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Sustainability Governance: Insights from a Cocoa Supply Chain

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Abstract: The food industry is one of the main drivers of climate change, with serious impacts on the living and working conditions in developing countries. Due to these sustainability issues, consumers, governments, and non-governmental organizations are pressuring food companies to rethink their current business concepts of food production. Food companies rely on supply chain governance and its mechanisms to implement sustainability standards across all tiers of their supply chains. This study examines the sustainability governance at all stages of a cocoa supply chain, from the raw material production to the retailer, by using a qualitative case study approach. The results show a differentiation of the sustainability governance according to the different supply chain stages. At the raw material production stage, sustainability is mainly improved using contracts, extensive and frequent knowledge sharing, and audits. After the raw material production stage, environmental and social sustainability is almost exclusively coordinated by certificates, while other governance mechanisms are used to foster long-term economic business relationships. This study gives detailed insights into the application intentions and the functioning of sustainability governance mechanisms and provides propositions on how to efficiently improve sustainability in food supply chains.

Keywords: food supply chain; sustainability; governance; mechanism; certificate



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1. Introduction

The food industry has a significant impact on the environment and society. Up to 37 percent of man-made greenhouse gas emissions is caused by the food industry, making the industry a major driver of climate change [1]. Today's food production affects entire ecosystems through converting land use, threatening biodiversity, consuming large amounts of water, overfertilizing soils, and damaging or destroying biotopes [2,3]. Additionally, social standards, such as the industry's working conditions and wages, are poor, especially in developing countries [4].

Consumers, governments, and non-governmental organizations (NGOs) are increasingly aware of the environmental and social effects of the food industry. They are calling for compliance with higher sustainability standards [5]. While many food companies aim for improving their sustainability, they face the challenge of implementing sustainability standards throughout their whole supply chains. Limited transparency in the supply chains and a missing influence on sub-suppliers, for example, make it difficult for food companies to increase sustainability throughout the whole supply chain [6]. To counteract these challenges, companies rely on supply chain governance and its mechanisms, which encourages partners to adopt more sustainable behaviors [7].

Supply chain governance refers to a system of mechanisms that aims to influence business partners' behavior, coordinate transactions, and safeguard against opportunism [8]. Implementing sustainability standards in food supply chains using governance has already been researched (e.g., [9–11]) whereby the focus was mainly on individual sections of supply chains (e.g., raw material production) [7]. To gain a comprehensive insight into the actual application intentions and the effects of the governance, research on the governance of supply chains should, however, consider the perspectives of all stages of a supply chain. Schäfer [12] investigated, for example, an entire supply chain in the food industry,

focusing on the ethical aspects of animal husbandry in food production. While the isolated focus on certain sustainability dimensions provides detailed insights on how to improve corresponding sustainability standards, it is recommended to consider the simultaneous implementation of environmental, economic, and social sustainability standards to ensure long-term compliance [13].

Therefore, this research aims to investigate the governance of food supply chains to simultaneously implement social, environmental, and economical sustainability standards at all stages of a supply chain. We focus on governance mechanisms (GM), which can be used by companies to actively influence actors and thus coordinate their activities in the supply chain [8]. To properly represent and analyze the influence of GMs throughout the whole supply chain and thus provide a holistic picture of the functioning of sustainability governance, it is important to consider all stages of the supply chain, from the raw material production to the retailer, during data collection. Therefore, we conduct a case study research of a whole food supply chain to answer the following research questions:

RQ1: How do governance mechanisms increase sustainability in food supply chains?

RQ2: How do the functioning and the application intentions of governance mechanisms differ between the stages of food supply chains?

This research contributes to the operations and sustainability literature by identifying and analyzing GMs for a holistic and long-term sustainability enhancement in food supply chains. We show how the application of GMs differs on the different tiers of supply chains and what actors intend by using certain GMs. Various propositions can be derived, which provide new insights for theorists but also practitioners interested in the sustainability governance of food supply chains.

2. Materials and Methods

2.1. Supply Chain Governance

Supply chain governance is a multi-faceted term used in various disciplines of academia and practice, such as political or economic science [14]. Supply chain governance refers to a concept for managing and coordinating business relationships between companies by providing a behavioral and decision-making framework when conducting transactions [15]. Governance aims to increase value creation in the supply chain and avoid opportunism [16,17]. While governance itself is not an activity, GMs are used to actively influence partners' behavior in business relationships.

GMs are distinguished into formal and informal mechanisms. Formal GMs are characterized by clear structures, which are often contractually defined. Formal mechanisms, such as contracts, establish a set of mutually accepted and required behaviors that define how to interact in the supply network [18]. Formal standards serve to specify product quality and define certain process requirements. Furthermore, the formal definition of roles and functions between organizations and individuals in a supply chain is another important mechanism within formal coordination [19].

Informal GMs, also called relational or social GMs, are based on a social, non-contractual level [20–22]. They enforce certain behavior in business relationships on a social-relational level (e.g., through social identification with the relationship or social pressure). Shared norms and values, repetitive social interactions, and trust build the basis of informal mechanisms. Informal mechanisms, such as an open communication culture and a willingness to comprise, provide substantial support for the coordination of business relationships [18,23]. Poppo and Zenger [23] emphasize that formal and informal governance are not substitutes for each other but support each other. Informal governance can, for example, be used to fill contractual gaps [24].

2.2. Sustainability Governance in Food Supply Chains

Compared to supply chains of other industrial and consumer goods, the coordination of food supply chains is challenging due to the perishability of food. Product spoilage must be prevented, and food safety must be ensured through appropriate transportation

measures and storage temperatures [25,26]. Additionally, volatile consumption on the consumer side and weather-dependent production of raw materials affect the design and coordination of supply chains in the food industry [27].

Food products pass through several companies in a supply chain, including farmers, distributors, processors, and retailers (see Figure 1) [28,29]. These actors share the responsibility of meeting consumer needs [30]. Actors in food supply chains should therefore work closely together to have a smooth flow of goods in the supply chain and to be able to ensure the sustainability of the products [31].

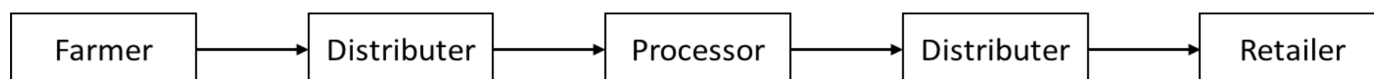


Figure 1. Actors in global food supply chains.

Sustainability can be defined as the “result of the activities of an organization, voluntary or governed by law, that demonstrate the ability of the organization to maintain viable its business operations (including financial viability as appropriate) whilst not negatively impacting any social or environmental systems” ([32], pp. 73–74). Sustainability is distinguished into social, environmental, and economic sustainability dimensions. The different dimensions support each other, and long-term sustainability can only be achieved by considering all three aspects of sustainability [33]. Sustainability in food supply chains refers specifically to environmental aspects, such as food waste, greenhouse gas emissions during production, and transportation distances from the point of production to the point of consumption [34], as well as social aspects, such as the employees’ wages or work place safety [35]. There are different approaches to increasing sustainability within food supply chains, e.g., local sourcing to reduce transport distances [36] or reducing food waste [37].

Companies are increasingly designing their supply chain governance to ensure the sustainability of agricultural inputs. For example, Bastian and Zentes [38] show that a high level of information exchange or the inclusion of sub-suppliers in supply chain coordination leads to greater transparency in food supply chains, which increases social and environmental, but also economic sustainability. Previous research has mainly focused on the governance perspective of retailers or manufacturers, with little investigation of the role of intermediaries (e.g., [39]). However, Grabs and Carodenuto [7] emphasize that, for example, traders in the intermediate stages of the supply chain can also substantially influence sustainability governance and therefore calls for a holistic investigation of the governance of all actors in food supply chains. Therefore, we aim to investigate sustainability governance in food supply chains considering all actors, from raw material producers to retailers.

