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Coordination mechanisms and methods of collaboration between actors in circular supply chain: Case study in cosmetic and packaging sector

TESI DI LAUREA MAGISTRALE IN
INGEGNERIA ALIMENTARE

Author: **Marco Franco**

Student ID: 970686
Advisor: Margerita Emma Paola Pero
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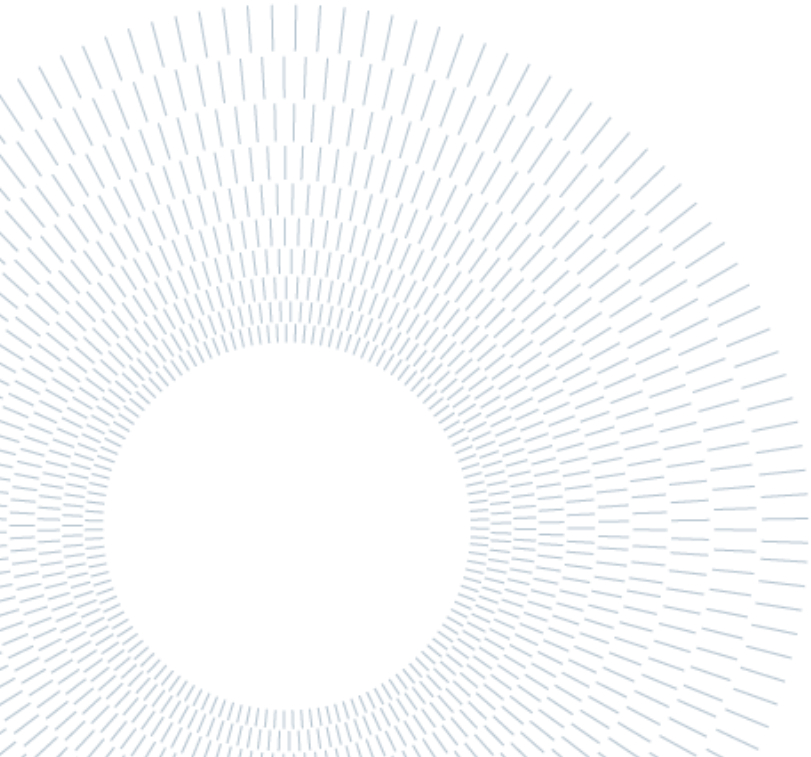


Abstract

This thesis delves into the critical role of supply chain collaboration in promoting sustainability and facilitating the transition to a circular economy. The study highlights the importance of information sharing, stakeholder relationships and supply contracts in optimizing the supply chain to minimize waste and improve environmental performance.

In addition, the research investigates potential barriers to implementing the circular economy, providing insight into the challenges and solutions associated with adopting greener business practices.

A systematic review of the literature forms the basis of the study, followed by in-depth interviews with representatives of three Italian start-ups operating in the cosmetics and packaging sector. The results underline the importance of information sharing, mutual trust, and joint decision-making in fostering collaboration between supply chain partners.

The research highlights the need for a comprehensive understanding and alignment of objectives, as well as the development of strong professional relationships between stakeholders.

In addition, the study identifies the need for further research into the actual economic and environmental benefits of circular economy practices, suggesting an expansion of the scope of research to include underrepresented sectors, such as the food industry.

The research also explores the various types of supply contracts and their impact on supply chain collaboration, considering factors such as market pressures, number of suppliers and bargaining power.

In addition, the thesis delves into the potential drawbacks and risks associated with supply chain collaboration, including mutual dependency and potential production slowdowns. By addressing these gaps and challenges, this thesis contributes to a deeper understanding of supply chain collaboration and its role in achieving a sustainable and circular economy.

By providing valuable insights and recommendations, the study serves as a useful resource for businesses and policymakers seeking to advance the implementation of circular economy principles in their operations and sectors.

Finally, the possible future evolutions on the subject are highlighted, trying to guess which are the fields on which to focus to achieve all the benefits deriving from the application of these techniques.

Key-words: coordination, collaboration, supply chain, circular economy, waste management, open loop, close loop

Abstract in italiano

Questa tesi approfondisce il ruolo critico della collaborazione nella catena di approvvigionamento nel promuovere la sostenibilità e facilitare la transizione verso un'economia circolare. Lo studio evidenzia l'importanza della condivisione delle informazioni, delle relazioni con gli stakeholder e dei contratti di fornitura nell'ottimizzazione della catena di approvvigionamento per ridurre al minimo gli sprechi e migliorare le prestazioni ambientali.

Inoltre, la ricerca indaga i potenziali ostacoli all'implementazione dell'economia circolare, fornendo informazioni sulle sfide e le soluzioni associate all'adozione di pratiche commerciali più ecologiche.

