply chain management. *International Journal of Operations & Production Management*, *34*, 695-719. https://doi.org/10.1108/IJOPM-11-2012-0515

World Commission on Environment and Development - WCED. (1987). Our Common Future Oxford. UK: Oxford University Press.

Wu, M. Y., Weng, Y. C., & Huang, I. C. (2012). A study of supply chain partnerships based on the commitment-trust theory. *Asia Pacific Journal of Marketing and Logistics*, *24*(4), 690-707. https://doi.org/10.1108/13555851211259098

Wu, L., Chuang, C. H., & Hsu, C. H. (2014). Information sharing and collaborative behaviors in enabling supply chain performance: A social exchange perspective. *International Journal of Production Economics*, *148*, 122-132. https://doi.org/10.1016/j.ijpe.2013.09.016

Yang, J., Wang, J., Wong, C. W., & Lai, K. H. (2008). Relational stability and alliance performance in supply chain. *Omega*, *36*(4), 600-608. https://doi.org/10.1016/j.omega.2007.01.008

Zhang, X., Yao, G., Vishwakarma, S., Dalin, C., Komarek, A. M., Kanter, D. R., ... & Davidson, E. A. (2021). Quantitative assessment of agricultural sustainability reveals divergent priorities among nations. *One Earth*, *4*(9), 1262-1277. https://doi.org/10.1016/j.oneear.2021.08.015

Chapter 2

A meta-analysis on the trust in agri-food supply chains

2 - A meta-analysis on the trust in agri-food supply chains

Abstract

The agrifood literature suggests that trust is one of the most prominent and critical aspect for not only the effectiveness of collaboration, but also for improving sustainability performance. In this sense, the understanding of how trust works in agrifood supply chains is essential to find better paths to improve the functioning of those structures. The purpose of this article was to carry out a meta-analysis on the relationships of trust among the stakeholders in agrifood supply chains, to obtain data on previous publications as well as to justify future research on the search topics. For the bibliometric study, the R software in RStudio and the R packages *bibliometrix* and *biblioshiny* were used. The documents were extracted from the Scopus and Web of Science databases. Documents related to the researched topics, that were published in the last 11 years, were collected to the following meta-analysis. Of 277 documents published from 1995 to 2021, 11 review articles and 74 papers were analyzed. From these publications, we obtained data on the main authors and sources related to trust among the stakeholders in agrifood supply chains, on the methodologies used, as well as on trends for future researches. The present work brings forward data in a unique and up-to-date way.

Keywords: agriculture, collaboration, food, governance, meta-analysis, relationship, supply chain, sustainability, trust.

This paper was published in the Food Frontiers Journal. The reference is: Assis, M. T., Lucas, M. R., & Rainho, M. J. M. (2022). A meta-analysis on the trust in agri-food supply chains. *Food Frontiers*, *3*(3), 413-427 (DOI: 10.1002/fft2.137). An earlier version of this paper was presented at *Workshop-Win CIBECM-GEOS, Salamanca,* 2021.

2.1 Introduction

To achieve more sustainable agrifood systems, stakeholders must build political alliances and coalitions beyond food and agriculture. The integrated and transformative nature of the 2030 Agenda for Sustainable Development of the United Nations requires policies that systematically consider intersetorial linkages and support cross-sectoral communications and collaboration. In particular, the food and agriculture sector must take an integrated approach to sustainability that includes mapping and analysing synergies and trade-offs between the economic, social, and environmental spheres, assessing the state of the sustainability of food systems and agriculture and identifying key issues, their causes and driving factors (FAO, 2018).

The value chain is a key concept in the development of sustainable agrifood systems, which must improve while aiming to be economically, socially, and environmentally sustainable: the so-called triple bottom line of profit, people, and planet. Value chains, as engines of growth, create added value such as salaries for workers, a return on assets (profits) to entrepreneurs and asset owners, tax revenues to the government, a better food supply to consumers, and a net impact on the environment, positive or negative (Neven, 2014).

The agrifood literature suggests that trust is one of the most important supply chain drivers in order to reach collaboration (Dania et al., 2018). In this sense, trust is the most prominent and critical aspect for not only the effectiveness of collaboration, but also for improving sustainability performance (Chen et al., 2017; Touboulic & Walker, 2015). Azevedo et al. (2018) point out some controversial studies on the relationship between collaboration and sustainability, such as Hubeauet et. al. (2017), León-Bravo et al. (2017), and Walker et al. (2014), but they suggest that trust is fundamental to understand individual's behaviors in the social network and how social actors are related to each other to implement collaboration initiatives to improve supply chain sustainability.

Trust is dynamic, relational, and difficult to define—there are many definitions, each highlighting different aspects depending on the context (Fleming et al., 2020). Most definitions convey something about accepting vulnerability, as well as making a 'choice' and weighing risks rationally and/or emotionally, and making judgments about character and potential risks and benefits from granting trust (Boschetti et al., 2016).

Paluri and Mishal (2020) reviewed the literature on trust and commitment in supply chain management, in all fields, mainly aiming at identifying the antecedents and consequences of the two topics. According to Trienekens et al. (2018), trust and commitment, as constructs of informal

relationships, can contribute to the three constructs of market orientation, namely, intelligence communication (by increasing the willingness of actors to share information), responsiveness (by increasing the willingness of actors to dedicate time, effort, and resources to the value chain), and intelligence generation (via their contribution to relationship quality and related information exchange).

Panahifar et al. (2018) indicate that a trading partner is willing to rely on exchange of information with other partners in whom it trusts. As trust enables the exchange of large amounts of information among trading partners, it facilitates the implementation of collaboration. Ghosh and Fedorowicz (2008) observed that trust, as a governance mechanism, plays a crucial role in sharing information among business partners. Important to remind that information is one of the main drivers in supply chain management, being the basis upon which to make decisions regarding the other supply chain drivers. It is the connection between all the activities and operations in a supply chain (Hugos, 2018).

Fleming et al. (2020) observed that trust was recognized as being hard to obtain, but nevertheless an essential and unavoidable process for the range of actors involved to start to develop further. Additionally, Kwon and Suh (2004) highlighted an important issue on the topic; they stated that a lack of trust among supply chain partners often results in inefficient and ineffective performance as the transaction costs (verification, inspections, and certifications of their trading partners) mount. This is another important point to consider, as it directly involves companies' profits.

The agrifood area is very specific; it presents a lot of informality and is vulnerable to different types of crises, such as sanitary, climate, supply, and others. In this sense, the understanding of how trust works in agrifood supply chains is essential to find better paths to improve the functioning of those structures. Specific review works in this field of study are scarce and research of this type can be of interest because they help in the development of research papers; optimize the work of researchers in the search for related articles; provide information on the main methodologies used; help in deciding on the specific fields and subfields to be studied; and enhance productivity.

Within this scope, the objective of this study was to carry out a meta-analysis on trust among the stakeholders in agrifood supply chains in order to justify future studies and to obtain data on the development of the research on the topic, methodologies used, the main documents and authors, and sources related to the subject, as well as on trends in this field of study.

2.2 Materials and Methods

The meta-analysis review is used to combine results of studies conducted independently of each other, made by different researchers, on a specific subject and reinterpret this information. With that, these results help to build knowledge about the situation in which research in a particular field of study finds itself (Huseyin, 2018).

In this way, a meta-analysis on a sample of documents published about the trust relationship in agrifood supply chains was carried out. The methodology used in bibliometrics was based on the work of Cardoso et al. (2020) and the methodology applied in the analysis of the documents was based on the work of Auler et al. (2017).

2.2.1 Data collection

In December 2021, articles and reviews published in sources indexed in the Scopus and Web of Science databases, in all years, were searched. The search in Scopus was made using the terms "Trust" and "Supply Chain," in the article title, abstract, and keywords. After finding 2.642 documents, the "Agricultural and Biological Sciences" area was selected, which culminated in a provisional base of 201 documents (182 articles and 19 reviews).

The main search in Web of Science included the same words, "Trust" and "Supply Chain," with 2.272 documents initially found. Subsequently, we selected the categories "Food Science Technology" (92 documents), "Agricultural Economics Policy" (72 documents), "Agriculture Multidisciplinary" (29 documents), "Agronomy" (11 documents), "Fisheries" (eight documents), "Agriculture Dairy Animal Science" (eight documents), and "Horticulture" (one documents). Therefore, the total number of documents found in Web of Science was 172, with 159 articles and 13 reviews. The data collection process is illustrated in Figure 2.1.

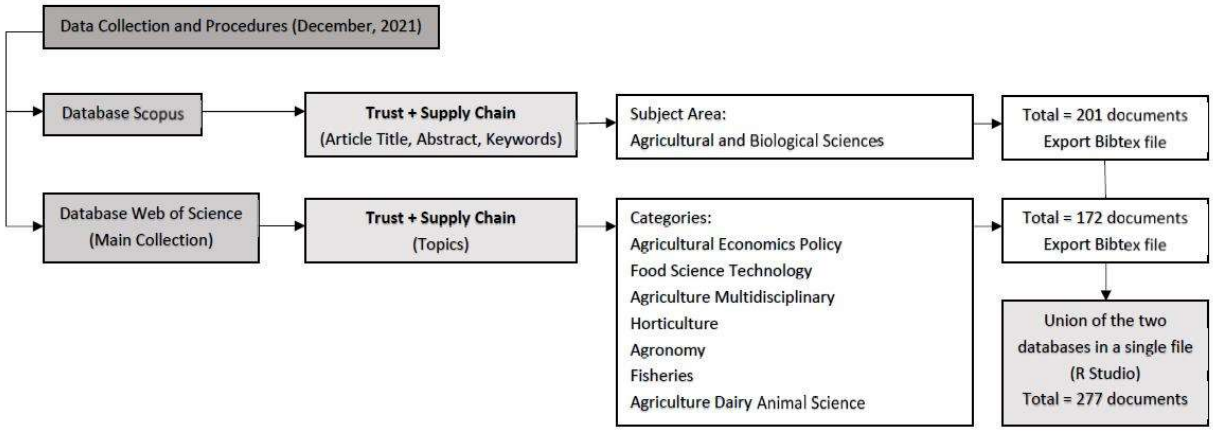


Figure 2.1. Data collection process.

2.2.2 Using the R software

"R" is a language and environment for statistical computing and graphics. The software provides a wide variety of statistical (linear and nonlinear modeling, classical statistical tests, time-series analysis, classification, clustering, etc.) and graphical techniques, and is highly extensible. "R" is available as Free Software under the terms of the Free Software Foundation's GNU General Public License in source code form. It compiles and runs on a wide variety of UNIX platforms and similar systems (including FreeBSD and Linux), Windows, and MacOS (The R Foundation, 2021).

The collected data were downloaded in two different files in the Bib-TeX format. Afterward, the R software was used (version 4.1.2 from 2021-11-01) in the RStudio Integrated Development Environment (IDE) to eliminate duplicate documents and create a single database. The bibliometrix R package had to be installed.

The R script is illustrated in the Figure 2.2. The BibTeX file extracted from Scopus was named "C: /R/TRUSTSCSCO.bib," while the one from Web of Science was named "C: /R/TRUSTSCWOS.bib." The single file with the data from the two databases, excluding duplicate documents, was named "REV4.RData". We loaded the data to analysis on the "biblioshiny for bibliometrix" website, according to what was established by Aria and Cuccurullo (2017).

```
library(openxlsx)
detach("package:openxlsx", unload=TRUE)
library(bibliometrix)

WW <- readFiles("C:/R/TRUSTSCWOS.bib")
SS <- readFiles("C:/R/TRUSTSCSCO.bib")

MWW <- convert2df(c("C:/R/TRUSTSCWOS.bib"), dbsource = "isi", format = "bibtex")
MSS <- convert2df(c("C:/R/TRUSTSCSCO.bib"), dbsource = "scopus", format = "bibtex")
M <- mergeDbSources (MWW,MSS, remove. Duplicated=TRUE)

save(M,file = "REV4.RData")
library(bibliometrix)
biblioshiny()
```

Figure 2.2. R script.

The final database comprised 277 documents (255 articles and 22 reviews) published in 105 different sources. The publication period runs from 1995 to 2021. The documents were published by 836 different authors, with 37 single-authored documents and an average co-authorship of 3.44.

Based on the sample collected, the bibliometric analysis consisted of evaluating the annual scientific production; the main sources of publication; the representativeness of the main authors, their productivity, longevity, affiliations, and the countries of the corresponding author's; the most global cited documents; and the conceptual structure in both a factor and network analysis, considering the Keywords Plus.

2.2.3 Analysis of documents

The analysis in the documents of the last 11 years was carried out, that is, published from the year 2011 on. Initially, the documents not written in English were excluded.

Second, the review articles were analyzed and, after that, the other documents were read. Articles that were of direct interest to our research were selected; in other words, those that somehow assessed trust among stakeholders in agrifood supply chains. The documents that did not address this issue in any way were excluded.

The abstracts of all documents were evaluated and, in case this part did not contain all the desired information, a more in-depth evaluation of the document was carried out. In the analysis, the types of documents were classified, with information such as the type of research approach and the method used.

2.3 Results

2.3.1 Bibliometric

The most important bibliometric data for the purpose of this work are shown below. More extensive bibliometric data can be viewed in the Supplementary File.

Annual Scientific Production

According to the databases searched, publications on the terms "Trust" and "Supply Chain" started in 1995, with one paper. Between 1998 and 2017, there were upward fluctuations in the number of published works, and from then on, the rise was more evident, culminating in a maximum number of publications in the year 2021, with 43 works on the terms of the combined subjects researched. The annual growth rate is 18.64% and the graphical representation of the annual scientific production can be seen in figure 2.3.

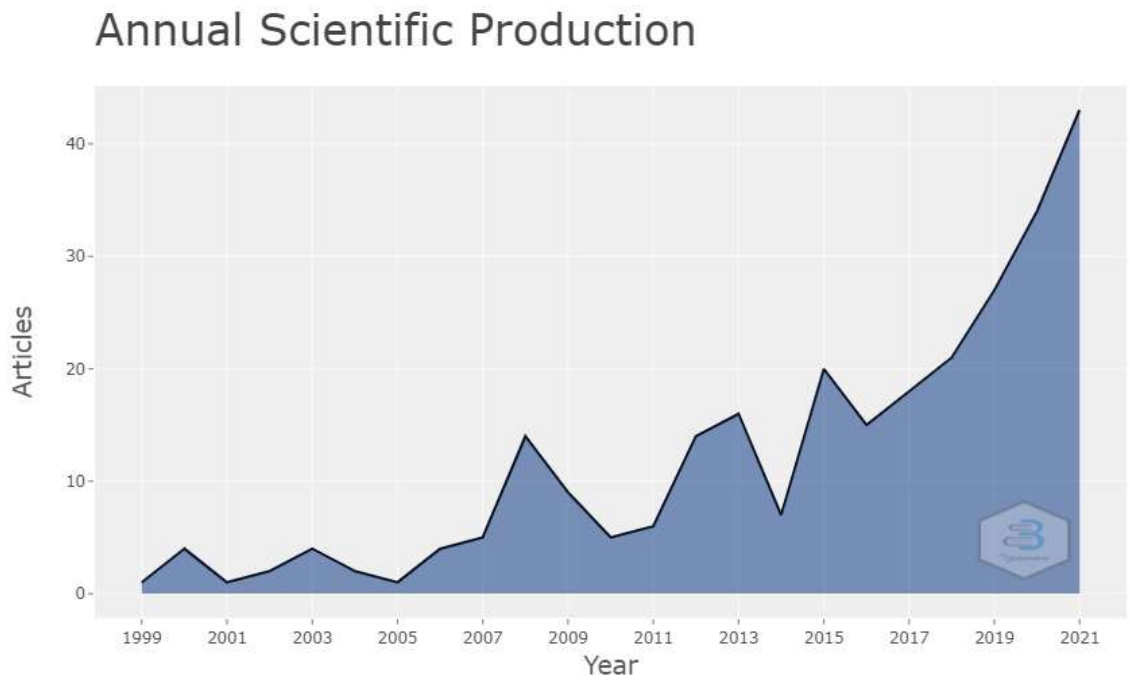


Figure 2.3. Annual scientific production.

Sources

Of the 118 sources found, the one with the most publications was the British Food Journal, with 36, followed by Food Control with 11, Agrekon with 8, and New Medit with 7. Regarding the number of citations, the British Food Journal obtained 633, again leading the list, but this time followed by the Agriculture and Human Values, Food Quality and Preference, and Food Policy, with 299, 249 and 222 citations, respectively.

The British Food Journal also showed a higher value of the h-index and its derivative, g-index, followed by Food Control in these two impact indicators. With regard to m-index, the journal Foods showed the highest value, followed by Food Control and British Food Journal.

Authors

Of the 836 authors, Manning L. stands out as the most relevant in the present research, with eight articles published, followed by Gellynck X. and Molnar A. with six articles. The fractionalized counting of Manning L. was also the higher (4.42) but, in this regard. This author was followed by Kirsten J.(1.92) and Canavari M.(1.87).

In terms of longevity, the production of Manning L., Kirsten J. and Trienekens J. stands out. Manning L. published eight articles on the studied subject from 2006 to 2021, the longest production gap was between the years of 2008 and 2019 and this author published four articles in the last two years. Kirsten J., who produced five papers on the topics studied during 14 years, from 2003 to 2017, presented a long hiatus of publication between 2007

and 2017. Trienekens J., who produced his first article on the subjects in 2008, published another paper in 2009 and had a long production gap after that, from 2009 to 2017. The top 20 author's production over time can be seen in figure 2.4. The lines represent the author's timelines, bubbles sizes are proportional to the number of documents published, and the colour intensity is proportional to the total citations per year.

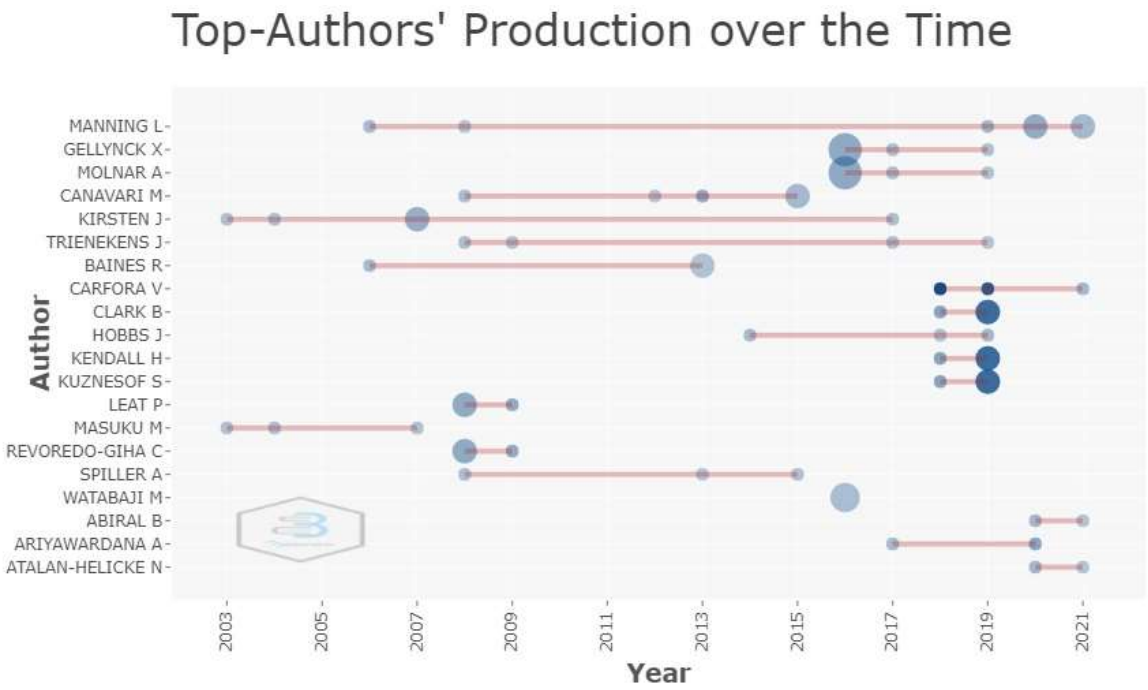


Figure 2.4. Top 20 author's production over time.

Regarding affiliated research institutions, the University of Ghent stands out with 17 publications on the combined searched terms. In second place we see the University of Sheffield, with 11 publications, followed by the China Agricultural University, with ten publications. The Universities of Bologna, Bonn, Gottingen, and Saskatchewan are close behind with eight publications each. The top 20 affiliated institutions that have published documents on the subject at hand are represented in the figure 2.5.

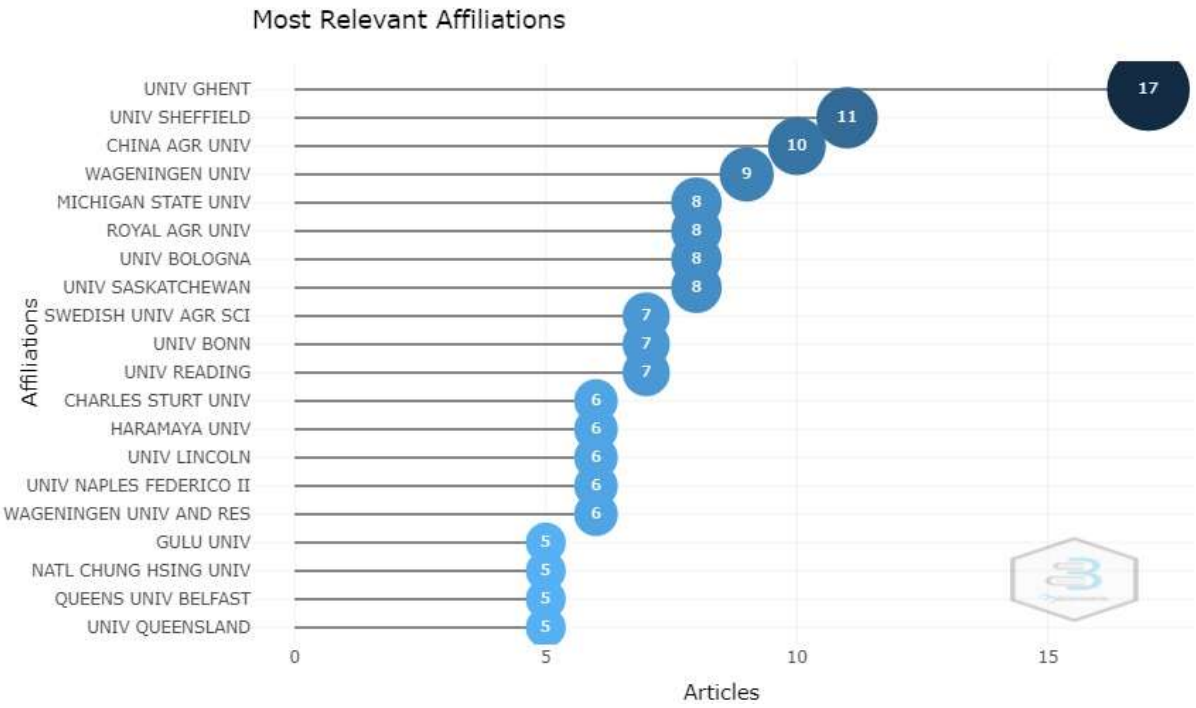


Figure 2.5. Top 20 affiliated institutions.

In the sample of 277 documents, the countries that most presented documents with corresponding authors was Italy and United Kingdom, with 31 documents each, followed by Australia, United States and China, with 20, 19 and 17 documents, respectively. Italians and British also obtained the largest number of single country publications, with 24 and 23 articles, respectively. On the other hand, the country that presented the most multiple country publications was the United Kingdom with eight documents, followed by Italy with seven documents.

The MCP ratio is the ratio between the MCP and the total number of publications in each country. The countries that showed the highest MCP ratio were Belgium and Brazil, with rates of 0.714 and 0.375, respectively. Netherlands, Indonesia, Ireland, and Switzerland occupied the third position in the MCP ratio, with rates of 0.333 each.

Documents

Regarding the most cited articles in the entire database, we can highlight the publications of Pellier M. (2008), Smith, B.G. (2008), Friedmann, H. (2007), and Jarosz, L. (2000), with 132, 128, 122 and 113 global citations, respectively. However, when we evaluate the citation rate per year, other documents stand out and. Considering this parameter, the most cited publication was from Giampietri, E. (2018), with a rate of 21 citations per year. The research by comes next, with a rate of 18.67 citations per year, is from Carfora V. (2019), and the

publication that obtained the third highest annual citation rate was that of George A.S. (2015), with 14.14 citations per year.

Looking at the most representative journals in the list of the top 20 most cited articles, we observed that Food Quality and Preference and British Food Journal were responsible for publishing three documents each, followed by the Agriculture and Human Values, Food Policy and Computers and Electronics in Agriculture, with two articles each.

Conceptual Structure

To begin an analysis of the conceptual structure of the documents listed in this work, we opted to study the occurrences of the main Keywords Plus in the search. The Keywords Plus are generated by an automatic algorithm and consist of words that appear frequently in the titles of the article's references and not necessary in the title of the articles or as Author's Keywords. In addition to the term *trust*, which appeared 56 times, the words *quality* and *management* stood out, with 27 and 21 occurrences, respectively. Then came the words *safety*, *supply chains*, *attitudes* and *food*, with 18, 14, 13, and 13 occurrences, respectively.

The keywords have been related to subfields of study and have had specific correlations. Therefore, we decided to divide the Keywords Plus into six clusters to better study the main themes and their correlations. Cluster 1, with topics such as *trust, quality, supply chain, food, traceability, economics* and *standards*, leads us to believe that it is a group related to trust relationships between the stakeholders of a given supply chain, or business-to-business relationships (B2B). Cluster 2, presented themes like *management, impact, supply chain management, market, model* and *supply chains,* signalling that the documents are also related to B2B relations, but at a more managerial level. Cluster 3, on the other hand, presented topics such as *information, safety, attitudes, willingness to pay, preferences and perceptions*, which implies that is a group of documents related to trust relationships between consumers and sellers, or business-to-consumers (B2C) relations.

Clusters 4, 5, and 6 were less representative and had few Keywords Plus in the top 50. The list of the 50 keywords that had more occurrences in the present research, as well as their position in each cluster, are listed in table 2.1.

Table 2.1. Top 50 Keywords Plus and their respective cluster.

Keyword Plus	Cluster	Ocurrences	Dim.1	Dim.2	Keyword Plus	Cluster	Ocurrences	Dim.1	Dim.2
trust	1	56	0,31	0,07	management	2	21	-0,43	-0,57
quality	1	27	-0,32	0,73	impact	2	13	-0,5	-0,42
supply chain	1	14	-0,17	0,09	supply chain management	2	13	-0,06	-0,33
food	1	13	0,85	0,21	market	2	11	0,5	-0,92
traceability	1	11	-0,25	0,58	model	2	11	-0,45	-0,44
economics	1	10	0,96	-0,22	supply chains	2	11	0,13	-0,57
standards	1	8	-0,22	0,16	framework	2	10	-0,61	-1,03
determinants	1	7	-0,25	0,13	performance	2	10	-0,45	-0,77
sustainability	1	7	0,55	-0,32	governance	2	9	-0,32	-0,54
agriculture	1	6	0,84	0,21	networks	2	8	-0,42	-0,53
challenges	1	6	0,06	0,15	integration	2	7	-0,57	-1,47
knowledge	1	6	-0,13	-0,14	satisfaction	2	7	0,26	-0,73
products	1	6	-0,07	0,88	systems	2	7	-0,51	-0,76
					commitment	2	5	-0,65	-1,45
information	3	19	-0,23	1,76	embeddedness	2	5	-0,49	-1,75
safety	3	18	-0,44	1,5	industry	2	5	-0,29	-0,73
attitudes	3	13	0,03	1,44	organization	2	5	0,05	-0,43
willingness to pay	3	13	-0,32	1,9	relationship quality	2	5	-0,54	-1,31
preferences	3	12	-0,23	1,67					
perceptions	3	10	-0,13	1,89	behaviour	4	10	1,34	1,42
system	3	9	-0,05	1,26	food safety	4	10	1,45	0,7
consumption	3	7	-0,24	1,44	risk	4	8	1,11	0,94
risk perception	3	6	-0,47	1,12					
choice	3	5	-0,34	1,22	human	6	7	4,18	-0,29
					article	6	5	4,25	-0,25
perception	5	9	1,91	0	consumer	6	5	4,62	-0,26

Dim. 1 = Dimension 1 - documents; Dim. 2 = Dimension 2 - keywords.

After that, we mapped the conceptual structure of the six selected clusters. We used factor analysis to reduce the dimensionality of the data and represent them in a low-dimensionality space. We performed the analysis using the Multiple Correspondence Analysis (MCA) method. In this model, the words are close to each other due to a greater proportion of articles that treat then together and are distant from each other when a small fraction of articles use them together. The origin of the map represents the average position of all column profiles

and therefore represents the centre of the research field, meaning common and large shared topics (Aria and Cuccurullo 2017). That way, it was possible to identify the clusters of documents that express common concepts in a two-dimensional map, represented in figure 2.6. Each colour represents a cluster of words (topic) and the clusters are identified by hierarchical clustering.

When analysing the map of the Keywords clusters, it can be noticed that clusters 4, 5, and 6 are not very representative and move away from the central point of the document axis (Dimension 1). We also noticed that cluster 3 (green) is smaller than clusters 1 and 2, and despite being in a central position on the documents' axis, moves away from the centre of the keywords' axis (Dimension 2). Cluster 1 (red) is the most central, followed by cluster 2 (blue), and they have similar sizes on the chart.

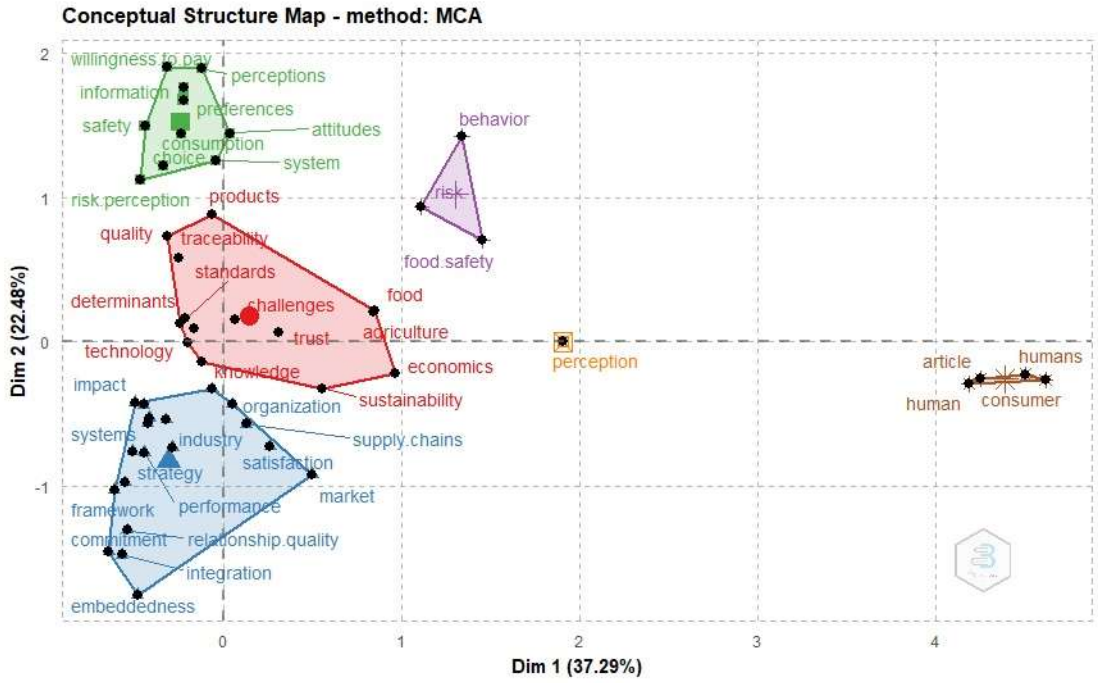


Figure 2.6. Cluster of documents.

The next step was to create the thematic map for the present search by applying a clustering algorithm on the keyword network, to highlight the different themes on the studied field. According to Cobo et al. (2011), each cluster or theme can be represented on a particular plot known as *Strategic* or *Thematic Map*, where the centrality is read as the importance of the theme in the entire research field and the density is read as a measure of the theme's development.