3. Methodology

We conducted a single case study to achieve the research objective and answer the research questions. Case studies are suitable for exploratory, descriptive, and explanatory research. Case studies are differentiated into multiple and single case studies according to the number of research objects. If a research object is analyzed in detail, single case studies are methodologically suitable [40]. In order to be able to develop a holistic governance approach for sustainability enhancements in food supply chains while considering the interactions and dynamics between all participants, we decided to conduct a single case study.

Following Yin [40], the methodological approach for case study research is divided into four phases: planning and design (1), data collection (2), data analysis (3), and reporting (4).

First, we developed the research goal, determined the research questions, designed the study, and selected the case. The analyzed food supply chain was selected because the final products (confectioneries) are advertised as particularly environmentally and socially sustainable. The trading company aims to enhance sustainability in the food industry and wants to trade exclusively organic and fair-trade products. The trading company claims

that all individual stages of the supply chain act sustainably, allowing comprehensive insights into the sustainability governance of the whole supply chain. It is striking that all actors in the supply chain do not implement their sustainability efforts due to political pressure. Instead, actors behave sustainably out of their own intention: “[...] it has to be [...] good for the environment, good for the business and good for the people [...]” (IP2). Most companies in the supply chain are therefore motivated and committed to ensuring that their business activities are as sustainable as possible.

Additionally, the sustainability standards required by the trading company exceed all legal minimum sustainability standards in the affected countries. Thus, few companies also increase the sustainability of their activities due to pressure from supply chain partners. The actors may only be part of the supply chain if they implement the sustainability standards set by the trading company, as these are, for example, required for marketing the end product. Actors who normally only comply with legal sustainability requirements (e.g., company D) therefore implement higher sustainability standards in order to earn money as a manufacturer in the supply chain.

We conducted semi-guided expert interviews at each stage of the supply chain. The interview guide consisted of four different interview sections. First, the partners were welcomed, the interview topic was introduced, and a mutual understanding of the most important terms was created (1). Afterward, the governance and coordination of the supply chain (2), sustainability in the organization and the supply chain (3), and, in the last section of the interviews, sustainability governance in the examined supply chain (4) were discussed. We selected at least one interviewee from each stage of the supply chain, from the raw material production to the food retailer (Table 1). The experts were selected based on their role in the companies. In order to make statements about supply chain processes and their sustainability, plant managers, purchasing managers, supply chain managers, and sustainability managers were mainly interviewed. The interviewees have an average professional experience in their current job position of over five years. Overall, the interviews at each company lasted an average of 1 h and 5 min. It was not possible to interview a representative of the raw material production cooperative in South America in person because they do not have a sufficient internet or phone connection. Instead, a comprehensive questionnaire based on the interview guide was completed by the farm.

Table 1. Interview participants.

Part of the Supply Chain	Company	Position of the Interview Partner	Interviewee Mnemonics
Raw material production	Company A	Supply Chain Manager	IP1
Raw material import	Company B	CEO	IP2
Commodity wholesale	Company C	CEO	IP3
Manufacturer	Company D	Plant Manager	IP4
Logistics service provider	Company E	Director of E-Commerce	IP5
Transportation service provider	Company F	Head of Transportation Purchase	IP6
Trading company	Company G	Project coordinator Sustainability	IP7
		Supply Chain Manager	IP8
Food wholesale	Company H	Head of Purchasing	IP9
		Sustainability Manager	IP10
Food retailer	Company I	Procurement Officer	IP11

The audio recordings of the interviews were transcribed and served as the primary data source. The structured and qualitative content analysis of the transcripts was performed according to Mayring [41] and was supported by the analysis software *MAXQDA 2020*. *MAXQDA* allowed us a software-based coding of the interview transcripts to structure the data analysis. The coding categories were first deductively derived from the preliminary theoretical consideration and the interview guide. Three categories were formed at the first coding level. The first category “General Information” includes all statements about the interview partners, the company or introductory formalities. The second category “Governance Mechanisms” includes all parts of the interviews in which mechanisms are named or described that manage and coordinate supply chains and contribute to increasing sustainability. In the third category “Sustainability”, all passages of the interviews that refer to the three dimensions of sustainability are coded. In order to better assess and distinguish the statements in the interviews, several subcodes were assigned to each coding category. The category of “Governance Mechanisms”, for example, was divided into formal and informal mechanisms, and within these categories, further subcategories regarding the individual mechanisms (e.g., contracts, audits and monitoring) were listed.

During the analysis of the interview transcripts, additional sub-categories were inductively developed and implemented into the coding system. For example, “obstacles to sustainable supply chains” were coded, which describe blockages that stand in the way of a more sustainable coordination of supply chains and reveal more about the actual application intentions of the individual mechanisms.

MAXQDA can help by creating overviews of code overlaps, e.g., of all text passages in the transcripts that deal with informal governance mechanisms and social sustainability aspects simultaneously. This allows a more precise and reliable analysis of the interviews since the researcher has a quicker overview of all text passages relevant to a certain topic and can easily detect agreements and contradictions between the interviewees.

The interviewees’ answers and comments mainly refer to the examined supply chain. In some cases, they also reflect general experiences regarding sustainability governance from other food supply chains. These comments are also considered as supplementary information in the results and discussion section to present the sustainability efforts at each stage of the supply chain more comprehensively.

While the interviews serve as the primary data source, we also collected secondary data to verify the interviewees’ statements. For this purpose, we analyzed documents and websites of the examined companies (e.g., sustainability reports) for aspects related to sustainability governance. This data triangulation makes it possible to identify contradictions in the primary data and, if necessary, to clarify them together with the interviewees. The results of the data analysis are presented in the next section, and the conclusions, which can be drawn from the analyzed data, are highlighted in the discussion section.

Quality Criteria of a Case Study

To ensure the high quality of our case study research, we considered several quality criteria for conducting qualitative case studies according to Yin [40], e.g., objectivity, reliability, internal, external, and construct validity.

First of all, the objectivity and reliability of a case study should be guaranteed to enable the reproducibility of the case study. Transparency and controllability of the scientific procedure are essential characteristics of reliable research. For this purpose, a research protocol was prepared, the case study data (e.g., transcripts) were archived, and the implementation of the case study was described in detail [40].

The case study validity is divided into construct validity, as well as internal and external validity. Construct validity ensures the choice of the correct measures for answering the research questions [40]. The interviewees received a summary of the interview guideline to prepare for the interview. Additionally, a non-disclosure agreement was signed to ensure that interviewees could freely disclose information without fearing social or professional consequences. During the development of the interview guide, a wide variety of already

existing scientific knowledge was used as a basis for the research to enhance construct validity. Further, the interviews were conducted with nine organizations in the same supply chain, allowing mutual data triangulation. Possible biases in the subjective expert perceptions could be identified, and any contradictions between the interviewees' answers could be clarified, e.g., through inquiries after the interviews.

Internal validity is characterized by the logical presentation of the cause–effect relationships in the research data [40,42]. Patterns in the data should be compared systematically and transparently, which was granted in the study by structuring the data analysis using a coding system. Furthermore, contradictions in the research data were searched for to ensure internal validity. External validity refers to the generalizability and transferability of the findings. Even though case studies are not intended to provide empirical evidence in research fields but are exploratory, we emphasized case selection to enhance external validity [40]. We chose a supply chain with nine actors extended over several countries and continents to best represent the challenges of governance across multiple supply chain stages. Additionally, the selected supply chain already provides sustainable end products (confectionaries), which allows the analysis of a consistently sustainable supply chain.

4. Sustainability Governance Approaches at Various Stages of Food Supply Chains

The analysis of the interviews shows a focus in the investigated supply chain on seven GMs, viz. contracts, certifications, audits and monitoring, risk sharing, shared values, information and knowledge sharing, as well as a trusting and close relationship. In the following sections, we show the intentions behind applying these GMs at the individual stages of the supply chain and how they coordinate the actions of the different actors in the supply chain. Thereby, we especially, but not exclusively, focus on how the GMs contribute to achieving the economic, environmental, and social sustainability goals. Table 2 summarizes the mechanisms' most important characteristics and their impact on sustainability at the different supply chain levels. Figure 2 provides an overview of all actors involved in the supply chain.