Una revisione sistematica della letteratura costituisce la base dello studio, seguita da interviste approfondite con i rappresentanti di tre start-up italiane operanti nel settore cosmetico e del packaging. I risultati sottolineano l'importanza della condivisione delle informazioni, della fiducia reciproca e del processo decisionale congiunto nel promuovere la collaborazione tra i partner della catena di approvvigionamento.

La ricerca evidenzia la necessità di una comprensione globale e dell'allineamento degli obiettivi, nonché lo sviluppo di forti relazioni professionali tra le parti interessate.

Inoltre, lo studio identifica la necessità di ulteriori ricerche sugli effettivi benefici economici e ambientali delle pratiche di economia circolare, suggerendo un'espansione dell'ambito della ricerca per includere settori sottorappresentati, come l'industria alimentare.

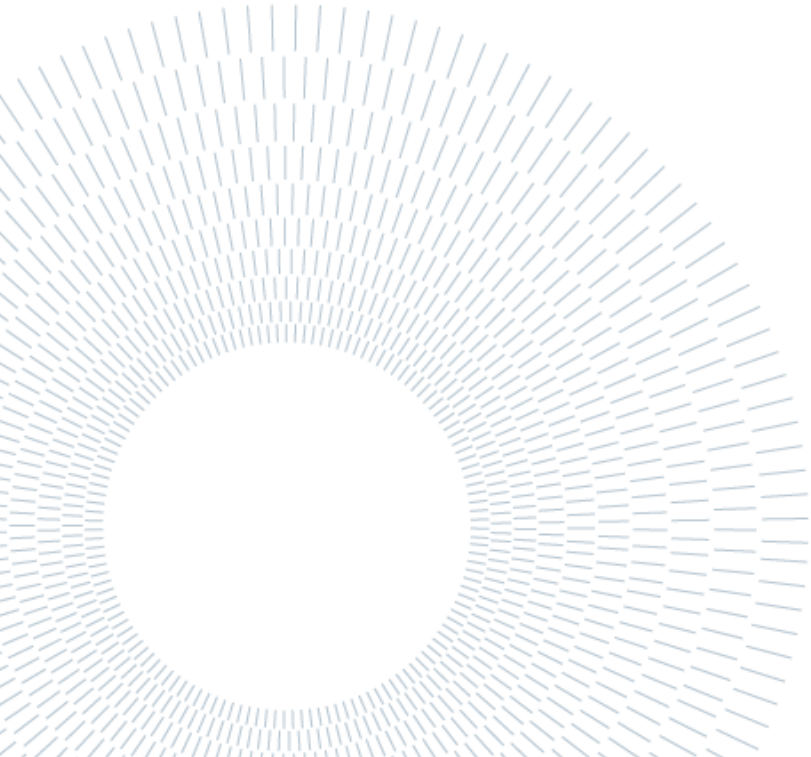
La ricerca esplora anche i vari tipi di contratti di fornitura e il loro impatto sulla collaborazione nella catena di approvvigionamento, considerando fattori quali le pressioni del mercato, il numero di fornitori e il potere contrattuale.

Inoltre, la tesi approfondisce i potenziali svantaggi e rischi associati alla collaborazione nella catena di approvvigionamento, compresa la dipendenza reciproca e potenziali rallentamenti della produzione. Affrontando queste lacune e sfide, questa tesi contribuisce a una comprensione più profonda della collaborazione nella catena di approvvigionamento e del suo ruolo nel

raggiungimento di un'economia sostenibile e circolare. Fornendo preziose intuizioni e raccomandazioni, lo studio funge da risorsa utile per le imprese e i responsabili politici che cercano di far progredire l'attuazione dei principi dell'economia circolare nelle loro operazioni e settori.

Infine, vengono evidenziate le possibili evoluzioni future sull'argomento, cercando di indovinare quali sono i campi su cui puntare per ottenere tutti i benefici derivanti dall'applicazione di queste tecniche.

Parole chiave: coordinamento, collaborazione, catena di approvvigionamento, economia circolare, gestione dei rifiuti, open loop, close loop



Contents

Introduction

The circular economy is an economic model that aims to reduce waste and maximize the use of resources, favoring the repair, recycling, and reuse of products to create a continuous cycle of materials and resources. In recent years, it has gained more and more importance due to the growing awareness regarding the depletion of natural resources, the increase in waste and the environmental impact of human activities.

One of the main benefits of implementing the circular economy for companies is the reduction of costs related to the procurement of raw materials. Through the practice of reuse and recycling, companies can reduce dependence on virgin resources and reduce the costs associated with extracting, producing, and transporting raw materials. In addition, recycling reduces the costs of waste disposal, which would otherwise end up in landfills.