Three maps about the evolution of the themes were portrayed, covering the past 11 years of research. On the maps, each bubble represents a network cluster. The bubble name is the Keyword Plus with the higher occurrence in the cluster and the bubble size is proportional to the cluster word occurrences.

Figure 2.7 shows the first map and depicts the position of the topics in the period from 2011 to 2015. In it, we can see that the word *trust* has high centrality and medium-low density, and its bubble being in the quadrant where the themes can be considered basic and transversal. The topic *food* also appears in this quadrant. The term *economics*, on the other hand, displays high centrality and high density, located in the motor themes quadrant. In this quadrant we also observe the words *conservation* and *mobilization*.

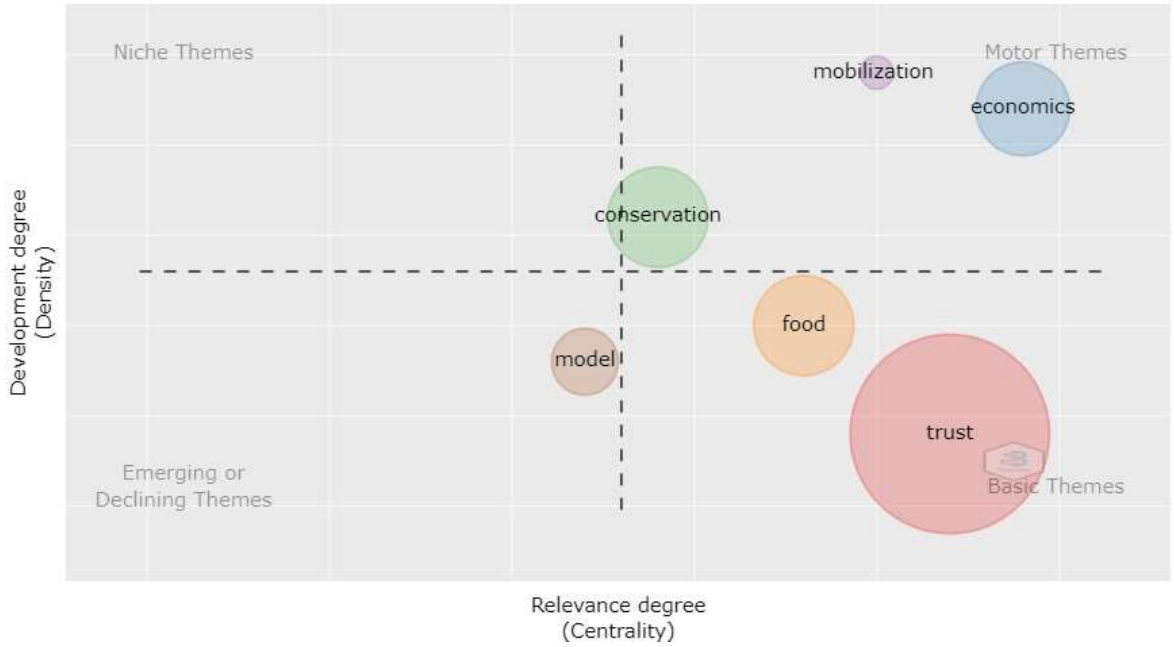


Figure 2.7. Thematic evolution—2011 to 2015.

In figure 2.8, the second map depicts the position of the topics in the period from 2016 to 2020. The *trust* theme practically remained in the same position as the previous five years, showing high centrality and medium-low density, keeping in the quadrant of basic and transversal themes. In this quadrant, the topic *management* comes up, but with lower centrality. The *supply chain management* theme appears in the motor themes quadrant, with medium-high intensity and density. In this map, we can also highlight the appearance of the words *risk* and *traceability*, both positioned in the motor themes quadrant.

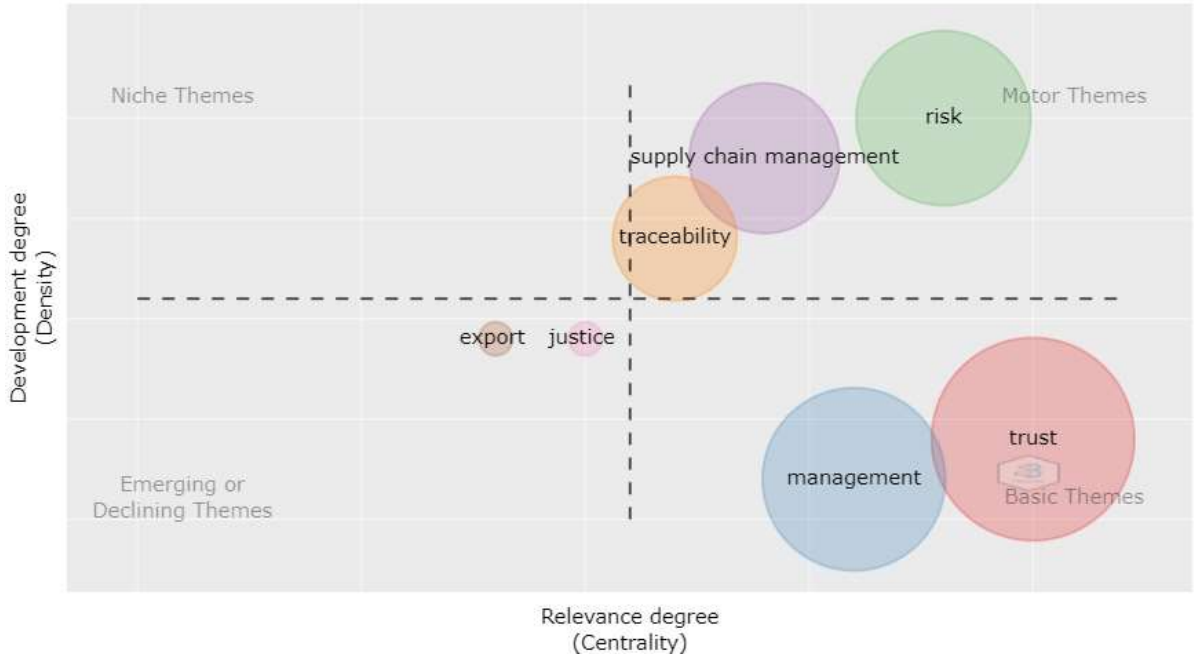


Figure 2.8. Thematic evolution—2016 to 2020.

Due to the high number of recent publications, we decided to analyse the evolution of research on the themes of this study in the specific period of the year 2021. In this sense, Figure 2.9 shows a remarkable migration of the word *trust*, from the quadrant of basic and central themes to the quadrant of motor themes, mainly due to the increase in the theme study density. In this same quadrant, the word *authentication* appears, but with less centrality. We can also observe that, in the last year, the words *adaptation* and *perceptions* emerged as central topics, positioning themselves in the quadrant of basic themes.

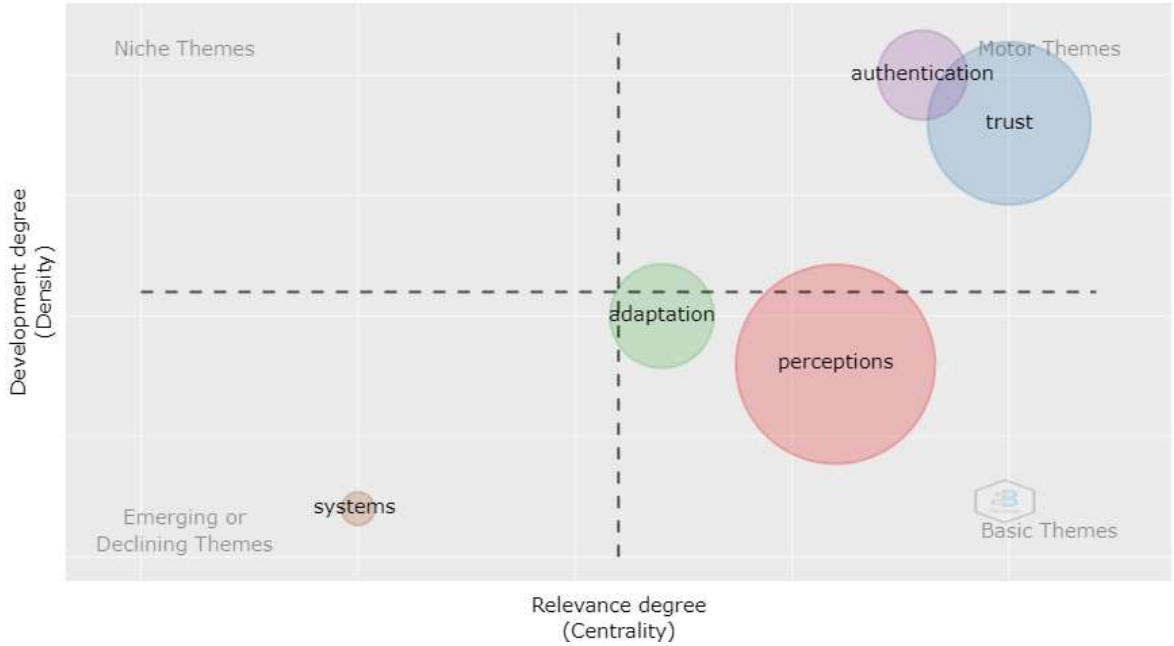


Figure 2.9. Thematic evolution—2021.

2.3.2 Documents Analysis

Of the total sample of 277 documents, 174 were published in the last eleven years and these have been properly analysed. Firstly, we excluded the seven documents written in languages other than English. Secondly, we excluded 31 articles that did not make any analysis of trust in agri-food supply chains. These articles covered several main subjects, such as fraud, food safety, public trust, coercive power, packaging, power within supply chains, food scares, marketing, willingness to pay, traceability, animal welfare, and biofuels. Afterwards, we analysed the seven review articles that assessed trust in some way.

Based on the previously obtained conceptual framework, we identified and removed from our analysis the 50 articles related to consumer trust, referring to cluster 3 of the topics found. Thus, 74 articles remained for further analysis, corresponding to clusters 1 and 2 of the previous conceptual structure. The publication of Sander et al. (2018), which addressed both consumer confidence and trust among stakeholders, was properly examined.

Reviews Analysis

Of the eleven evaluated review articles, we could notice that most of them, nine documents, dealt with the relationships of trust between consumers and institutions, be they governmental or private. From this group, corresponding to cluster 3 found in the factorial analysis of the conceptual structure, we were also able to find three subgroups: the document by Nardi et. al. (2020) addressed the relationship between consumers and institutions with a

concern related to food safety; the articles by Wang et al. (2021), Kendall et al. (2019) and Manning and Monaghan (2019) focused on food fraud; and Rahman et al. (2021), Wu et al. (2021), Kamrath et al. (2019), Pearson et al. (2019), and Lehmann, Reiche and Schiefer (2012) have written reviews addressing the influence of new technologies and food traceability on consumer trust.

The work of Durrant et al. (2021) fits into the objective of this research, related to cluster 1 of the conceptual structure. The authors built a review on the role of technology within the stakeholder's information sharing, and deeply they addressed the relationship between Data Trust and Data Sharing.

Manning L.'s (2020) article approached trust from a managerial perspective, corresponding to cluster 2. The author sought some definitions of trust, one of which was as an aspect of integrity, and advocated the use of cultural maturity models and assessment tools to build trust. Table 2.2 below shows the list of the 11 review articles found in our search.

Table 2.2. List of the eleven review articles.

Authors	Trust approach
Wang et al. (2021)	Trust between consumers and institutions (government or private) - Fraud
Durrant et al. (2021)	Trust among stakeholders - New Technologies and Traceability
Rahman et al. (2021)	Trust between consumers and institutions (government or private) - New Technologies and Traceability
Wu et al. (2021)	Trust between consumers and institutions (government or private) - New Technologies and Traceability
Nardi et al. (2020)	Trust between consumers and institutions (government or private) - Food Safety
Manning (2020)	Assesses trust in a managerial environment - Management
Kendall et al. (2019)	Trust between consumers and institutions (government or private) - Fraud
Manning and Monaghan (2019)	Trust between consumers and institutions (government or private) - Fraud
Kamrath et al. (2019)	Trust between consumers and institutions (government or private) - New Technologies and Traceability
Pearson et al. (2019)	Trust between consumers and institutions (government or private) - New Technologies and Traceability
Lehmann, Reiche and Schiefer (2012)	Trust between consumers and institutions (government or private) - New Technologies and Traceability

Articles Analysis

To assess the articles, we first sought to classify them according to the type of publication. This process showed us that most of the documents were research papers, 54 publications, followed by case studies, conceptual papers, and short communications, with eleven, six, and three publications, respectively. The case studies, whether addressing project designs, product designs or qualitative analysis, the conceptual papers, and short communications presented different issues related to trust, such as trust among stakeholders, governance,

sustainability, technology, blockchain, compliance, bargaining power, and food safety, as shown in table 2.3.

Table 2.3. List of the case studies, conceptual papers, and short communications.

Authors	Type	Approach
Weber and Wiek (2021)	Case study (Project Design)	Governance/Sustainability
Schrobback and Rolfe (2021)	Case study (Qualitative analysis)	Trust among stakeholders
Orjuela, Gaona-García and Marin (2021)	Case study (Product Design)	Technology/Blockchain
Qian et al. (2020)	Case study (Product Design)	Technology/Blockchain
Probst (2020)	Conceptual paper	Technology/ Trust among stakeholders
Longo, Nicoletti and Padovano (2019)	Case study (Product Design)	Technology/Blockchain
Lin (2019)	Conceptual paper	Technology/ Blockchain
Sorrentino, Russo and Cacchiarelli (2018)	Conceptual paper	Governance/ Bargaining power
Dwyer, et al. (2018)	Short Comunication	Governance
Maréchal, et al. (2018)	Short Comunication	Governance
Fleury, et al. (2016)	Case study (Qualitative analysis)	Trust among stakeholders
Modekurti (2016)	Case study (Product Design)	Technology
Thorsøe (2015)	Case study (Qualitative analysis)	Trust among stakeholders
Carrer, de Souza Filho and Vinholis(2014)	Case study (Qualitative analysis)	Governance
Steen and Maijers (2014)	Short Comunication	Trust among stakeholders
Weseen,Hobbs and Kerr (2014)	Case study	Governance
Hirschauer, Bavorová and Martino (2012).	Conceptual paper	Compliance
Ng and Salin (2012)	Conceptual paper	Trust among stakeholders/ Food safety
Busch (2011)	Conceptual paper	Governance
Abate-Kassa and Peterson (2011)	Case study (Qualitative analysis)	Trust among stakeholders

Of the 54 research papers, 15 took a qualitative approach, 29 addressed quantitative methods, and ten applied mixed methods, that is, qualitative and quantitative.

Regarding the documents with qualitative methods, in addition to trust among stakeholders approach, some addressed other issues, such as the research by Costa et al. (2019), which addressed aspects of trust management, the work of Malagon-Zaldua, Begiristain-Zubillaga and Onederra-Aramendi (2018), which studied the trust within alternative food networks, the article by Sander, Semejin and Mahr (2018), which had a focus on the study of blockchain, and the publication of Pascucci et al. (2015), which addressed governance in supply chains.

Most authors adopted the interview as the main qualitative methodology, with the exception of Romero Granja and Wollni (2019), who used The Trust Game method, and Malagon-Zaldua, Begiristain-Zubillaga and Onederra-Aramendi (2018), who used the methods of

Input-output analysis and Rapid Market Assessment - RMA. In addition to the interviews, some authors used complementary methods, such as Camanzi, Hammoudi and Malorgio (2019), Musa, Van Niekerk and Retief (2018), and Pascucci et al. (2015), who also used the Expert Panel, Focus Group, and Survey in their research, respectively. The list of articles with a qualitative approach and the methodologies used are in table 2.4.

Table 2.4. List of the qualitative research articles.

Authors	Methodology	Authors	Methodology
Deka et al. (2020)	Interviews	Musa, Van Niekerk and Reief (2018)	Focus group, interviews
Huang (2020)	Interviews	Malagon-Zaldua, Begiristain-Zubillaga and Onederra-Aramendi (2018)	Input-output analysis, RMA
Love et al. (2020)	Interviews	Sander, Semejin and Mahr (2018)	Interviews
Nakandala, Smith and Lau (2020)	Interviews	Knoll et al. (2017)	Interviews
Camanzi, Hammoudi and Malorgio (2019)	Expert panel, inteviews	Aggarwal, Srivastava and Griffith (2016)	Interviews
Costa et al. (2019)	Interviews	Pascucci et al. (2015)	Interviews, survey
Romero Granja and Wollni (2019)	The trust game	Beckeman, Bourlakis and Olsson (2013)	Interviews
Liu (2019)	Interviews		

Publications that used quantitative methods also addressed issues other than trust between stakeholders, but related to the theme. The works of Kataike et al. (2019), Souza Filho and Miranda (2019), Amentae, Gebresenbet andLjungberg (2018), and Wilson, MacDonald and Monnane (2015) studied governance, the work of Wongprawmas et al. (2015) addressed the credibility, and the research of Heyder, Theuvsen and Hollmann-Hespos (2012) also studied aspects of traceability.

The quantitative methods were diverse, the most used being the Structural Equation Model - SEM, Exploratory Factor Analysis - EFA, Keiser-Meyer-Okin - KMO, Cronbach's Alpha, Descriptive Statistics, and Logit Model. The list of documents with a quantitative approach and the methodology used is shown in table 2.5.

Table 2.5. List of the quantitative research articles.

Authors	Methodology	Authors	Methodology
Karim et al. (2021)	SEM	Charatsari et al. (2018)	Hierarquical regression
Amoako et al. (2021)	SEM	Sun, Liu and Yang (2018)	SEM, EFA, CFA, Cronbach's alpha
Sun, Zhu and Yang (2021)	SEM	Van der Merwe, Kirten and Trienekens (2017)	SEM
Mehmeti, Zanoli and Xhoxhi (2021)	CFA, SEM	Susanty et al. (2017)	SEM
Solazzo, Petriccione and Perito (2020)	Logit model	Odongo et al. (2016)	SEM

Kiriveldeniya and Rosairo (2018)	Farmer loyalty index	Truong and Ariyawardana, (2015)	EFA, KMO, Bartlett test
Nguyen, Le and Kingsbury (2020)	KMO, Cronbach's Alpha, EFA	Wilson, MacDonald and Monnane (2015)	Multiple regression model, Cronbach's alpha
Lees, Nuthall and Wilson (2020)	SEM	Wongprawmas et al. (2015)	Descriptive statistics, independent-samples t-test, Mann-Whitney U-test
Martins, Trienekens and Omta (2019)	Cronbach's Alpha, SEM	Akhtar and Khan (2015)	EFA, SEM
Udoye et al. (2019)	Descriptive statistics	Cechin et al. (2013)	Descriptive statistics, PCA, Cronbach's Alpha, Ordinary least squares regression test
Musabelliu et al. (2019)	Logit model, EFA, KMO	Jie, Parton and Cox (2013)	Cronbach's alpha, EFA, multiple regression
Kataike et al. (2019)	SEM	Sauer, Gorton and White (2012)	Bootstrapped mixed-effects linear regression model
Dlamini-Mazibuko, Ferrer and Ortmann (2019)	KMO, Cronbach's Alpha, VIF, MANOVA	Heyder, Theuvsen and Hollmann-Hespos (2012)	SEM
Souza Filho and Miranda (2019)	Negative binomial model	Lu et al. (2012)	Logit model
Amentae, Gebresenbet and Ljungberg (2018)	SEM, Cronbach's alpha		

VIF = Variance inflation factor; MANOVA = Multivariate analysis of variance; CFA = Confirmatory factor analysis; PCA = Principal component analysis.

Regarding the researches with mixed methodology, the work of Pignatti, Canavari and Spadoni (2012), O'Donovan, Quinlan and Barry (2012), and Zhang and Hu (2011) also studied supply chain governance. The most used qualitative methods were interviews and Focus Group, and the quantitative was descriptive statistics. The list of publications that addressed both qualitative and quantitative methods are shown in table 2.6.

Table 2.6. List of the qualitative and quantitative research articles.

Authors	Methodology	Authors	Methodology
Hoogstra-Klein and Meijboom (2021	Interviews, descriptive statistics	Pignatti, Canavari and Spadoni (2012)	Interviews, descriptive statistics
Joffre et al. (2020)	Focus group, hierarquical regression	Boniface (2012)	Interviews, CFA, Cronbach's alpha, KMO, PCA, cluster analysis
Shanoyan, Bankuti and Colares-Santos (2019)	Interviews, descriptive statistics	Bezuidenhout, Bodhanya and Brenchley (2012)	Interviews, Supply Chain Collaboration Index, descriptive statistics
Dunning (2016)	Interviews, descriptive statistics	O'Donovan, Quinlan and Barry (2012)	Focus group, descriptive statistics
Mutonyi et al. (2016)	Interviews, SEM	Zhang and Hu (2011)	Focus group, EFA, Cronbach's alpha

2.4 Discussion

The approach to trust in agrifood supply chains is growing, but it has been shown to be dispersed, considering the productivity and longevity of publications. Despite the main referenced authors, the production of Manning L. stood out due to the two recent review articles, the two articles

published in 2021 and the high fractional counting index (4.42), which indicates a high intellectual contribution.

Regarding the countries of authors, although the United Kingdom and Italy have the highest numbers of Multiple Country Publications—MCP (eight and seven), the MCP ratios are not the highest (0.258 and 0.226). This can happen due to the high number of publications in general (31 each) and it can be a natural fact because of that. It can be observed that this does not occur with Australia, for example, which has 19 Single Country Publications and only one MCP, with a MCP ratio of only 0.05, which implies that it is a more isolated country in this field of study.On the other hand, Belgium proves to be quite integrated because, despite not having as many total publications (seven), it has the highest MCP ratio of 0.714 and has a greater propensity for international research cooperation.

The analysis of the conceptual structure using Keywords Plus is supported by the work of Zhang et al. (2016), where the authors concluded that Keywords Plus is as effective as Author Keywords in terms of bibliometric analysis investigating the knowledge structure of scientific fields and revealed similar research trends. In this research, the Keywords Plus were fewer (919) than Author's Keywords (1018) and this allowed us to concentrate more on the topics of interest in the reference's sample. In addition, it is a less discretionary selection and the representation in the map of the keywords clusters was more coherent using the Keywords Plus than that representation provided by Author's Keywords.

Considering the thematic evolution of the topics of this study, except for the last year, trust has not been shown to be much studied, despite being a central and transversal theme. In the period from 2016 to 2020, the topics of "Supply Chain Management" and "Traceability" appear as motor themes and these subjects, as well as their relationship with trust, can be considered trends in this field of study. Some authors suggest new research on the subject, such as Roy et al. (2017), Dania et al. (2018), and Newell et al. (2019).

With regard to publications in 2021, the density of studies on the topic "Trust" has increased significantly; that is, 43 papers were published, an increase of 18.64% compared to the previous year. However, only seven works that dealt with the relationship of trust among stakeholders could be used for the present analysis. This was because 12 papers were discarded due to not have any type of analysis on trust, and another 18 were not analyzed because they dealt with trust between sellers and consumers, which was not the focus of this research. Thus, despite bibliometric data showing a significant growth in publication in 2021, only a small percentage (16.28%) could be used.

In general, many articles related to consumer trust were found, even when a search focused on the relationship of trust within supply chains was conducted. This fact agrees, in a way, with the work of Lees et al. (2020), which stated that despite the considerable research on buyer–seller relationships in the marketing and management literature, only a small proportion of it has focused on procurement relationships between producers and buyers in food supply chains.

Only 11 review articles were available, which we consider a low number. Of these, five reviews were about new technologies and traceability involving trust between sellers and consumers, and three were about product fraud, which demonstrates that these two topics were important in the bibliometric part of this work. Nevertheless, two works were related to the field of trust among stakeholders and valid for this research. The work of Durrant et al. (2021) presented a very interesting approach to Data Trust and Data Sharing, and Manning (2020) assessed trust in a managerial environment.

Recent publications, in the form of Case studies, conceptual papers, and qualitative researches, dealt with the relationship of trust within blockchain. This was the case with the works of Orjuela et al. (2021), Qian et al. (2020), Longo et al. (2019), Lin (2019), and Sander et al. (2018). In this sense, the use of blockchain may be influencing the relationships of trust between actors in supply chains and the use and research of this technology is a trend in the present field of study.

Several studies also focused on the study of governance, since there is a close relationship between trust studies and the governance of structures. This fact agrees with the statement by Ebers and Oerlemans (2016), who claimed that trust can be an independent variable that mediates the organizational building process, affecting the features of governance structures. Moreover, Ghosh and Fedorowicz (2008) observed that trust, as a governance mechanism, plays a crucial role in sharing information among business partners.

2.5 Conclusion

The use of bibliometric analysis using the R software proved to be efficient for carrying out this work, especially in the search for the main documents and authors, for the identification of specific clusters, and for the mapping of themes and definition of the conceptual structure of the search, allowing to know the trends of the researches carried out.

Although the term “Supply Chain” was placed in the search, a large number of researches were related to trust between sellers and consumers. This demonstrates a solid scientific concern with this specific area, mainly linked to marketing and consumer information. In this regard, research in the area of management and sustainability of agrifood supply chains is smaller and can be

increased, as trust remains a central theme. Furthermore, the fact that literature reviews on trust among stakeholders in agrifood supply chains were not found corroborates this consideration.

Several works were found regarding the use of technology to trust, both among stakeholders and between sellers and consumers. These types of technologies, especially those related to block-chain and traceability, are emerging and constitute current trends in the present field of research.

The publications found were carried out through different approaches. Most works took a quantitative approach. The main qualitative methodology was interviews and, in the case of works with a mixed approach, that qualitative method was combined in many cases with descriptive statistics. The data collected on quantitative researches show that the Structured Equation Model (SEM) has been the main method used and should be considered in future researches within this field of study.

The present meta-analysis can be of great use to researchers and practitioners who wish to study or deepen the knowledge of trust among the stakeholders in agrifood supply chains, since we found no specific reviews on this subject.

References

Abate-Kassa, G., & Peterson, H. C. (2011). Market access for local food through the conventional food supply chain. *International Food and Agribusiness Management Review*, *14*(1030-2016-82895), 63–82.

Aggarwal, S., & Srivastava, M. K. (2016). Towards a grounded view of collaboration in Indian agri-food supply chains: A qualitative investigation. *British Food Journal*, *118*, 5.

Akhtar, P., & Khan, Z. (2015). The linkages between leadership approaches and coordination effectiveness. *British Food Journal*, *117*(1), 443–460.

Amentae, T. K., Gebresenbet, G., & Ljungberg, D. (2018). Examining the interface between supply chain governance structure choice and supply chain performances of dairy chains in Ethiopia. *International Food and Agribusiness Management Review*, *21*(1030-2019-606), 1061–1082.

Amoako, D. K., Zakuan, M. N., Okyere-Kwakye, E., & Tetteh, F. K. (2021). Effect of training and reward on social sustainability in Ghana's cocoa supply chain: The role of green buyer-supplier relationship. *Journal of International Food & Agribusiness Marketing*, 1–32, DOI: 10.1080/08974438.2021.1981511.

Aria,M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4), 959–975. Auler, D., Teixeira, R., & Nardi, V. (2017). Food safety as a field in supply chain management studies: A systematic literature review. *International Food and Agribusiness Management Review*, *20*(1), 99–112.

Azevedo, S.G., Silva, M. E., Matias, J. C., & Dias, G. P. (2018). The Influence of collaboration initiatives on the sustainability of the cashew supply chain. *Sustainability*, *10*(6), 2075.

Beckeman, M., Bourlakis, M., & Olsson, A. (2013). The role of manufacturers in food innovations in Sweden. *British Food Journal*, *115*(7), 953–974.

Bezuidenhout, C. N., Bodhanya, S., & Brenchley, L. (2012) An analysis of collaboration in a sugarcane production and processing supply chain. *British Food Journal*, *114*(6), 880–895.

Boniface, B. (2012) Producer relationships segmentation in Malaysia's milk supply chains. *British Food Journal*, *114*(10), 1501–1516.

Boschetti, F., Cvitanovic, C., Fleming, A., & Fulton, E. (2016). A call for empirically based guidelines for building trust among stakeholders in environmental sustainability projects. *Sustainability Science*, *11*(5), 855–859.

Busch, L. (2011). The private governance of food: Equitable exchange or bizarre bazaar? *Agriculture and Human Values*, *28*(3), 345–352.

Carfora, V., Cavallo, C., Caso, D., Del Giudice, T., DeDevitiis, B., Viscecchia, R., Nardone, G., & Cicia, G. (2019). Explaining consumer purchase behaviour for organic milk: Including trust and green self-identity within the theory of planned behavior. *Food Quality and Preference*, *76*, 1–9.

Camanzi, L., Hammoudi, A., & Malorgio, G. (2019). Stakeholder perception of EU food safety governance: The case of EU fruit and vegetable imports from Southern Mediterranean Countries. *New Medit: Mediterranean Journal of Economics, Agriculture and Environment*, *18*(4), 19–34.

Cardoso, L., Silva, R., Almeida, G. G. F. D., & Santos, L. L. (2020). A bibliometric model to analyze country research performance: SciVal topic prominence approach in tourism, leisure and hospitality. *Sustainability*, *12*(23), 9897.

Carrer, M. J., de Souza Filho, H. M., & Vinholis, M. D. M. B. (2014). Plural forms of governance in the beef industry: A case study in Brazil. *British Food Journal*, *116*(4), 643–661.

Cechin, A., Bijman, J., Pascucci, S., & Omta, O. (2013). Decomposing the member relationship in agricultural cooperatives: Implications for commitment. *Agribusiness*, *29*(1), 39–61.

Charatsari, C., Kitsios, F., Stafyla, A., Aidonis, D., & Lioutas, E. (2018). Antecedents of farmers' willingness to participate in short food supply chains. *British Food Journal*, *120*(10), 2317–2333.

Chen, L., Zhao, X., Tang, O., Price, L., Zhang, S., & Zhu, W. (2017). Supply chain collaboration for sustainability: A literature review and future research agenda. *International Journal of Production Economics*, *194*, 73–87.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). Science mapping software tools: Review, analysis, and cooperative study among tools. *Journal of the American Society for information Science and Technology*, *62*(7), 1382–1402.

Costa, F. H. D. O., Da Silva, A. L., Pereira, C. R., Pereira, S. C. F., & Paredes, F. J. G. (2019). Achieving organisational resilience through inbound logistics effort. *British Food Journal*, *122*(2), 432–447.

Dania, W. A. P., Xing, K., & Amer, Y. (2018). Collaboration behavioural factors for sustainable agri-food supply chains: A systematic review. *Journal of Cleaner Production*, *186*, 851–864.

Deka, N., Goswami, K., Thakur, A. S., & Bhadoria, P.B. (2020). Are farmer producer companies ready to behave as business entities? Insights from the vegetable-based farmer companies in West Bengal, India. *International Journal of Agricultural Sustainability*, *18*(6), 521–536.

Dlamini-Mazibuko, B. P., Ferrer, S., & Ortmann, G. (2019). Examining the farmer-buyer relationships in vegetable marketing channels in Eswatini. *Agrekon*, *58*(3), 369–386.

Dunning, R. (2016). Collaboration and commitment in a regional supermarket supply chain. *Journal of Agriculture, Food Systems, and Community Development*, *6*(4), 21–39.

Durrant, A., Markovic, M., Matthews, D., May, D., Leontidis, G., & Enright, J. (2021). How might technology rise to the challenge of data sharing in agri-food? *Global Food Security*, *28*, 100493.

Dwyer, J., Berriet-Solliec, M., Lataste, F. G., Short, C., Maréchal, A., & Hart, K. (2018). A social-ecological systems approach to enhance sustainable farming and forestry in the EU. *EuroChoices*, *17*(3), 4–10.

Ebers, M., & Oerlemans, L. (2016). The variety of governance structures beyond market and hierarchy. *Journal of Management*, *42*(6), 1491– 1529.

Fischer, C. (2013). Trust and communication in European agri-food chains. *Supply Chain Management: An International Journal*, *18*(2), 208– 218.