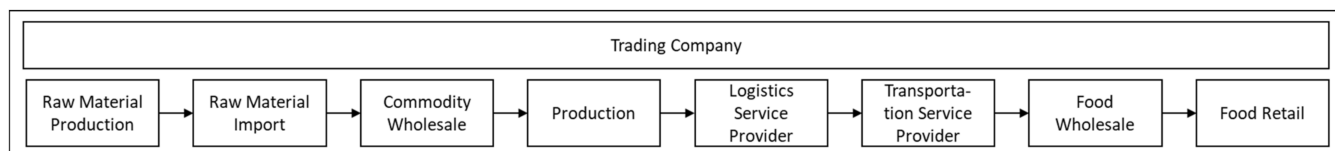


Figure 2. Investigated supply chain with black arrow indicating the material flow.

Table 2. Governance mechanisms at the different food supply chain stages and their effects on the ecological (ecol.), economic (econ.), and social (s.) sustainability dimensions.

Formal Governance Mechanisms					Formal and Informal Governance Mechanism		Informal Governance Mechanisms	
	Contracts	Certifications	Audits and Monitoring	Risk Sharing	Information and Knowledge Sharing	Shared Values	Trusting and Close Relationship	
Raw material production	<ul style="list-style-type: none">- Bundling effects, market access, and a secure income by forming a cooperative using contracts- Informal agreements to use organic pesticides and fertilizers (econ., ecol., s.)	<ul style="list-style-type: none">- Organic and fair-trade certifications to prove water and soil resource savings and ensure fair payment (ecol., s.)	<ul style="list-style-type: none">- Audits of all farms to ensure the contractually defined environmental and social standards (ecol., s.)	<ul style="list-style-type: none">- Farming cooperative jointly owned by all involved farms increases economic stability and enables joint distribution (econ.)	<ul style="list-style-type: none">- Regular training and on-site contacts with the farmers lead to:- Coordinated product and price management- Education regarding ecological cultivation methods and increase of efficiency (econ., ecol., s.)	<ul style="list-style-type: none">- Shared values are not used as governance mechanisms at the raw material production stage	<ul style="list-style-type: none">- Close relationship to all farmers enables provision of technical tools and skilled workers, leading to higher efficiency and more ecological methods of cultivation (econ., ecol.)	
Raw material import	<ul style="list-style-type: none">- Contractual exclusion of pesticides, protection of the environment, preservation of biodiversity, and agreement on payment of fair wages (ecol., s.)	<ul style="list-style-type: none">- Organic and fair-trade certification to enhance environmental and social sustainability standards- Certifications allow better marketing in European market (econ., ecol., s.)	<ul style="list-style-type: none">- Site visits to control the sustainability of the farmers- Inspection of the delivered goods for compliance to organic standards (ecol., s.)	<ul style="list-style-type: none">- Risk sharing is not used as a governance mechanism at the raw material import stage	<ul style="list-style-type: none">- Regular exchanges with local employees to improve farming methods- Transparent communication with customers leads to higher willingness to pay, and greater awareness for sustainability (econ., ecol., s.)	<ul style="list-style-type: none">- Considering the social and ecological values when selecting new suppliers (ecol., s.)	<ul style="list-style-type: none">- Alignment of mutual needs regarding the three dimensions of sustainability- Willingness to compromise (econ., ecol., s.)	
Commodity Wholesale	<ul style="list-style-type: none">- Long-term commitment of important suppliers through contracts- Contractual regulation of price and delivery conditions- Contractual regulation of energy management (econ., ecol.)	<ul style="list-style-type: none">- Certified compliance with organic standards- Certified fair payment and working conditions (ecol., s.)	<ul style="list-style-type: none">- Verification of ecological aspects of incoming goods- Randomized audits in upstream stages (ecol., s.)	<ul style="list-style-type: none">- Joint investments with raw material producers for more economic and environmentally friendly manufacturing practices (econ., ecol.)	<ul style="list-style-type: none">- Strengthening of the business relationship via regular face-to-face meetings- Exchange of operational data (econ.)	<ul style="list-style-type: none">- Consideration of a social and ecological value base when selecting new suppliers (ecol., s.)	<ul style="list-style-type: none">- Aiming for a close, long-term relationships to enhance economic security, knowledge sharing and joint optimization of sustainability performance (econ., ecol.)	
Production	Contractually binding and safeguarding of the financial parts of the business relationship through contracts (econ.)	<ul style="list-style-type: none">- Certificates enable market access- Expanding the potential customer base and secures ecological and social manufacturing practices (econ., ecol., s.)	Quality monitoring for incoming goods (econ.)	Joint investment in better production technologies (econ.)	<ul style="list-style-type: none">- No exchange of information or data	<ul style="list-style-type: none">- Shared values are not used as governance mechanisms at the production stage	<ul style="list-style-type: none">- Little trust- Formalities dominate coordination	

Table 2. Cont.

	Formal Governance Mechanisms				Formal and Informal Governance Mechanism	Informal Governance Mechanisms	
	Contracts	Certifications	Audits and Monitoring	Risk Sharing	Information and Knowledge Sharing	Shared Values	Trusting and Close Relationship
Logistics Service Provider	<ul style="list-style-type: none"> - Contractual commitment to customers <p>Safeguarding of the financial parts of the business relationship (econ.)</p>	<ul style="list-style-type: none"> - Certificates enable market access - Set minimum environmental and social requirements <p>Expanding the potential customer base (econ., ecol., s.)</p>	<ul style="list-style-type: none"> - Yearly assessment of suppliers and customers regarding KPIs, such as delivery or payment accuracy <p>Internal audits at their own sites to enhance social sustainability (econ., s.)</p>	<p>Joint investment in better warehouse technologies (econ., ecol.)</p>	<ul style="list-style-type: none"> - Informal exchanges to ensure good, personal business relationships <p>Optimization of operational business through data exchanges (econ.)</p>	<ul style="list-style-type: none"> - Shared values simplify sustainability improvements <p>Shared values as supplier selection criterion (econ., ecol., s.)</p>	<p>Price increases are negotiated in a trusting and close partnership (econ.)</p>
Transportation Service Provider	<ul style="list-style-type: none"> - Safeguarding of the financial parts of the business relationship <p>Sustainability requirements are specified for partners by Code of Conduct (econ., ecol., s.)</p>	<ul style="list-style-type: none"> - No industry-wide sustainability certificates available 	<ul style="list-style-type: none"> - Audits and monitoring are not used as governance mechanisms by the transportation service provider 	<p>Sharing financial risks and promoting greener technologies through joint investment with sub-service providers (econ., ecol.)</p>	<ul style="list-style-type: none"> - Strengthens business relationship and joint planning - Creates transparency and controls reliability <p>through information and data exchanges (econ.)</p>	<p>Code of conduct to communicate values to all partners (ecol., s.)</p>	<p>Close, long-term cooperation is sought and fostered through joint investments with partners in more ecological technologies (econ., ecol.)</p>
Trading Company	<p>Safeguarding of the financial parts of the business relationship (esp. with producer) (econ.)</p>	<ul style="list-style-type: none"> - Uses exclusively organically certified raw materials and products - Certification for fair working conditions - Certificates enable market access <p>Certified plastic-free packaging (econ., ecol., s.)</p>	<ul style="list-style-type: none"> - Control of food safety <p>Organic certificates are checked (econ., ecol.)</p>	<ul style="list-style-type: none"> - Risk sharing is not used as a governance mechanism by the trading company 	<p>Information and data exchanges coordinate operational business activities and support strategic planning (econ., ecol.)</p>	<p>Shared values with customers create higher willingness to pay for sustainability of products (econ., ecol., s.)</p>	<ul style="list-style-type: none"> - Close relationship with partners for flexible purchase volumes and stable prices <p>Joint coordination regarding sustainability approaches (econ., ecol.)</p>
Food Wholesale	<p>Safeguarding of the financial parts of the business relationship (econ.)</p>	<ul style="list-style-type: none"> - Uses exclusively organically certified raw materials and products <p>Certification for fair working conditions (ecol., s.)</p>	<ul style="list-style-type: none"> - Audits and monitoring are not used as governance mechanisms by the food wholesaler 	<ul style="list-style-type: none"> - Shared financial risk through joint investments (e.g., in better refrigeration equipment at customer's site) <p>Over- or underproduction is compensated by adjusted distribution strategy (econ., ecol.)</p>	<ul style="list-style-type: none"> - Regular supplier visits to strengthen relationships <p>Information and data exchanges simplify the operational business (econ., ecol., s.)</p>	<p>Shared values as a criterion for supplier selection simplifies sustainable approaches (ecol., s.)</p>	<p>Close collaboration with partners to strengthen regional structures (econ.)</p>

Table 2. Cont.