Another important advantage is the reduction of environmental impact. The circular economy aims to reduce carbon emissions, pollution, and the exploitation of natural resources. Through the design of eco-sustainable products and the adoption of clean production practices, companies can contribute to the preservation of the environment and mitigate climate change. This can lead to a better corporate reputation and attract consumers who are increasingly interested in buying sustainable products and services.

In addition, the circular economy can create innovative businesses and encourage diversification of business activities. Companies can develop new business models based on leasing, sharing, or restoring products, opening new markets, and generating new revenue. In this way, it is possible to create an economic model focused purely on services, in which values such as efficiency are also considered, rather than focusing only on the sales of the final product.

It is also fundamental to create collaborative networks within the supply chain, through the collection and consequent recycling of materials, with the possibility of improving operational and managerial aspects and carrying out an innovative transition towards reducing waste, increasing efficiency, and reducing environmental impact. This is the key argument, as this cooperation requires that the actors of the supply chain collaborate with each other to obtain substantial benefits, such as increased efficiency due to cost reduction and better market positioning, also improving their financial indicators compared to competitors. To conduct the research, the research question that was used was:

RQ1. What are the coordination mechanisms and methods of collaboration between supply chain actors that allow a transition to the circular economy?

To answer this question, we focused on three Italian start-ups in the cosmetics and food packaging sector; this is because, being small realities that have developed in recent years, we wanted to understand how the problem of coordination and collaboration was considered in a company that was taking its first steps in the market.

To conclude, the implementation of the circular economy offers numerous advantages for companies, including cost reduction, reduction of environmental impact, opening new markets and, indeed, increasing collaboration within the supply chain. This demonstrates a strong commitment to sustainability, a factor that in recent years has gained consensus among consumers, given the worsening of environmental situations around the world, submerged by tons of waste that make our planet unlivable.

1 Methodology of literature

The analysis was conducted through three steps:

- Planning of reviews, identifying the search path and the protocol to follow.
- Carrying out the analysis in which the material was collected and selected the basis for the purpose of the research, and then carried out through a coding of the articles.
- Reporting, where the results are reported and described analytically and thematically (see table 1).

	Number of articles**
Material collection* Keyword group 1: (collaboration OR coordination OR integration) AND ("circular supply chain")	388
Filter 1: Source type = Document type = article, review	351
Keyword group 2: engineering OR business	267
Filter 2: Language = English	266
Material selection Step 1: Compilance with Research Topic Step 2: Compilance with Research Objective Step 3: Compilance with Research Question, limit to contribution from Q1, Q2 journals ***	 94 62 39
Literature analysis Material selection based on inclusion and exclusion criteria Discussion among authors for inclusion and exclusion of articles Extraction and storage of descriptive information Coding of literature based on the coding scheme Development of freamework and future research avenue Incorporation of feedback from journal review Revision of conceptual freamework and future research avenue	x x x x x x x
Note (s): * Keywords are combined by AND operator between groups and searched in title-abstract-keywords **Searched with Scopus *** Journal ranking refers to the JCR Impact factor and Quartile published by Clarivate analytics available at: http://manuscriptlab.com/journals/	

Figure 1

To carry out the research, several keywords were identified (Durach et al., 2017; Tranfield et al., 2003) which can be divided into: (1) CCC-related (2) "circular supply chain" and (3) "engineering" and "business". CCC-related keywords were extrapolated from the description of the terms coordination, collaboration, and cooperation (Elaheh et al., 2022) and then validated with the search query used in existing review articles in related articles.

The terms "engineering" and "business" have been inserted to link to the search for engineering implications in primary studies. Moreover, the fact of not considering the technological aspects is because these topics would have been too technical and come out of interest of the subject matter (Ardito et al., 2019).

The collection was carried out in the Scopus database that allows access to a high bibliographic coverage in scientific, managerial, and technological areas (Lamba and Singh, 2017) of publishers such as Emerald, Science Direct and Wiley.

The research is based on articles and reviews from peer-reviewed journals in English to ensure quality and consistency of the material. (Arunachalam et al., 2018).

Moreover, by analyzing a sample of conference articles, it could be said that these have a shorter delay of publications in journals and a greater extension. The revision was regularly updated to have a database always in real time (Durach et al., 2017) with a final consolidation in April 2023 with a result of 266 articles.

The selection process was adapted in a three-step approach by Brinch (2018)

- Step 1, compliance with research topic: the articles are checked by first analyzing the title, dissemination outlet and keywords to understand the context of the research, thus managing to delete off-topic articles (e.g., automotive, textile, energy, social sciences, finance, mathematics). (Lamba and Singh, 2017)

- Step 2, compliance with the research objective: through the abstract, the articles have been analyzed and selected according to the topic of interest covered.
- Step 3, compliance with the research questions. At this stage, the scope of application was imitated to high-level journals, named Q1 and Q2 in the JCR 2020 ranking. Some articles have been eliminated by comparing research questions with their contributions, thus not considering those that allow limited implications (see Figure 1). This process resulted in 39 articles for full-text analysis.