Fleming, A., Ogier, E., Hobday, A. J., Thomas, L., Hartog, J. R., & Haas, B. (2020). Stakeholder trust and holistic fishery sustainability assessments. *Marine Policy*, *111*, 103719.

Fleury, P., Lev, L., Brives, H., Chazoule, C., & Desole, M. (2016). Developing mid-tier supply chains (France) and values-based food supply chains (USA): A comparison of motivations, achievements, barriers and limitations. *Agriculture*, *6*(3), 36.

Food and Agriculture Organization of the United Nations (FAO) (2018). Transforming food and agriculture to achieve the SDGs. 20 interconnected actions to guide decision-makers.

Friedmann, H. (2007). Scaling up: Bringing public institutions and food service corporations into the project for a local, sustainable food system in Ontario. *Agriculture and Human Values*, *24*(3), 389–398.

Giampietri, E., Verneau, F., Del Giudice, T., Carfora, V., & Finco, A. (2018). A Theory of Planned behaviour perspective for investigating the role of trust in consumer purchasing decision related to short food supply chains. *Food Quality and Preference*, *64*, 160–166.

Ghosh, A., & Fedorowicz, J. (2008). The role of trust in supply chain governance. *Business Process Management Journal*, *14*(4), 453–470.

George, A. S., Mehra, V., Scott, K., & Sriram, V. (2015). Community participation in health systems research: A systematic review assessing the state of research, the nature of interventions involved and the features of engagement with communities. *Plos One*, *10*(10), e0141091.

Heyder, M., Theuvsen, L., & Hollmann-Hespos, T. (2012). Investments in tracking and tracing systems in the food industry: A PLS analysis. *Food Policy*, *37*(1), 102–113.

Hirschauer, N., Bavorová, M., & Martino, G. (2012). An analytical framework for a behavioural analysis of non-compliance in food supply chains. *British Food Journal*, *114*(9), 1212–1227.

Hoogstra-Klein, M. A., & Meijboom, K. (2021). A qualitative exploration of the wood product supply chain—Investigating the possibilities and desirability of an increased demand orientation. *Forest Policy and Economics*, *133*, 102606.

Huang, C. C. (2020). Cocreating social innovations between an agro-food company and rice farmers in Taiwan: Exploring the process mechanisms. *British Food Journal*, *122*(2), 3837–3851.

Hubeau, M., Marchand, F., & Van Huylenbroeck, G. (2017). Sustainability experiments in the agri-food system: Uncovering the factors of new governance and collaboration success. *Sustainability*, *9*(6), 1027.

Hugos, M. H. (2018). *Essentials of supply chain management*. John Wiley & Sons.

Huseyin, A. (2018).Meta-analysis of organizational trust studies conducted in educational organizations between the years 2008–2018. *International Journal of Educational Methodology*, *4*(4), 287–302.

Jarosz, L. (2000).Understanding agri-food networks as social relations. *Agriculture and Human Values*, *17*(3), 279–283

Jie, F., Parton, K. A., & Cox, R. J. (2013). Linking supply chain practices to competitive advantage. *British Food Journal*, *115*(7), 1003–1024.

Joffre, O. M., De Vries, J. R., Klerkx, L., & Poortvliet, P. M. (2020). Why are cluster farmers adopting more aquaculture technologies and practices? The role of trust and interaction within shrimp farmers' networks in the Mekong Delta, Vietnam. *Aquaculture*, *523*, 735181.

Kamrath, C., Wesana, J., Bröring, S., & De Steur, H. (2019). What do we know about chain actors' evaluation of new food technologies? A systematic review of consumer and farmer studies. *Comprehensive Reviews in Food Science and Food Safety*, *18*(3), 798–816.

Karim, I., Wulandari, E., Arsal, A., & Mandasari, N. F. (2021) The causality model of maize farmers' income: Integrating social capital, supply chain, and competitive advantage. *International Journal on Advanced Science, Engineering and Information Technology*, *11*(1), 252–258.

Kataike, J., Molnar, A., De Steur, H., & Gellynck, X. (2019). Examining the relationship between chain governance structures and chain performance: An empirical evidence of the dairy sector. *British Food Journal*, *121*(8), 850–1870.

Kendall, H., Clark, B., Rhymer, C., Kuznesof, S., Hajslova, J., Tomaniova, M., Brereton, P., & Frewer, L. (2019). A systematic review of consumer perceptions of food fraud and authenticity: A European perspective. *Trends in Food Science & Technology*, *94*, 79–90.

Kiriveldeniya, K. K., & Rosairo, H. S. (2018). Value chain actors, farm-gate price and farmer loyalty in strategic vertical coordination in the maize out-grower farming in Sri Lanka. *The Journal of Agrocultural Scienes—Sri Lanka*, *15*(2), 154–172.

Knoll, S., Marques, C. S. S., Liu, J., Zhong, F., Padula, A. D., & Barcellos, J. O. J. (2017). The Sino-Brazilian beef supply chain: Mapping and risk detection. *British Food Journal*, *119*(1), 164–180.

Kwon, I.W. G., & Suh, T. (2004). Factors affecting the level of trust and commitment in supply chain relationships. *Journal of Supply Chain Management*, *40*(1), 4–14.

Lees, N., Nuthall, P., & Wilson, M. M. (2020). Relationship quality and supplier performance in food supply chains. *International Food and Agribusiness Management Review*, *23*(1030-2020-1733), 425–445.

Lehmann, R. J., Reiche, R., & Schiefer, G. (2012). Future internet and the agrifood sector: State-of-the-art in literature and research. *Computers and Electronics in Agriculture*, *89*, 158–174.

León-Bravo, V., Caniato, F., Caridi, M., & Johnsen, T. (2017). Collaboration for sustainability in the food supply chain: A multi-stage study in Italy. *Sustainability*, *9*(7), 1253.

Lin, C. F. (2019).Blockchainizing food law: Promises and perils of incorporating distributed ledger technologies to food safety, traceability, and sustainability governance. *Food & Drug LJ*, *74*, 586.

Liu, R. (2019). Challenges for the development of safe vegetables in Vietnam: An insight into the supply chains in Hanoi city. Doctoral dissertation, Faculty of Agriculture, Kyushu University.

Longo, F., Nicoletti, L., & Padovano, A. (2019). Estimating the Impact of blockchain adoption in the food processing industry and supply chain. *International Journal of Food Engineering*, *1*(forthcoming).

Love, D. C., Lane, R. M., Kuehl, L. M., Hudson, B., Harding, J., Clancy, K., &Fry, J. P. (2020). Performance and conduct of supply chains for United States farmed oysters. *Aquaculture*, *515*, 734569.

Lu, H., Feng, S., Trienekens, J. H., & Omta, S.W. F. (2012). Network strength, transaction-specific investments, inter-personal trust, and relationship satisfaction in Chinese agri-food SMEs. *China Agricultural Economic Review*, *4*(3), 363–378.

Malagon-Zaldua, E., Begiristain-Zubillaga, M., & Onederra-Aramendi, A. (2018). Measuring the economic impact of farmers' markets on local economies in the basque country. *Agriculture*, *8*(1), 10.

Manning, L., & Monaghan, J. (2019). Integrity in the fresh produce supply chain: Solutions and approaches to an emerging issue. *The Journal of Horticultural Science and Biotechnology*, *94*(4), 413–421.

Manning, L. (2020). Moving from a compliance-based to an integrity-based organizational climate in the food supply chain. *Comprehensive Reviews in Food Science and Food Safety*, *19*(3), 995–1017.

Maréchal, A., Baldock, D., Erjavec, E., Juvanc̆ic̆, L., Rac, I., Dwyer, J., & Hart, K. (2018). Towards a step change for enhanced delivery of environmental and social benefits from EU farming and forestry. *EuroChoices*, *17*(3), 11– 15.

Martins, F. M., Trienekens, J., & Omta, O. (2019). Implications of horizontal and vertical relationships on farmers performance in the Brazilian pork industry. *Livestock Science*, *228*, 161–169.

Mehmeti, G., Zanoli, R., & Xhoxhi, O. (2021). Non-financial factors affecting livestock farm's performance in meat supply chain. *New Medit: Mediterranean Journal of Economics, Agriculture and Environment*, *20*(4).

Modekurti, D. P. V. (2016). Automation of modified marketing procedural system to maximize transparency: A case study of vegetables in Madanapalle market. *Journal of Agribusiness in Developing and Emerging Economies*, *6*(1), 72–88.

Musa, K., VanNiekerk, P., & Retief, C. P. (2018). Challenges of contract farming among small-scale commercial vegetable farmers in Eastern Cape South Africa. *Journal of Agricultural Extension*, *22*(3), 195–206.

Musabelliu, B., Imami, D., Skreli, E., Xhoxhi, O., & Keco, R. (2019). The role of intermediaries' power on contracting decision between farmers and intermediaries. *New Medit: Mediterranean Journal of Economics, Agriculture and Environment*, *18*(3), 3–15.

Mutonyi, S., Beukel, K., Gyau, A., Hjortsø, C. N., & Griffith, C. (2016). Price satisfaction and producer loyalty: The role of mediators in business to business relationships in Kenyan mango supply chain. *British Food Journal*, *118*(5), 1067–1084.

Nakandala, D., Smith, M., & Lau, H. (2020). Shared power and fairness in trust-based supply chain relationships in an urban local food system. *British Food Journal*, *122*(3), 870–883.

Nardi, V. A. M., Teixeira, R., Ladeira, W. J., & de Oliveira Santini, F. (2020). A meta-analytic review of food safety risk perception. *Food Control*, *112*, 107089.

Neven, D. (2014). Developing sustainable food value chains, Guiding Principles. FAO, Roma, Italia.

Newell, W. J., Ellegaard, C., & Esbjerg, L. (2019). The effects of goodwill and competence trust on strategic information sharing in buyer–supplier relationships. *Journal of Business & Industrial Marketing*, *34*(2), 389–400.

Ng, D., & Salin, V. (2012) An institutional approach to the examination of food safety. *International Food and Agribusiness Management Review*, *15*(2), 21–45.

Nguyen, D. D., Le, T. M., & Kingsbury, A. J. (2020). Farmer participation in the lychee value chain in Bac Giang province, Vietnam. *Journal of Agribusiness in Developing and Emerging Economies*, *10*(2), 203–216.

Odongo, W., Dora, M., Molnar, A., Ongeng, D., & Gellynck, X. (2016). Performance perceptions among food supply chain members. *British Food Journal*, *118*(7), 1783–1799.

O'Donovan, I., Quinlan, T., & Barry, T. (2012). From farm to fork: Direct supply chain relationships in the hospitality industry in the south east of Ireland. *British Food Journal*, *114*(4), 500–515.

Orjuela, K.G., Gaona-García, P. A., & Marin, C. E. M. (2021). Towards an agriculture solution for product supply chain using blockchain: Case study agro-chain with BigchainDB. *Acta Agriculturae Scandinavica, Section B—Soil & Plant Science*, *71*(1), 1–16.

Paluri, R. A., & Mishal, A. (2020). Trust and commitment in supply chain management: A systematic review of literature. *Benchmarking: An International Journal*, *27*(10), 2831–3862.

Panahifar, F., Byrne, P. J., Salam, M. A., & Heavey, C. (2018). Supply chain collaboration and firm's performance. *Journal of Enterprise Information Management*, 31.

Pascucci, S., Dries, L., Karantininis, K., Martino, G., Passuello, F., Boccaletti, S., & Soregaroli, C. (2015). Governance implications of non-GM private standards on poultry meat value chains. *British Food Journal*, *117*(10), 2564–2581.

Pearson, S., May, D., Leontidis, G., Swainson, M., Brewer, S., Bidaut, L., & Zisman, A. (2019) Are distributed ledger technologies the panacea for food traceability? *Global Food Security*, *20*, 145–149.

Pelletier, N. (2008). Environmental performance in the US broiler poultry sector: Life cycle energy use and greenhouse gas, ozone depleting, acidifying and eutrophying emissions. *Agricultural Systems*, *98*(2), 67–73.

Pignatti, E., Canavari, M., & Spadoni, R. (2012). Information management as a value-enhancement tool in the small pelagic fish supply chain. *New Medit: Mediterranean Journal of Economics, Agriculture and Environment*, *11*(1), 33–40.

Probst, W. N. (2020). How emerging data technologies can increase trust and transparency in fisheries. *ICES Journal of Marine Science*, *77*(4), 1286–1294.

Qian, J., Wu, W., Yu, Q., Ruiz-Garcia, L., Xiang, Y., Jiang, L., & Yang, P. (2020). Filling the trust gap of food safety in food trade between the EU and China: An interconnected conceptual traceability framework based on blockchain. *Food and Energy Security*, *9*(4), e249.

Rahman, L. F., Alam, L., Marufuzzaman, M., & Sumaila, U. R. (2021). Traceability of sustainability and safety in fishery supply chain management systems using radio frequency identification technology. *Foods*, *10*(10), 2265.

Romero Granja, C., & Wollni, M. (2019). Opportunistic behaviour and trust: Experimental results from broccoli farmers in Ecuador. *Journal of Agricultural Economics*, *70*(1), 62–80.

Roy, H., Hall, C. M., & Ballantine, P.W. (2017). Trust in local food networks: The role of trust among tourism stakeholders and their impacts in purchasing decisions. *Journal of Destination Marketing & Management*, *6*(4), 309–317.

Sander, F., Semeijn, J., & Mahr, D. (2018). The acceptance of blockchain technology in meat traceability and transparency. *British Food Journal*, *120*(9), 2066–2079.

Sauer, J., Gorton, M., & White, J. (2012). Marketing, cooperatives and price heterogeneity: Evidence from the CIS dairy sector. *Agricultural Economics*, *43*(2), 165–177.

Schrobback, P., & Rolfe, J. (2021). Methodological and ideological options exploring supply chain models for Sydney rock oysters. *Aquaculture*, *534*, 736270.

Shanoyan, A., Bankuti, S. M. S., & Colares-Santos, L. (2019). Analysis of incentive structures at producer–processor interface of beef supply chain in Brazil. *Journal of Agribusiness in Developing and Emerging Economies*, *9*(2), 59–174.

Smith, B. G. (2008). Developing sustainable food supply chains. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *363*(1492), 849–861.

Solazzo, R., Petriccione, G., & Perito, M. A. (2020). The contractual relationships in the Italian durum wheat chain: Empirical survey evidence. *New Medit: Mediterranean Journal of Economics, Agriculture and Environment*, *19*(2), 101–111.

Sorrentino, A., Russo, C., & Cacchiarelli, L. (2018) Market power and bargaining power in the EU food supply chain: The role of Producer Organizations. *New Medit: Mediterranean Journal of Economics, Agriculture and Environment*, *17*(4), 21–31.

Souza Filho, H. M., & Miranda, B. V. (2019). Asset specificity, intensity of coordination, and the choice of hybrid governance structures. *Journal of Agribusiness in Developing and Emerging Economies*, *9*(2), 139–158.

Steen, M., & Maijers, W. (2014). Inclusiveness of the small-holder farmer key success factors for Ethiopian agribusiness development. *International Food and Agribusiness Management Review*, *17*(1030-2016-82993), 83–88.

Sun, Y., Liu, Z., & Yang, H. (2018). How does suppliers' fairness affect the relationship quality of agricultural product supply chains? *Journal of Food Quality*, *2018*, 1–16.

Sun, Y., Zhu, Z., & Yang, H. (2021). Fairness perception, trust perception, and relationship quality in agricultural supply chains. *Journal of Food Quality*, *2021*.

Susanty, A., Bakhtiar, A., Jie, F., & Muthi, M. (2017). The empirical model of trust, loyalty, and business performance of the dairy milk supply chain. *British Food Journal*, *19*(12), 2765–2787.

The R Foundation (2021). What is R? *R-project*. https://www.r-project.org/about.html. Accessed December 21, 2021.

Thorsøe, M. H. (2015). Maintaining trust and credibility in a continuously evolving organic food system. *Journal of Agricultural and Environmental Ethics*, *28*(4), 767–787.

Touboulic, A., & Walker, H. (2015). Theories in sustainable supply chain management: A structured literature review. *International Journal of Physical Distribution & Logistics Management*, *45*(1/2), 16–42.

Trienekens, J., Velzen, M. V., Lees, N., Saunders, C., & Pascucci, S. ((2018). Governance of market-oriented fresh food value chains: Export chains from New Zealand. *International Food and Agribusiness Management Review*, *21*(2 Special Issue), 249–268.

Truong, D. Q., & Ariyawardana, A. (2015). Small-scale shrimp grower–collector relationships: The case of Thua Thien Hue Province, Central Vietnam. *Aquaculture Economics &Management*, *19*(4), 404–422.

Udoye, C. E., Dimelu, M. U., Anugwa, I. O., Ozioko, R. I., & Azubuike, F. C. (2019). Actors' satisfaction with poultry value chain approach of the commercial agricultural development project in Enugu State, Nigeria. *Journal of Agricultural Extension*, *23*(4), 157–174.

Van der Merwe, M., Kirsten, J. F., & Trienekens, J. H. (2017). Information sharing as a safeguard against the opportunistic behavior of South African Karoo Lamb farmers. *Agricultural Economics*, *48*(Suppl. 1), 101–111.

Walker, H., Seuring, S., Sarkis, J., Klassen, R., Blome, C., Paulraj, A., & Schuetz, K. (2014). Supply chain collaboration and sustainability: A profile deviation analysis. *International Journal of Operations & Production Management*, *34*(5), 639–663.

Wang, Z., Ren, P., Wu, Y., & He, Q. (2021). Recent advances in analytical techniques for the detection of adulteration and authenticity of bee products—A review. *Food Additives & Contaminants: Part A*, *38*(4), 533–549.

Weber, H., & Wiek, A. (2021). Cooperating with "open cards"—The role of small intermediary businesses in realizing sustainable international coffee supply. *Frontiers in Sustainable Food Systems*, *5*(663716).

Weseen, S., Hobbs, J., & Kerr, W. A. (2014). Reducing hold-up risks in ethanol supply chains: A transaction cost perspective. *International Food and Agribusiness Management Review*, *17*(1030-2016-82979), 83–106.

Wilson, M. M., MacDonald, I. A., & Monnane, M. M. (2015). Governance of procurement relationships in the wine industry. *International Journal of Wine Business Research*, *27*(4), 299–311.

Wongprawmas, R., Bravo, C. P., Lazo, A., Canavari, M., & Spiller, A. (2015). Practitioners' perceptions of the credibility of food quality assurance schemes: Exploring the effect of country of origin. *Quality Assurance and Safety of Crops & Foods*, *7*(5), 789–799.

Wu, W., Zhang, A., van Klinken, R. D., Schrobback, P., & Muller, J. M. (2021). Consumer trust in food and the food system: A critical review. *Foods*, *10*(10), 2490.

Zhang, J., Yu, Q., Zheng, F., Long, C., Lu, Z., & Duan, Z. (2016). Comparing keywords plus of WOS and author keywords: A case study of patient adherence research. *Journal of the Association for Information Science and Technology*, *67*(4), 967–972.

Zhang, X., & Hu, D. (2011). Farmer-buyer relationships in China: The effects of contracts, trust and market environment. *China Agricultural Economic Review*, *3*(1), 42–53.

Supplementary File

Tables with broad bibliometric results.

Detailed presentation of the final database.

Description	Results	Description	Results
MAIN INFORMATION ABOUT DATA		MAIN INFORMATION ABOUT DATA	
Timespan	1995:2021	DOCUMENT TYPES	
Sources (Journals, Books, etc)	118	Article	246
Documents	277	Article; early access	4
Average years from publication	5,65	Article; proceedings paper	5
Average citations per documents	14,45	Review	22
Average citations per year per doc	2,351		
AUTHORS		AUTHORS COLLABORATION	
Authors	836	Single-authored documents	37
Author Appearances	952	Documents per Author	0,331
Authors of single-authored documents	35	Authors per Document	3,02
Authors of multi-authored documents	801	Co-Authors per Documents	3,44
		Collaboration Index	3,34
DOCUMENT CONTENTS			
Keywords Plus (ID)	919	Author's Keywords (DE)	1018

Top 20 journals publishing documents on the combined research topics.

Journal	NP	TC	h-index	g-index	PY-start	m-index
British Food Journal	33	633	14	24	2003	0,74
Food Control	11	196	9	11	2012	0,90
Agrekon	8	98	6	8	1999	0,26
New Medit	7	42	4	6	2009	0,31
Agriculture and Humam Values	6	299	5	6	2000	0,23
Food Quality and Preference	6	249	5	6	2015	0,71
Journal of Agribusiness in Developing and Emerging Economies	6	20	3	4	2016	0,50
Food Policy	5	222	5	5	2007	0,33
Foods	5	21	2	4	2020	1,00
International Food and Agriculture Management Review	5	66	4	5	2011	0,36
Acta Horticulturae	4	7	2	2	2009	0,15
Computers and Electronics in Agriculture	4	166	4	4	2012	0,40
Journal of International Food and Agribusiness Marketing	4	89	4	4	2000	0,18
Agricultural and Food Economics	3	21	3	3	2015	0,43
Agricultural Systems	3	140	2	3	2008	0,14
Aquaculture	3	34	3	3	2018	0,75
Economia Agro-Alimentare	3	50	2	3	2013	0,22
Global Food Security-Agriculture Policy Economics and Environment	3	99	3	3	2015	0,43
International Journal on Food System Dynamics	3	46	2	3	2015	0,29
Journal of Food Products Marketing	3	40	3	3	2002	0,15

NP = Number of publications; TC = Total of citations; PY-start = Initial year of publication.

The 20 most relevant authors.

Rank	Authors	Articles	Articles Fractionalized	Rank	Authors	Articles	Articles Fractionalized
1	Manning L	8	4,42	11	Kendall H	3	0,31
2	Gellynck X	6	1,57	12	Kuznesof S	3	0,31
3	Molnar A	6	1,57	13	Leat P	3	1,13
4	Canavari M	5	1,87	14	Masuku M	3	1,08
5	Kirsten J	5	1,92	15	Revoredo-Giha C	3	1,13
6	Trienekens J	4	1,17	16	Spiller A	3	1,03
7	Baines R	3	1,00	17	Watabaji M	3	0,92
8	Carfora V	3	0,51	18	Abiral B	2	1,00
9	Clark B	3	0,31	19	Aryawardana A	2	0,67
10	Hobbs J	3	1,83	20	Atalan-Helicke N	2	1,00

Top 20 nationalities of the authors.

Country	Articles	Frequency	SCP	MCP	MCP-Ratio
Italy	31	0,125	24	7	0,226
United Kingdom	31	0,081	23	8	0,258
Australia	20	0,077	19	1	0,05
USA	19	0,069	14	5	0,263
China	17	0,060	12	5	0,294
Germany	15	0,044	11	4	0,267
Canada	11	0,040	11	0	0
South Africa	10	0,036	8	2	0,2
Netherlands	9	0,032	6	3	0,333
Brazil	8	0,028	5	3	0,375
Belgium	7	0,024	2	5	0,714
France	6	0,024	3	3	0,5
Malaysia	6	0,024	3	3	0,5
New Zealand	6	0,020	5	1	0,167
Sweden	5	0,016	4	1	0,2
India	4	0,012	3	1	0,25
Colombia	3	0,012	3	0	0
Indonesia	3	0,012	2	1	0,333
Ireland	3	0,012	2	1	0,333
Switzerland	3	0,012	2	1	0,333

Sample = 277 articles; Frequency = Articles per country/277; SCP = Single Country Publication; MCP = Multiple Country Publication; MCP-Ratio = MCP/Articles per country.

Top 20 most global cited documents.

Paper (1st Author, Year, Journal)	TC	TC per Year	Paper (1st Author, Year, Journal)	TC	TC per Year
Pelletier N, 2008 Agricultural Systems	132	9,43	Lindgreen A, 2003 British Food Journal	73	3,84
Smith BG, 2008 Philos Trans R. Soc. B. Biol. Sciences	128	9,14	Fischer C, 2009 Eur. Review of Agric. Economics	58	4,46
Friedmann H, 2007 Agriculture and Human Values	122	8,13	Yee WMS, 2005 British Food Journal	57	3,35
Jarosz L, 2000 Agriculture and Human Values	113	5,14	Carfora V, 2019 Food Quality and Preference	56	18,67
George AS, 2015 Plos One	99	14,14	Goodsman DW, 2013 New Phytologist	56	6,22
Nocella G, 2010 Appl Econ. Perspectives and Policy	91	7,58	Heyder M, 2012 Food Policy	56	5,6
Giampietri E, 2018 Food Quality and Preference	84	21	Sander F, 2018 British Food journal	55	13,75
Lehmann RJ, 2012 Comput. and Eletronics in Agriculture	82	8,2	Tarjan L, 2014 Comput. and Eletronics in Agriculture	53	6,63
Schipmann C, 2011 Food Policy	78	7,09	Raspor P, 2008 Trends in Food Sci. and Technology	50	3,57
Migliore G, 2015 Food Quality and Preference	74	10,57	Carriquiry M 2007, American J. of Agric. Economics	49	3,27

TC = Total citations; TC per Year = Total citations per year.

Chapter 3

The influence of trust for sustainable agri-food production

3 - The influence of trust for sustainable agri-food production: Empirical evidence of a mariculturist supply chain in Southern Brazil.

Abstract

Purpose: The purpose of our work was to study the relationships of trust in a local agri-food supply chain in Southern Brazil. In an unsustainable context, where the number of mariculturists is decreasing, we seek to identify what the factors are and how they contribute to this problem, as well as find solutions aimed at the sustainability of that chain.

Design/methodology/approach: Qualitative research was carried out with 15 semi-structured interviews that took place in the year 2021. The thematic analysis of the results applied the IRAMUTEQ software and the assessment of the narratives was guided by prior thematic analysis.

Findings: The supply chain under investigation requires better organisation. Communication and interpersonal trust proved important in the relationship between producers and control bodies. The university, as a seed supplier, needs predictability and efficiency to convey inter-organisational trust. Informal relationships are interpersonal and extremely trust-based, and inter-organisational trust increases the performance of establishments and promotes the development of innovative structures. Furthermore, in crisis periods interpersonal trust increases.

Originality: An unprecedented research was done on the studied supply chain, knowing the relationships of trust among them, identifying peculiar partnerships and recognizing some constructs and outcomes of trust.

Practical implications: The results allow policymakers to plan better their actions and build more effective tactics in order to reach sustainable development. This work is also important for stakeholders and managers, as it guides improvements in management, governance and sustainability of agri-food supply chains.

Keywords: Trust; agri-food; supply chain; governance; sustainability.

This paper was published in the British Food Journal. The reference is: Assis, M. T. Q. M., Lucas, M. R. D. P. V., & Rainho, M. M. (2023). The influence of trust for sustainable agri-food production: empirical evidence of a mariculturist supply chain in Southern Brazil. *British Food Journal*, *125*(12), 4268-4290.(DOI: 10.1108/BFJ-08-2022-0734). An earlier version of this paper was presented at *British Food Journal (BFJ) Conference on Promoting Sustainable Food Production, Malang,* 2022.

3.1 Introduction

Sustainability, or Sustainable Intensification (SI), is one of the drivers that will influence the food system over the next decades. It argues: (i) that increased production must play at least some role in meeting the food security challenge of the next fifty years; (ii) that most of this increase must come from existing agricultural land; (iii) that increasing the sustainability of food production is as important as increasing production; and (iv) that we must consider a broad range of tools and production methods to achieve these goals (Godfray & Gamett, 2014).

A food value chain is sustainable when it is profitable throughout all its stages (economic sustainability); has broad-based benefits for society (social sustainability); and has a positive or neutral impact on the natural environment (environmental sustainability) (FAO, 2018). The United Nations explained that a successful sustainable development agenda requires partnerships between governments, the private sector and civil society. These inclusive partnerships built upon principles and values, a shared vision, and shared goals that place people and the planet at the centre, are needed at the global, regional, national, and local levels. Sustainable Development Goal 17 (Partnerships for the goals) encourages and promotes effective public, public-private, and civil society partnerships, building on the experience and resourcing strategies of cooperation, data monitoring and accountability.

Trust is an important topic for discussion under supply chain management, where the relational view of business competitiveness is getting attention and providing rewards. Many authors discussed trust as the vital issue influencing relationships in supply chains. In summary of the literature, trust determines many aspects including how chain actors choose the governance structure (Amentae et al., 2018; Ghosh and Fedorowicz, 2008). Fawcett et al. (2012) argued that trust is the foundation for building and sustaining collaborative alliances in the supply chain. According to the authors, trust in the supply chain can grow if and only if partners wish to build it and are willing to invest in its signals that create mutual confidence. Trust is the key enabler of collaboration which points to the importance of social relationships in partnership (Panahifar et al., 2018). Tejpal et al. (2013) showed that research on trust focus on characteristic trust, with negligible attention being given to other forms of trust, for example, rational and institutional trust. Perspectives of trust in supply chain relationships and the lack of theories related to the economic aspect and competitive advantage of trust are other research subjects, the authors suggest improving.

According to the work of Assis *et al.* (2022), conducted specifically in the agri-food area, despite being a central and transversal theme, trust has not been shown to be much studied in the last 11

years. After performing a meta-analysis on the subject, the authors concluded that research on trust linked with the areas of management and sustainability of agri-food supply chains is small and can be increased. They cite other authors that suggest new research on the topic and an example is the work of Roy et al. (2017), who declares that there is a much more limited body of research on trust in the B2B setting, especially with respect to the food supply chain, despite its recognition as a central construct to the development of successful relationships.

Schrobback and Rolfe (2021) have explored oyster supply chains through a qualitative study and the interviewees stated that an important advantage present in the supply chain model they chose is trust-based relationships between producers and wholesalers. In the studied model, in addition to the indirect financial value (e.g. marketing and branding), the non-financial one, represented by direct links among stakeholders and the trust-based relationship, proved to be factors that motivated the choice of model and increased product price.

Research in the field of food supply chain management (FSCM) has gained momentum in the 15 years. However, compared to other FSCM sub-areas, few authors have addressed issues and challenges related to agri-food supply chains in developing countries (Patidar *et al*., 2022). Moreover, the agri-food area is very specific. It has a lot of informality and is vulnerable to different types of crises, caused by sanitary emergencies, adverse weather conditions, discontinuity in supply, and others. In this sense, understanding how trust works in agri-food supply chains is essential to find better ways to improve the functioning of these structures.

The Greater Florianópolis mariculture chain, located in Southern Brazil, is an important supply chain for the region and has specific characteristics: it is quite traditional; it benefits a product with many food safety issues; it represents more than 95% of the national production of bivalve molluscs; and it often goes through periods of red tide, when producers have to completely paralyze their activities until algae dissipate. However, although being traditional, quite demanded products, a considerable number of producers have abandoned the activity in recent years (Epagri, 2021).

Based on these backgrounds, the aim of this case study was to research the relationships between trust and governance in that supply chain. In this unsustainable context, it was sought to understand how that chain is organized, how is the relationship of producers with the control bodies and other indirect actors, how trust affects the performance and sustainability of companies and of the whole chain, how is trust in times of crisis, and what are the factors that may be contributing to the reduction in the number of mariculturists. In the present work, section 2 presents literature that deals with trust, sustainability and the studied mariculture chain. In

section 3 we explain the methodology used and section 4 shows the results along with the specific discussions. Afterwards, section 5 brings the generic discussions mainly regarding sustainability, and section 6 presents the conclusions and implications of the research.

3.2 Literature Review

3.2.1 Trust

Trust contributes significantly to the stability of an organisation in the long term by building faith, reliance, and confidence among the supply chain partners. Long-term positive interpersonal relationships among key staff members in respective organisations can assist in establishing or enhancing the level of trust among the organisations towards coordinated activities for value co-creation. Moreover, the fluidity of collaboration represents and contributes to the dynamics of relationships in the supply chain (Dania et al., 2018; Paluri and Mishal, 2020).