Formal Governance Mechanisms						Formal and Informal Governance Mechanism	Informal Governance Mechanisms	
Contracts		Certifications	Audits and Monitoring		Risk Sharing	Information and Knowledge Sharing	Shared Values	Trusting and Close Relationship
Food Retail	Safeguarding of the financial parts of the business relationship (econ.)	Uses organically certified raw materials and products (ecol.)	-	Audits and monitoring are not used as governance mechanisms by the food retailer	-	Little risk sharing	-	Supplier visits and trainings to strengthen trade relationships
					-	Few loans for partners to reduce risks		
							-	Regionality as most important value to ensure short transportation routes
								Strengthening of regional, social, and economic structures (econ., ecol., s.)
								Close business relationships to strengthen regional, social, and economic structures (econ., s.)

4.1. Raw Material Production

The main ingredient of the confectioneries produced in the investigated supply chain is cocoa, which originates in South America. The cocoa is produced by a farming cooperative that brings together over 200 farmers. The farmers are the owners of the cooperative, and they are closely connected. To collect data from the raw material production stage, a supply chain manager was interviewed who manages the relationships between the cooperative and the farmers and can thus show the perspective of the raw material production stage on the governance of its business relationships.

Contracts are used to coordinate the business relationships between the farmers and the cooperative to set prices and delivery quantities. In addition to formal contracts, the cooperative relies on informal agreements to ensure sustainability standards, e.g., ecological farming practices. The cooperative regularly audits the farming practices (e.g., compliance with the ban on child labor or deforestation). Additionally, the cooperative has several sustainability certificates that ensure that the protection of the environment, soils, groundwater, and employees and are regularly reviewed by certificate issuers (e.g., EU organic logo, Fair Choice certificate, and local organic logo). The EU organic logo restricts, for example, companies in the use of fertilizers, and prohibits the use of genetic engineering [43]. These regulations are regularly checked by EU inspection bodies or correspondingly commissioned audit companies [44].

Informal GMs are also important for the cooperative when working with farms. The cooperation informally supports the farms with the implementation of the sustainability standards, e.g., by providing training to the farmers. The coordinators are constantly exchanging knowledge and information with the farms, e.g., regarding the cocoa beans' cultivation, harvesting, or collection. The close relationship between the cooperative and the farms makes it possible to coordinate production quantities and harvest times at the cooperative level to meet customers' needs. IP1 emphasizes that the close cooperation between the cooperative and the farmers creates a trusting relationship and can generate efficiency gains in cultivation, which also improves the economic sustainability.

4.2. Raw Material Import

An import company (Company B) transports the cocoa beans on container ships from South America to Europe. The import company is specialized in fair and ecological trading. When selecting raw materials, the import company places great emphasis on sustainability and tries to enforce these claims on the suppliers.

The basis of the cooperation between the cooperative and the import company is a signed contract, which includes social and environmental aspects (e.g., exclusion of pesticides during cultivation, and fair wages). The contract does not include quantities and prices and is negotiated in personal meetings. Further, the raw material importer requires social and environmental certificates (e.g., EU organic logo or Fair Choice certificate) from its suppliers: "You cannot market a product as organic if it is not certified [. . .]" (IP2).

Company B supports its partners' sustainability efforts using informal mechanisms such as frequent information exchange and trust-based partnerships. The employees seek face-to-face interaction with suppliers and sub-suppliers through regular site visits. Some employees are even stationed in the farming areas and carry out regular audits as part of the supplier selection and development process: "We visit them [new suppliers] to hear and to see what their goals are, what they want. Because then I see, we are in the same track." (IP2). During the visits, a lively exchange of information on sustainability-related topics is possible. For example, the raw material import company can pass on the increasingly important sustainability requirements of the customers (e.g., call for water resource conservation) to allow the farmers to react to these requirements. On the other hand, the actors can exchange information on acute challenges in cocoa cultivation and discuss how, for example, fertilizers can be used as sustainably as possible, which has an impact on ecological (soil conservation) and social sustainability (e.g., less contact of employees with fertilizers that are harmful to health).

The import company also tries to build close relationships with customers. The company records the sustainability wishes and needs of the downstream stages and passes them on to the raw material production. The expert sees the company in the role of a mediator and would like to connect all parties of the supply chain so that an exchange of communication occurs in the whole supply chain: “I think all the partners are interested in having a strong relationship.” (IP2).

4.3. Commodity Wholesale

The cocoa is supplied to the production facility by a commodity wholesaler (Company C). Commodity wholesalers buy large quantities of commodities and raw materials from importers or directly from producers and break the deliveries into smaller sub-quantities. Company C is a medium-sized commodity wholesaler and started as a pure commodity trader, although they now see themselves as “value chain shapers” (IP3).

Both formal and informal GMs are used to coordinate and manage partnerships of Company C. Suppliers from whom goods are purchased regularly are bound by contracts, ensuring delivery quantity and quality. The commodity wholesaler does not use contracts for small purchase quantities and short-term requirements. Since Company C has a very large number of suppliers, they do not audit and control the compliance to sustainability standards at the suppliers’ sites on their own due to cost reasons. However, compliance with sustainability standards is verified using certificates. All products of suppliers must have the EU organic logo. At Company C, incoming goods are visually inspected for their organic certification and damage. Additionally, samples are taken for analytical quality control. Here, the products are tested, e.g., for pesticide residues, to verify compliance with organic standards.

The formal coordination instruments are supported by regular, personal exchange and close cooperation: “We have known [. . .] them [partners] for a very, very long time. [. . .] So with [our] partners we have very close relationships [. . .], we make regular visits.” (IP3). IP3 states that a trusting relationship between partners improves sustainability. If partners trust each other, the actors fear less that a partner could behave opportunistically and, for example, leave the business relationship. This enables long-term investments in sustainable equipment and facilities, e.g., in a new oil mill, which can produce with less waste and thus increase the ecological (resource conservation), but also the economic sustainability (more output at the same cost).

Additionally, trust in business relationships allows comprehensive knowledge exchanges. If actors believe that their partners will not leave the business relationship, they are willing to invest time and effort in sharing knowledge with partners and giving them training, e.g., on a more sustainable cultivation method, which can improve the ecological (e.g., water conservation), the social (e.g., improved working conditions), and the economical sustainability (e.g., cost reduction).

4.4. Production

From the commodity wholesaler, the products are transported to the producer (Company D). Company D produces confectioneries for its own labels, but also for labels from other trading companies as a contract manufacturer.

Sustainability standards are mainly implemented to be able to sign contracts with organic labels: “It is quite clear [. . .] these decisions [to produce a sustainable product] are, after all, always economically driven.” (IP4). Ecological improvement processes, such as packaging optimization, are driven by economic considerations. Company D does not set its own environmental sustainability targets.

Contracts with customers include details on packaging, delivery terms, quality levels, penalties, insurances, and pricing. According to IP4, there is hardly any exchange of information on a personal level between the producer and their partners: “There is a contract; we have to establish the ability to deliver. At that point, the friendly relationship [. . .] stops.” (IP4). IP4 states that “facts dominate purchasing and no[t] personal preference[s]” (IP4).