Several authors were considered, having a database to keep track of the entire selection of articles read.

2 Research Background

To understand which the most important aspects within a supply chain are, research was carried out that would allow us to have a vision of internal dynamics, trying to identify the points of action where it is possible to improve the modus operandi of a company to allow a transition to the circular economy.

In particular, the aspect that most influences the recovery of waste materials, and the consequent reuse is the exchange of information between the various company teams; In this way it is possible to achieve an alignment of the vision and collaborate to achieve the company objectives.

Subsequently, attention was paid to the relationship with stakeholders, both internal and external, to understand what the possible economic, social, and environmental advantages are in establishing a lasting relationship based on trust between the various actors involved. In addition, the relationship with suppliers has been analyzed as it constitutes the key factor of differentiation towards competitors through commercial relationships and supply contracts.

Precisely for this reason, the possible contracts that can be concluded with suppliers were analyzed, based on market pressures, the number of suppliers and the bargaining power that each supplier can exercise.

Finally, the barriers to the implementation of the circular economy were analyzed to understand the possible obstacles to be faced and if it is something that can be solved easily and in the short term and how these factors slow down the actual course of companies that try to be greener.

2.1. Information sharing

The first aspect to consider is the sharing of information; (Cao and Zhang, 2011) defined information sharing *as "the act of exchanging accurate, complete, and relevant information among partners".* The opportunities arising from this habit are many, ranging from reducing operational risks, expanding, and improving collaboration, streamlining, optimizing the planning and execution of required tasks, and eliminating any asymmetries that can be created during daily work (Liu et al., 2021).

This practice is one of the cornerstones of collaboration between actors in the supply chain; going into detail, sharing of information allows to have continuous communication with members of the supply chain to have continuous developments on the progress of work, problem solving, sharing ideas, and creating social relationships that are not always considered with respect to economic and operational topics.

It is therefore necessary to specify that the exchange of information is only one of the components of collaboration between actors, which includes several factors such as supply contracts, joint decision making, and the implementation of ICT resources.

Over the years there have been different currents of thought regarding the collaboration between the actors in the supply chain; at the beginning of 1998, through the thought of (Spekman et al., 1998), it was possible to understand how the attention of companies and managers were focused more on the strategic part of Supply Chain Management (SCM), therefore considering necessary a high level of mutual trust, dedication to work and, indeed, exchange and sharing of information.

Subsequently, the company's internal vision has changed; more precisely (Manthou et al., 2004) in his study at the beginning of 2004, he was the first to state that in addition to the purely strategic aspects, the operational part is also equally important during supply chain management, considering factors such as supply and demand forecasting, inventory management managed entirely by warehouse workers (Vendor managed inventory) and e-collaboration as key points to achieve certain business objectives.

Of course, these aspects, so different and complicated, need a common thread that acts as an intermediary for the activities to be carried out daily, making sure to understand the work of each component of the production chain.

According to (Liao and Kuo, 2014), however, the sharing of information is not disconnected from the operational part, but rather it is one of the fundamental aspects also for the achievement of the operating results of a company, together with the sharing of resources and synchronization in decision making.

This concept is further reinforced by (Flygansvær et al., 2018) which identifies the exchange of information with suppliers and customers as a key aspect to ensure collaboration within the supply chain.

In detail, the sharing of information with suppliers / key customers, includes continuous daily communication, the conception and development of products and a process design with the possibility, through a sharing of ideas, to improve it to obtain mutual benefits.

The importance of communication is taken up by (Kalverkamp, 2018), in which e-procurement is proposed as a tool to improve the exchange of information between supply chain partners, also through the continuous use of communication.

It also emerged that bad or non-existent information sharing can cause slowdowns in achieving business operating results, due to failure to learn and manage operational standards (Kurilova-Palisaitiene et al., 2018). As described by (Basso et al., 2019), the lack of flow of information represents one of the 14 barriers to a correct realization of horizontal logistics collaboration, especially with regard to planning and operations. (Karam et al., 2021) extends the concept of barriers, expanding the number of barriers to 31, always identifying the lack of information sharing as one of the problems to achieve adequate HLC, also linking the lack of appropriate ICT tools to this problem.

Several empirical studies (Badraoiu et al., 2022) have confirmed that to have an effective collaboration, competence, but above all trust, are very influential to achieve the objectives set. Trust is seen as a mode of relational governance that is never obliged to stakeholders but is carried out for a common good; this allows actors to have a solid foundation, blindly trust the intentions of others, make important economic investments, share resources and information and fight for a common goal (Collier et al., 2022).