Supply chain management is complex in many aspects and refers to information transfer and relationships. When partners find a way to understand and recognize the positive side of complexity, there are more opportunities in the sense of pounding and resource sharing. However, achieving this collaborative environment requires confidence and commitment (Manfredi and Capik, 2022). Although dependence on customers/suppliers has no direct effect on supply chain integration (SCI), it improves SCI indirectly through trust with customers/suppliers. Both supplier integration and customer integration significantly improve financial performance. That way, trust among customers and suppliers significantly influences SCI (Zhang and Huo, 2013). The work of Alshurideh et al. (2022) showed that trust influenced the entire supply chain integration in organizational performance. Based on the results of the study, the authors consider that it is important for supply chain managers to consider and show more focus on their main partners through reliable communication, which can improve their performance. Companies should also diversify the means to achieve trust, as this promotes greater effects to influence their partners since trust plays a prominent role in shaping the perceptions and attitudes of partners. In the same direction, Baah et al. (2022) stated that trust between stakeholders has a positive influence on both business and environmental performance.

There is often some confusion in the definition of trust and confidence, but Cheung et al. (2011) clarify the difference between them. According to them, trust can affect the outcome of a situation, while confidence cannot, that is, when one is in a strongly compelling situation, with few or no possibilities to exit. In the former case, one can consider alternatives, but not in the latter. (Tejpal *et al.,* 2013). According to Delbufalo (2012), the influence of trust is classified into

direct economic outcomes, indirect economic outcomes, and relational outcomes. He mentions that the duration of the collaboration, expectation of continuity, financial performance, and future purchase intentions are the direct outcomes of trust. In addition, innovativeness, interdependence, investment in relation-specific assets, joint action, joint problem solving, joint responsibility, knowledge transfer, loyalty, perceived risk, and purchasing cost reduction are the indirect economic outcomes of trust. Chlebicka (2015) states that trust has its external value in terms of social capital and adds that social capital is understood as the ability to reach common objectives through interpersonal cooperation in organisations. To receive trust, social actors need to present themselves as credible (or trustworthy - literally worthy of trust), credibility, therefore, being a perception of other social actors.

The Social Exchange Theory is a comprehensive sociological and psychological theory, that studies social behaviour during many interpersonal exchanges, and it can have economic implications. In the field of sociology, trust is an important construct within this theory, positively influencing reciprocity of relations, both personal and commercial. (Cook et al., 2013; Cropanzano et al., 2017; Thorsoe, 2015).

The vulnerability of trust can be defined in two types: integrity and competence. The former is established based on the integrity, character, personality, and honesty of a partner. Since integrity trust is predicated upon honesty, it is implicitly accompanied by a decrease in the peril presented by opportunism. This contrasts with competence-based trust, which is founded upon the competence of a partner, experience, reliability, and practical or technical knowledge and skills (Connelly et al., 2018; Han et al., 2021).

Paluri and Mishal (2020) state that trust refers to “the willingness to rely on an exchange partner on whom one has confidence, without worrying about the exposure of one’s weakness of vulnerability and considering the partner as credible, reliable and benevolent. According to Fawcett et al. (2017), there is divergence in the definition of trust by academicians and the way firms operationalise it, and, in the context of the supply chain, practitioners describe trust as consisting of credibility and relationship commitment. Mount (2012), researching local food systems, argues that trust may be as much a predisposition as an outcome.

Among the main factors that build trust, there is benevolence, effective communication, partner’s reputation, competence, lasting relationship, dedicated investment, information sharing, integrity, planning, and sharing of values (Cerri, 2012; Dlamini-Mazibuko et al.; 2019; Gosh & Fedorowicz, 2008; Kwon & Suh, 2005; Mayer et al., 1995; Nyaga et al., 2010; Paiva et al., 2014; Panahifar et al., 2018; Tejpal et al., 2013; Wu et al.; 2012). Regarding the main outcomes of a

trustworthy relationship, we find collaboration, commitment, cooperation, information sharing, innovation, integration, operational efficiency, performance, stability, satisfaction, and cost reduction (Delbufalo, 2012; Dlamini-Mazibuko et al.; 2019; Kwon & Suh, 2005; Nyaga et al., 2010; Paiva et al., Panahifar et al., 2018; Revilla & Knoppen, 2015; Wu et al.; 2012; Wu et al.; 2014; Yang et al., 2008)

3.2.2 Mariculture in the state of Santa Catarina, Brazil

Mariculture, marine aquaculture, or marine farming, is conducted in the sea, in a marine water environment. For some species whose production relies on the naturally occurring seed in the sea, the production cycle is entirely in the sea. For those species that rely on seeds produced from hatchery and nursery y facilities even in freshwater, mariculture represents the grow-out phase of the production cycle (FAO, 2020).

The Sustainable Development Goal 14 of the United Nations 2030 Agenda (SDG 14 - Conserve and sustainably use the oceans, seas, and marine resources for sustainable development) calls specifically for small-scale artisanal fishers to be provided with access to marine resources and markets. Such access needs to be underpinned by secure tenure and user rights to the aquatic resources that form the basis for social and cultural well-being, livelihoods and sustainable development of communities, including both women and men, that depend on fisheries and aquaculture (FAO, 2020).

Suplicy (2020) points out some contributions that mariculture can offer, such as improving global warming, improving ocean eutrophication, alleviating water and land use for food production, benefiting human nutrition, being a sustainable alternative for fishmeal replacement in fish and animal nutrition, and providing additional benefits to human health and potential bioactive compounds of molluscs. In the research, he states that marine farming still has a long way to go to become a major source of high-quality protein for humankind. Nevertheless, in light of the available data, it is possible to argue that this industry can play a vital role in world food security and economic and social development, with a much lower environmental cost and increased benefits in comparison to the current sources of animal protein for human and animal nutrition. The author also ponders that this industry can contribute to ensuring the sustainability of living aquatic resources and their environment for present and future generations, through a cleaner and more sustainable supply chain, with multiple benefits for the environment and society.

Marine farming was introduced in the state of Santa Catarina at the end of the ‘80s by the extinct Association of Credit and Fishing Assistance of Santa Catarina - Acarpesc together with the

Federal University of Santa Catarina - UFSC, with the objective of providing a complementary source of income for artisanal fishermen. The good results obtained in the pilot projects developed together with a Florianópolis Fishermen's Colony were reproduced between 1990 and 2005 in other communities on the island and coastal municipalities throughout the state, through a successful partnership between UFSC and the Agricultural Research and Rural Extension Company of Santa Catarina – Epagri (Suplicy, 2019).

According to Epagri (2021), the production of molluscs marketed in 2020 in the State of Santa Catarina (mussels, oysters and scallops) was 16,252 tons., which represented 97.9% of the Brazilian production of these animals, and 478 mariculturists acted directly in the production. Analysing the evolution of mollusc production and the number of producers in the state of Santa Catarina, we can see that there is a great oscillation in the amount produced. In the last decade, the production peak was in 2012, with 23,499 tonnes, and the lowest level was obtained in 2017, with 13,596 tonnes. Regarding the number of mariculturists, we see that it is declining, reaching the lowest level in the historical series in the year 2020, with only 478 producers, compared to 683 in 2011, a decrease of 30% in ten years. This is an important point that should be considered, as the social issue involved in it deserves attention. Santa Catarina mariculturists are organised into 20 municipal associations, a state association, a cooperative and two federations. These organisations are distributed in 12 coastal municipalities. Although constituted, only two associations are active and hold regular meetings. The level of associativism in this sector is still extremely low and cooperativism is present only in two cooperatives, located in Penha and Florianópolis (Suplicy, 2019).

3.3 Methodology

At this time, it was decided to take a qualitative approach to the subject, because this type of method provides a deeper understanding of social phenomena that would not be obtained from purely quantitative methods, such as questionnaires. In a purely quantitative analysis, there is often a previous notion of what is happening, but not why and how it is happening, which does not happen in qualitative research, since it presents the causes and reasons for a particular phenomenon (Patton, 2014; Silverman, 2013). Moreover, initial qualitative research can help the design of later quantitative research.

The qualitative method chosen was interviewing, as Assis *et al.* (2022) observed in their work that it was the most used method for qualitative research on trust in the agri-food area. The purpose of the research interview is to explore the views, experiences, beliefs and/or motivations of individuals on specific subjects. Interviews are therefore more appropriate when little is known

about the phenomenon of the study or where detailed ideas are required of individual participants. They are also particularly suitable for exploring sensitive topics, about which participants may not want to talk in group settings (Gill *et al.*, 2008).

The universe of the analysis was the mariculture chain in the Metropolitan region of Florianópolis, state of Santa Catarina - Brazil, comprising five coastal municipalities (Florianópolis, Palhoça, São José, Biguaçu and Governador Celso Ramos). Initially, we identified some key stakeholders in the local chain through professional networks, whom we set out to interview. The first interviewees were asked to recommend others who they thought might be relevant (snowball technique). We sought to interview professionals from distinct categories to address different points of view, both local and systemic. Participants were invited through email, text messages, and phone calls. Interviews were scheduled in advance.

The interviews were individual so that it was possible to gather more detailed information, providing an opportunity for the interviewer to probe and expand the interviewee's responses. Questions were asked according to a previously defined guide to seeking data on the role of trust among stakeholders (Appendix I). The interview's average length was 52 minutes – the shortest 32 minutes and the longest 82 minutes. The interview started with a brief introduction and then sought information on the stakeholder's current role in the studied mariculture chain. During the in-depth interview process, we covered the following subtopics: the creation and maintenance of business relationships; the performance of the company and the supply chain; the sustainability of the company and the supply chain; and in times of crisis.

The semi-structured interviews were conducted with 15 participants (10 men and 5 women). Interviews were conducted by the first author of this paper, face to face or via video chats, in the year 2021. Among the stakeholders interviewed were mariculturists (3), professionals from Municipal (2) and Federal Inspection Services (2), extension researchers (2), consultants (2), technical manager (1), member of producer associations (1), member of the State Public Prosecution (1) and Public Manager (1). The interviews were digitally recorded and transcribed. The transcripts were formatted into a textual corpus for thematic analysis before the narrative assessment. The questions were not included, only their answers were kept. We used the IRAMUTEQ (*Interface de R pour les Analyses Multimensionnelles de textes et de Questionnaires*) software, version 0.7 alpha 2, of 11/05/2020. The method used in the software was the Descending Hierarchical Analysis (DHA), as the corpus of the study worked with a textual group focused on a subject.

By using matrices that cross reduced forms with text segments (TS), the DHA method allows us to obtain a definitive classification. It is a multivariate analysis and aims at obtaining TS clusters with similar vocabulary, but different from other segments. The software then calculates descriptive results of each cluster conforming to its main vocabulary (lexical) and words with an asterisk (variables). "Based on the chosen clusters, the software calculates and provides the most typical TS of each cluster, giving context to them" (Camargo and Justo, 2013). After Descending Hierarchical Classification (DHC), the disconnected segments were discarded and it was selected those that were coherent with the respective class. In addition, the classes were divided into subclasses, which were discussed separately. Based on the clusters provided by thematic analysis, a deeper assessment of the narratives was carried out and these were then confronted with the existing theoretical foundation, seeking comparisons, conclusions, and policy implications. Figure 3.1 presents the diagram of the methodological process.

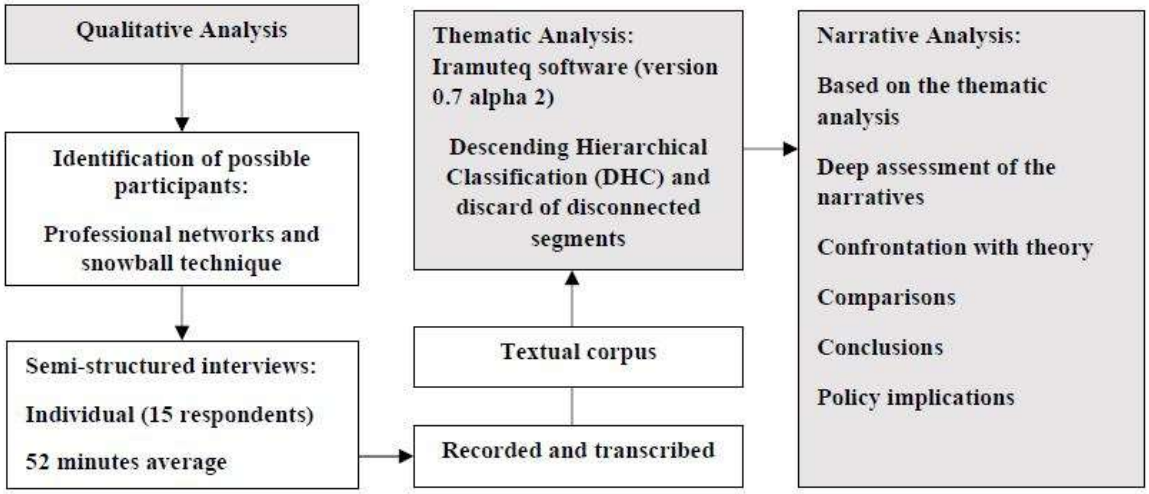


Figure 3.1 - Diagram of the methodological process.

3.4 Results and Discussion

3.4.1. Thematic analysis

The general corpus consisted of 15 texts, separated into 535 text segments (TS), with a utilisation coefficient of 439 TS (82.06%). In total, 18.794 occurrences emerged (words, forms or vocabulary), with 2.832 distinct words and 1.487 single occurrences. Through DHC, evocations that have similar and different vocabulary from other classes emerge. The program uses the chi-square test ($\chi 2$) for creating a dictionary of words, which reveals the associative strength between words and their respective class. This associative strength is analysed when the test is greater than 3.84 and $p<0{,}0001$ (Lahlou, 2001; Souza *et al.*, 2018). The analysed content was categorised

into four classes: Class 1, with 146 TS (33.26%); Class 2, with 84 TS (19.13%), Class 3, with 116 TS (26.42%); and Class 4, with 93 TS (21.18%). Figure 3.2 presents a class dendrogram according to word occurrences created by the DHC.

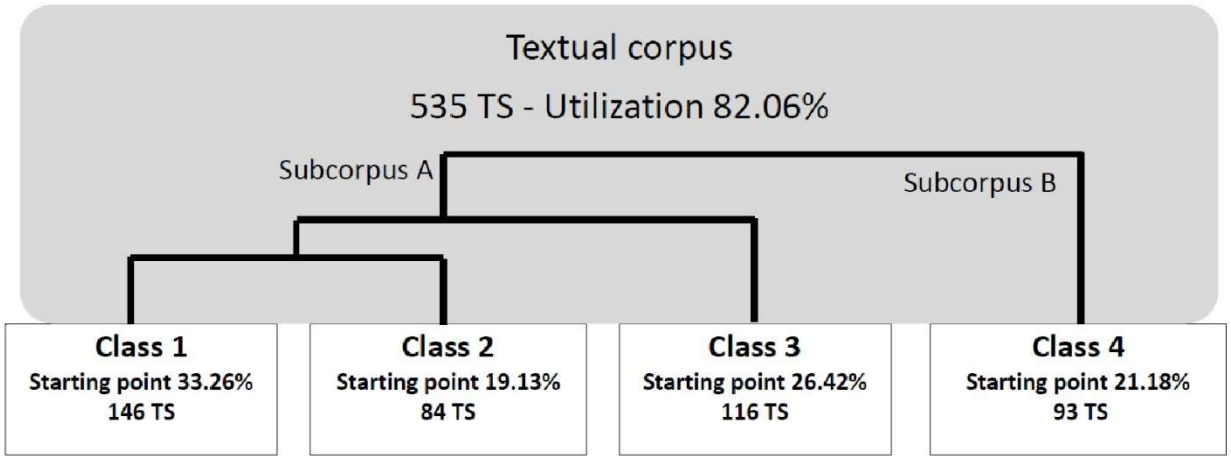


Figure 3.2 - Class Dendrogram.

The four classes were divided into two branches (A and B) of the total corpus under analysis. Subcorpus A, composed of class 1, class 2 and class 3 refers to how the studied mariculture chain was built and is currently organised. Subcorpus B contains the speeches of class 4, and it refers more specifically to the relationships among actors in the value chain. Classes 1 and 2 are part of the same branch of subcorpus A and refer to each other, demonstrating that the subjects covered by these two clusters have certain proximity. In the supplementary material are the most representative words of each class, according to DHC.

3.4.2. Narrative analysis

Class 1 – Organisation of the supply chain

Class 1 presented important segments related to the organisation of the chain. When asked about this topic, the interviewees were unanimous in reporting that it is a chain that needs more organisation. They pointed out deficiencies in the relationship among marine farmers, lack of trust and difficulties in conducting associations and cooperatives, findings that agree with Suplicy (2019).

> *There is a lot of lack of trust between one another. Certainly, the increase in trust strengthens the relationships and then there would be a social gain and a commercial gain with the increase in associativism.* (Member of the State Public Prosecution)

> *There is no leadership because the mariculturists themselves have personal relationship problems, and it is a production chain made up of many former fishermen, people who were born right here and have a lot of difficulty in organising.* (Municipal Inspector)

> *Regarding the organisation of the chain, this individualism makes it difficult for people to unite in the form of cooperatives. There is even one cooperative, a given building, land, everything built, and people do not get down to business.* (Researcher)

Several authors emphasize the importance of organisation within supply chains. Pomponi *et al.* (2015) argue that the organisation of a chain is essential for its sustainable development and a mutual understanding between stakeholders in the supply chain is required to build trust. Associated with this, but from another perspective, when talking about the creation of linkages to build more robust value chains, Shiferaw *et al.* (2011) assert that this mutually beneficial relationship is currently undermined by a lack of trust and unproductive rivalry.

Barrau-Didier *et al.* (2012) claim that the producer-cooperative relationship stresses psycho-social elements mainly related to participation, commitment, trust and leadership. Trust is the starting point which explains a member's favourable behaviour towards his/her cooperation. In view of the Social Exchange Theory's reciprocity, Higuchi *et al.* (2020) assert that members' trust depends on the cooperative's capacity to act competently and reliably, remain close to members, be heedful of their demands and show strong concern for their interests. Moreover, as collaborative advantages among the chain partners and their willingness to collaborate increase, trust builds up (Amentae *et al.*, 2018).

In this context, FAO (2018) asserts, "Associations and cooperatives are structures that can collaborate to organise the supply chain, as the group when seeking common interests, gets more attention from government agencies and the population in general. The partnership is particularly relevant in value chains, where producers, governments and private actors can work together towards more sustainability".

Cultural aspects emerged in this class mainly addressing the hypothesis that individuals are so individualistic due to an Azorean cultural background. The settlement of the Greater Florianópolis region began in the 18th century, in the period of colonial Brazil, with the arrival of Portuguese from the Azores archipelago, who occupied the coast. This Azorean population has cultivated, over time, activities related to the sea, fishing and, more recently, mariculture and tourism (Florianópolis, 2021).

> *This is as intrinsic in the sector as in the cultural issue. The main actors in the chain have this intrinsic Azorean culture in their way of acting, with a lot of lack of trust.* (No. 15 - Member of the State Public Prosecution)

> *I certainly think that this issue of increasing trust breaks this paradigm that exists, which is culture, of the Azorean, of not associating, of not being able to work together with common goals.* (No. 13 - Consultant)

> *They are very disunited in this sense and fight a lot among themselves, they cannot organise themselves. There are several theories, even a little prejudiced, that say that it is because of their Azorean culture, but I believe that this is not the case.* (No. 1 - Municipal Inspector)

The testimonies we found are controversial. However, the work of Teixeira *et al.* (2017) corroborates the hypothesis, as they found that the mariculture cluster in the Greater Florianópolis region is influenced by the local culture, predominantly of Azorean origin, with strong traits of individualism, tolerance for uncertainty, indulgence, short-term orientation and idleness. According to Ndubisi (2011), culture plays a subtle, yet powerful role in influencing people's social behaviours and, in our case, there is evidence to suggest that the culture of the stakeholders should not be ignored in trying to understand and model the drivers of trust in the relationship among the authors of the supply chain (Leidner and Kayworth, 2006).

Class 2 – Trust on Inspection Service

The next segments refer to the interpersonal relationship between the inspected producers and the inspectors, which many times is a complex and turbulent relationship because it involves aspects of legal compliance and authority. The first testimony is from a producer and the second is from an inspector.

> *We had an inspector at the Inspection Service who understood a lot of the moment and she went a little beyond the strict legislation. She knew how to use common sense in some situations to give in at one point and demand at another, and in another week demand more there and give a little here. Why? Because she was trustful that we were not committing irregularities with intent, with the risk of harming consumers, these were things that we could quickly correct.* (No. 14 - Technical Manager)

> *We trust but are attentive, we are very present, both in inspections and in conversations, and we always try to be close to them, both with our vision of a sanitary inspector and*

> *with our vision of public servants, I think we must give this support.* (No. 3 - Municipal Inspector)

Trust is fundamentally important for public administration because it addresses several central and interrelated concerns, such as public cooperation and compliance with laws and regulations (Marlowe, 2004). In our case, we can observe that the interviewees emphasise the importance of communication and interpersonal trust so that impasses are resolved and for cooperation between the parties, even considering the organisational position of the stakeholders. These findings agree with the works of Cerri (2012), Dlamini-Mazibuko *et al.* (2019) and Wu *et al.* (2012).

Class 3 – Trust in the University

The theme of this cluster refers to the research and development in the University's oyster seeds production. The name of the University naturally emerged during the interview because, as previously mentioned in section 2.3, the Federal University of Santa Catarina played a fundamental role in the development of the mariculture chain in the State and still produces most oyster seeds used in cultivation.

> *I think that this issue of monitoring and supporting the seed's basic input, which also has a very strong relationship within the chain, has established this trust among all peers. The seed has come from the University for 30 years and today other laboratories are emerging. The University promotes research, in visits and monitoring they also talk with the producers and report what happens in others, so we take this issue of research and science.* (No. 10 - Consultant)

> *I've bought oysters from the University since the beginning, so my relationship with the University is one of great trust. I highly praise the work that the University does in the field of oyster cultivation. I even take many pictures, periodically, of the evolution of oysters and send them to them. For example, native oysters used to take a year and a half to grow but now grow from 9 months to a year. If it weren't for the University, the activity wouldn't exist.* (No. 6 - Mussel Farmer)

According to Lang (2013), university scientists are highly trustworthy. And the University conveys this solid trust for being a recognized public institution, for having a history in the value chain since the implantation of the first cultivations and for always carrying out research and relating to producers so that productivity is improved. In this sense, trust has several roles both as an antecedent and a consequence of knowledge sharing. A number of studies suggest trust as

an important factor that prompts an increase in mutual knowledge creation, knowledge management and willingness to share knowledge (Bouncken *et al.*, 2020; Roy *et al.*, 2017).

Despite this reputation, the University cannot always meet the efficiency standards necessary for supplying the chain, as can be seen in the statements below.

> *There is a question of the physical structure and our dependence, not only on the use of public resources but also on specialised labour and adequate equipment. Therefore, it has sometimes happened that we delay or do not follow our research schedule or other laboratory activity due to these factors and this, whether we like it or not, reflects later in the production chain because it ends up not generating seeds. And this creates wear and tear because the producers work with a forecast of purchasing animals so that the lots are ready to be sold at certain times of the year. In this sense, I say that no matter how hard you try, there is always this noise that prevents you from having 100% trust.* (No. 9 - Researcher)

This type of situation evokes the need for efficiency in public service, as pointed out by Aitalieva (2018). However, here the University is also positioned as a supplier in the chain, in which, to obtain full inter-organizational trust, it must comply with performance and predictability requirements. “The higher the uncertainty in the chain, the lesser would be the trust” (Amentae *et al.*, 2018).

Class 4 – Trust relationships

Trust relationships among the actors were the main subject of the interview. The first type of discourse that catches our attention is the fact that they are basically informal business relationships, built in the local context of the supply chain.

> *Trust is very present, mainly because of the informality of these bonds.* (No. 13 - Consultant)

> *Our relationship is very informal, it's very trusting and I've always liked to take people's word for it, but you must be always connected, you know, always keeping an eye out. Everything is very informal.* (No. 11 - Mussel Farmer)

> *I think that this whole relationship of trust has been built in the development of the production chain, it is one point, and another is about the neighbourhood culture of the community itself.* (No. 10 - Consultant)

> *Relationships are quite informal. I have a lot of this particularity of trusting until proven otherwise, and I do this in commercial relationships, for example, if we provided, and the guy didn't pay, we no longer provide.* (No. 4 - Mussel Farmer)

Due to the locality of the chain and the informality of the commercial agreements, trust is very present in these relationships. Honesty appears here and, as part of upright behaviour, is an important construct for trust, agreeing with Mayer *et al.* (1995). Studies have highlighted that trust could be developed by personal relations in the exchange. Both instrumental communication (transfer of information about current and future tasks) and personal interactions are positively and directly related to interpersonal trust (Chowdhury, 2012, Schipmann and Qaim, 2011). According to Nakandala *et al.* (2020), coherent and interdependent, informal partnerships in a B2B relationship are based on trust, without undervaluing the importance of operational efficiency.

Considering that most of the mariculture labour in the studied supply chain is familiar (Suplicy and Novaes, 2015), the work of Bouncken *et al.* (2020) argues important points, such as that family firms (non-owner-run and owner-run) benefit the most by forging trust in their alliances as a means of social enforcement. When operating on trust, family firms enact expectations and agreements based on bond or word over and above contract completeness.

This type of relationship, when trust is strengthened, also leads to high levels of commitment, that is, the reciprocity of the attitudes of the parties is essential for maintaining the relationship. Based on this narrative, the Social Exchange Theory is again raised and the commitment appears here as a clear construct of increased trust, which agrees with the works of Dlamini-Mazibuko *et al.* (2019), Kwon and Suh (2005), Nyaga *et al.* (2010) and Wu *et al.* (2012).

A characteristic of this scenario is that trust develops over time, requires consistency, and significantly predicts chain actors' supply chain governance choices, agreeing with Aggarwal and Srivastava (2016), Manfredini and Capik (2022), Love *et al.* (2020), and Dlamini-Mazibuko *et al.* (2019). The interaction of interpersonal trust and relational experience helps to strengthen trust the study of Belhadi *et al.* (2021) supports that positive relational experience is critical to shaping Sustainable Supply Chain Governance (SSCG). Furthermore, Han *et al.* (2021) argue that integrity trust is more challenging to establish and/or repair than competence trust, that is, the former is more complex than the latter.

In interviews, the issue of the relationship between trust and the performance of establishments was directly addressed. In this regard, respondents agreed with this connection and tended to cite

technical and administrative skills as fundamentals for building partnerships and improving performance.

> *I think that you gain from the moment you have trust, I believe that the relationships are more solid, and the gain is in all these aspects, such as logistics and finance.* (No. 15 - Member of the State Public Prosecution)

> *I think trust has a lot of influence on performance, logistics, and productivity. Today I have a sales partner who sells my oysters in São Paulo and, with that, we can greatly increase our productivity because of this trust. He is a very good salesman, cool, agile, he plays his role well and I keep mine. He takes my products to a far-flung market and has been getting new customers.* (No. 4 - Mussel Farmer)

> *There are also producers who rent their structure and pack it to others that do not have a legal structure. Trust surely improves performance*. (No. 5 – Researcher)

The above statements confirm what was defined by Cerri (2012) and Paiva *et al.* (2014), who establish competence and planning as antecedents of trust. Some trust outcomes are also evident here, such as collaboration, commitment, cost reduction and the performance itself, regarding their efficiency and productivity, which agrees with Delbufalo (2012), Dlamini-Mazibuko *et al.* (2019), Kwon and Suh (2006), Nyaga *et al.* (2010), Panahifar *et al.* (2018), Wu *et al.* (2012) and Wu *et al.* (2014). Other authors support this line. Amentae *et al.* (2018) and Alshurideh *et al.* (2022) found that, in addition to helping the building of partnerships, trust has a direct effect on all performance indicators they studied, which are efficiency, flexibility, quality and safety, level of losses, and level of integration. Chu *et al.* (2012) argue that trust leads to a shared vision, which further leads to flexibility, which, in turn, influences performance. And Han *et al.* (2021) stated that competence-based trusts are founded upon the expectation of reliable performance.

A specific partnership drew attention where one farmer who works on the seed growth stage, in a better place for this type of activity, supplies the young oysters for finishing on another farm. As he does not have investment capacity, as he is starting the activity, the other mariculturist helps with some investments, mainly structural ones. This relationship is completely informal.

> *In one of the meetings organised by Sebrae (Brazilian Micro and Small Business Support Service), we met. The partnership is doing very well, we are always talking, adjusting, looking at the calendar, and always trying to adjust so that it is comfortable for all sides. It is a big company, and we were impressed with its transparency, with their honesty, and open dialogue, so this was what strengthened our trust between us*

> *the most. And one thing for us is certain, signed paper is worth nothing, what counts is the people's word and we always believed in it. For example, he buys the seed for us, we bring the seed here, plant it, cultivate it and then we sell this seed to him, and this goes down from what he already did in the first place, which was the payment of that seed.* (No. 11 – Mussel Farmer)

"Trust influences organisational behaviour in such ways that organisations having a high level of trust with each other will take more initiative in pursuing new business opportunities and partnerships" (Qu and Yang, 2015). In the interview excerpts above, we can emphasise that the respondent identifies an essential construct that builds trust with their partner, integrity, which encompasses issues related to adherence to principles and consistency of past behaviours, agreeing with Mayer *et al.* (1995). Transparency, information sharing, and effective communication are also highlighted and corroborate the research of Huang (2020) and Joffre *et al.* (2020), which point out that stakeholders aiming to shape senses of identification and trust and strengthen relationships with their partners are suggested to communicate their values with suppliers via frequent interactions and share transparent information and knowledge.

Trust also creates an atmosphere of satisfaction in which mutual knowledge creation can flourish and foster innovation (Bouncken *et al.*, 2020; Delbufalo, 2012; Nyaga *et al.*, 2010). This partnership is an initial trial of a type of vertical integration, a complex structure that is very innovative in this value chain. "A key enabler of most – if not all – SDGs, innovation is the main driver of agricultural and rural transformations" (FAO, 2018). In this sense, innovation refers not only to technologies and practices but also to organisational forms such as public-private partnerships and farmer's cooperatives.

Respondents agreed to the influence of trust in local mariculture sustainability. The environmental aspect of sustainability was not highlighted, the interviewees focused their responses on the social and economic areas, as shown next.

> *I think the three pillars of sustainability depend on this trusting relationship. Social because it is linked to an economic issue. When your economic situation improves, your social condition improves, right? This for me is totally interconnected. The environmental issue is more linked to the cultural issue of the person, having this understanding, right, that they need to have sustainability and support.* (No. 3 – Municipal Inspector)

> *I think that if the mariculture sector learned to work more together, based on trust, based on professionalism, we would benefit there in terms of sustainability, not only environmental but mostly social. The social issue from now on, this cooperative issue, associations, this brings a social gain, it brings a healthy gain.* (No. 12 – Member of producer's association)

Literature often refers to the sustainability of business partnerships citing the stability of these relationships. According to Kwon and Suh (2005) and Yang *et al.* (2008), stability is a consequence of trust. Associated with this, but under a cyclical perspective, Bezuidenhout *et al.* (2012) mention that stability, reliability and trust are three critical components that have mutual influences: stability creates reliability, and reliability generates trust. In accordance with Ostrovsky (2008), an agri-food supply chain is considered a stable system if no supply chain members break their contracts during the supply chain processes and they are optimistic about the condition of the relationship. In our case, what we can clearly realize is that trust positively affects stability in the partnership process, which is in line with Dania *et al.* (2018). Organisations with high levels of trust are more comfortable in building good relationships and putting more effort into ensuring stability than those who operate with a lower level of trust. It opens opportunities that will benefit all parties in collaboration (Nyaga *et al.*, 2010).

When the design of this research was started, we were in the middle of the Covid-19 pandemic and it was considered that invariably the answers would be somehow affected. This situation, added to the fact that crises are common in agri-food supply chains, whether of a climate, economic or supply order, we decided to face this subject and openly address the issue in the interviews.

In the studied mariculture chain, it is common to have periodic red tide crises or shocks, and when this happens, the mariculturists must suspend the sale of molluscs until the algae dissipate. Depending on the duration of this natural phenomenon, considerable economic losses can occur. Below are the most representative segments on this subject.