Due to the formal nature of Company D's business relationships, there is no significant difference in the cooperation with long-term partners compared to new partner companies.

Contracts are supplemented by production standards, which the company needs in order to sell produced food in certain countries. Additionally, some products are certified and produced according to kosher, organic, or fair-trade conditions. When purchasing raw materials, Company D watches out for certain certificates, such as the RSPO label for sustainable palm oil: "[...] environmentally conscious purchasing or certificate-driven purchasing" (IP4) is important to fulfill customers' sustainability expectations.

IP4 sees producers generally under high pressure to respond to customers' demands. Trading companies are in the position to choose from many contract manufacturers and can thus use their market power to depress prices and dictate contract terms: "[...] retailers already have a high power." (IP4). Company D sees itself in a price war with the retail companies: "[...] they present themselves as the advocate of the end customer." (IP4).

4.5. Logistics Service Provider

The finished products are picked up from the production and transported to a refrigerated warehouse of a logistics service provider (Company E). Company E is a medium-sized company with expertise in intralogistics, transportation, storage services, and value-adding services (e.g., product finishing, and labeling), especially in the food industry.

When coordinating supply chain processes in the food industry, Company E uses contracts to determine the scope of services, contractor and customer obligations, insurances and liabilities, inventory procedures, running times, fees, or payment modalities. Company E uses industry-specific and sustainability certificates (e.g., IFS, Smeta Sedex, and EU organic logo) to be more attractive to its customers and determine the sustainability standards in its business relationships. IP5 calls for mandatory social and environmental standards in the logistics industry so that all companies can work under the same conditions and workers can be paid fairly: "[...] of course I think it makes sense to implement this [standards] in the industry because then everyone will have the same conditions and [...] the employees in logistics will also benefit from this [...]." (IP5).

In addition to formal governance, coordination on an informal level is also important for Company E. Personal exchanges begin during the initial contract negotiations and continue throughout the contractual relationship. Company E exchanges information with both customers and service providers (e.g., disposal partners or transportation companies). Particularly in the case of price increases, e.g., due to rising personnel costs, the business relationship on a personal level is advantageous. The understanding for price increases is largely present due to mutual trust: "[...] we introduced a price increase [...] at the end of the year, [and] our customers understand that." (IP5).

At the logistics service provider level, the ability of the governance to increase environmental and social sustainability in the supply chain is limited. However, Company E itself pays attention to increasing sustainability, e.g., through energy-efficient warehouses or ecological waste systems. Additionally, all employees receive fair pay and additional performance bonuses.

4.6. Transportation Service Provider

The confectioneries are transported from the warehouses of Company E to the wholesalers and the retailers by two different transportation companies. We interviewed IP6 as a representative of one of the transportation companies (Company F). Company F is a large logistics group that focuses on transporting, sorting, and delivering mail and parcel shipments. Packaged dry products, such as confectioneries, can be shipped with the transportation service provider.

The business relationships of Company F are all based on written contracts: "[...] we only work based on written contracts, [...] they are standardized [...]" (IP6). With subcontractors providing transportation services, e.g., the routes, prices and number of transports are regulated through contracts. The company's own sustainability standards

are passed on to partners through a code of conduct. The expert criticizes the lack of industry-wide standards, especially in the field of sustainability: “[...] it would be great if there were standards that were generally specified. Unfortunately, we lack something like that completely. That’s why we are already working on developing our own internal standards for the [freight division of the company], for example [...]” (IP6).

When outsourcing orders to other logistic service providers, Company F pays attention to compliance with social and environmental standards and regulations. The payment of the local minimum wage, for example, is a basic requirement for entering into a contractual relationship with other companies. In order to increase sustainability in the supply chain, the group uses its market share and the associated negotiating power to let supply chain actors compete against each other regarding their sustainability level.

Furthermore, joint sustainability efforts are developed in bilateral discussions, and the logistics group creates incentives for its partners to act more sustainably (e.g., using electric transportation means).

4.7. Trading Company

The central actor of the examined supply chain is the trading company (Company G). Company G has developed the central product of the supply chain and connects all actors in the supply chain. Two employees—one from sustainability management [IP7] and one from supply chain management [IP8]—were available for interviews. The supply chain management department maintains contact with all supply chain actors and interacts in case of disruptions or other challenges. The trading company has particular strong governance of its business relationships to the production and retail stages of the supply chain. Generally, the company pursues a sustainable mission: “Behind all the products, [...] there is of course something much bigger, namely our mission. [We want...] to give something back to this planet through sustainable consumption and through doing something for the climate.” [IP7].

The trading company uses several formal and informal mechanisms to coordinate the business relationships in the supply chain and its sustainability. Contracts on minimum purchasing quantities per year and order, prices, the desired method of communication, delivery conditions, and penalties are concluded exclusively with the producer in the supply chain. Sustainability aspects are not included in the contract. All other relationships are maintained on a transactional basis without contracts.

Certificates play a very important role in coordinating sustainability ambitions in the supply chain. The company’s products are certified as organic and vegan. Some suppliers and producers are additionally Fairtrade certified, and some farms of the cocoa cooperative have the Control Union Fair Choice label. The packaging of the confectionaries is certified with a Plastic Free label. The carbon footprint of all products will also be communicated using a seal in the future. Due to many different seals and certificates on the market, IP8 would like to see more “[...] uniformly recognized certificates that are analyzed, monitored, [and] audited by an independent organization.”

In addition to formal mechanisms, personal agreements and trust-based business relationships are pursued when working with producers and their suppliers. Interaction is often based on trust, as contracts make the company less flexible: “[...] but we [have] a very good relationship [...] with the suppliers and producers in a personal, professional context [...]” (IP8). The close and trusting partnerships enable a high degree of willingness to compromise. In the event of disruptions or overproduction in the supply chain, for example, the delivery quantities can be flexibly adjusted, strengthening economic (e.g., no contractual penalties due to insufficient delivery quantities) and ecological sustainability (e.g., no destruction of food in the event of overproduction). Additionally, information and data sharing is fostered in close and trusting relationships, which increases the transparency in the supply chain. The increased transparency also promotes the disclosure of all sustainability-related aspects. Since actors know their activities are transparently visible, they are more likely to comply with the agreed-upon sustainability standards. Otherwise,

they will be seen as unreliable actors by the trusting partners, which could damage the long-term business relationship.

Next to the direct cooperation with the producer and the retailers, Company F is also interested in integrating the supply chain vertically and aims to establish contacts with the suppliers of the producers. Company F has specifically selected the cooperative for cocoa production in South America which supplies the main ingredients of the confectioneries. However, the contract manufacturer procures other ingredients of the confectioneries (e.g., sugar) from suppliers with whom the trading company has no close contact. IP8 states that contract manufacturers are rarely willing to disclose their trade relationships: “But of course, they won’t tell us the exact name of this supplier, because they run the risk that we will then bypass them and source from them [. . .] directly.” (IP8).

4.8. Food Wholesale

The trading company’s products are sold through a variety of sales channels. The products are sold either via the company’s own online store directly to the end consumers or via various retail companies. The most important retail customers are drugstores, organic food retailers, and food retailers. These stores purchase their products through food wholesalers, such as Company H. Company H mainly supplies stores close to the company’s headquarters and defines itself by high sustainability standards. The company works with many small producers in the region but also large industrial companies. The interview was conducted with the purchasing manager [IP9] and the quality and sustainability manager [IP10].

As the basis of its business relationship, Company H relies on contracts that define, for example, delivery formalities. The purchasing manager describes how the business relationships are coordinated more formally, especially with large or international companies: “[. . .] the exchange exists on a formal level [. . .]” (IP9). Further, certificates and standards play an important role for Company H when managing transactions and selecting new partners. The EU organic logo is a basic requirement for any cooperation with Company H. In addition to the EU organic logo, other social and environmental sustainability certificates are requested of the suppliers. The wholesaler does not conduct audits at its suppliers, as sustainability standards are guaranteed by certifications and are verified by the certificate issuer.