(Cruijssen, 2020) emphasizes this concept, adding that the exchange of information allows a synchronization between actors and activities that allow to avoid important costs deriving from a sub-optimization.

In addition, (Agarwal and Narayana, 2020) states that it is an essential work tool to build mutual trust and understand the way of doing the other person, sensing strengths and weaknesses, and having a clear vision also of the work of one's colleagues. Only in this way, as reinforced by (Zhang and Cao, 2018), can collective benefits be achieved and succeed in the collaboration mechanism.

Through empirical studies carried out over the years, it has been shown how companies benefit from collaboration, also in terms of operational results, as well as strategic. In detail, (Chen, 2019) has demonstrated how an intense and continuous exchange of information has a strong influence on business collaboration.

Furthermore (Olorunniwo And Li, 2010) they were able to demonstrate that reverse logistics is also strongly connected to the exchange of information and is positively influenced by it. Finally, (Panahifar et al., 2018) followed the same guideline, underlining here too the effectiveness of collaboration is achieved with continuous communication between stakeholders.

In this sense (Nyaga et al., 2010) has collected ideas and opinions of both customers and suppliers trying to understand how the exchange of information has influenced their work compared to the past; it emerged that there was an increase in mutual trust and commitment, reflecting these improvements on the corporate collective. It is therefore clear that the exchange of information is one of the cardinal factors for a correct horizontal logistics collaboration (HLC), improving the quality, completeness, timeliness of information.

All these studies, therefore, have shown that a company must urge all actors within the supply chain to continuous communication and carry out actions that allow to build mutual trust, which, according to the article (Badraoui et al., 2023) is an important fact of success for HLC; only in this way is it possible to have effective and efficient coordination and collaboration.

Also (Liao et al., 2017) states that information sharing, along with other factors such as incentives and synchronization during the decision-making phase, are very important to achieve competitive advantages.

According to (Badraoui et al., 2023there are ten factors that cause difficulties in implementing collaborative behavior within companies, among them is the resistance to disseminate and share key information. In detail, this impacts on the ability to plan and execute logistics activities and make key decisions correctly (Ramesh et al., 2010); this is highlighted by (Fawcett And Magnan, 2001), where it is stated that the lack of information sharing is the most recurring problem to achieve vertical collaboration.

There are also three reasons why it is difficult to achieve effective information sharing:

- An inadequate connection system (Basso et al., 2019). This problem clashes with costs; In particular, the technology required can be expensive, but the transition costs saved would offset the fixed investment costs required for the acquisition of the systems.
- The second important problem is that of data sensitivity: in fact, in the case of competitive collaboration, the possibility of dispersion of information can cause high opportunity cost.
- The third problem concerns territoriality, that is, having a mind closed to one's goal without considering the overall vision of the company to achieve a common goal. This problem, according to (Fawcett et al., 2015) mainly affects the managerial part of the company.

The Delphi study carried out in the article allowed to identify several factors that slow down the construction of a healthy collaboration within the supply chain; these include the lack of transparency regarding personal benefits, the lack of propensity to share information with other actors in the supply chain and the lack of integrity of partners.

In this case, the lack of information sharing can be caused essentially by two factors: a poor or non-existent connectivity system or by the competitive nature of people. That of the two more complicated is certainly the second, as it can cause a difficulty in understanding the process of one's colleagues, not understanding some choices made; all this negatively impacts the establishment of a strong mutual trust. (Chen et al., 2011)

In addition, operational activities are also affected by this difficulty in relating to colleagues, slowing down the execution of tasks (Badraoui et al., 2020). Instead, promoting the exchange of information reduces the risk of opportunism, with a cut also in the costs of monitoring and control.

At managerial level, the culture of information exchange should therefore be encouraged; In detail, those who deal with horizontal logistics must make sure to make adequate ICT systems available, open their minds to the work of their colleagues. All this would lead to them, in addition to avoiding a waste of their products, also to have a profitability in the long term by reducing transition and risk costs, increasing operational efficiency, and reducing business risk (Cruijssen, 2020).

According to (Badraoui et al., 2020), if you avoid sharing information, you also influence "joint relationship efforts", that is, a mutual effort to help, in times of need, a colleague during his work. So, the two aspects are not separated from each other, but closely connected.

As indicated by (Kotzab et al., 2019), information sharing, together with mutual trust and commitment, represent the cornerstones for obtaining collaboration and cooperation.