> *The trust relationship exists, it is important, but it is sustainable to a limit because if this crisis lasts for a long time, it might shake this trust relationship a little, but we always try to strengthen it again.* (No. 2 – Public Manager)

> *I think that trust in times of crisis is very positive. The Azorean, the actor in the chain, and the producer in mariculture have this difficulty in working together, but in times of crisis, we can perceive solidarity. They sympathise a lot because for many this is their*

> *livelihood. From the moment a crisis like the red tide, a seed crisis, the moment the mariculturist sees that the producer on the side is facing a need with serious problem, he must interrupt his production, for example, I believe he tends to show solidarity and not want to bury a competitor*. (No. 14 – Technical Manager)

Initially, a concern about the duration of a crisis is exposed, however, in the same segment, the interviewee recognizes the strengthening of trust, even if only momentarily. The other testimonies reinforce that this strengthening exists and emphasize these statements. Although there is some evidence that trust is weakened in times of crisis, as shown in the work by Van der Cruijsen *et al.* (2016), important research contrasts with this statement. The study by Ervasti *et al.* (2019), for example, shows that when analysing the levels of trust in Greece in the period from 2002 to 2011, during a severe socio-economic crisis, interpersonal trust increased, to the surprise of the authors. Along the same line, Manfredi and Capik (2022) concluded that trust is built in response to the uncertainty of a business environment.

Empathy is mentioned in one of the excerpts and, according to Mayer *et al.* (1995) is considered a construct of trust. One of the reasons listed by de Ervasti *et al.* (2019) is the possibility that shared experiences of nearly overwhelming adversities may increase togetherness among people. Iglič (2014) agrees with this line of thinking when she asserts that the need for mutual help and support arises during crisis periods and strengthens social networks. Trust appears here as an important resilience factor. Solidarity is also mentioned in one of the narratives. According to the work of Delbufalo (2012), it is part of a consequence of trust that is relationism, which in turn, in addition to solidarity itself, also includes flexibility and mutuality. Beyond that, we ponder that the reciprocity of this kind of situation can also be seen from the perspective of the Social Exchange Theory, where there are some social values in exchange.

3.5 Further Discussion

Godfray and Gamett (2014) argue that sustainable intensification is a key factor to achieve food security. SDG 17 deals specifically with partnerships for the goals and advocates the encouragement of multi-stakeholder partnerships and the construction of coherent policies for sustainable development (UN, 2016). In this sense, social sciences are closely related to sustainability, and we need to evolve into knowledge and methods for improving the necessary collaboration between partners. Improvements in these relationships directly influence other SDGs and, regarding food systems, SDG 2 (Zero Hunger) is the most affected.

FAO (2020) explicitly recommends the promotion of trust across value-chain relationships in the field of economic sustainability. Building trust among stakeholders is essential to achieving a stable environment that positively affects supply chain collaboration, and it will generate long-term benefits for the entire system (Yang *et al.*, 2008). The creation and maintenance of stakeholder groups become an important tool for the dissemination of knowledge and technology, and are key corporate platforms for the adoption and dissemination of sustainable practices, both for private and public Services (Joffre *et al.*, 2020). However, this is not an easy task. According to Deka (2020), convincing small farmers to be enrolled as members of organisations and building trust among them is going to be a major hurdle to organising them towards a common goal. For this, management tools are required, both at the strategic and tactical levels.

The organization of the studied supply chain proved to be a fundamental point in our research, as well as the trust and acting of control and promotion organizations. These factors are directly influenced by government representation and deserve attention, as the lack of trust in supply chain linkage, low level of supply chain integration, and the lack of Government policies and regulation support are among the most critical barriers in the food supply management (Jharkharia and Shankar, 2005; Patidar *et al*., 2023).

When the relationship between trust and sustainability was addressed, respondents showed greater interest in highlighting its social and economic aspects but putting in the background the importance of this relationship with the environmental area. These data, in the context of Agri-Food Supply Chain Quality (AFSCQ), especially when approaching constructs related to relationship quality and supply chain integration, corroborate the work of Siddh *et al*. (2022), which did not confirm the hypothesis of the relationship between AFSCQ and environmental sustainability in the Indian context.

Besides being undesirable for the integration of the supply chain, the lack of trust can cause deleterious effects and impair development and economic sustainability. When suppliers are trustworthy and transparent, their customers are willing to pay the premium for good quality products. In addition, since there is no trust between stakeholders, it is necessary to implement more rigid controls, which require more costs for the company. And if this relationship can no longer support itself, partner change may also require complementary and unplanned costs. Lastly, performance and even product quality can be compromised (Fleury et al., 2016; Love *et al*., 2020).

3.6 Conclusions, Policy Implications and Limitations

3.6.1 Conclusions

The results found showed that the studied supply chain needs greater organisation and improvements in the relationships of trust between marine farmers. In some cases, there is a lack of trust among stakeholders, which makes it difficult to appoint leaders and hinders the formation of associations and cooperatives. In this context, the actors have little access to government institutions and the construction of public policies for the sector is compromised.

Cultural aspects emerged spontaneously during the interviews. Although controversial, our results showed that the fact that there was an Azorean colonization in the region, whose individuals have strong traces of individualism, tolerance for uncertainty, and short-term orientation may represent an obstacle to trust building.

In the relationship between companies and control bodies, we could observe the importance of communication and interpersonal trust, so that there is a better understanding of impasses and their resolution.

The Federal University of Santa Catarina is historically an important stakeholder in the chain, as it has for many years provided most oyster seeds for markets and conducted various research initiatives in the area. Because of that, trust in the university was clearly confirmed.

Informal relationships are interpersonal and extremely trust-based. Some factors, such as the locality of the chain, the large presence of family labour, and long-term relations can positively contribute to building trust. In some cases, we could notice that trust was directly related to the reciprocity of social relationships, which leads us to corroborate the Social Exchange Theory.

Regarding inter-organizational trust, when associated with technical and administrative skills, it increases the performance of establishments. In addition, high levels of trust promote the development of innovative structures and create opportunities, contributing to the sustainability of producers and to the chain.

The relationship between trust and sustainability proved more consistent when respondents discussed social and economic sustainability. The interviewees made the connection between the social and economic aspects of sustainability, cited the stability of relationships, and when addressed, environmental sustainability was commented in a superficial way.

When approaching the possible crises that occur in the chain, respondents said that trust increases, even if it is temporary in some cases. Elements such as empathy and the need for help or support are related to this, and trust has been a resilience factor in our study.

Important constructs of trust were identified, such as benevolence, communication, transparency, efficiency, competence, lasting relationship, reputation, knowledge sharing, predictability, information sharing, and integrity. Some outcomes of trust were also found, such as collaboration, commitment, cooperation, information sharing, innovation, integration, operational efficiency, performance, stability, satisfaction, and cost reduction.

The lack of trust between actors, individualism, poor organisation of the studied chain, and low efficiency and unpredictability of suppliers were the negative factors we found that can contribute to decreasing the number of mariculturists. If this number continues to decrease, this will lead to a reduction in the production of molluscs in the region and shrinkage of the chain, and to the concentration of production by a few actors. Both situations can generate undesirable consequences, such as a decline in community income, a decrease in the social and economic development of the region, unfair competition, and a fall in the supply of molluscs, not only in the region but also in the whole country.

3.6.2 Policy Implications

Given the context of this research, the establishment and improvement of policies to organise and professionalise agri-food supply chains are critical. Without neglecting cultural aspects, the organisation of stakeholders promotes relationship strengthening, exchange of information and knowledge, stronger partnerships, and the understanding that together they can enhance the development of the activity and make it sustainable in the long run. Encouraging the creation of associations and cooperatives can also be a good alternative.

When the study of trust is deepened among control and promotion bodies, the public service can better plan their actions, build more effective tactics, and implement efficient operations for local and regional development. In addition, by identifying constructs and outcomes of trust among the private stakeholders, policymakers can design more efficient governance systems that work in both local and regional agri-food supply chains, aiming at better performance, social well-being, food security, and sustainable development.

The results also suggest that the efficiency of control bodies is very important, as they transmit trust to those controlled and facilitate governance in the chain. Meanwhile, being an important agent for promoting local mariculture, the university, which is public, was positioned as a

supplier in the chain, and to obtain inter-organizational trust, it must meet performance and predictability requirements.

The construction of trust with partners consists of a good market strategy, as it directly affects the efficiency of trade. A reliable and transparent relationship adds value to products, and suppliers can market their products for higher and more stable values. For customers who receive the goods, control costs and supplier exchange costs decrease, which further contributes to the economic sustainability of both stakeholders and the chain as a whole.

This work is important for managers, policymakers, and stakeholders, to improve the management, development, and governance of agri-food supply chains. It also can greatly contribute to the knowledge about the sustainability of these structures.

3.6.3 Limitations and Future Research

Because of the Covid-19 pandemic, some actors could not be interviewed in person, hence, some refused to take part in the survey. The time required for the interviews was also a limitation, as some respondents did not have a long time to participate in the study. The present study offered outputs specifically related to the studied supply chain. And even applying a previously elaborated questionnaire, since they were semi-structured interviews, the respondents often avoided the subjects and did not answer some of the questions that were asked. Several variables related to trust were identified, but it was not possible to measure them or test the significance of the relationships found.

Further research could be carried out in this field of study, to not only deepen the topic but also to specifically assess trust relationships between producers and control bodies and trust in times of crisis within agri-food supply chains. Conducting qualitative research in other agri-food supply chains would be important, in order to expand the sample of this study and to make comparisons possible. Quantitative assessments on the topic should also be considered, with a view to exploring factors that can influence this driver within agri-food supply chains, as well as confirming models and paths between the possible variables.

Acknowledgements

We acknowledge the interviewees for being available to participate in this research.
We acknowledge the CFAGE and CETRAD for supporting this research.
We thank the editors and reviewers for contributing to the necessary improvements to the article.

We are grateful for the work of the proof-reader of this article, Mr Marcel Milcent.

References

Aggarwal, S. and Srivastava, M. K. (2016), "Towards a grounded view of collaboration in Indian agri-food supply chains: a qualitative investigation", *British Food Journal*, Vol. 118, No. 5, pp. 1085-1106.

Aitalieva, N. R. (2018), "Bureaucracy and Public Trust", *Global Encyclopedia of Public Administration, Public Policy, and Governance,* Vol 10, pp. 3.

Alshurideh, M., Kurdi, B., Alzoubi, H., Obeidat, B., Hamadneh, S., and Ahmad, A. (2022), "The influence of supply chain partners' integrations on organizational performance: The moderating role of trust", *Uncertain Supply Chain Management*, Vol. 10, No. 4, pp.1191-1202.

Amentae, T. K., Gebresenbet, G. and Ljungberg, D. (2018), "Examining the interface between supply chain governance structure choice and supply chain performances of dairy chains in Ethiopia", *International Food and Agribusiness Management Review*, Vol. 21, pp. 1061-1082.

Assis, M. T., Lucas, M. R., and Rainho, M. J. M. (2022), "A meta-analysis on the trust in agri-food supply chains". *Food Frontiers*, Vol. 3, No. 3, pp. 413-427.

Baah, C., Acquah, I. S. K., and Ofori, D. (2022), "Exploring the influence of supply chain collaboration on supply chain visibility, stakeholder trust, environmental and financial performances: a partial least square approach", *Benchmarking: An International Journal*, Vol. 29 No. 1, pp. 172-193.

Barraud-Didier, V., Henninger, M. C. and El Akremi, A. (2012), "The relationship between member's trust and participation in governance of cooperatives: The role of organizational commitment", *International Food and Agribusiness Management Review*, Vol. 15, No. 1, pp. 1-24.

Bezuidenhout, C. N., Bodhanya, S. and Brenchley, L. (2012), "An analysis of collaboration in a sugarcane production and processing supply chain", *British Food Journal*, Vol. 114, No. 6, pp. 880-895.

Bouncken, R. B., Hughes, M., Ratzmann, M., Cesinger, B. and Pesch, R. (2020), "Family firms, alliance governance and mutual knowledge creation", *British Journal of Management*, Vol. 31 No. 4, pp. 769-791.

Camargo, B. V., and Justo, A. M. (2013). "Tutorial para uso do software de análise textual IRAMUTEQ". *Florianópolis: Universidade Federal de Santa Catarina*, pp. 1-18.

Çerri, S. (2012), "Exploring factor affecting trust and relationship quality in a supply chain context", *Journal of Business Studies Quarterly*, Vol. 4 No. 1, pp. 74.

Cheung, S. O., Wong, W. K., Yiu, T. W. and Pang, H. Y. (2011), "Developing a trust inventory for construction contracting", *International Journal of project management*, Vol. 29, No. 2, pp. 184-196.

Chlebicka, A. (2015), "Producer Organizations in Agriculture-Barriers and Incentives of Establishment on the Polish Case", *Procedia economics and finance*, Vol. 23, pp. 976-981.

Chowdhury, P. P. (2012), "Antecedents and consequences of trust and commitment in B2B relationship: A review of literature", *Focus*, Vol. 4, No. 2, 49-63.

Chu, P., Chang, K. and Huang, H. (2012), "How to increase supplier flexibility through social mechanisms and influence strategies?", *Journal of Business & Industrial Marketing*, Vol. 27, No. (2), pp. 115-131.

Connelly, B. L., Crook, T. R., Combs, J. G., Ketchen Jr, D. J., and Aguinis, H. (2018). "Competence-and integrity-based trust in interorganizational relationships: Which matters more?". *Journal of Management*, Vol. 44, No. 3, pp. 919-945.

Cook, K. S., Cheshire, C., Rice, E. R. and Nakagawa, S. (2013), "Social exchange theory", *Handbook of social psychology*, Springer, Dordrecht, NE.

Cropanzano, R., Anthony, E. L., Daniels, S. R. and Hall, A. V. (2017), "Social exchange theory: A critical review with theoretical remedies", *Academy of management annals*, Vol. 11, No. 1, pp. 479-516.

Dania, W. A. P., Xing, K. and Amer, Y. (2018), "Collaboration behavioural factors for sustainable agri-food supply chains: A systematic review", *Journal of cleaner production*, Vol. 186, pp. 851-864.

Deka, N., Goswami, K., Thakur, A. S. and Bhadoria, P. B. S. (2020), "Are farmer producer companies ready to behave as business entities? Insights from the vegetable-based farmer companies in West Bengal, India", *International Journal of Agricultural Sustainability*, Vol. 18, No. 6, pp. 521-536.

Delbufalo, E. (2012), "Outcomes of inter-organizational trust in supply chain relationships: a systematic literature review and a meta-analysis of the empirical evidence", *Supply Chain Management*, Vol. 17, No. 4, pp. 377-402.

Dlamini-Mazibuko, B. P., Ferrer, S. and Ortmann, G. (2019), "Examining the farmer-buyer relationships in vegetable marketing channels in Eswatini", *Agrekon*, Vol. 58, No. 3, pp. 369-386.

EPAGRI – Empresa de Pesquisa Agropecuária e Extensão Rural de Santa Catarina (2021), *Infoagro. Produção de moluscos em 2020*, avaiable at: https://www.infoagro.sc.gov.br/index.php/safra/producao-animal-2 (accessed July 11, 2022).

Ervasti, H., Kouvo, A. and Venetoklis, T. (2019), "Social and institutional trust in times of crisis: Greece, 2002–2011", *Social Indicators Research*, Vol. 141, No. 3, pp. 1207-1231.

Fawcett, S. E., Jones, S. L. and Fawcett, A. M. (2012), "Supply chain trust: The catalyst for collaborative innovation" *Business Horizons*, Vol. 55, No. 2, pp. 163-178.

Fawcett, S., Fawcett, A., Jin, Y. and Magnan, G. (2017), "I know it when I see it: the nature of trust, trustworthiness signals, and strategic trust construction", *International Journal of Logistics Management,* Vol. 28, No. 4, pp. 914-938.

Fleury, P., Lev, L., Brives, H., Chazoule, C., and Désolé, M. (2016). Developing mid-tier supply chains (France) and values-based food supply chains (USA): A comparison of motivations, achievements, barriers and limitations. *Agriculture*, Vol 6, No. 3, pp. 1-13.

Florianópolis (2021), "História", available at: http://www.pmf.sc.gov.br/entidades/turismo/index.php?cms=historia (accessed may 10, 2022).

Food and Agriculture Organization of the United Nations (FAO), (2018), "Transforming food and agriculture to achieve the SDGs. 20 interconnected actions to guide decision-makers", FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO), (2020), "The State of World Fisheries and Aquaculture 2020. Sustainability in action", FAO, Rome.

Gill, P., Stewart, K., Treasure, E., and Chadwick, B. (2008). "Methods of data collection in qualitative research: interviews and focus groups". *British dental journal*, Vol. 204, No. 6, pp. 291-295.

Ghosh, A. and Fedorowicz, J. (2008), "The role of trust in supply chain governance", *Business Process Management Journal*, Vol. 14, No. 4, pp. 453-470.

Godfray, H. C. J. and Garnett, T. (2014), "Food security and sustainable intensification", *Philosophical transactions of the Royal Society B: biological sciences*, Vol. 369, pp. 20120273.

Han, W., Huang, Y., Hughes, M. and Zhang, M. (2021), "The trade-off between trust and distrust in supply chain collaboration", *Industrial Marketing Management*, Vol. 98, pp. 93-104.

Higuchi, A., Coq Huelva, D., Arias Gutiérrez, R. and Alfalla Luque, R. (2020), "Farmer satisfaction and cocoa cooperative performance: evidence from Tocache, Peru", *International Food and Agribusiness Management Review*, Vol. 23, No. 2, pp. 217-234.

Huang, C. C. (2020), "Cocreating social innovations between an agro-food company and rice farmers in Taiwan: exploring the process mechanisms", *British Food Journal*, Vol. 122, No. 12, pp. 3837-3851.

Iglič, H. (2014), "The crumbling or strengthening of social capital? The economic crisis' impact on social networks and interpersonal trust in Slovenia", *Družboslovne razprave*, Vol. 30, No. 77, pp. 7-26.

Jharkharia, S., and Shankar, R. (2005). IT-enablement of supply chains: understanding the barriers. *Journal of Enterprise Information Management*, Vol. 18, No. 1, pp. 11-27.

Joffre, O. M., De Vries, J. R., Klerkx, L., and Poortvliet, P. M. (2020). "Why are cluster farmers adopting more aquaculture technologies and practices? The role of trust and interaction within shrimp farmers' networks in the Mekong Delta, Vietnam". *Aquaculture*, Vol. 523, No.735181, pp. 1-11.

Kwon, I. W. G. and Suh, T. (2004), "Factors affecting the level of trust and commitment in supply chain relationships", *Journal of supply chain management*, Vol. 40, No. 1, pp. 4-14.

Kwon, I. W. G. and Suh, T. (2005), "Trust, commitment and relationships in supply chain management: a path analysis", *Supply chain management: an international journal*, Vol. 10, No. 1, pp. 26-33.

Lahlou, S. (2001), "Text mining methods: an answer to Chartier and Meunier", *Papers on Social Representations*, Vol. 20, No. 38, pp. 1-7.

Lang, J. T. (2013), "Elements of public trust in the American food system: Experts, organizations, and genetically modified food", *Food Policy*, Vol. 41, pp. 145-154.

Love, D. C., Lane, R. M., Kuehl, L. M., Hudson, B., Harding, J., Clancy, K., and Fry, J. P. (2020). "Performance and conduct of supply chains for United States farmed oysters". *Aquaculture*, Vol. *515*, No.734569, pp 1-20.

Manfredi, E., and Capik, P. (2022), "A case of trust-building in the supply chain: Emerging economies perspective", *Strategic Change*, Vol. 31, No. 1, pp. 147-160.

Marlowe, J. (2004), "Part of the solution or cogs in the system?: The origins and consequences of trust in public administrators", *Public Integrity*, Vol. 6, No. 2, pp. 93-113.

Mayer, R. C., Davis, J. H. and Schoorman, F. D. (1995), "An integrative model of organizational trust", *Academy of management review*, Vol. 20, No. 3, pp. 709-734.

Mount, P. (2012), "Growing local food: scale and local food systems governance", *Agriculture and Human Values*, Vol. 29, No. 1, pp. 107-121.

Nakandala, D., Smith, M. and Lau, H. (2020), "Shared power and fairness in trust-based supply chain relationships in an urban local food system", *British Food Journal*, Vol. 122, No. 3, pp. 870-883.

Ndubisi, N. O. (2011), "Conflict handling, trust and commitment in outsourcing relationship: A Chinese and Indian study", *Industrial Marketing Management*, Vol. 40, No. 1, pp. 109-117.

Nyaga, G. N., Whipple, J. M. and Lynch, D. F. (2010), "Examining supply chain relationships: do buyer and supplier perspectives on collaborative relationships differ?", *Journal of operations management*, Vol. 28, No. 2, pp. 101-114.

Ostrovsky, M. (2008), "Stability in supply chain networks", *American Economic Review*, Vol. 98, No. 3, pp. 897-923.

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice*. Sage publications.

Paiva, E. L., Teixeira, R., Vieira, L. M. and Finger, A. B. (2014), "Supply chain planning and trust: two sides of the same coin", *Industrial Management & Data Systems*, Vol. 114, No. 3, pp. 405-420.

Paluri, R.A. and Mishal, A. (2020), “Trust and commitment in supply chain management: a systematic review of literature”, *Benchmarking: An International Journal,* Vol. 27, No. 10, pp. 2831-2862.

Panahifar, F., Byrne, P. J., Salam, M. A. and Heavey, C. (2018), “Supply chain collaboration and firm’s performance: the critical role of information sharing and trust”, *Journal of Enterprise Information Management*, Vol. 31, No. 3, pp. 358-379.

Patidar, S., Shukla, A.C. and Sukhwani, V.K. (2022), "Food supply chain management (FSCM): a structured literature review and future research agenda", *Journal of Advances in Management Research*, Vol. 19, No. 2, pp. 272-299.

Patidar, S., Sukhwani, V. K., and Shukla, A. C. (2023). “Critical barriers od food supply chain management and application of blockchain technology to mitigate their impacts”, *International Journal of Industrial Engineering,* Vol. 30, No 1, pp. 189-202.

Pomponi, F., Fratocchi, L. and Tafuri, S. R. (2015), “Trust development and horizontal collaboration in logistics: a theory based evolutionary framework”, *Supply Chain Management: An International Journal*, Vol. 20, No. 1, pp. 83-97.

Qu, W. G. and Yang, Z. (2015), “The effect of uncertainty avoidance and social trust on supply chain collaboration”, *Journal of Business Research*, Vol. 68, No. 5, pp. 911-918.

Revilla, E., and Knoppen, D. (2015). “Building knowledge integration in buyer-supplier relationships: The critical role of strategic supply management and trust”. *International Journal of Operations & Production Management*, Vol. 35, No. 10, pp. 1408-1436.

Roy, H., Hall, C. M. and Ballantine, P. W. (2017), “Trust in local food networks: The role of trust among tourism stakeholders and their impacts in purchasing decisions”, *Journal of Destination Marketing & Management*, Vol. 6, No. 4, pp. 309-317.

Sahay, B. S. (2003), “Supply chain collaboration: the key to value creation”, *Work study*, Vol. 52, No. 2, pp. 76-83.

Schrobback, P., and Rolfe, J. (2021). “Methodological and ideological options exploring supply chain models for Sydney rock oysters”, *Aquaculture*, Vol. 534, pp. 1-10.

Shiferaw, B., Hellin, J. and Muricho, G. (2011), “Improving market access and agricultural productivity growth in Africa: what role for producer organizations and collective action institutions?”. *Food Security*, Vol. 3, No. 4, pp. 475-489.

Siddh, M. M., Kumar, S., Soni, G., Jain, V., Chandra, C., Jain, R.,... and Kazancoglu, Y. (2021). "Impact of agri-fresh food supply chain quality practices on organizational sustainability". *Operations Management Research*, Vol. 15, pp. 146-165.

Silverman, D. (2013). *Doing qualitative research: A practical handbook*. SAGE publications limited.

Souza, M. A. R. D., Wall, M. L., Thuler, A. C. D. M. C., Lowen, I. M. V. and Peres, A. M. (2018), "The use of IRAMUTEQ software for data analysis in qualitative research", *Revista da Escola de Enfermagem da USP*, Vol. 52, pp 1-7.

Suplicy, F. M. (2019), "Plano Estratégico para o Desenvolvimento Sustentável da Maricultura Catarinense (2018-2028)", unpublished manuscript, Epagri, Florianópolis/SC, BR.

Suplicy, F. M. (2020). "A review of the multiple benefits of mussel farming". *Reviews in Aquaculture*, Vol. 12, No. 1, pp. 204-223.

Suplicy, F. M. and Novaes, A. L. T. (2015), "Caracterização socioeconômica da maricultura catarinense e perspectivas para o futuro deste setor", *Panorama da Aquicultura,* Vol. 25, No. 150, pp. 38-43.

Teixeira, F. R., Paisana, A., Vieira, F. D. and Mayr, L. R. (2017), "Contribuição do estudo das características culturais do cluster da malacocultura da grande Florianópolis para a gestão das atividades de turismo na região", *Turismo - Visão e Ação*, Vol. 19, No. 1, pp. 5-30.

Tejpal, G., Garg, R.K. and Sachdeva, A. (2013), "Trust among supply chain partners: a review", *Measuring Business Excellence*, Vol. 17, No. 1, pp. 51-71.

Thorsøe, M. H. (2015), "Maintaining trust and credibility in a continuously evolving organic food system", *Journal of Agricultural and Environmental Ethics*, Vol. 28, No. 4, pp. 767-787.

United Nations (UN), (2016), "Transforming our world: The 2030 agenda for sustainable development", available at: https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E (accessed November 13, 2021).

Van der Cruijsen, C., de Haan, J. and Jansen, D. J. (2016), "Trust and financial crisis experiences". *Social Indicators Research*, Vol. 127, No. 2, pp. 577-600.

Wu, M. Y., Weng, Y. C. and Huang, I. C. (2012), “A study of supply chain partnerships based on the commitment-trust theory”, *Asia Pacific Journal of Marketing and Logistics*, Vol. 24, No. 4, pp. 690-707.

Wu, L., Chuang, C. H. and Hsu, C. H. (2014), “Information sharing and collaborative behaviours in enabling supply chain performance: A social exchange perspective”, *International Journal of Production Economics*, Vol. 148, pp. 122-132.

Yang, J., Wang, J., Wong, C. W. and Lai, K. H. (2008), “Relational stability and alliance performance in supply chain”, *Omega*, Vol. 36, No. 4, pp. 600-608.

Zhang, M. and Huo, B. (2013), "The impact of dependence and trust on supply chain integration", *International Journal of Physical Distribution & Logistics Management*, Vol. 43, No. 7, pp. 544-563.

Appendix 3.1 - Interview Design

Prior to conducting and scheduling the interviews, contact with the known individuals will be made personally or by telephone, so to verify their availability. The interviews must be scheduled and shall take place at the interviewee's preferred location. The interviewer must be the PhD student himself.

Considering the level of knowledge on the topics covered by the respondents, a simple and more succinct language should be used.

In the interview, an introduction shall be performed, presenting the interviewer, the basic information on the research developed and how the data is to be used. The interview process, the confidentiality of the data, and the interview video-recording authorization must be presented to the interviewee.

Follows, the script with the intended questions.

Part 1 – Firstly, I would like us to talk about your organization:

- The present interview begins with Mr. or Mrs. ..... who works in ..... and occupies the position of ....
- Briefly, how does the company/association work in institutional terms? Is there a steering board? A President? Who makes the strategic decisions? And defines the day-to-day operational?
- Is there any form of organization among the actors in this supply chain?
- Is there any leadership in the studied chain?

Part 2 - Now I would like to address the relationships of trust between parties in creating and maintaining trade relations:

- How were the partners in the supply chain found?
- What is the bond between partners (formal, informal)? Are these long-lasting bonds?
- In your opinion, how can trust contribute towards good relationships between partners?
- In your opinion, how do you build a relationship of trust?
- What are the defining factors for a company to rely further or less in another?
- Was there a break from any business relationship? What were the reasons?

Part 3 - Now, regarding the role of trust between partners in the performance of the supply chain:

- Do you think trust in some way influences the logistics efficiency of the supply chain?
- Does trust in any way influence the quality of the company's products?
- Do you think it influences the company's profitability in any way?

- And when making investments, trust between your organization and your partners influences somehow?
- As a whole, how do you think trust between partners impacts governance and the commercial environment in the supply chain?

Part 4 - I would like to specify the relationship of trust between your organization and the control and inspection bodies:
- Do you think it exists or should there be trust in the relationship between your organization and the control and inspection bodies?
- Does your organization trust these organs?
- And on the contrary, do you think these organs trust your organization?

Part 5 - It's almost there, let's talk about sustainability and crisis. On the role of trust in the sustainability of your organization and the supply chain as a whole:
- Do you think trust between partners influences the economic sustainability of your organization? What about the chain as a whole?
- And in social sustainability, both in your organization and throughout the chain, do you perceive this kind of influence?
- What about environmental sustainability, also in both situations?

Part 6 - To finish the interview, I would like to address the role of trust in crisis:
- Do you think trust is important for the company/institution and the supply chain in times of crisis?
- In your opinion, is there any difference between the relationships of trust in a time of crisis and in the absence of crisis? If there are, what are these differences?
- What was the last crisis your organization had?
- Do you think trust between partners has somehow directed the decisions made during that crisis?

Thank you very much for your collaboration!

Supplementary material - Thematic analysis

Through the Descending Hierarchical Classification (DHC), the profiles of each class were obtained, containing the most representative words of each cluster as well as the chi-square and "p" values. In table 3.1, the values related to classes 1 and 2 are shown, and in table 3.2 are displayed the values corresponding to the classes 3 and 4.

Class 1				**Class 2**			
Starting point 33.26% - 146 TS				Starting point 19.13% - 84 TS			
Word	***f***	X^2	**p**	**Word**	***f***	X^2	**p**
sell	16	23.23	<0.0001	inspection	20	67.62	<0.0001
personal	17	11.44	0.00071	inspector	10	28.91	<0.0001
old	7	10.8	0.00101	service	10	25.56	<0.0001
fishermen	7	10.8	0.00101	inspect	9	24.88	<0.0001
people	25	10.3	0.00133	public	12	22.62	<0.0001
time	15	8.54	0.00347	close	5	21.37	<0.0001
see	22	8.48	0.00359	tm	5	21.37	<0.0001
future	7	8.2	0.00417	trade	6	20.38	<0.0001
thinking	4	8.1	0.00442	control	16	18.57	<0.0001
relationship	4	8.1	0.00442	license	4	17.06	<0.0001
end	4	8.1	0.00442	state	4	17.06	<0.0001
history	4	8.1	0.00442	communicate	4	17.06	<0.0001
continue	4	8.1	0.00442	quality	9	16.76	<0.0001
talk	4	8.1	0.00442	official	5	16.2	<0.0001
need	11	7.88	0.00499	product	13	12.19	0.00048
cooperative	11	7.88	0.00499	industry	5	9.9	0.00164
feud	5	6.87	0.00875	resource	5	9.9	0.00164
leadership	5	6.87	0.00875	understand	6	9.14	0.00249
family	3	6.06	0.01381	trust	9	9.06	0.00261
political	3	6.06	0.01381	formalised	3	8.14	0.00432

TS = test segments; X^2 = chi-square; *f* = frequency of the words; tm = technical manager.

Table 3.1 - Profile of classes 1 and 2.

The most representative words of class 1, which had the highest number of TS, have not very high chi-square values and high p-values (sell: $X^2 = 23.23$, p<0.0001; personal: $X^2 = 11.44$, p =

0.00071; old: X^2 = 10.8, p = 0.00101; fishermen: X^2 = 10.8, p = 0.00101; people: X^2 = 10.3, p = 0.00133), if compared to the other classes, and denotes that these terms have a lower relationship among them and are not very representative. Its theme is somewhat generic, addressing the relationships between mariculturists and how they have organized themselves over time. In class 2, which had the lowest amount of TS, the chi-square values are higher and p-values lower (inspection: X^2 = 67.62, p<0.0001; inspector: X^2 = 28.91, p<0.0001; service: X^2 = 25.56, p<0.0001; inspect: X^2 = 24.88, p<0.0001; public: X^2 = 22.62, p<0.0001) demonstrating a greater relationship among the most significant words. The most expressive theme in class 2 is related to the inspection of products and the control bodies that carry out inspections.