In the cooperation with producers, Company H compensates for cultivation risks and crop failures: “[. . .] if there should be crop failures in the fruit and vegetable sector with our regional suppliers, [. . . we] compensate for this by means of prices, which are then calculated differently [. . .]” (IP10). In cases of overproduction, Company H tries to sell additional quantities so that no economic damage occurs for the companies involved. In its cooperation with customers, the organic wholesaler strives to promote investments in sustainable technologies. For example, a joint investment was made in a new refrigeration system for an organic market by providing a one-time payment and a loan from Company H.

The organic wholesaler complements the formal arrangements with close and trusting partnerships, especially with regional suppliers and customers: “[this kind of] partnership cooperation is quite strong. So we have intensive contacts here, we have regular meetings [. . .]” (IP9). Site-visits and the trust gained from the close contacts replace audits: “You know the region here, so there’s really no need for an in-depth audit [. . .].” (IP10).

4.9. Food Retail

The wholesaler distributes the finished products to the food retailers (e.g., Company I). Company I is a regionally active company with a dense network of stores in the urban area, which customers use “[. . .] to cover their daily needs.” [IP11]. The size of the retail stores ranges from 100 to 1000 square meters and are mostly located in urban areas.

The formal coordination of the supplier relationships depends on the size of the suppliers: “supplier contracts are only common with large suppliers [. . .]” (IP11). Contracts

with large suppliers regulate, for example, the assurance of delivery days, advertising cost subsidies, and refunds. Sustainability aspects are not part of any written agreements or contracts. Company I purchases most of its products through wholesalers and maintains direct contractual relationships with most trading companies in parallel. These agreements are not about formal delivery conditions but about advertising measures and a better external presentation of the brand in the grocery stores. To ensure the sustainability of the purchased products, Company I relies on certificates. All organic products need to be labeled with the EU organic logo.

In the case of direct supplier relationships without a wholesaler as an intermediary, Company I aims for long-term supplier relationships since they are more rational to manage. In long-term relationships, the partners understand each other better, and through the existing, familiar communication channels (sustainability), demands can be understood and implemented in the supply chain more quickly. To build long-term relationships, the suppliers are visited in person: “I take a look at the production facilities, you get to know each other in person [. . .].” (IP11). By visiting the production sites, trust is built, and the companies become more connected: “Those who like to show their production sites and also give tours; you [. . .] have a more trusting relationship with them.” (IP11).

Besides using sustainability certificates, the promotion of social or environmental sustainability among its partners is not fostered in any particular way by Company I.

5. Discussion

After analyzing the different GMs at each stage of the supply chain, the following section discusses the results to extend the current findings from the literature. The analyzed data from the interviews will be compared with the literature to develop propositions that provide new insights into sustainability governance in food supply chains.

The analysis of the interviews shows that contracts and certificates are popular GMs to increase sustainability. In the examined supply chain, the producer and the actors of the following stages use contracts to increase the economic sustainability of their business relationships, while certificates are used to ensure ecological and social sustainability standards. At the raw material production stage, in addition to the economic aspects, also ecological and social requirements are included in contracts and informal agreements (e.g., cultivation methods or energy management). The inclusion of ecological and social standards in contracts and agreements fosters the certification of all farmers at the raw material production stage. The interview partners emphasize that the implementation of certificates is very complex and expensive. Especially for individual farmers, it is difficult to become certified on their own. Often, small farms lack the necessary financial and human resources to implement the certification requirements [45]. Therefore, the pooling of capacities (e.g., [46]) in cooperatives is observed in the case study at the raw material production level. Training provided by the cooperative to the farms, as well as the sharing of technical equipment, enables the certification of all farms in the cooperative. The cooperative supports the farmers in implementing the certificates’ standards and controls them itself, e.g., through audits. To ensure that the cooperative’s strong commitment to helping certify farms is profitable, the cooperative needs a warrant for the long-term compliance of the farms with the required minimum sustainability standards and thus the retaining of the certification. Therefore, the cooperative uses contracts and informal agreements with the farms, which specify the compliance with all required sustainability standards in the long-term. Contracts urge farmers to comply with social and environmental sustainability standards (e.g., fair and safe working conditions, and limited use of pesticides), as there can be, for example, penalties for non-compliance. On the other side, contracts allow the cooperative to be more committed during the certification process, as the effort promises long-term benefits. Thus, through the use of contracts, sustainability standards can be jointly implemented (e.g., ecological cultivation methods, and improvement of working conditions), which enable the certification of the supply chain.

P1: At the raw material production level, sustainability standards should be included in formal contracts and informal agreements to enable the certification of farming cooperatives.

After the raw material production and import stage, only transactions of particularly economically important business relationships are coordinated and controlled using contracts. Strategically and financially unimportant business relationships are less frequently governed by contracts to remain flexible and agile when fluctuations in production, raw material prices, or the sales market occur. For example, raw materials can be procured at short notice from other suppliers if there are no contractually binding minimum purchase quantities or rhythms.

Although different types of contracts are discussed in the literature for managing sustainable supply chains (e.g., [47,48]), no contractual regulations on environmental and social aspects are used in the examined supply chain after the raw material production and import stage. Instead, sustainability standards are ensured via certificates. The use of certificates enables spontaneous purchases from different suppliers who have the same certificates. Minimum sustainability requirements of products do not have to be regulated by contracts and checked with the help of audits but are ensured through certifications. We can therefore draw up the following proposition:

P2: After the raw material production and import stage, companies should mainly use certificates to secure environmental and social sustainability, while contracts should be used to secure economic interests.

Formal and informal information and knowledge sharing are among the most intensively used GMs in the analyzed supply chain. Information and knowledge are exchanged at every stage of the supply chain and mostly personally through emails and phone calls.

The exchange of information in food supply chains is a common phenomenon to support the operational business, for example, by providing demand data (e.g., [49,50]). The exchange of operational data makes it possible to create greater transparency in the supply chain. The increased transparency allows actors to anticipate, for example, when deliveries will arrive from the upstream stages of the supply chain, which enables a more efficient planning and handling of the receipt, transport, processing and storage of the goods. As a result, capacities (e.g., transport or storage capacity) can be optimized and saved, which increases economic sustainability in the supply chain.

It is remarkable that in the analyzed supply chain, not only are data regarding operational processes exchanged, but also knowledge on sustainability issues is shared—specifically by the actors involved in the production of raw materials. The cooperative, and the import company share, for example, their technical and agricultural knowledge with the farms in trainings and on-site visits to enable the certification of the farms. An active and honest exchange of information and knowledge between the farms and the cooperative allows sustainability challenges to be addressed openly. Farmers can receive, for example, training and information on how to use pesticides to prevent crop failure. The training enables the farmers to use the right pesticides in the right quantities in order to not endanger ecological sustainability (e.g., groundwater damage due to excessive pesticide use), but also to increase economic sustainability through good crop yields.

P3: The exchange of information and knowledge should be specifically used to improve social and environmental sustainability in the raw material production stage, e.g., through training and knowledge exchanges on new cultivation methods.

A distinction is made between formal and informal information exchanges in the literature. The formal exchange of information and data happens in a professional relationship without personal or social intentions [18]. In the analyzed supply chain, information and data are, for example, exchanged formally to support the operational handling and planning of the business processes.

The informal exchange of information is rather unplanned and mostly happens in personal conversations, e.g., after a meeting [51]. At the stage of the raw material production and import of the examined supply chain, the informal exchange of information

is used, for example, to increase sustainability by informally explaining and supporting more sustainable farming methods. In subsequent stages of the supply chain, information related to sustainability is still exchanged informally, but it does not include advice on implementing sustainability measures. The informal exchange of information rather relates to the future strategic direction of the business relationship. The food retailer informs, for example, the trading company and its other partners informally about new perceived sustainability demands of the end consumers. The trading company can check the implementation possibilities of these new sustainability claims and spread according plans in the supply chain. Currently, for example, customers increasingly call for the implementation of the Fairtrade certificate. Its implementation is now being planned in the entire supply chain which contributes greatly to increasing environmental and social sustainability (e.g., bans on exploitative child labor and hazardous pesticides). Therefore, the following proposition can be made.