As can be seen in figure 2, (Ghasemi et al., 2023) created a four-axis representation that contains the level of communication, the level of resource utilization, the flow

of information, and the level of commitment to participation and planning between actors in a production-inventory system. Within the graph are inserted the so-called CCC, namely:

1. Coordination, with informal communication, use of separate resources, low commitment, and low information sharing.
2. Collaboration, with formal communications, high sharing of available resources, high operational and strategic commitment, and continuous exchange of information between stakeholders.
3. Cooperation, intermediate situation between the two.

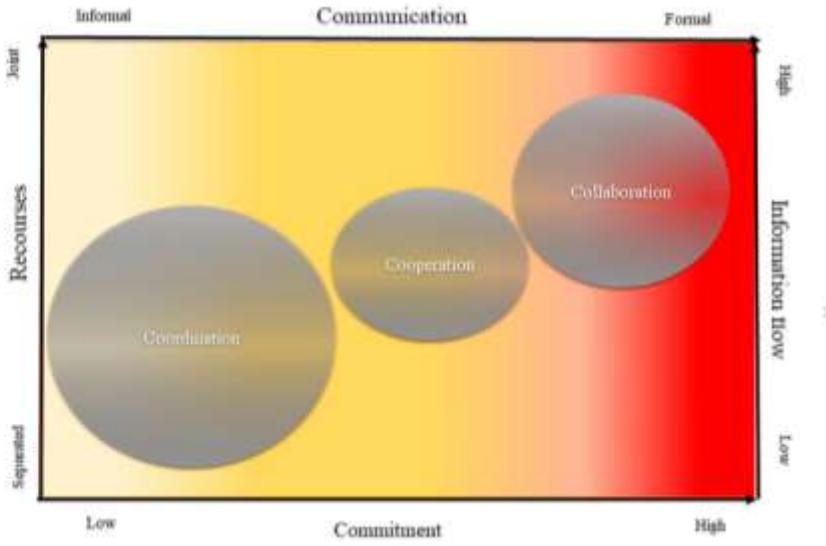


Figure 2

In short, the collaboration also focuses on long-term relationships by implementing joint operational-strategic planning. Coordination, on the other hand, is more suitable for short and purely operational working relationships, trying to achieve one's objectives without its partners benefiting from it.

According to (Ghasemi et al., 2023), the mechanisms of the CCC are:

- Information Sharing
- Contracts
- Joint decision-making

As defined by (Mehr et al., 2017), the exchange of information is one of the key factors in successfully coordinating the supply chain; in particular, members of the supply chain are free to work without having to share information with other colleagues; but collaboration also means being transparent and having precise details on the work to be done in the future, which is important factors when making important decisions.

In particular, the managerial part of the company, having access to information such as warehouse stocks, annual demand forecast, can provide a better level of stocks, customer service and an effective production schedule (Wang and Zhang, 2020)

In the business and even academic field, this information is however clear and established, the real problem is that, with sensitive data for the company, we tend to be more conservative and be indisposed towards these actions.

Mehr et al., 2017), for example, analyzed and created a mathematical model that compares supply chain performance by exchanging information about production planning and warehouse inventory level in real time on a three-echelon supply chain. The results showed that there was, in addition to economic savings due to the reduction of transition costs, also an increase in sales and a reduction in stock-out and unsold products.

The study of (Wang and Zhang, 2020) instead focused on the selection of partners with whom to share information, also here in a production-inventory-distribution

chain. In detail, a manufacturer had the opportunity to choose between two priority dealers, but only one of the two was selected.

In this way the manufacturer is incentivized to develop a selective data transmission channel system and the retailer is more driven to be faithful and integral with respect to the information obtained. In this way, according to their study, the benefits obtained with this way of operating are high.

As mentioned by (Airike et al., 2016), the sharing of information between the various stakeholders is also a key factor in solving the social problems that are created within the company, which are not always at the center of the company's management.

As argued by (Fontana, 2017) a sharing of knowledge and information, makes it possible to understand the needs of the various stakeholders, both socially and environmentally; in this way it is possible to have access to external resources and competitive advantages.

In this way we would also consider the social aspects that, until a few years ago, were neglected to the detriment of the economic performance of the company (Padilla-Rivera et al., 2020).

According to (Agyabeng et al., 2022), to be innovative and open to change, medium-sized companies must be able to share information and knowledge among interested stakeholders; however, this aspect is particularly difficult as there are stringent limits such as scarcity of resources, constraints, and little propensity to share information outside their team. (Wong et al., 2020)

The development and continuous improvement of digital technologies and platforms has also assumed considerable importance for the exchange of information; in particular, IoT, blockchain and cloud systems are ideal for

promoting this aspect, as they allow in minimum time to carry out planning and make decisions jointly in real time allowing, in a short time, to reach different stakeholders of the supply chain in an immediate and facilitated way (Gebhardt et al., 2022).