Class 3				**Class 4**			
Starting point 26.42% - 116 TS				Starting point 21.18% - 93 TS			
Word	***f***	***X²***	**p**	**Word**	***f***	***X²***	**p**
oyster	30	68.77	<0.0001	relationship	36	66.9	<0.0001
water	13	37.3	<0.0001	trust	46	51.34	<0.0001
university	11	27.01	<0.0001	informal	14	36.0	<0.0001
research	11	27.01	<0.0001	group	8	30.32	<0.0001
meeting	13	25.67	<0.0001	sector	13	24.09	<0.0001
sea	9	25.58	<0.0001	strengthen	6	22.63	<0.0001
mollusc	9	25.58	<0.0001	actor	6	22.63	<0.0001
monitoring	9	21.27	<0.0001	commercial	9	21.4	<0.0001
seed	10	17.57	<0.0001	logistic	5	18.82	<0.0001
committee	7	15.63	<0.0001	bureaucracy	5	18.82	<0.0001
laboratory	8	1511	0.00010	informality	5	18.82	<0.0001
collection	5	14.08	0.00017	social	9	18.52	<0.0001
region	5	14.08	0.00017	environmental	8	17.95	<0.0001
mussel	5	14.08	0.00017	crisis	7	17.63	<0.0001
structure	7	12.46	0.00041	professionalization	4	15.02	0.00010
origin	4	11.24	0.00080	bond	7	14.6	0.00013
mapa	4	11.24	0.00080	develop	3	11.24	0.00080
mariculture	14	10.69	0.00107	azorean	4	10.48	0,00120
epagri	5	10.13	0.00145	entrepreneur	4	10.48	0.00120
demand	5	10.13	0.00145	sustainability	7	10.2	0.00140

TS = test segments; X^2 = chi-square; *f* = frequency of the words; mapa = Ministry of Agriculture, Livestock an Food Supply; epagri = Agricultural Research and Rural Extension Company of the State of Santa Catarina.

Table 3.2 - Profile of classes 3 and 4.

In class 3, as in class 2, we can see a good relationship among the main words, especially because of the high chi-squares (oyster: $X^2 = 68.77$, $p<0.0001$; water: $X^2 = 37.3$, $p<0.0001$; university: $X^2 = 27.01$, $p<0.0001$; research: $X^2 = 27.01$, $p<0.0001$; meeting: $X^2 = 25.67$, $p<0.0001$) and the theme of this cluster refers to the development of mollusc production in the studied region. And class 4 is the most representative, presenting the highest chi-square values in the main words and the lowest p-values (relationship: $X^2 = 62.07$, $p<0.0001$; trust: $X^2 = 51.34$, $p<0.0001$; informal: $X^2 = 36.0$, $p<0.0001$; group: $X^2 = 30.32$, $p<0.0001$; sector: $X^2 = 24.09$, $p<0.0001$). This cluster specifically deals with the trust relationships among the actors in the studied value chain.

Chapter 4

The Influence of Informality in a Local Agri-food Supply Chain in Brazil

4- The Influence of Informality in a Local Agri-food Supply Chain in Brazil

Abstract

Informal businesses are persistent worldwide and influence local and regional economies, especially in developing countries. Allied to that, the agriculture sector presents itself as an important factor for the informal economy, mainly due to specificities regarding types of work, such as family labour, temporary jobs and others. Nevertheless, informality can cause undesirable consequences for sustainable development. Fieldwork data from broader qualitative research studied trust between the stakeholders of a local agri-food supply chain located in southern Brazil. The topic of informality emerged spontaneously in 9 of the 15 in-depth interviews. In evaluating the data, we found that informality is prevalent in the Brazilian supply chain. It hinders the organization of the activity, and there is a correlation between the level of education of entrepreneurs with the size and legalization of their business. We also found factors that can favour this informal status, such as the lack of adequate supervision and cultural aspects. Further research needs to be carried out in order to collect more data on the subject, as well as to find possible ways to tackle the problem from an organizational point of view.

Keywords: informality; supply chain; governance; agri-food; sustainability.

This paper was published in the EuroChoices Journal. The reference is: Assis, M. T., Tümpel, M., Lucas, M. R., & Rainho, M. J. M. (2023). The Influence of Informality in a Local Agri-food Supply Chain in Brazil. *EuroChoices*, *22*(1), 37-43 (DOI: 10.1111/1746-692X.12385).

4.1 Background

The informal economy or what has been variously called the 'off-the-books', 'undeclared', 'shadow', 'cash-in-hand' or 'hidden' sector, has been defined as, 'the paid production and sale of goods and services unregistered by or hidden from the state for tax and/or benefit purposes' (Williams and Nadin, 2010). The agricultural sector is usually one of the main drivers of the informal economy, due to some specific work types, such as family labour, seasonal jobs, work for domestic consumption and product exchange, sale of products in local markets without receipts, cooperative help and part-time work. Because of these peculiarities, informality in agriculture is difficult to measure, and researchers have been striving to estimate the number of informal workers in this sector (Morkunas, 2022; Schneider *et al.*, 2019).

Data from the International Labour Organization - ILO (2018) show the prevalence of informal jobs and informal entrepreneurs: at the global level, including agriculture, informal employees represent 39,7 per cent and informal entrepreneurs represent 83.1 per cent. In emerging and developing countries, informality rates are higher, with rates of 49.7 per cent (employees) and 84.5 per cent (entrepreneurs), against 10.2 per cent (employees) and 61.8 per cent (entrepreneurs) in developed countries. According to ILO, "informal entrepreneurs refer to employers and own-account workers in the informal sector".

Informality promotes insecurity regarding labour rights, social security rights and is often related to precarious working conditions. Moreover, informal producers have difficulties in participating in governmental purchases and in obtaining loans (Silva *et al*., 2022). Williams and Nadin (2010) state that the informal economy is extensive, enduring and expanding in many regions. From a modernization perspective, the authors refute the theory of informal entrepreneurship as some disappearing 'minor remnant' and they highlight new theories explaining 'its persistence and growth'. This explanation had already been reported in the 1990s, and continues to be confirmed, according to the reports of Schneider *et al.* (2019), who point out that agricultural informality in EU-15 countries increased over the analysed period, from 11.99 per cent in 1996 to 13.51 per cent of GVA (Gross Value Added) in 2019.

Informality occurs at many levels in business, from self-employed peddlers to large scale commercial enterprises, but tends to be unproductive and inefficient. Informal markets struggle to become formal due to a lack of suitable government regulation and one of the greatest perceived obstacles is the lack of access to finance. Informal entrepreneurs are typically low-skilled and rather unproductive, and their businesses usually result in low quality and low added value products that are marketed to low-income consumers. (La Porta and Shleifer, 2014).

The exact indices of informality in the Brazilian agri-food sector are unknown. Silva *et al*. (2022) estimate that only 5 per cent of food producers are properly legalized, in terms of only the number of producers and not the volume of food produced. In the Mariculture chain of the Greater Florianópolis region, Santa Catarina State, Brazil, these informality rates are probably also high. This damage supply chain governance and is a potential risk to public health, while constituting unfair competition with properly formalized producers. In Brazil, it is usual to call informal business 'clandestine', especially in the agri-food area.

4.2 Case study: the maricultural industry in Brazil

In 2020, the production of molluscs in the State of Santa Catarina (mussels, oysters and scallops) was 16,252 tons., which represented 97.9 per cent of the Brazilian production of these species. Nevertheless, despite the fact that the annual production volume varied significantly in the last decade, the number of registered mariculturists is declining, reaching the lowest level historically in 2020, with only 478 producers, compared to 683 in 2011, a decrease of 30 per cent in a decade (Epagri, 2021). These data are presented in Figure 4.1 and suggest a deficiency in the social and economic sustainability of the activity.

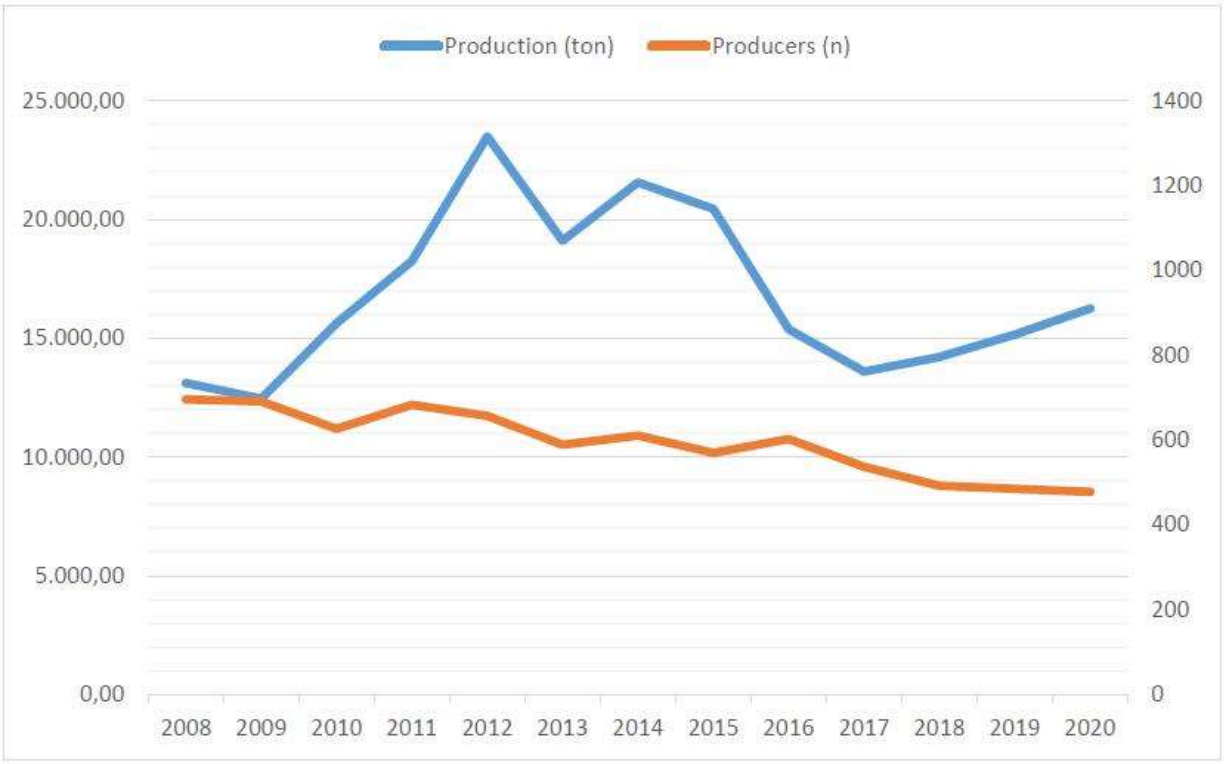


Figure 4.1 - Evolution of production and number of mollusc producers in the State of Santa Catarina – Brazil. Data source: Epagri, 2021.

This case study report aims to present some data obtained in interviews with stakeholders of the supply chain, reporting on the level of informality in that chain and the connexion of this issue to the development and sustainability of the activity in that region.

4.3 Methodology

The data in this report were extracted from more comprehensive research on trust relationships between stakeholders of agri-food supply chains. Initially, it comprised 15 semi-structured interviews with stakeholders (10 men and 5 women), from a local agri-food supply chain producing bivalve molluscs in the Great Florianópolis region, State of Santa Catarina, southern Brazil (Figure 4.2).

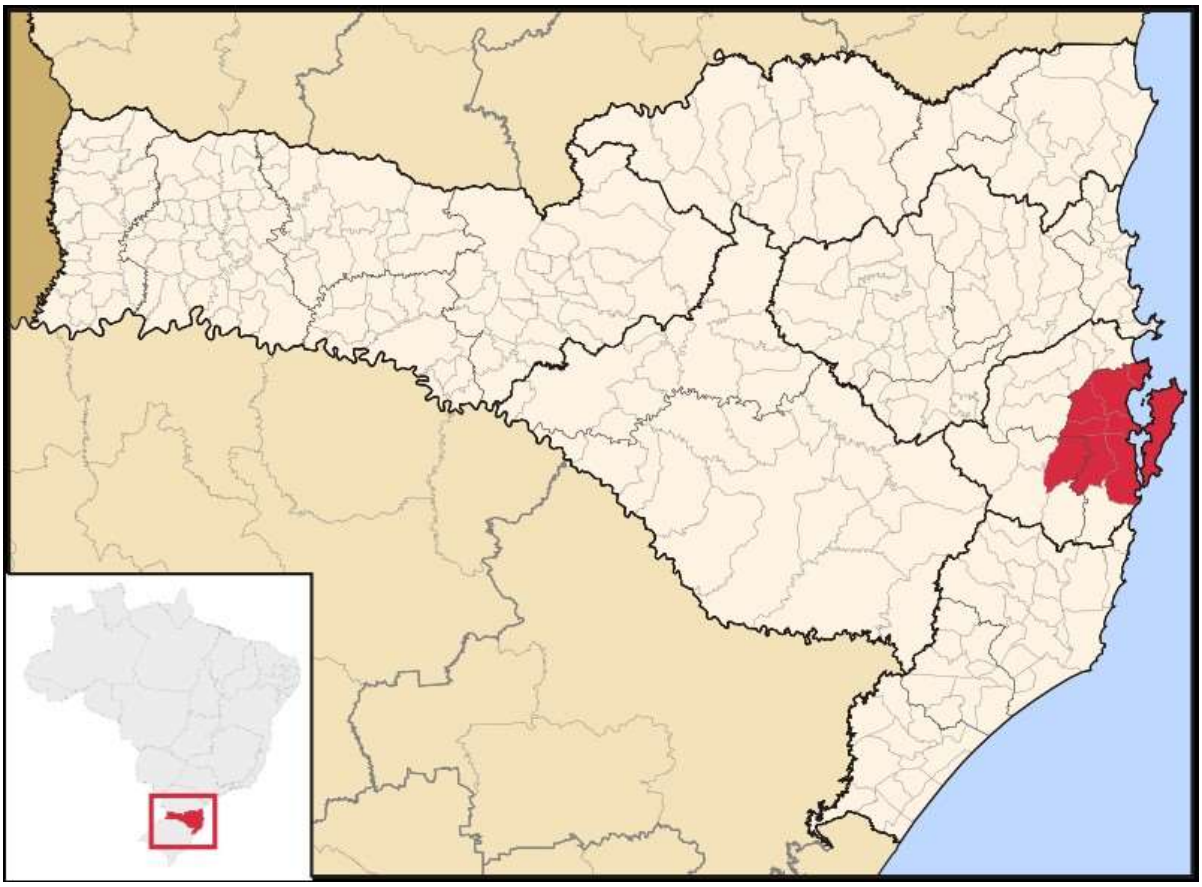


Figure 4.2 - Metropolitan region of Florianópolis, state of Santa Catarina – Brazil. Source: Raphael Lorenzeto de Abreu, via pt.wikipedia.org.

After identifying some key actors in the supply chain, we asked them to suggest other important stakeholders. We talked with actors within the various stages in the chain, with the aim of collecting different points of view, both local and systemic. Many types of actors participated in the interviews, including mariculturists, employees of municipal and federal inspection services, extension researchers, a consultant, a technical manager, members of producer associations, a member of the public prosecution service, and a public sector manager.

The interviews took place in person or by video in 2021. Questions were asked according to a previously defined guide to seek data on the role of trust among stakeholders. During the in-depth interview process, we covered the following topics: the creation and maintenance of business relationships; the performance of the company and the supply chain; the sustainability of the company and the supply chain; and the impact of crises. The interviews were digitally recorded and transcribed, and the transcripts were analysed on a thematic and narrative basis, using Iramuteq software (Version 0.7 Alpha 2 of 11/05/2020). Through Descending Hierarchical Classification (DHC), the content was categorised into four classes, in which class 2, with 84 text segments (19.13% of the total text segments), was related to the inspection of products and the control bodies that carry out inspections.

4.4 What our study found

During the interviews, the subject of informality in production and trade of molluscs emerged spontaneously; 9 of the 15 interviewees referred to this issue as a problem for the development and sustainability of the supply chain. Most comments relate to the negative impact of informality in the organization of the supply chain. In addition, unfair competition and insufficient inspection are also pointed out. The following are the main excerpts of the interviewees who spontaneously addressed these issues.

> *Regarding governance, I think it varies a lot because there are people at the front of the chain who are already legalized, ..., and there are people who are still clandestine and sell in the informal market. And there is a certain rift between them because, while everyone is selling and there is a market for everyone, they are doing it in a way that competes with them (the legalised group). (*employee of the municipal inspection service)

> *So, I think this understanding is mainly there in the third part of the chain (clandestine) which is complicated and ends up harming those who are formalized, those who cultivate and the industry, and it ends up compromising the entire chain, because that harms the entire organization of the chain. Clandestine is the big problem in the chain.* (employee of the federal inspection service)

> *In my view, everything revolves around that. If you are regularized, you have the strength to demand that the State do this or do that, you can go to a discussion table and talk. (*consultant)

In addition to segregating formal and informal activities, it was suggested that there is a feud between these two groups that make good governance difficult, implicitly addressing the subject of unfair competition.

> *I think the big issue of the organization is that the chain is kind of divided between establishments registered with the Federal Inspection Service (SIF), where the cultural level of the owners is very different from the rest of the chain. These consist of those humbler people who are natives who already cultivated something, and the people of SIF who have an academic background, already have a knowledge of sustainability, and a notion of responsibility over the food they are producing, and of critical issues, so I see the chain as very divided. (*employee of the federal inspection service)

Another aspect was pointed out by a professional who works in a company with the Federal Inspection Service, emphasizing the high level of education of the owners of establishments.

> *Those who decide to start a business and really do it right run into competition with the clandestine sector, with lower, much lower costs, and, in fact, there is no good supervision of the clandestine trade, while the supervision is not efficient despite having already had some operations of the pulled group by the State Public Prosecutor's Office. This does not have the frequency, intensity, disclosure, and adequate punishment to really curb it. So, this is very discouraging for those who try to do the right thing, because when they decide to do the right thing, they are immediately inspected with much greater inspection over their entire operation and if they go underground, there is no inspection at all, they can sell cheaper, right? So, this is a problem, this issue. Today we do not have reliable data on the percentage of producers who work clandestinely. (*extension researcher)

> *I think it needs inspection, the producers are really seeing this, but they have to make it work for everyone, not for one or two or three, to do the right thing. So, I think there is a lack of inspection in a correct way, of all the mariculturists, all of them, and not only one or two. (...) Unfortunately, we know that this happens. (*member of producer's association)

> *If everyone worked within the legislation, I think that companies would see the inspection bodies as quality guarantee partners - As soon as I am regularized and work within the law, I have all the costs that the legislation requires for my product. So, I*

> *think the biggest problem in this relationship between producer, entrepreneur and inspection body, is the informality of the sector. (*member of the public prosecution)

In these passages, a researcher states that the number of informal mariculturists is big but unknown, that costs are higher when business is formalized and that this can be a decisive point in market competition. The respondents claim that there should be a policy that promotes the formalization of this kind of informal business. It is also emphasized that the supervision is poor, not adequate in clandestine establishments and that this generates discontent on the formalized producer's side as it diminishes the trust, they have with the control bodies.

> *I see a very large margin of appreciation for those who have become legal, but with regard to the informal, hard work is still needed because they are older people, more difficult to convince that legalization will bring a much greater benefit to them.* (public manager)

This interviewee recognize that formalization is necessary but find it difficult to apply in the supply chain in question, especially due to cultural issues.

4.5 Issues with the informal sector

Informality can negatively impact regional development as public authorities fail to collect taxes on food production and trade or to support activities related to the organization of a particular supply chain. As for the consumers, there is no guarantee of food safety: informal food products risk health hazards linked to chemical and microbiological contamination, fraud and adulteration, incorrect use of food additives, misleading or absent labels as well as the usage of ingredients of uncertain quality and shelf-life (Silva *et al*., 2022; Gizaw, 2019).

The disorganization of the informal mariculturist sector makes it difficult to establish a dialogue with public agencies in order to further develop the sector. Good communication seems to be essential for understanding the supply chain environment. Identifying risks and taking advantage of opportunities contribute to strategic planning, one of the pillars of good governance (Alqooti, 2020). Producers know that the implementation of these policies is important, but from their point of view, it is poor governance that hinders any advancement.

The presence of family labour may be contributing to the high rates of informality in Brazilian mariculture. When they studied this supply chain, Suplicy and Novaes (2015) found that 59 per cent of producers employed family labour. The authors also reported that there were many

temporary jobs, especially in the periods of intense harvest, in the Easter and Christmas times. This association is corroborated by the works by Morkunas (2022) and Schneider *et al.* (2019).

The high level of education of the owners of the companies with Federal Inspection Service, is in line with the observations of La Porta and Shleifer (2014), who claim that low skilled entrepreneurs, in both the informal and formal sectors, generally run inefficient firms and educated entrepreneurs run more efficient companies. They also argue that there is a link between informality and low productivity in poor countries.

The poor productivity of informal firms may also be reflected in their growth rates. In La Porta and Shleifer (2008), lower employment growth rates are observed for informal compared to formal firms (5 per cent versus 10 per cent per year). The authors also found that most informal firms continued their existence with modest growth even in a period of considerable growth of formalized enterprises. These results are supported by the statements of the interviewees about chain organization difficulties because of informality. In addition, the data from Epagri (2021) regarding the decrease in the number of producers is also corroborated. This decrease, as well as compromising the development and the sustainability of the activity, can generate other undesirable consequences, such as a decline in community income, production concentration, and a fall in the supply of molluscs, not only in the region, but also for the whole country.

When respondents talk about the high costs of formalization, this invokes the neo-liberal perspective, where informal entrepreneurs reject the bureaucracy of an over-regulated market, and they choose to work informally to avoid the costs, time and effort of formal registration. Some even see the informal economy as a state enemy, not only because they are in an informal sector, outside the law, but also as an alternative to the entire bureaucratic framework of governments. And the complaint regarding equal treatment by the inspection services questions the efficiency of these services, which is consistent with the findings of Beramendi *et al*. (2016) who claim that the inefficiency of public services in executing their role and meeting the demands of citizens do not contribute to the improvement of trust between the population and the government.

The complaints observed that address unfair competition are contrary to La Porta and Shleifer (2014), who state that informal firms do not threaten formal firms: "'the development comes from formal firms, and their expansion as the economy modernizes eventually dooms the informal economy'. What we observe in our study is that the persistence of a large number of informal workers is contributing to reducing the number of formalized entrepreneurs. Meantime, the segregation of formal and informal producers is not well defined yet many know each other

and coexist peacefully. In case of some irregularity, it is hard for one to denounce the other, and this makes organization difficult even if it is only from formal producers. Other harms may come from this coexistence because issues related to animal health and water drinkability are common to all, as they in practice produce in the same area, and when any business contributes to these problems, whether formal or informal, they compromise the entire local supply chain.

In the situations of old, informal producers, who are difficult to convince of the importance of legalization, the interviewees essentially are confirming a post-structuralist perspective. According to this perspective, informality is a way of life related to identity, social position and/or resistance against the formal structure, and these overlap with issues related to costs, opportunity and over-regulation of the businesses.

Some informal entrepreneurs seek formalization, simply to be properly legalized or for other reasons, such as having more access to loans, as well as being recognized as legitimate entrepreneurs. Nonetheless, this type of entrepreneur is not the majority and most informal firms never become formal (Williams and Nadin, 2010). The simplification of business registration could be a good alternative, even though this measure may not be very efficient.

Another solution to informality would be better education of entrepreneurs, so that they can be more efficient and make their business more productive. According to La Porta and Shleifer (2014), the bottleneck of economic growth is the supply of educated entrepreneurs, who are those who can create and expand modern businesses. In this scenario, informal companies, although they get benefits such as avoiding taxes and regulations, cannot compete. The authors state that this is how the informal economy dies out in the process of development.

4.6 Conclusions and implications for policy

Our study shows that:

- informality is quite prevalent in the maricultural supply chain and is a delicate issue that bothers some properly formalized producers;
- informality hinders the formal organizations, as informal producers will not act as members of the chain and can generate unfair competition;
- family labour and temporary jobs contribute to the informality of the studied chain;
- there is a strong relationship between the level of education of entrepreneurs and the size and legalization of their business, which can also promote the development of the activity and as a company grows, it becomes more difficult for it to stay informal;

- some other factors can favour informality, such as the lack of adequate supervision, cultural aspects, or other issues related to necessity and opportunity;
- the persistence of informality in the supply chain is contributing to reducing the number of registered producers;
- the research corroborated the perspectives of modernization, neo-liberal and post-structuralist theories.

Given the findings reported in this article, we consider that further studies, qualitative and quantitative, should be undertaken in this and other agri-food supply chains, so that we can reach further conclusions, as well as solutions to the problem, aiming at the sustainable development of these chains. Moreover, the conclusions can have important implications for policy, and these need to be explored further.

Further Reading

Alqooti, A. A. (2020). Public governance in the public sector: literature review. *International Journal of Business Ethics and Governance*, *3*(3), 14-25. https://doi.org/10.51325/ijbeg.v3i3.47

Beramendi, M., Delfino, G., & Zubieta, E. (2016). Confianza institucional y social: una relación insoslayable. *Acta de investigación psicológica*, *6*(1), 2286-2301. https://doi.org/10.1016/s2007-4719(16)30050-3

EPAGRI – Empresa de Pesquisa Agropecuária e Extensão Rural de Santa Catarina (2021). *Infoagro. Produção de moluscos em 2020*. https://www.infoagro.sc.gov.br/index.php/safra/producao-animal-2. (accessed 21 September 2022).

Gizaw, Z. (2019). Public health risks related to food safety issues in the food market: a systematic literature review. *Environmental health and preventive medicine*, *24*(1), 1-21. https://doi.org/10.1186/s12199-019-0825-5

International Labor Office (2018). Women and Men in the Informal Economy: A Statistical Picture. Geneva: International Labor Office. https://www.wiego.org/sites/default/files/migrated/publications/files/Women%20and%20Men%20in%20the%20Informal%20Economy%20-%20A%20Statistical%20Brief%20-%20for%20web.pdf

La Porta, R., & Shleifer, A. (2008). *The unofficial economy and economic development* (No. w14520). National Bureau of Economic Research. https://www.nber.org/papers/w14520

La Porta, R. L., & Shleifer, A. (2014). Informality and development. *Journal of economic perspectives*, *28*(3), 109-126. https://doi.org/10.1257/jep.28.3.109

Morkunas, M. (2022). Measuring the Cohesion of Informal Economy in Agriculture in New European Union Member States. *Economies*, *10*(11), 285. https://doi.org/10.3390/economies10110285

Ohnsorge, F., & Yu, S. (2022). The Long Shadow of Informality: Challenges and Policies. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/35782 License: CC BY 3.0 IGO.

Schneider, F., Morkunas, M., & Quendler, E. (2022). An estimation of the informal economy in the agricultural sector in the EU-15 from 1996 to 2019. *Agribusiness Early View,* 1-42. https://doi.org/10.1002/agr.21774

Silva, N. F. N., de Lelis, D. A. S., & de Carvalho, A. F. (2022). Animal-source food legislation as a tool for the exclusion of smallholder farmers in Brazil. *Nature Food*, 1-4. https://doi.org/10.1038/s43016-022-00490-2

Suplicy, F., & Novaes, A. L. T. (2015). Caracterização socioeconômica da maricultura catarinense e perspectivas para o futuro deste setor. *Panorama da Aquicultura*, *25*, 38-43. https://www.researchgate.net/publication/282646602_Caracterizacao_socioeconomica_da_maricultura_catarinense_e_perspectivas_para_o_futuro_deste_setor

Williams, C. C., & Nadin, S. (2010). Entrepreneurship and the informal economy: An overview. *Journal of Developmental Entrepreneurship*, *15*(04), 361-378. https://doi.org/10.1142/S1084946710001683

Chapter 5

Trust, governance, collaboration, and sustainability within the Brazilian agri-food sector

5- Assessment of the relationships among trust, governance, collaboration, and sustainability within the Brazilian agri-food sector

Abstract

In the context of sustainable development, agri-food supply chains stand out as necessary for humanity survival. Good stakeholder relationships can influence and mitigate unsustainable threats, and trust is a significant factor in the quality of the relationship. Therefore, the purpose of this research was to study the relationship between trust and sustainability (environmental, economic, and social), whose path passed through two different variables, governance and collaboration. Questionnaires were distributed to Brazilian agri-food supply chain professionals, and the final sample included 204 respondents. The methodology used was the PLS-SEM, through the SmartPLS software. The final model achieved was able to confirm all the proposed hypotheses: the direct relationships between trust and governance, and trust and collaboration; that governance and collaboration are directly related to sustainability; and, the indirect relationship between trust and sustainability. Some similarities of the model with stakeholder theory were also found. The evidence confirms that trust, governance and collaboration must be considered when establishing public and private policies for the sustainability of agri-food systems. Although the number of respondents was triple the recommended by the methodology adopted, a larger number of participants would offer more representative results. To obtain even more indicative results, similar research can be conducted in specific supply chains. The tested model is unprecedent and, considering trust as the initial construct and sustainability as the final variable, provided important strategic data for achieving good governance, collaboration and sustainable development of agri-food supply chains.

Keywords: sustainable development; governance; collaboration; trust; agri-food; supply chain.

This paper was submitted to the Discover Sustainability Journal in may 2024.

5.1 Introduction

Agri-food supply chains deserve to be studied as an agricultural production essential for human survival, especially in a world population growth context. Nevertheless, these are supply chains that have unsustainability threats, such as high informal work rates and vulnerabilities to different types of crises caused by sanitary emergencies, adverse weather conditions, supply discontinuity, and others, depending on their location. Moreover, the agri-food sector has great responsibility for environmental and social issues and there is no doubt that agri-food systems need to be more sustainable [1, 2].

Definitions of sustainable agriculture vary considerably and few quantitative assessments of agricultural sustainability are available. Sustainability has been defined by scholars and professionals as an ideology or a group of objectives, while others describe it as a set of management strategies. However, sustainable agriculture is increasingly related to its impact on the environmental, economic, and social pillars of sustainability [3, 4]. An agri-food value chain is sustainable when it is profitable in all its stages (economic sustainability), offers consistent benefits for society (social sustainability), and has a positive or neutral impact on the environment (environmental sustainability) [5].

Sustainable development can be defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition consists of three main ideas relevant to companies and institutions: development should not be strictly defined in economic terms, more broad objectives related to human well-being and planetary health should be sought; a company or institution should seek an integrated approach that meets these wider goals simultaneously; and a company or insight should be guided not only by short-term but also long-term goals, designed to ensure future health and longevity of the organization itself and the well-being of the base of resources on which current and future generations to depend [6].

Despite improvements in the study and dissemination of sustainability processes over the last decades, current indicators and methodologies do not yet provide an appropriate basis for assessing the impacts related to socioeconomic, governance, and environmental dimensions of sustainable development. In addition, as current structures and indicators are designed mainly for for-profit entities, sustainability reports often ignore public, non-profit, and social economy institutions that seek social and environmental goals aside from economic objectives [7].

The United Nations explain that a successful sustainable development agenda requires partnerships between governments, private sector, and civil society. These inclusive partnerships built on principles and values, a shared view and shared objectives that place people and the planet in the centre are necessary at the global, regional, national, and local level [8].

In this same direction, to achieve more sustainable agri-food systems, stakeholders must have good relationships and build political alliances and coalitions. The integrating foundations of the 2030 agenda for the sustainable development of the United Nations consider it systematically the promotion of inter sectoral connections through good communication and collaboration. The food and agriculture sector should address sustainability in an integrated manner, mapping and analysing synergies and compensations between economic, social, and environmental spheres, and reducing key issues, their causes, and determining factors [5].

Good relationships require trust, because this driver is one of the factors that positively affects the stability of a partnership. Forming as a bridge mechanism, trust helps to connect us to people who are different, from a critical condition and necessary to build strong relationships. Others consider trust as a stable personality feature, a rational choice strategy, or a social capital factor. On the other hand, weaknesses in trust, in various ways such as distrust, mistrust, and nontrust among different actors and institutions, limit progress to solving collective problems, and these weaknesses reverberate for the future [9].