P4: After the raw material production and import stage, informal information exchanges should be used to align strategic interests regarding the implementation of environmental and social sustainability standards.

Certificates are used on every level of the analyzed supply chain to manage the supply chain's environmental and social standards. The early stages of the supply chain use the EU organic logo to demonstrate environmentally friendly farming practices, pesticide exclusion, and biodiversity to their customers. The downstream organizations use these certificates to be allowed to advertise the product as organic and environmentally friendly. Fair trade and good working conditions are also ensured by certificates, such as the Fairtrade or Fair Choice labels, at several supply chain stages.

In the literature, certificates are mainly seen as a mechanism to support customers in their purchasing decisions (e.g., [52,53]). While interviewees support the use of certificates for such promotional and advertising purposes, they also emphasize a reduced control effort of the required sustainability standards, thanks to the certificates. Most actors in the supply chain refrain from conducting their own audits of partners and rely on external audits by the certificate issuers. The effort required for carrying out their own audits would not be feasible for most companies due to insufficient financial and human capacities (e.g., IP3, IP7, IP8, and IP10). Thus, certificates ensure compliance with the most important social and ecological sustainability standards at no great expense to trading companies, which is why the following proposition can be made.

P5: Certificates should be used not only to market a product but also to ensure compliance with sustainability standards without having to conduct own audits and monitor supply chain partners.

All companies maintain formal and informal governed business relationships with their direct upstream and downstream partners in the supply chain. The trading company maintains business relationships not only with its direct partners, but also with all other actors in the supply chain and thus holds an informal leading role in the supply chain. The trading company uses formal and informal GMs to maintain relationships with its most important partners, such as the manufacturing company or the food retailers. In addition, informal mechanisms are used in the relationships with all other partners, especially with the raw material production stage, in order to control and influence compliance with sustainability standards. Through these "non-operational", informal business relationships, the trading company can not only identify possible challenges and disruptions earlier, but also creates additional incentives for compliance with the sustainability standards. Actors who particularly stand out in complying with the sustainability standards could, for example, also be included in the supply chains of other products of the trading company in the future. As a leading company, the retail brand also performs an overarching cohesion function for the supply chain and contributes new product ideas and sustainability goals for the whole supply chain.

Further, the leading role of the trading company will be important in the future to comply with new supply chain due diligence laws. Governments are increasingly obliging

companies to make their entire supply chains transparent (e.g., [54]). Trading companies could fulfill this due diligence obligation particularly well due to their central, cross-company role, as they maintain contacts with all partners and can present their activities transparently. The following proposition can therefore be derived.

P6: The trading company should hold a leading role in the supply chain in order to coordinate and foster the sustainability efforts holistically and to create additional incentives for increasing sustainability.

This study provides several novel findings, compared to the existing literature. In particular, we place special emphasis on showing how the governance in food supply chains differs at the various stages of the supply chain to improve sustainability (see Figure 3).

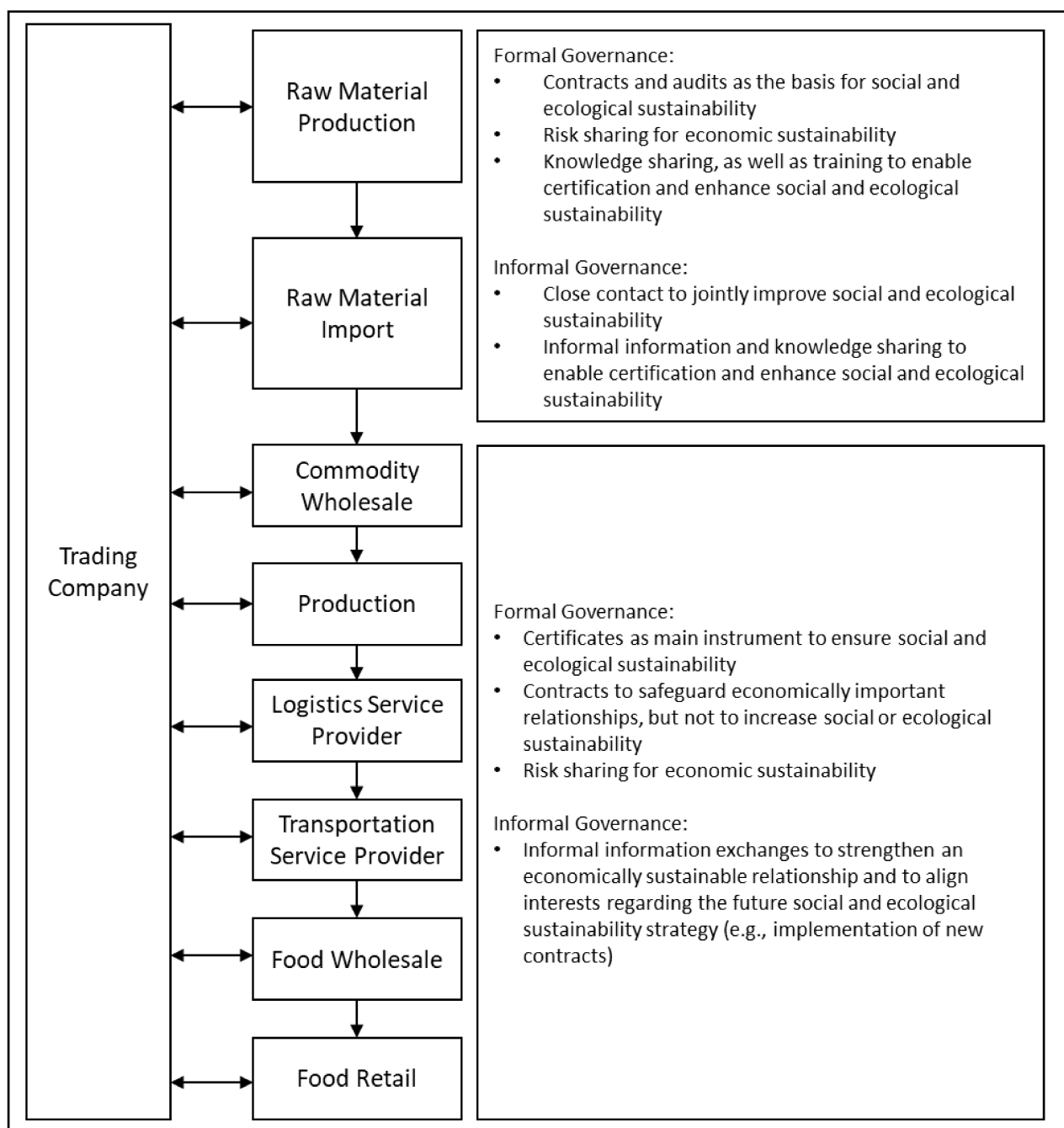


Figure 3. Governance mechanisms distinguished based on the different steps of the food supply chain.

At the raw material production and importing stage, sustainability standards are implemented using contracts and are verified through audits. Close contact with regular mutual visits, training on new cultivation methods, and sharing technical, financial, and human resources enable certifications at this stage of the supply chain. In the downstream stages of production, logistics, and retail, sustainability certificates are the most important tool for compliance with social and ecological sustainability standards. Contracts are a less commonly used mechanism at these stages of the supply chain and are only used to coordinate financial and economic aspects of strategically important business relationships. Due to the limited contractual ties and the usage of certificates, the changing of suppliers and service providers is easily achieved without sustainability losses. To additionally set incentives to increase sustainability, it is recommended that a leading company of the supply chain has informal business relationships with all partners in the supply chain. Actors with outstanding sustainability commitments could also be used as partners in other supply chains of the leading company in the future.