2.2. Relationship With Stakeholders

To be able to implement circular economy effectively, an important part to consider are the actors in your supply chain, both internal and external to the company. In fact, there are several factors that influence our success with their work, creating a fundamental competitive factor for the core business.

Continuous collaboration with these actors can certainly bring economic benefits for both parties, but also improvements in environmental and social impact, aspects that in recent years have been in the limelight compared to past years. It is therefore important to understand what the current situation is told in the literature, trying to identify possible improvements and future developments.

In this way, the idea of zero waste spreads in the company's business model, innovating both the daily operations and the organizational structure of the company throughout the product life cycle. To do this, it is essential to involve all the company's stakeholders, from producers to consumers through service providers.

As can be seen in the figure 3 and figure 4, following the previous reasoning, it is possible to identify different stakeholders participating in the redesign of the supply chain, following an open loop configuration, that is, collaborating with a company external to one's own with a continuous exchange of products, information, and services to obtain mutual benefits.

In this way, the production of waste would be minimized by increasing efficiency. Examples of these methods of collaboration are present in different areas, from the automotive sector to textiles, electrical and cement, all sectors that in recent years have been subject to strong interest from consumers due to the very high level of carbon dioxide produced during production. (Sosnowski and Cyplik, 2022)

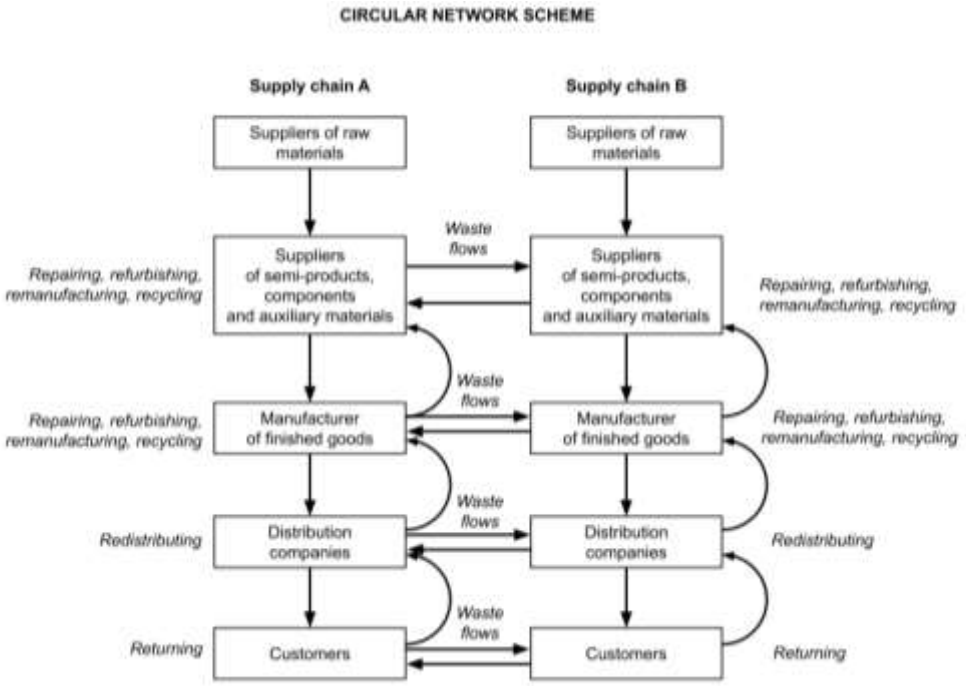


Figure 3

Working closely with all the company's stakeholders, it is therefore possible, through the development of the circular economy, to carry out an assessment of its employees and collaborators in terms of commitment to the environment, collaboration with its producers and suppliers and the satisfaction rate of the end customer. (Sosnowski and Cyplik, 2022)