According to Ostrovsky [10], an agri-food supply chain is considered a stable system if no chain member breaks their contracts during processes and transactions and if they are optimistic about their relationship. In addition, the stability of a supply chain refers to its sustainability. Organizations that have high levels of trust are more comfortable building good relationships, creating more opportunities to benefit through collaboration and striving to ensure the stability of their relationships than those who operate with lower levels of trust [11].

Thus, the purpose of this research was to study the relationship between trust and sustainability among the stakeholders within agri-food supply chains. A model was proposed to test the hypotheses of the direct and indirect relationships between the chosen variables, starting from trust to sustainability, through governance and collaboration. Since the choice of indicators, it seeks to separate sustainability in the three classic pillars: environmental, social, and economic. Furthermore, we intended to compare the findings of the model related to sustainable development with what is described in Stakeholder Theory, identifying their similarities and differences.

5.2 Background

Trust is an abstract concept that, while difficult to observe, is a constant feature of human experience. It is a phenomenon that can be deeply incorporated and shaped by individual experiences and expectations. Trust manifests itself in relationships and interactions between and among individuals and groups [12]. Although there are many definitions of trust in the existing management literature, concepts often address two key elements: positive expectations regarding the actions and/or intentions of partners; and vulnerabilities in relation to a partner [13].

There is trust between institutions at the inter organizational level, which can be defined as "the extent of trust in the organization by members of another organization". This form of trust reflects the expectations of an organization that the partner organization will not act opportunistically and that there is predictability in the behaviour of the partner organization. Trusting behaviours lead to a predisposition to cooperate and collaborate towards a mutual goal [14, 15, 16].

Governance can be defined as the process of relationship and decision-making, including decisions made about the implementation of activities and solutions. The literature on governance is increasingly questioning the generation of sustainable solutions through classic paths, both guided by governments and by the liberal approach of the free market [17]. In this sense, there is a need to develop new forms of interactive decision-making processes aiming at achieving social consensus, differently approaching sustainability transitions, and developing new models of transition management [18].

Especially in small and medium business, it is difficult to establish a supply chain model or a governance system. Therefore, alternative trade agreements and conditions that allow these types of agreements include, among other factors, direct contacts, trust, accountability, and commitment [19]. According to Weber and Wiek [20], all these factors indicate that transparent collaboration contributes to the promotion of sustainability throughout the supply chain.

The collaboration between actors in a supply chain consists of a partnership process, where two or more companies plan and perform supply chain operations towards common objectives and mutual benefits. The view that value creation is a process that results in different outcomes for different stakeholders is common in the literature that deals with sustainability-oriented business models. An explanation is that solving sustainability issues requires collaboration with various stakeholders to provide the necessary knowledge and other resources [21-24].

Stakeholder theory involves topics about business ethics and business management. According to this theory, it is possible to promote practical, ethical, and effective ways of managing business

and organizational issues during different situations and in different business environments. Stakeholder theory in instrumental form primarily considers the performance of stakeholders in highly ethical relationships, characterized by high levels of trust, cooperation, and information sharing [25, 15].

Scholars have held debates that stakeholder theory can be usefully applied to sustainability management. When approaching aspects related to the purpose of business, stakeholder theory and sustainability management reject the idea of separating ethical issues from business, as they do not see business and ethics as conflicting, but fundamentally interconnected. Instead of separating these issues, in order to create real value for stakeholders and, consequently, to contribute to sustainable development, social and environmental issues must be linked to a company's core business [22, 26].

5.3 Hypotheses

5.3.1 Trust and governance

There are some theories that try to explain strategic alliances in a supply chain and their relational governance. Trust is considered one of the roots of commitment, an essential factor for the achievement between partners [27].

Scholars often define trust as an important construct of drivers related to governance, such as cooperation, integration with partners, contract flexibility, exchange performance, stability, and quality of relationships. Lee and Cavusgil [28] advocate the positive impact of trust on the stability of alliances, as well as the effective transfer of knowledge.

Trust facilitates the relationships for effective and efficient governance structures, allowing actors from various groups to engage in negotiations and complex actions [29].

Ghosh and Federowicz [30] stated that the three constructs of governance structure (trust, bargaining power, contract) are intertwined, and especially trust, as a governance mechanism, plays a crucial role in sharing information among business partners. Some authors have used trust to explain governance mechanisms in uncertain environments, and works show trust as a condition to influence a partner's propensity for a specific governance structure [31].

Researchers showed that high levels of interorganizational trust increased the likelihood that a less formal governance mode had been chosen over a more formal relationship. In addition, trust-based governance contributes positively to improving performance in business relations between partners [32, 33].

Ryu et al. [34] stated that trust directly influences the type of governance performed by the institution. The study showed that when an actor does not rely on the partner under environmental volatility conditions, unilateral governance is usually considered, while if a stakeholder trusts the partner, bilateral governance is usually considered in their relationship.

Suiseeya et al. [35] suggest that more attention must be given to trust so that scholars and professionals can better understand how relational phenomena shape possible governance templates.

H1. Trust has a positive and significant effect on governance in agri-food supply chains (AFSC).

5.3.2 Trust and collaboration

We can also define trust as a process based on social expectations, where we assume mutual risk with someone else (for example, co-worker, business partner, friend) in collaboration aiming at a common goal [36, 37].

Many authors shape trust as one of the antecedents of collaboration. According to Wu et al. [38], trust between partners has a strong influence on collaboration and stands out among other antecedents. By maintaining a buyer-supplier relationship, a high level of trust should be the initial goal of partners when they are willing to take risks in building a partnership relationship. Trust is an important factor in decision-making processes in food supply networks, where farmers, food manufacturers, and distributors are willing to share risks. “In other words, trustworthy is equal to risk worthy” [39].

Trust is one of the most critical behavioural drivers for the successful collaboration of the supply chain. Trust influences organizational behaviour in such a way that organizations that have a high level of trust with each other will take more initiative in search of new opportunities and business partnerships [40, 41].

A culture of trust must be fostered, as given the central importance of this driver in successful collaborations. Building and maintaining trust is an ongoing practice that is fundamental to all other practices during the collaboration project. Without achieving this initial objective, other issues related to social exchanges such as commitment, reciprocity, and power are more difficult to achieve. Therefore, a high level of trust is the base to allow the construction of a long-term collaborative strategy [33, 42].

Relationships with high levels of trust elicit a desire among actors to cooperate with each other for mutual gain. Where a profound collaboration is required for effective results, such as global climate governance, for example, trust can promote the necessary strength for the quality of relationships between actors [15, 35].

Long-term positive interpersonal relationships and the improvement of the levels of trust between business partners collaborate for the execution of coordinated activities for the co-creation of value [21]. Some forms of cooperation may even happen when trust is low. However, deep collaboration requires trust because there are individual risks associated with the execution of collective actions [43].

H2. Trust has a positive and significant effect on collaboration in AFSCs.

5.3.3 Governance and sustainability

Progress in the sustainability of forests, peoples and agri-food systems depend widely on integrated governance and territorial planning. Among the Sustainable Development Goals - SDGs, two large groups can be found: one includes SDGs that are concentrated mainly under institutional, governance, and social conditions (1 No Poverty; 3 Good Health and Well Being; 4 Quality Education; 5 Gender Equality; 10 Reduced Inequalities; 12 Responsible Consumption and Production; 13 Climate Action; 16 Peace, Justice, and Strong Institutions); and a second group of SDGs referring directly to land use and therefore directly affecting nature (2 Zero Hunger; 6 Clean Water and Sanitation; 7 Affordable and Clean Energy; 8 Decent Work and Economic Growth; 9 Industry, Innovation, and Infrastructure; 14 Life below Water; 15 Life on Earth). While the second group directly reverberates the environment, the first contributes to management and promotes synergistic interactions and positive results for forests and peoples. To move forward, integrated governance approaches are required, as then the SDGs can be treated as they are: intertwined and indivisible [44-46, 8].

Discussions on governance have become increasingly necessary in sustainable development. Among the most commonly used study methods today are: the Environmental, Social, and Governance (ESG) evaluation, which adopts an external approach, evaluating the impacts and risks that the external world imposes on the company in environmental, social, and governance domains, to ascertain the value of the company; and the Sustainable Development Performance Indicators assessment (SDPI), or neo-ESG, a qualitatively different way that addresses a perspective from the inside out of impacts and risks, evaluating the impacts of a company on the

outside world. Anyway, both aim to identify and contextualize the impacts and performance of companies and institutions in the search for sustainability goals [7].

The important theme of how governance settings for sustainability evolve is emerging in the literature. Agri-food governance has been debated and, according to some researchers, is related to how food is produced, exchanged, and consumed in agri-food systems, as well as, increasingly, how sustainability is defined, understood, and pursued in this domain [47, 48].

De Schutter et al. [49] argue that EU governance structures are proving to be ill-adapted to address the systemic nature of the challenges that food systems currently face, and state that an integrated food policy is needed to build sustainable food systems in Europe.

Rubio-Andrés et al. [50], assert that the inclusion of good governance in their sustainability model was a relevant contribution in their work and point out that a very important aspect in this variable is ethics codes, as they constitute governance management tools and include values of the organization and its responsibility policies [51].

H3a. Governance has a positive and significant effect on environmental sustainability in AFSCs.

H3b. Governance has a positive and significant effect on social sustainability in AFSCs.

H3c. Governance has a positive and significant effect on economic sustainability in AFSCs.

5.3.4 Collaboration and sustainability

Corporate Collaboration is a paradox of corporate sustainability. Due to competing interests, lack of a single purpose, and lack of trust among stakeholders, companies have failed to work together to tackle the most complex challenges facing the world today, such as climate change, the depletion of resources, and the loss of ecosystems [42].

Collaborative effort plays the main mediator role in obtaining supply chain performance, and without the mediator role of collaboration, supply chain performance is deficient [38].

The fluidity of collaboration contributes to the dynamics of relationships in the supply chain, where there are many stakeholders with different origins and interests [40]. Collaboration around common tasks also increases the accessible pool of knowledge and experience, which is often crucial in solving complex problems, supports negotiation and agenda setting, planning and

coordination of joint activities, division of labour, and promotes social acceptance of implemented solutions [52].

Weber and Wiek [20], after evaluating two coffee supply chains in USA and Mexico, found that collaboration among small and medium coffee stakeholders has the potential to infuse sustainability in its supply and value chain to a much larger extension than operating independently.

To evolve regarding sustainable development goals (SDG), collaborative efforts from states, private sector, and civil society are needed to expand initiatives and accelerate sustainability processes. This is because, within a specific SDG, it is very difficult for an actor alone to completely solve a sustainability issue. Thus, progress towards sustainable production and consumption or prevention of climate change needs collaboration between stakeholders [53, 54]. This fact was also demonstrated by Bodin and Nohrstedt [55], who stated that collaboration improves performance in the management of common resources and in the collective response to natural disasters.

H4a. Collaboration has a positive and significant effect on environmental sustainability in AFSCs.

H4b. Collaboration has a positive and significant effect on social sustainability in AFSCs.

H4c. Collaboration has a positive and significant effect on economic sustainability in AFSCs.

5.4 Methodology and analysis

5.4.1 Sample

The survey sample corresponded to 208 professionals from agri-food supply chains in Brazil, who work both in public bodies and those linked to private companies. The questionnaires were applied from November 2022 to January 2023 through Google Forms. The links were sent by email or via WhatsApp, and the filling was done by both computer and smartphone. Only the fully answered questionnaires were recorded and, after an initial check of the professional's profiles and inconsistencies, we excluded four participants. Thus, the sample was reduced to 204 respondents. To use the statistics software, the minimum size of the sample has been verified through the G*Power 3.1.9.7 software, and we considered the latent variable (LV) that had the largest number of predictors, since for the PLS analysis is this construct that decides on the sample size [56]. The LVs that dealt with sustainability had all two predictors each, the power of

the test used was 0.80 and the f^2 value was median (0.15) as, suggested by Cohen [57] and Hair et al. [58]. Thus, the minimum sample calculated for the proposed model was 68 participants, and we achieved the triple of the minimum sample required.

The sample comprised auditors (65, 31.9%), managers (57, 27.9%), inspectors (21, 10.3%), technicians/agents (11, 5.4%), consultants/experts (10, 4.9%), analysts (8, 3.%), entrepreneurs (7, 3.4%), teachers/researchers (7, 3.4%), veterinarians (6, 2.9%), technical responsible (6, 2.9%), assistants/advisors (3, 15 %), and supervisors (3, 1.5%). Managers included chiefs, coordinators, directors, presidents, and superintendents. The Southern region of the country presented the largest number of participants, with 127 professionals (62.2%), followed by the Southeast region, with 36 participants (17.7%), and the Central region, with 33 participants (16.3%). The North and Northeast regions were less representative, totalling 12 participants (4%).

At the beginning of the questionnaire, respondents were asked about the formality of the bonds with other stakeholders in their supply chain. Most (102, 50%) answered that their links were completely formal, followed by the group that stated to have both formal and informal relations (51, 25%) and the group that said they had mostly formal relations (49, 24%). Only two participants (1%) responded to having mostly informal bonds, and no professional said they had totally informal relationships.

5.4.2 Scales

For the design of the questionnaire, in addition to the researched references, we performed an initial qualitative study with 15 professionals. The average duration of the in-depth interviews was 52 minutes and we addressed issues such as the organization of the supply chain, business relations, performance, and sustainability of both the company/institution and the supply chain.

The questionnaire was built specifically for the present study. We proposed 29 questions for respondents to rate their degree of agreement with the statements, according to a 7-point Likert scale. We used scales already validated in previous works, translated, and adapted to meet the needs of the research. In addition, we created three new scales based on indicators already validated in the literature.

The scales used with the trust construct were adapted from Liu et al. [59], Khan et al. [60], and Sun et al. [61]. The observed variables related to governance and collaboration were adjusted from Rubio-Andrés et al. [50], and Wang and Dai [62], respectively. The sustainability indicators were adapted from the works of Khan et al. [60], Wang and Dai [62], and Das [63].

5.4.3 Measurement instrument

We analysed the proposed hypotheses through the structural equation modelling method using partial least squares (PLS-SEM) with the support of the Smart-PLS 4 software (version 4.0.9.1). The structural equation modelling (SEM) is a general character technique of multivariate statistical modelling, which is widely used in the human and social sciences, and which has gained close attention in the areas of green management and operations management [64]. The method consists of a theoretical construction of a model based on latent variables and the relations between them are represented by regression coefficients or trajectory coefficients between observed variables and/or the latent variables themselves. The advantages of this method include allowing to work simultaneously with estimation and measurement, allowing direct and indirect effects to be estimated between latent variables, and presenting interpretative ease from their graphic interfaces [65].

And when one comes across data not adherent to multivariate normal distribution, complex conceptual structures (many constructs and many observed variables), formative models or also formative VL, or "few" data and/or models with less consecrated theoretical support or also little explored, it is recommended to use the PLS approach [58].

When we used the PLS-SEM, the conceptual model test required to obtain the measuring model (outer model) and later the structural one (inner model). In the measurement model, to understand how much the variance of each indicator is explained by the respective construct, we first evaluated the indicator reliability. Then, to find how the indicators measure the latent variables, we obtained the reliability of the constructs through the Cronbach's α test and the composite reliability. To measure the convergent validity of the model, namely, to find how much the construct converges to explain the variance of its indicators, we performed the averaged variance extracted (AVE). In addition, to verify the extent to which a construct is empirically distinct from other constructs in the structural model, we measured the discriminant validity through the Fornell-Larcker criterion test, cross loading matrix, and heterotrait-monotrait indicator (HTMT).

To the structural model, we studied multicollinearity in the structural model through the variance inflation factor (VIF). Then, we measured the intensity of the relationships between the latent variables and its significance through the *path* coefficients (β coefficients), *p* values, and *t* values. And the model's ability to explain the dependent variables that it is composed was obtained through the determination coefficient (R^2).

In the use of SmartPLS Software, to adjust the final model, we performed several tests, both in the measurement and structural models. After a few rounds, 6 indicators were removed and the final model remained with 23 observable variables. The scales used in the final model are present in Appendix I.

5.5 Results

5.5.1 Measurement model

In the final model, we kept the observed variables that presented indicator loadings above 0.708, as they indicate that each construct explains more than 50% of the variance of the respective indicator [58].

Reliability of the six constructs was showed within the recommended standards and demonstrated great internal consistency. The Cronbach's α were all above 0.79, higher than the 0.70 recommended by the literature. None of the composite reliability coefficients were lower than 0.80 or higher than 0.93, meeting the recommended standards between 0.70 and 0.95 [66].

Convergent validity also showed consistent values, as the Average Variance Extracted (AVE) values were all over 0.62. The AVE, which is equivalent to the communality of a construct, is acceptable when greater than 0.50, meaning that the construct explains 50% or more of the indicator's variance that make up the construct [58]. Table 5.1 presents the Cronbach's α, the composite realizability, and the AVE data.

Table 5.1 - Construct reliability and validity.

Constructs	Cronbach's α	Composite reliability	AVE
Trust	0.896	0.898	0.706
Governance	0.795	0.800	0.622
Collaboration	0.927	0.932	0.775
Environmental Sustainability	0.858	0.863	0.779
Social Sustainability	0.914	0.915	0.853
Economic Sustainability	0.844	0.850	0.761

Source: Authors, based on SmartPLS; Composite reliability (rho_a); AVE (Average Variance Extracted).

The discriminating validity according to the Fornell-Larcker criterion presented good results, as the relationship of the construct's loadings with themselves surpasses the coefficients of the inter-construct loadings. That metric can be demonstrated in Table 5.2. When we compared the loads

of the indicators in its corresponding latent variable, we observed that they are greater than its loads crossed in the rest of the latent variables, which can be verified through the cross-loadings matrix in Appendix II.

Table 5.2 - Fornell-Larcker criterion.

	Trust	Governance	Collaboration	Environmental Sustainability	Social Sustainability	Economic Sustainability
Trust	0.841					
Governance	0.577	0.788				
Collaboration	0.643	0.664	0.880			
Environmental Sustainability	0.492	0.649	0.604	0.883		
Social Sustainability	0.466	0.647	0.533	0.709	0.924	
Economic sustainability	0.478	0.658	0.551	0.817	0.824	0.873

Source: Authors, based on SmartPLS.

The discriminant validity using the Heterotrait-monotrait method showed great results in most constructs, with a result below 0.80 in 13 of the 15 relations. Only two of the relationships had higher coefficients, Economic Sustainability/Environmental Sustainability (0.958) and Economic Sustainability/Social Sustainability (0.928), as can be seen in Table 5.3. Although these results are above the 0.90 recommended by Henseler et al. [67], they are still below 1, that is, the average correlations between the indicators that measure the same construct is higher than the average value of the correlations of the indicators between the constructs. Therefore, since the Fornell-Larcker criterion and cross-loadings were great and considering that there is indeed a connection between the three pillars of sustainability, the so-called Triple Bottom Line, we considered this proximity to the constructs acceptable and we decided to keep the model.

Table 5.3 - Heterotrait-monotrait ratio (HTMT).

	Trust	Governance	Collaboration	Environmental Sustainability	Social Sustainability
Governance	0.671				
Collaboration	0.703	0.762			
Environmental Sustainability	0.562	0.782	0.674		
Social Sustainability	0.515	0.759	0.578	0.793	
Economic sustainability	0.547	0.799	0.620	0.958	0.928

Source: Authors, based on SmartPLS.

5.5.2 Structural model

We began to study the structural model evaluating multicollinearity through the variance inflation factor (VIF). According to Hair et al. [58], values of 5 or above indicate collinearity problems in the indicators. In the final model, all indicators had coefficients below 5, as shown in Appendix III.

Subsequently, we used bootstrapping to test the statistical significance of the model's paths, which implied the generation of 10,000 subsamples of cases randomly selected with replacement from the original data. In the adjusted final model, all hypotheses have been supported.

Relations between trust and governance, trust and collaboration, governance and the three pillars of sustainability, and collaboration and environmental sustainability presented great path values. Regarding the relation between collaboration and economic sustainability, the path value was close to the limit established by Chin [68] of at least 2, and in the relation between collaboration and social sustainability, the path value was below the mentioned standard.

In the final model, the *t* values fell within the standards, as taking a significance level of 5%, a value above 1.96 (bicaudal test) suggests that the weight of the indicator is statistically significant [58]. In this sense, we observed the most representative *t* values in the relations between trust and governance and collaboration, and in the relations between governance and the three pillars of sustainability.

For *p* values, the relations of trust > governance, trust > collaboration, governance > environmental sustainability, governance > social sustainability, governance > economic sustainability, and collaboration > environmental sustainability achieved the highest level of significance ($p < 0.001$). In turn, the relations collaboration > social sustainability and collaboration > economic sustainability had medium significance rates ($p < 0.05$). Table 5.4 shows the hypothesis and respective results of path coefficients, *t* values, and *p* values.

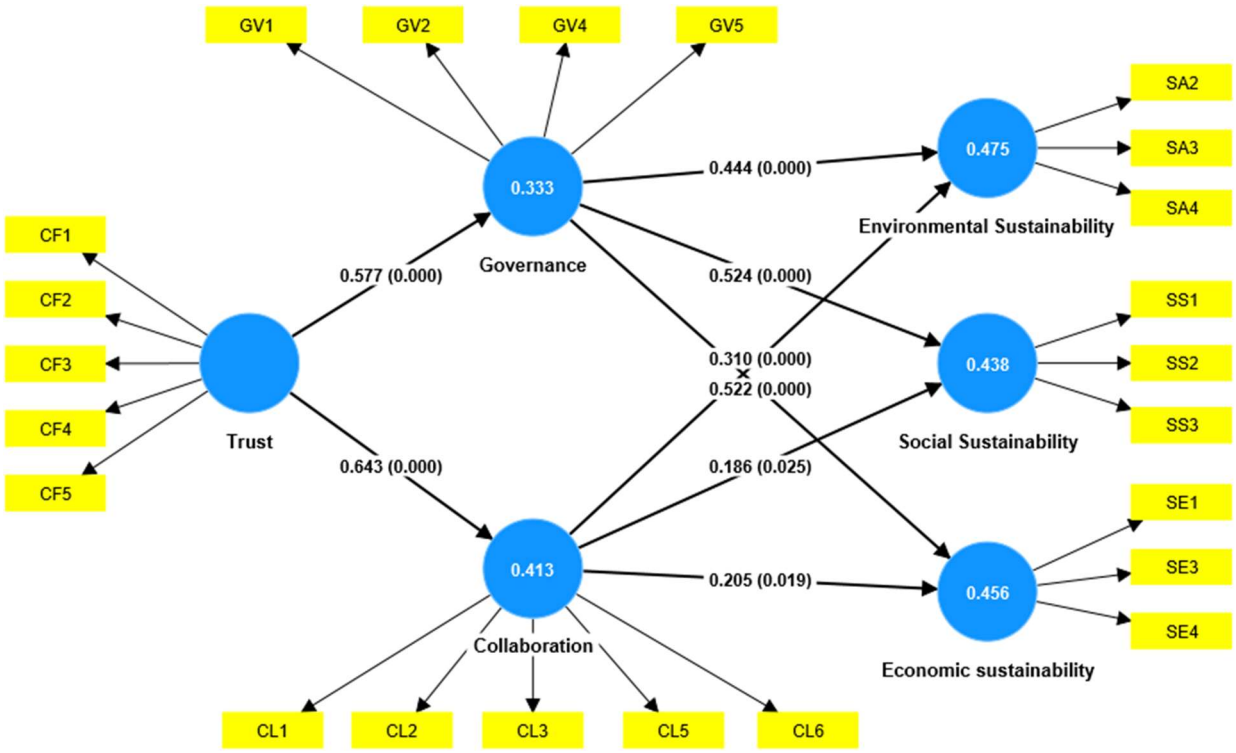
Table 5.4 - Research hypothesis.

Hypothesis and correspondences	Path (β) coefficients	*t* values	*p* values	Validation
H1 Trust -> Governance	0.577	10.732	0.000	Supported
H2 Trust -> Collaboration	0.643	13.416	0.000	Supported
H3a Governance -> Environmental Sustainability	0.444	6.030	0.000	Supported
H3b Governance -> Social Sustainability	0.524	6.195	0.000	Supported
H3c Governance -> Economic sustainability	0.522	6.551	0.000	Supported
H4a Collaboration -> Environmental Sustainability	0.310	4.292	0.000	Supported
H4b Collaboration -> Social Sustainability	0.186	2.246	0.025	Supported
H4c Collaboration -> Economic sustainability	0.205	2.339	0.019	Supported

Source: Authors, based on SmartPLS.

In measuring the predictive power, named the coefficient of determination of endogenous constructs, we mostly found moderate R^2 values, close to 0.5 [58]. Environmental sustainability presented the highest explanatory value, of 0.475, followed by economic sustainability (0.456) and social sustainability (0.438), these three constructs with two predictors each. Collaboration presented an R^2 of 0.413 and governance had the lower coefficient, of 0.333, a level considered intermediate between weak (0.25) and moderate (0.50) power. Figure 5.1 depicts the structural model containing latent variables and observable variables, relations paths, path coefficients and their respective *p* values, and the R^2 values of each construct.

Figure 5.1. Structural model.



Source: Authors, based on SmartPLS.

When analysing the indirect effects, we found representative data. Total indirect effects showed a positive influence between trust and the three pillars of sustainability through both paths of governance and collaboration, on the higher level of significance (p<00.1). Upon deeper analysis of these data, the results of the specific indirect effects also showed a positive relationship between the variables and a clear difference between paths through governance and through collaboration.

Path coefficients through governance are all over 2, while through collaboration they are weaker and below 2. The *t* values in tun are all above 1.96 (bicaudal test) suggesting that the weight of the indicator is statistically significant [58]. The most representative *t* values were observed in the path through governance, while through collaboration they were weaker.

For *p* values, the specific indirect relations of trust > governance > environmental sustainability, trust > governance > social sustainability, trust > governance > economic sustainability, and trust > collaboration > environmental sustainability achieved the highest level of significance (p <0.001). The specific indirect effects of trust > collaboration > social sustainability and trust > collaboration > economic sustainability had medium significance rates (p <0.05). The specific indirect effects and their results of path coefficients, *t* values, and *p* values can be seen in Table 5.5.

Table 5.5 - Specific indirect effects.

Indirect relations	Path coefficients	*t* values	*p* values
Trust -> Governance -> Environmental Sustainability	0.256	5.139	0.000
Trust -> Governance -> Social Sustainability	0.302	5.024	0.000
Trust -> Governance -> Economic sustainability	0.301	5.279	0.000
Trust -> Collaboration -> Environmental Sustainability	0.199	3.928	0.000
Trust -> Collaboration -> Social Sustainability	0.119	2.130	0.033
Trust -> Collaboration -> Economic sustainability	0.132	2.215	0.027

Source: Authors, based on SmartPLS.

5.6 Discussion

The model confirmed the influence of trust on governance and on collaboration, corroborating the cited authors who supported these hypotheses.

When analysing the impact of governance on sustainability, we found that it is quite significant, not only in terms of governance in the private sector, but also in terms of the public one. De Schutter et al. [49] argue that a system-wide approach to governance, both public and private, is

needed to address negative externalities in food systems (e.g., unhealthy diets, climate change, loss of biodiversity, poor working conditions for agricultural workers). By building an integrated food policy, new goals can be prioritized, conflicts can be replaced by synergies, and great progress can be made. We identified four distinct aspects of the necessary governance shift towards integrated food policies: coherence across policy areas; coherence between governance levels; governance for transition; and food democracy. Each one of these was considered by the authors to be essential for building sustainable food systems.

Van Zanten & van Tulder [69] suggested that the solutions to improve the sustainable development of the companies were categorized in some specific areas of governance: public policies, business policies, and technological innovation. Public policies were the most requested, followed by business policies. In addition, mitigation of negative impacts was particularly seen as requiring combinations of these policies.

Moreover, governance arrangements in a local community in Brazil, based both on investments in local institutions and on multi-stakeholder collaborations, have shown a potential way to overcome historical setbacks that limit sustainable agricultural development in the Amazon [70].

As for collaboration, this construct may be linked to governance and may even function as a governance mechanism [48], though they are different variables. Paluri and Mishal [23] define collaboration as a bilateral relational governance form between supply chain partners, which results in integration at various levels of these partnerships. Stupak et al. [71], in turn, have a slightly different view of these relationships, seeing governance as a collaborative tool that can contribute to finding solutions to sustainability challenges and building adequate levels of legitimacy and trust for its implementation.

The influence of collaboration on sustainability was also representative, especially regarding environmental sustainability. Considering the social and economic pillars, the significance of this relationship was smaller compared with governance. In this context, some authors point out conditions for this relationship to be significant. Bergsten et al. [52] showed that, as actors in a supply chain engage with new issues collaboratively, these engagements are more likely to lead to the desired sustainability, especially if they have to make little institutional adjustment. In this sense, to improve collaboration, it is important to consider some collaborative adjustments, allowing each actor to adapt its actions in response to the management decisions taken by its partners.

Weber and Weik [20] report that small businesses are willing to improve their economic resilience through collaboration. However, although small companies show some advantages in seeking sustainability compared to large companies, they are also vulnerable due to their small size [72]. Furthermore, some solutions, in addition to the growth of small companies, can be achieved through cooperation and collaboration, such as alternative food network support structures, different forms of cooperative companies, or multi-stakeholder cooperatives [72, 42, 20].

Anyway, Nidumolu et al. [42] suggest, as one of the solutions to improve collaboration, to start with a small group, bring experience in project management, link the self-interest of each stakeholder to the common interest, encourage productive competition, and, above all, build and maintain trust.

When we analysed the indirect relationship of trust on sustainability, following the example of what was perceived in the relationships of governance and collaboration on sustainability, we were able to confirm the hypotheses, especially when the path passed through governance. The fact that the indirect relationship of trust, when it involves collaboration, is more significant when we approach environmental sustainability, can be supported by Uslaner's [9] work, where the researcher reports that, when addressing issues such as reliability, truth, and integrity of others, trust appeared prominently in popular discourses on climate change.

Regarding the indirect relationship of trust when passing through governance, the data are corroborated by the work of Nidumolu et al. [42], where the authors report that deficiency of trust can undermine even the most well-intentioned sustainability effort. In a scenario like this, actors struggle to establish an adequate governance model and a shared vision, disagree about how investments and rewards are divided, and show concern about benefits accruing to non-participating actors.

On the same line, Vazquez-Bruts et al. [48] report that uncertainties in the relationship between actors decrease due to mutual trust and, in this context, highlight the adaptive element of governance mechanisms used to extend sustainability. Specifically, the authors mention that it is common to alternate between the formal phase of the relationship, based on contracts, with few incentives and more control, and the informal phase, of the more relational partnership, with more flexibility and incentive, and based on trust.

Trust, above all, generates value in relationships, both commercial and social, and this contributes to sustainability. Considering that transaction costs tend to be higher where tasks and outcomes

are interdependent, reducing them through trust-based governance mechanisms can be quite valuable, therefore increasing the potential for sustainable competitive advantage [15]. In the Weber and Wiek [20] project, reliable relationships facilitated open price conversations and confirmed the appropriate benefit distribution commitment, as shown in the iterative increase in payments to a stakeholder group. Kramer and Porter [73] took a social approach to trust, relating the creation of shared value and sustainability, where the controversy between the interests of the company and those of society is exceeded, and proposing that there are many opportunities for companies to perform good performance and generate social value at the same time (harmonic growth).

And finally, when the model is viewed as a whole and stakeholder theory applied, some similarities can be seen: first, trust supports the ethical behaviour needed in this theory, so that the stakeholder behaves correctly with their partners knowing that they will act in the same way; second, for good sustainability management, there is purpose in business, as well as in stakeholder theory; third, this theory empathizes that the short-term view must be complemented by a long-term perspective and rejects simplistic and conventional management approaches, so that when we highlight governance in the model, we can identify that planning and good management techniques are really needed; forth, when we note the influence between governance and social sustainability, stakeholders are called upon to integrate responsibility into their core businesses; fifth, the relationship of trust, collaboration, and governance on the economic pillar shows us that profit is not something immoral and that it should be considered; and sixth, the influence of collaboration on sustainability confirms that creating synergies and reciprocity between different interests is one of the main challenges.