Quantitative Analysis

The propositions provide novel insights into which governance mechanisms should be used at different stages of food supply chains to enhance sustainability. It is striking that certain governance mechanisms are used preferentially to achieve certain sustainability goals, while other mechanisms are hardly used to improve in certain sustainability dimensions. Quantitative analysis helps clarify the particularly strong and weak effects of governance mechanisms on the individual sustainability dimensions. In addition to the quantitative data (Table 3), the results of the qualitative analysis are also taken into account during the analysis to be able to consider, for example, supply chain stage specifics.

Table 3. Quantitative analysis of the impact of governance mechanisms on sustainability dimensions.

Governance Mechanism/ Supply Chain Stage	Sustainability Dimension	Raw Material Prod.	Raw Material Import	Commodity Whole-sale	Production	Log. Service Provider	Transp. Service Provider	Trading Company	Food Whole-sale	Food Retail	Sum
Contracts	Economical	x		x	x	x	x	x	x	x	8
	Ecological	x	x	x			x				4
	Social	x	x				x				3
Certificates	Economical		x		x	x		x			5
	Ecological	x	x	x	x	x		x	x	x	8
	Social	x	x	x	x	x		x	x		7
Audits and Monitoring	Economical				x	x		x			3
	Ecological	x	x	x		x		x			5
	Social	x	x	x							3
Risk Sharing	Economical	x		x	x	x	x		x		6
	Ecological			x		x	x		x		4
	Social										0
Information and Knowledge Sharing	Economical	x	x	x		x	x	x	x	x	8
	Ecological	x	x	x				x	x	x	6
	Social	x	x	x					x	x	5
Shared Values	Economical					x		x		x	3
	Ecological		x	x		x	x	x	x	x	7
	Social		x	x		x	x	x	x	x	7
Trusting and close relationship	Economical	x	x	x		x	x	x	x		7
	Ecological	x	x	x			x	x		x	6
	Social		x							x	2

Quantitatively analyzing the collected data shows that *contracts*, *certificates* and *information and knowledge sharing* stand out due to their particularly strong influence on certain sustainability dimensions. Eight of the nine supply chain stages specifically use contracts to ensure economic sustainability in their business relations. Agreements on delivery quantities and prices can be made in contracts, which enables longer-term financial planning. The

financial planning security allows larger investments, for example, in new, more efficient equipment and facilities, which sustainably increases the economic performance.

The positive influences of certificates on sustainability are mainly on the ecological (eight stages) and the social dimension (seven stages). Through the use of certificates, partners are audited by independent certification bodies regarding their compliance with social and environmental sustainability standards. Without certificates, the actors could no longer be part of the business relationships, which motivates them to comply with the sustainability standards, promoting environmental and social sustainability (e.g., compliance with maximum working hours on farms, limitation of pesticides).

Information and knowledge sharing is used at eight out of nine stages to increase economic sustainability. In the first stages of the supply chain, for example, training on more efficient cultivation methods is given, enabling the farms to grow cocoa cost efficiently and in less time, making the farms more economical in the long term. At the later stages of the supply chain, data and information are exchanged to optimize operational exchanges. Through the exchange of operational data, the partners in transactions can be better coordinated (e.g., with regard to the expected delivery quantity), and thus processes can be designed more economically in the long term.

In addition to the governance mechanisms, which have a particularly positive influence on sustainability, the quantitative analysis also showed that *risk sharing* as well as a *trusting and close relationship* do not have a noteworthy influence on social sustainability. Further, the analysis showed that *shared values* have no significant impact on economic sustainability.

6. Conclusions, Limitations, and Future Research Agenda

Coordinating food supply chains is challenging and complex due to the perishable nature of the products and volatile yields of raw material production. Implementing sustainability standards in food supply chains is increasingly requested by customers but represents an additional challenge. The implementation of sustainability standards has so far mainly been examined at individual stages of supply chains (e.g., raw material production or manufacturer), without considering the holistic implementation of the standards [7]. However, sustainability standards should be introduced at all supply chain stages, from raw material producers to end retailers, to receive long-term sustainability. We used a single case study at all levels of a sustainable food supply chain to analyze the different GMs used to coordinate the implementation of sustainability standards throughout the whole supply chain. Thereby, we analyzed the effects of the used GMs and highlighted the intentions behind why certain GMs were applied. We show that the effective, holistic management of sustainability governance relies on different mechanisms at different supply chain stages. At the beginning of the supply chain, contracts are used to ensure economic sustainability, while information and knowledge sharing are specifically used to increase environmental and social sustainability. At the later stages of the supply chain, contracts and informal information sharing are used to increase economic sustainability, while social and environmental sustainability is ensured through certificates. Without the holistic management of the supply chain by the trading company, sustainability efforts at the individual stages would not be aligned. For example, the first stages of the supply chain would not seek to certify the cocoa, which would compromise the sustainability efforts of the downstream stages, which rely mainly on certificates. Therefore, we not only highlight the mechanisms used at the individual stages, but also emphasize the relevance of the trading company in its overarching coordinating function for the long-term enhancement of sustainability in the complete supply chain.

Even though the case study research was conducted carefully and with regard to several quality criteria, the results show several limitations, offering future research possibilities. While conducting a single case study enables the collection of very detailed data from each stage of the supply chain, it also limits the transferability and generalizability of the results. We placed a lot of emphasis on the representative character of the examined

supply chain, taking into account that the supply chain produces a common product (confectionaries) with usual ingredients (e.g., cocoa) and that each stage of the chain pursues activities to comply with economic, environmental and social sustainability standards. Additionally, the representative character of our research is fostered through the ability to comprehensively analyze each stage of the investigated supply chain, which makes it easier to transfer the results to other agricultural supply chains. However, Yin [40] states that case studies can be used to develop new theoretical constructs, but not to generalize their results to a broader ‘population’. Therefore, we call for quantitative survey research to test our propositions and ensure their transferability to other supply chains. For example, it can be quantitatively discussed at what level in the supply chain certificates are the preferred mechanisms to enforce social and ecological standards. In addition, the role of contracts should be quantitatively investigated to examine whether they are also used in other supply chains to ensure economic and not social and ecological sustainability.

Next to a comprehensive quantitative analysis of governance mechanisms to enhance sustainability, we call for research that examines ways to measure the effects of governance mechanisms on the different sustainability dimensions. By being able to measure the effects of governance mechanisms, the effort/benefit ratio of the mechanisms can be better estimated and, accordingly, the sustainability goals can be achieved more efficiently.

Furthermore, it is remarkable that the sustainability efforts in the examined supply chain focus particularly on ecological and economical sustainability. The low consideration of social sustainability aspects is also a phenomenon that appears in the literature [55]. Future research should therefore focus more on the implementation of social sustainability goals in food supply chains through the specific usage of GMs.

In addition to the limitations, the current challenges mentioned during the interviews also result in future research needs. Especially in the logistics and production industry, price competition is very high, and there are hardly any industry-wide sustainability standards or certificates. We, therefore, call for the development of sustainability certificates that specifically address environmental and social sustainability in the manufacturing and logistics industry. Additionally, future research could investigate whether such industry-wide certificates can reduce cost pressures in the industry.

Further, few information technology tools were used to support GMs in the supply chain considered. Future research should focus on integrating technologies, such as blockchain technology, artificial intelligence, or the Internet of Things to enhance sustainability in food supply chains. Blockchain technology can be used, for example, to create credible transparency regarding the compliance with social and environmental sustainability standards in supply chains in which partners do not trust each other [56]. Therefore, future research could explore how from raw material production to retailers, blockchain technology can be used to increase credible transparency in food supply chains. Further, Wang [57] shows, for example, how Internet of Things and data mining can be used to collect data in the food industry and analyze them to enhance the quality of products. The systematic collection and analysis of data could also be used for sustainability-related goals, e.g., to avoid food waste by detecting overstocks at an early stage.

When exploring the potential use of new technologies in the food industry, comparing other industries would be useful to transfer existing concepts (e.g., blockchain governance [58]) to food industry supply chains.

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