Still about the stakeholder theory, Waheed and Zhang [74] concluded that, in the current competitive business context, companies must embrace corporate social responsibility practices and ethical cultural practices to achieve sustainable competitive performance. The authors also concluded that these practices can be used as a strategic weapon for institutions, since stakeholders are becoming increasingly aware of ethical and socially responsible issues.

5.7 Conclusions

In the proposed model of the research, trust significantly influenced both governance and collaboration. Governance and collaboration positively influenced sustainability in its three pillars, the impact of governance being more significant. Despite being representative, the relationship between collaboration and sustainability was weaker, especially when dealing with

social and economic sustainability. This fact may be due to specific conditions of each supply chain.

We were also able to confirm that trust indirectly influences sustainability in its three pillars, the path through governance being more significant than that through collaboration. In other words, considering trust as a primary construct and sustainability as a final variable, the way an agri-food chain is evaluated, directed, monitored, and even managed seems to be more important than the way supply chain actors collaborate with each other.

Relationships of trust generate value in commercial and social relationships, and this contributes to the sustainable management of supply chains. Moreover, the strengthening of these relationships can be interpreted as a strategic action for good governance, collaboration, and sustainable development.

Although stakeholder theory does not highlight the connection between social, ecological, and economic aspects and does not emphasize that organizations must act within ecological systems, it is similar to the model when it suggests that business must have a purpose, that business and ethics are intertwined, that companies should be concerned with social responsibility, that making a profit is not immoral, and that a long-term view is needed.

As for the sustainability of agri-food systems, our data confirm that trust, governance, and collaboration must be considered in the institution of policies, both public and private. We suggest that, in the elaboration of strategies for sustainable development, the main constructs of trust, such as transparency, proper communication, information and knowledge sharing, predictability, integrity, and competence are promoted and strengthened.

Internal governance structures should be studied according to each stakeholder and external governance mechanisms, that is, how the actors relate to their partners and to the supply chain as a whole deserves attention. Regarding public governance, it is important to prioritize some factors, such as transparency, access to information, correct selection of leaders, compliance, and accountability.

A good organization of the sectors through associations, cooperatives, and other structures improves not only governance but also allows collaboration initiatives to be applied, which, according to the results found, helps in the stability and durability of trade relations and, consequently, in sustainability of supply chains. Furthermore, this stability allows improvements, and changes that evolve certain risks can be adopted, especially regarding environmental and

energy transition issues. Economic and social sustainability are very important for initiatives related to environmental sustainability to happen.

Although the number of respondents was triple the recommended by the methodology adopted, a larger number of participants would offer more representative results.

To obtain even more indicative results, similar research can be conducted in specific supply chains. And to achieve more comprehensive data, we suggest the performance of works such as this in other countries, including comparisons. Moreover, considering that governance was very important in the model, future work to evaluate this variable, separating corporate governance from the public, would be quite useful.

References

1. Assis, M. T., Lucas, M. R., & Rainho, M. J. M. 2022. A meta-analysis on the trust in agri-food supply chains. Food Frontiers. https://doi.org/10.1002/fft2.137

2. Trigo, A., Marta-Costa, A., & Fragoso, R. 2021. Principles of sustainable agriculture: Defining standardized reference points. Sustainability. https://doi.org/10.3390/su13084086

3. Bathaei, A., & Štreimikienė, D. 2023. A Systematic Review of Agricultural Sustainability Indicators. Agriculture. https://doi.org/10.3390/agriculture13020241

4. Zhang, X., Yao, G., Vishwakarma, S., Dalin, C., Komarek, A. M., Kanter, D. R., ... & Davidson, E. A. 2021. Quantitative assessment of agricultural sustainability reveals divergent priorities among nations. One Earth. https://doi.org/10.1016/j.oneear.2021.08.015

5. Food and Agriculture Organization of the United Nations (FAO). 2018. Transforming food and agriculture to achieve the SDGs. 20 interconnected actions to guide decision-makers. https://www.fao.org/3/ca1612en/ca1612en.pdf. Accessed 28 march 2023.

6. World Commission on Environment and Development - WCED. 1987. Our Common Future. Oxford: Oxford University Press.

7. Yi, P., Dong, Q., Li, W., & Wang, L. 2023. Assessment of city sustainability with the consideration of synergy among economy–society–environment criteria. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-022-02364-w

8. United Nations (UN), 2016. Transforming our world: The 2030 agenda for sustainable development. https://documents-dds-

ny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement. Aaccessed February 24 2023).

9. Uslaner, E. M. 2018. The Oxford handbook of social and political trust. New York: Oxford University Press.

10. Ostrovsky, M. 2008. Stability in supply chain networks. American Economic Review. https://doi.org/10.1257/aer.98.3.897

11. Nyaga, G. N., Whipple, J. M., & Lynch, D. F. 2010. Examining supply chain relationships: do buyer and supplier perspectives on collaborative relationships differ?. Journal of operations management. https://doi.org/10.1016/j.jom.2009.07.005

12. Beck, S. 2012. Between tribalism and trust: the IPCC under the" public microscope". Nature and Culture. https://doi.org/10.3167/nc.2012.070203

13. Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. 1998. Not so different after all: A cross-discipline view of trust. Academy of management review. https://doi.org/10.5465/amr.1998.926617

14. Gulati, R., & Nickerson, J. A. 2008. Interorganizational trust, governance choice, and exchange performance. Organization science. https://doi.org/10.1287/orsc.1070.0345

15. Jones, T. M., Harrison, J. S., & Felps, W. 2018. How applying instrumental stakeholder theory can provide sustainable competitive advantage. Academy of Management Review. https://doi.org/10.5465/amr.2016.0111

16. Roehrich, J. K., Selviaridis, K., Kalra, J., Van der Valk, W., & Fang, F. 2020. Inter-organizational governance: a review, conceptualisation and extension. Production Planning and Control. https://doi.org/10.1080/09537287.2019.1647364

17. Grin, J., Rotmans, J., & Schot, J. 2010. Transitions to sustainable development: new directions in the study of long term transformative change. New York: Routledge.

18. Edelenbos, J. 2005. Institutional implications of interactive governance: Insights from Dutch practice. Governance. https://doi.org/10.1111/j.1468-0491.2004.00268.x

19. Edelmann, H., Quiñones-Ruiz, X. F., & Penker, M. 2020. Analytic framework to determine proximity in relationship coffee models. Sociologia Ruralis. https://doi.org/10.1111/soru.12278

20. Weber, H., & Wiek, A. 2021. Cooperating with “open cards”—the role of small intermediary businesses in realizing sustainable international coffee supply. Frontiers in Sustainable Food Systems. https://doi.org/10.3389/fsufs.2021.663716

21. Lüdeke-Freund, F., & Dembek, K. 2017. Sustainable business model research and practice: Emerging field or passing fancy?. Journal of Cleaner Production. https://doi.org/10.1016/j.jclepro.2017.08.093

22. Hörisch, J., Freeman, R. E., & Schaltegger, S. 2014. Applying stakeholder theory in sustainability management: Links, similarities, dissimilarities, and a conceptual framework. Organization and Environment. https://doi.org/10.1177/1086026614535786

23. Paluri, R. A., & Mishal, A. 2020. Trust and commitment in supply chain management: a systematic review of literature. Benchmarking: An International Journal. https://doi.org/10.1108/BIJ-11-2019-0517

24. Schaltegger, S., Hansen, E. G., & Lüdeke-Freund, F. 2016. Business models for sustainability: Origins, present research, and future avenues. Organization and Environment. https://doi.org/10.1177/1086026615599806

25. Harrison, J. S., Freeman, R. E., & Abreu, M. C. S. D. 2015. Stakeholder theory as an ethical approach to effective management: Applying the theory to multiple contexts. Revista brasileira de gestão de negócios. https://doi.org/10.7819/rbgn.v17i55.2647

26. Loorbach, D., & Wijsman, K. 2013. Business transition management: exploring a new role for business in sustainability transitions. Journal of cleaner production. https://doi.org/10.1016/j.jclepro.2012.11.002

27. Kwon, I. W. G., & Suh, T. 2005. Trust, commitment and relationships in supply chain management: a path analysis. Supply chain management: an international journal. https://doi.org/10.1108/13598540510578351

28. Lee, Y., & Cavusgil, S. T. 2006. Enhancing alliance performance: The effects of contractual-based versus relational-based governance. Journal of business research. https://doi.org/10.1016/j.jbusres.2006.03.003

29. Walker, H., & Biedenkopf, K. 2020. Why do only some chairs act as successful mediators? Trust in chairs of global climate negotiations. International Studies Quarterly. https://doi.org/10.1093/isq/sqaa018

30. Ghosh, A., & Fedorowicz, J. 2008. The role of trust in supply chain governance. Business Process Management Journal. https://doi.org/10.1108/14637150810888019

31. Delbufalo, E. 2012. Outcomes of inter-organizational trust in supply chain relationships: a systematic literature review and a meta-analysis of the empirical evidence. Supply Chain Management: An International Journal. https://doi.org/10.1108/13598541211246549

32. Carson, S. J., Madhok, A., Varman, R., & John, G. 2003. Information processing moderators of the effectiveness of trust-based governance in interfirm R&D collaboration. Organization science. https://doi.org/10.1287/orsc.14.1.45.12811

33. Gulati, R., & Nickerson, J. A. Interorganizational trust, governance choice, and exchange performance. Organization science; 2008. https://doi.org/10.1287/orsc.1070.0345

34. Ryu, S., Lim, Y., & Hong, H. 2009 Volatile environments and interfirm governance: does trust matter?. Journal of Business-to-Business Marketing. https://doi.org/10.1080/10517120902762443

35. Suiseeya, K. R. M., Elhard, D. K., & Paul, C. J. Toward a relational approach in global climate governance: Exploring the role of trust. Wiley Interdisciplinary Reviews: Climate Change. 2021. https://doi.org/10.1002/wcc.712

36. Cox, J. C. 'How to identify trust and reciprocity' Games and economic behaviour. 2004. https://doi.org/10.1016/S0899-8256(03)00119-2

37. Simpson, J. A. 2007. Psychological foundations of trust. Current directions in psychological science. https://doi.org/10.1111/j.1467-8721.2007.00517.x

38. Wu, L., Chuang, C. H., & Hsu, C. H. 2014. Information sharing and collaborative behaviours in enabling supply chain performance: A social exchange perspective. International Journal of Production Economics. https://doi.org/10.1016/j.ijpe.2013.09.016

39. Laeequddin, M., Sardana, G. D., Sahay, B. S., Abdul Waheed, K., & Sahay, V. 2009. Supply chain partners' trust building process through risk evaluation: the perspectives of UAE packaged food industry. Supply Chain Management: An International Journal. https://doi.org/10.1108/13598540910970117

40. Dania, W. A. P., Xing, K., & Amer, Y. 2018. Collaboration behavioural factors for sustainable agri-food supply chains: A systematic review. Journal of cleaner production. https://doi.org/10.1016/j.jclepro.2018.03.148

41. Qu, W. G., & Yang, Z. 2015. The effect of uncertainty avoidance and social trust on supply chain collaboration. Journal of Business Research. https://doi.org/10.1016/j.jbusres.2014.09.017

42. Nidumolu, R., Ellison, J., Whalen, J., & Billman, E. 2014. The collaboration imperative. Harvard business review. 92(4): 76-84.

43. Misztal, B. 2013. Trust in modern societies: The search for the bases of social order. Cambridge: John Wiley and Sons.

44. Waage, J., Yap, C., Bel, S., Levy, C., Mace, G., Pegram, T., Unterhalter, E., Dasandi, N., Hudson, D., Kock, R., Mayhew, S. H., Marx, C., & Poole, N. 2015. Governing Sustainable Development Goals: interactions, infrastuctures, and institutions In: Thinking Beyond Sectors for Sustainable Development, ed. Jeff Waage and Christopher Yap, 79-88. London: Ubiquity Press.

45. Boas, I., Biermann, F., & Kanie, N. 2016. Cross-sectoral strategies in global sustainability governance: towards a nexus approach. International Environmental Agreements: Politics, Law and Economics. https://doi.org/10.1007/s10784-016-9321-1

46. Katila, P., Colfer, C. J. P., De Jong, W., Galloway, G., Pacheco, P., & Winkel, G. 2019. Sustainable Development Goals. Cambridge: Cambridge University Press.

47. Siegel, K. M., & Lima, M. G. B. 2020. When international sustainability frameworks encounter domestic politics: The sustainable development goals and agri-food governance in South America. World Development. https://doi.org/10.1016/j.worlddev.2020.105053

48. Vazquez-Brust, D., Piao, R. S., de Melo, M. F. D. S., Yaryd, R. T., & Carvalho, M. M. 2020. The governance of collaboration for sustainable development: Exploring the “black box”. Journal of Cleaner Production. https://doi.org/10.1016/j.jclepro.2020.120260

49. De Schutter, O., Jacobs, N., & Clément, C. 2020. A ‘Common Food Policy’ for Europe: How governance reforms can spark a shift to healthy diets and sustainable food systems. Food Policy. https://doi.org/10.1016/j.foodpol.2020.101849

50. Rubio-Andrés, M., Ramos-González, M. D. M., Sastre-Castillo, M. Á., & Danvila-del-Valle, I. 2020. Exploring sustainability, good governance, and social responsibility in small and

medium enterprises. Corporate Social Responsibility and Environmental Management. https://doi.org/10.1002/csr.1849

51. Ruiz-Lozano, M., Ríos Berjillos, A. D. L., & Millán Lara, S. 2016. Son los códigos éticos un instrumento de gestión de la responsabilidad social? Un estudio exploratorio en Andalucía. Intangible Capital. http://hdl.handle.net/2117/87832. Accessed 22 july 2023.

52. Bergsten, A., Jiren, T. S., Leventon, J., Dorresteijn, I., Schultner, J., & Fischer, J. 2019. Identifying governance gaps among interlinked sustainability challenges. Environmental Science and Policy. https://doi.org/10.1016/j.envsci.2018.10.007

53. Mintrom, M., & Thomas, M. 2018. Policy entrepreneurs and collaborative action: Pursuit of the sustainable development goals. International Journal of Entrepreneurial Venturing. https://doi.org/10.1504/IJEV.2018.092710

54. Yakovleva, N., Frei, R., & Rama Murthy, S. 2019. Editorial introduction: Achieving sustainable development goals through sustainable supply chains in the post-global economy. e-Book: Springer International Publishing. https://doi.org/10.1007/978-3-030-15066-2_1

55. Bodin, Ö., & Nohrstedt, D. 2016. Formation and performance of collaborative disaster management networks: Evidence from a Swedish wildfire response. Global Environmental Change. https://doi.org/10.1016/j.gloenvcha.2016.10.004

56. Ringle, C. M., Da Silva, D., & de Souza Bido, D. 2014. Modelagem de equações estruturais com utilização do SmartPLS. REMark-Revista Brasileira de Marketing. https://doi.org/10.5585/remark.v13i2.2717

57. Cohen, J. 2013. Statistical power analysis for the behavioural sciences. New York: Academic press.

58. Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. 2021. Partial least squares structural equation modeling (PLS-SEM) using R: A workbook. e-Book: Springer Nature.

59. Liu, Y. H. S., Deligonul, S., Cavusgil, E., & Chiou, J. S. 2018. Always trust in old friends? Effects of reciprocity in bilateral asset specificity on trust in international B2B partnerships. Journal of Business Research. https://doi.org/10.1016/j.jbusres.2018.05.012

60. Khan, M., Hussain, M., Papastathopoulos, A., & Manikas, I. 2018. Trust, information sharing and uncertainty: An empirical investigation into their impact on sustainability in service supply chains in the United Arab Emirates. Sustainable Development. https://doi.org/10.1002/sd.1856

61. Sun, Y., Liu, Z., & Yang, H. 2018. How does suppliers' fairness affect the relationship quality of agricultural product supply chains?. Journal of food quality. https://doi.org/10.1155/2018/9313068

62. Wang, J., & Dai, J. 2018. Sustainable supply chain management practices and performance. Industrial Management and Data Systems. https://doi.org/10.1108/IMDS-12-2016-0540

63. Das, D. 2017. Development and validation of a scale for measuring Sustainable Supply Chain Management practices and performance. Journal of Cleaner Production. https://doi.org/10.1016/j.jclepro.2017.07.006

64. Peng, D. X., & Lai, F. 2012. Using partial least squares in operations management research: A practical guideline and summary of past research. Journal of operations management. https://doi.org/10.1016/j.jom.2012.06.002

65. Neves, J. A. B. 2018. Modelo de equações estruturais: uma introdução aplicada. Brasília, DF: ENAP – Escola Nacional e Administração Pública.

66. Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P., & Kaiser, S. 2012. Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective. Journal of the Academy of Marketing Science. https://doi.org/10.1007/s11747-011-0300-3

67. Henseler, J., Ringle, C. M., & Sarstedt, M. 2015. A new criterion for assessing discriminant validity in variance-based structural equation modelling. Journal of the academy of marketing science. https://doi.org/10.1007/s11747-014-0403-8

68. Chin, W. W. 1998. The partial least squares approach to structural equation modelling. In Modern methods for business research, ed. George A. Marcoulides, 295-336. Mahwah, NJ: Erlbaum.

69. van Zanten, J. A., & van Tulder, R. 2021. Towards nexus-based governance: defining inter-actions between economic activities and Sustainable Development Goals (SDGs). International Journal of Sustainable Development and World Ecology. https://doi.org/10.1080/13504509.2020.1768452

70. Futemma, C., De Castro, F., & Brondizio, E. S. 2020. Farmers and social innovations in rural development: collaborative arrangements in eastern Brazilian Amazon. Land Use Policy. 104999. https://doi.org/10.1016/j.landusepol.2020.104999

71. Stupak, I., Mansoor, M., & Smith, C. T. 2021. Conceptual framework for increasing legitimacy and trust of sustainability governance. Energy, sustainability and society. https://doi.org/10.1186/s13705-021-00280-x

72. Burch, S., Andrachuk, M., Carey, D., Frantzeskaki, N., Schroeder, H., Mischkowski, N., & Loorbach, D. 2016Governing and accelerating transformative entrepreneurship: exploring the potential for small business innovation on urban sustainability transitions. Current opinion in environmental sustainability. https://doi.org/10.1016/j.cosust.2017.04.002

73. Kramer, M. R., & Porter, M. 2011. Creating shared value. Boston: FCG.

74. Waheed, A., & Zhang, Q. 2022. Effect of CSR and ethical practices on sustainable competitive performance: A case of emerging markets from stakeholder theory perspective. Journal of Business Ethics. https://doi.org/10.1007/s10551-020-04679-y

Appendix I – Variables chosen in the model.

Latent variables (LV)	Observable variables (indicators)	References
Trust	CF1. The other actors/partners of the supply chain keep their promises.	Liu et al., 2018 (adapted)
	CF2. The information transmitted by other actors/partners is reliable.	
	CF3. Supply chain actors protect the rights of their partners.	
	CF4. When making important decisions, the other actors/partners in the supply chain consider the welfare of all stakeholders.	Khan et al., 2018 (adapted)
	CF5. When circumstances change, other actors/partners are willing to offer assistance and support.	Sun et al., 2018 (adapted)
Governance	GV1. Good governance is widely known and applied by the management of the company/institution where I work.	Rubio-Andrés et al., 2019 (adapted)
	GV2. The company/institution where I work has code of ethics, which is followed.	
	GV4. The company/institution where I work makes evaluations on the environment in the workplace.	
	GV5. Companies in the supply chain act in accordance with the legislation.	New scale
Collaboration	CL1. The actors/partners work together in the area of social and environmental responsible management.	Wang & Dai, 2017 (adapted)
	CL2. Companies/institutions in the supply chain make joint efforts with other actors/partners to reduce waste and improve waste management.	
	CL3. Companies/institutions in the supply chain make joint efforts with other actors/partners to improve trust and personal values.	
	CL5. Companies/institutions in the supply chain make joint efforts with other actors/partners to ensure food safety.	New scale
	CL6. Companies/institutions in the supply chain make joint efforts with other actors/partners to value cultural aspects in production processes.	New scale
Sustainability	General question: In the last three years my company/institution has achieved…	
Environmental sustainability	SA2. Significantly reduce the consumption of hazardous/toxic materials.	Khan et al., 2018 (adapted)
	SA3. Improve compliance with environmental standards.	Wang & Dai, 2017 (adapted)
	SA4. Improve the ability to recycle/reuse.	
Social sustainability	S1. Improve the image of the company/institution in the eyes of the community and other actors in the supply chain.	Wang & Dai, 2017 (adapted)
	S2. Improve relationship with the community and stakeholders.	Khan et al., 2018 (adapted)
	S3. Greater compliance with applicable social laws.	
Economic sustainability	SE1. Significantly reduce waste and its disposal costs.	Khan et al., 2018 (adapted)
	SE3. Improve the profit and competitiveness of companies or the cost/benefit ratio of the institution.	Wang & Dai, 2017 (adapted)

	SE4. Improve the quality of products/services.	Das, 2017 (adapted)

Apendix II – Cross-loadings matrix.

Indicators	Trust	Governance	Collaboration	Environmental Sustainability	Social Sustainability	Economic sustainability
CF1	0.829	0.472	0.507	0.443	0.393	0.432
CF2	0.857	0.514	0.498	0.428	0.403	0.396
CF3	0.795	0.429	0.550	0.372	0.340	0.342
CF4	0.863	0.521	0.604	0.412	0.420	0.421
CF5	0.857	0.485	0.536	0.414	0.398	0.417
GV1	0.492	0.853	0.585	0.531	0.525	0.527
GV2	0.326	0.785	0.426	0.453	0.537	0.483
GV4	0.324	0.707	0.418	0.528	0.466	0.580
GV5	0.645	0.802	0.639	0.529	0.512	0.486
CL1	0.571	0.606	0.908	0.563	0.490	0.492
CL2	0.555	0.606	0.917	0.567	0.470	0.524
CL3	0.614	0.665	0.915	0.573	0.507	0.538
CL5	0.580	0.534	0.835	0.481	0.470	0.462
CL6	0.502	0.494	0.821	0.465	0.403	0.396
SA2	0.421	0.511	0.499	0.858	0.529	0.638
SA3	0.421	0.617	0.537	0.921	0.695	0.772
SA4	0.461	0.585	0.561	0.868	0.642	0.745
SS1	0.416	0.601	0.470	0.597	0.936	0.765
SS2	0.474	0.558	0.500	0.625	0.925	0.720
SS3	0.404	0.631	0.507	0.735	0.909	0.794
SE1	0.391	0.539	0.475	0.821	0.658	0.860
SE3	0.400	0.519	0.471	0.639	0.635	0.870
SE4	0.456	0.653	0.495	0.683	0.845	0.888

Source: Authors, based on SmatPLS.

Appendix III – Variance Inflation Factor (VIF).

Indicators	Variance Inflation Factor (VIF)
CF1	2.844
CF2	3.110
CF3	1.961
CF4	2.590
CF5	2.608
GV1	2.044
GV2	1.679
GV4	1.337
GV5	1.677
CL1	3.934
CL2	4.651
CL3	4.126
CL5	2.285
CL6	2.279
SA2	2.158
SA3	2.842
SA4	2.009
SS1	3.869
SS2	3.541
SS3	2.646
SE1	1.939
SE3	2.071
SE4	2.040

Source: Authors, based on SmatPLS.

Chapter 6

Conclusions

6 - Conclusions

In this final chapter, the first subsection presents the main conclusions of the thesis and the theoretical and practical contributions according to the study objectives proposed in the project. In the second subsection, the limitations found during the research are addressed, and suggestions for future research on the subjects studied are expressed in the third subsection.

6.1 Main conclusions

The general objective of the thesis was achieved through the specific objectives and, for each of them, the main conclusions obtained with the accomplishment of work will be presented.

O1	**Identify the research agenda on trust in agri-food supply chains.**

The review article, corresponding to Chapter 2, was responsible for the achievement of this objective and showed that the approach to trust in agri-food supply chains is growing, but is not very studied. It is a central and transverse theme and, considering the thematic evolution of the topic, was shown with decreasing density and centrality in the studied period. Because of this, authors were found who suggest further research on the subject.

Many articles related to consumer trust were found, even when we conducted research focused on the relationship of trust in supply chains. This demonstrates that despite considerable research on business to consumers (B2C) relations in marketing and management literature, only a small proportion of it has focused on relationships between business to business (B2B) in food supply chains. Only seven review articles were available, which we considered a low number. In addition, we did not find works that dealt with trust relationships between the stakeholders within a supply chain (B2B relations).

We observed that recent publications, in the form of case studies, conceptual works and qualitative researches, dealt with the relationship of trust involving blockchain and this leads us to consider that the use of this technology may be influencing these relationships among stakeholders of these supply chains. Studies on this kind of relationship can be a trend.

Most works adopted a quantitative approach. The main qualitative methodology was the interviews and, in the case of articles with a mixed approach, this methodology was combined in many cases with descriptive statistics. Due to the close relationship between trust and governance studies, several researches have involved this last theme.

O2	**Establish the main variables to build trust in local agri-food value chains.**

The second objective was achieved with qualitative research. In Chapter 3, through the narratives of the interviewees it was possible to identify important constructs of trust, such as: benevolence, when crisis situations were addressed; communication, especially where it was reported on the relationship between companies and control bodies; transparency, efficiency and competence, items directly linked to partner performance; lasting relationship and reputation, when respondents mention personal interactions and their enduring family ties; knowledge and information sharing, as occurred in the report of the innovative structure similar to an integration; predictability, as in the case of the relationship between mariculturists and the university; and integrity, when the need for honesty among stakeholders was addressed. Reciprocity appears as an important factor for strengthening relationships of trust, which corroborates the Social Exchange Theory. Furthermore, as collaborative activities between chain partners and their willingness to collaborate increase, trust builds up.

And when the theme of informality was analysed specifically in chapter 4, it was detected that when public services are not efficient, it generates discontent in properly formalized producers, which ends up decreasing their trust with control bodies.

O3	**Discover how trust between stakeholders influences the sustainability of local agri-food supply chains, addressing economic, social and environmental aspects.**

In the qualitative analysis of Chapter 3, the relationship between trust and sustainability was confirmed, where the term stability was inserted in this context. It has been mentioned that organizations with high levels of trust are more comfortable in building good relationships and striving more to ensure stability than those who operate with a lower level of trust. This relationship was more consistent when respondents discussed social and economic sustainability, contrary to what happened when they addressed environmental sustainability, which was commented on a superficial way. The work also showed that high levels of trust promote the development of innovative structures and create opportunities, contributing to the sustainability of producers and chain.

In chapter 5, where the quantitative study was conducted, it was concluded that trust indirectly influences sustainability in its three pillars, with the way through governance being more significant than through collaboration. In other words, considering trust as a primary construct and sustainability as a final variable, the way an agri-food supply chain works and is managed,

as well as its actors relate, it seems to be more important than how these stakeholders collaborate with each other. It was also possible to conclude that trustworthy relationships generate value in commercial and social links, and this contributes to the sustainable management of supply chains.

O4	**Evaluate and compare the relationship between trust and sustainability in local agri-food supply chains, considering crisis and non-crisis times.**

This objective was possible to be achieved through the work of Chapter 3. An interviewee showed concern for the duration of a crisis was exposed, however, the strengthening of confidence was not only momentary. Other testimonies emphasized that this relationship really strengthens itself. Empathy was mentioned in situations such as this, being considered a confidence construct, as the possibility that shared experiences of adversity could increase the union between people. It has been concluded that the need for help and mutual support arises during crisis periods and strengthens social networks, and trust appears here as an important factor of resilience. Solidarity and reciprocity were also mentioned and, in this sense, crisis situations can be seen as the perspective of Social Exchanges Theory.

O5	**Based on the results, provide management subsidies, in the form of theoretical and practical contributions, to improve governance and sustainability in agri-food systems.**

The qualitative work of Chapter 3 concludes that when we talk about relationships between stakeholders, people's cultural aspects have to be considered and may represent an obstacle to the construction of trust. In the relationship between companies and control bodies, interpersonal communication is important to a better understanding of impasses and their resolution. Regarding inter organizational trust, when associated with technical and administrative skills, the performance of establishments increases. The creation and improvement of policies to organize and professionalize the chains of agri-food supplies is essential. Without neglecting cultural aspects, the organization of stakeholders promotes the strengthening of the relationship, the exchange of information and knowledge, stronger partnerships and the understanding that together they can improve the development of activity and make it sustainable in the long run. Encouraging the creation of associations and cooperatives is encouraged.

When importance is given to the study of trust, public and private bodies can better plan their actions, build more effective tactics and implement efficient operations for local and regional development. Furthermore, by identifying constructs and outcomes of trust among stakeholders,

policymakers can design more efficient governance systems, targeting better performance, social welfare, food security and sustainable development.

The efficiency of control bodies is very important, as they transmit trust to those controlled and facilitate governance in the chain. The case of the (public) university also deserves attention, where it positioned itself as an important agent for promoting local mariculture as a supplier to the chain and, in order to obtain inter-organizational trust, it must meet performance and predictability requirements.

Building trust with partners proved to be a good market strategy, as it directly affects trade efficiency. A trusting and transparent relationship adds value to products, and suppliers can market their products for higher and more stable values. For customers who receive the goods, the costs of controlling and changing suppliers are reduced, which further contributes to the economic sustainability of both stakeholders and the chain as a whole.

Chapter 4 research has shown that informality should be discouraged, as it impairs the organization of the supply chain, promotes feuds between formalized producers and those informal, and reduce trust throughout the chain, including between legalized producers and control bodies.

In the quantitative research, it was corroborated that the strengthening of trust relationships should be interpreted as a strategic action of good governance, collaboration and sustainable development. The survey data in Chapter 5 also confirmed that trust, governance and collaboration must be considered in the creation of policies, both public and private, for the management of agri-food supply chains. From there, we were able to suggest that, in the elaboration of strategies for sustainable development, the main constructs of trust be promoted and strengthened, such as transparency, adequate communication, sharing of information and knowledge, predictability, integrity and competence.

The internal governance structures must be studied according to each stakeholder and the external governance mechanisms, that is, how the actors relate to their partners and to the supply chain as a whole, also deserves attention. Regarding public governance, it is important to prioritize some factors, such as transparency, access to information, correct selection of leaders, compliance and accountability.

A good organization of the sectors improves not only governance but also allows the application of collaboration initiatives, which, according to the results found, helps in the stability and durability of commercial relations and, consequently, in the sustainability of supply chains. In

addition, this stability allows for improvements, with the possibility of adopting changes that involve certain risks, especially with regard to environmental issues and energy transition. Economic and social sustainability proved to be very important for initiatives related to environmental sustainability to take place.

6.2 Limitations

In the review article, the search performed in only two databases, Scopus and Web of Science, was a limitation of the software used. In view of this, the continuation of the bibliographic review in other databases was continuous and manual.

In the qualitative study, due to the Covid-19 pandemic, some actors could not be interviewed in person, as well as some refused to participate in the survey. The time required for the interviews was also a limitation, as some respondents did not have much time to participate in the study. Even applying a previously prepared questionnaire, respondents avoided the subjects and did not answer some of the questions that were asked. In this research, several variables related to trust were identified, but it was not possible to measure them or test the significance of the relationships found.

In the quantitative analysis, although the number of respondents was three times that recommended by the adopted methodology, a larger number of participants would provide more representative results.

6.3 Future research

The work carried out in Chapter 2 can be updated, as this will provide an up-to-date overview of the research agenda on trust in agri-food supply chains.

Chapter 3 indicated that further research could be carried out in this field of study, to not only deepen the topic but also to specifically assess trust relationships between producers and control bodies and trust in times of crisis within agri-food supply chains. Conducting qualitative research in other agri-food supply chains would also be important, in order to expand the sample of this study and to make comparisons possible.

In view of the results found in Chapter 4, we believe that more studies on informality should be carried out, both qualitative and quantitative, as it is a topic that is very present throughout the world and little studied. We realize that the field of study lacks new conclusions so that new solutions can be found as a basis for policy-making to tackle this problem.

And as for quantitative studies, to obtain even more indicative results, similar research can be carried out in specific supply chains. To obtain more comprehensive data, we suggest carrying out studies like this one in other countries, including comparisons. Furthermore, considering that governance was quite representative in our model, future work to evaluate this variable, separating corporate governance from public governance, would be useful.