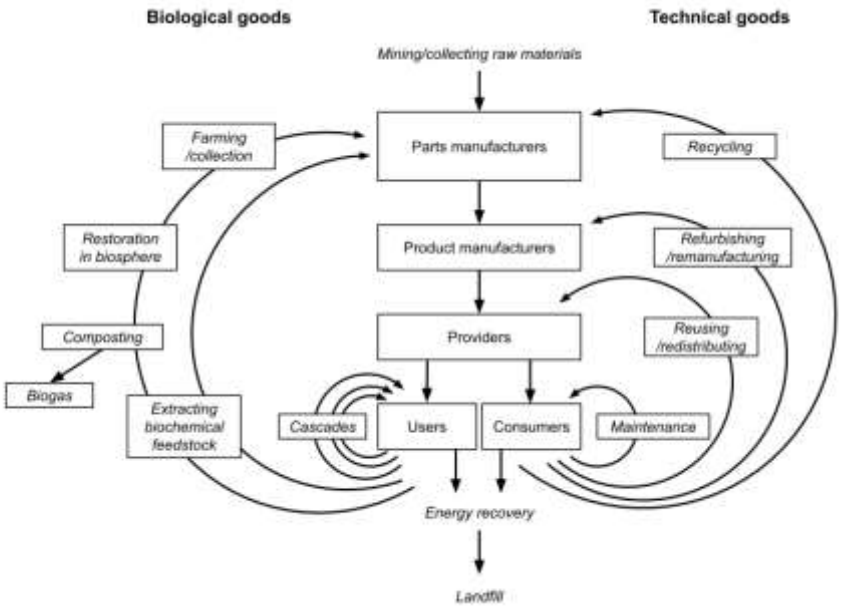


Figure 4

Another very important study also includes the so-called stakeholder theory, where it is stated that the success of the company is directly attributable to the relationship that is created with each stakeholder, stating that there is a mutual influence between the company and external stakeholders that allow the success of both parties. (Freeman, 1994)

In a broader sense, not only the operational part of the process is considered, but it is also essential to collaborate with governmental and non-governmental agencies to streamline bureaucracy, have the opinion of experts and deal with the relevant regulations, managing to be efficient and effective. A difficulty in doing this is the lack of intention of stakeholders to actively participate in achieving circular supply chain management; this fact could be very negative for the company because the collaboration of the entire supply chain apparatus is essential to achieve certain set goals. (Wang et al., 2021)

It is therefore normal to say that to collaborate in this way it is necessary to have compatible interests and a strong mutual trust. (Friedman and Miles, 2002)

This collaboration between the various actors in the supply chain is called Cross-Sector Collaboration (C-SC) and is defined as the collaboration and negotiation between independent actors with the aim of sharing resources and developing the core competencies and capabilities of the company.

It includes long-term relationships with a high level of mutual dependence, sharing of risk and resources, with a common goal, sharing of the benefits achieved, addressing problems caused by cultural and social differences, as well as in the way of working. (Brown et al., 2021)

To do this requires a precise long-term plan, open and continuous communications, a definition of roles and actions to be carried out every day (Kania and Kramer, 2011); only in this way can environmental sustainability issues be addressed with the right focus.

However, business managers must be ready to capture emerging needs to support work in the supply chain, to be the first to introduce innovations that can create competitive advantages, especially in markets where it is difficult to imitate or replace a resource.

A strong classification of the various stakeholders was offered by (Van Tilburg et al., 2022) identifying 8 classes: dormant, discretionary, demanding, dominant, dangerous, dependent, definitive, and non-stakeholder-depending.

(Choi et al., 2013) has also identified three types of stakeholders that are necessary for reverse logistics:

- The brand owner, who oversees processing the waste again.

- The buyer
- External collector, i.e., the external company that takes care of recycling the waste making it reusable by the brand owner.

According to (Choi et al., 2013) the real leader of this channel of material reuse is the downstream buyer compared to the head of the company that resells or reuses the product. This is because the other interested parties are excessively focused on their own interests, going to negatively impact market demand, perhaps through an excessive selling price compared to the real value of the product sold. To do this, of course, the buyer must mediate between the two actors, so they must be granted unconditional trust.

In the end, however, the one who creates value both for primary stakeholders (customers, suppliers, service providers, shareholders, and employees) and for secondary ones (government and non-governmental agencies and, above all, the environment). Both these classes have objectives to achieve, which are economic for primary stakeholders and improvement of environmental conditions with reduction of pollution for secondary ones. (Ciarnien et al., 2010)

To please everyone, however, it would be necessary to decide on personal incentives and set goals that are not in contradiction with each other; it is also clear that there is a mutual influence between the various actors, for example secondary stakeholders can impose laws that limit the operational part of companies.

Unfortunately, the objectives of primary stakeholders prevail over those of secondary stakeholders. A clear definition of the tasks of the various stakeholders and the responsibilities towards the implementation of the EC is also important.

The best results, however, are achieved by collaboration between these two camps, generalizing an effective leadership channel, which is key to achieving coordination within the supply chain (Arshinder et al., 2008)

Another factor that allows to obtain better results for the implementation of the CE is to put pressure on managerial figures to push them towards an ecological transition; in other words, you should have access to critical resources and collaborate internally and with external companies, including competitors in the sector, to achieve better performance, better satisfaction and profit. (Baah et al. 2023)

2.3. Partnership with supplier

The stakeholders who are most interested in establishing a long-lasting collaboration relationship are certainly the suppliers, i.e., those who sell our company products and services that will be used to generate the final product that will be sold on the market. They are also those who could propose innovative technologies present in the market, bringing innovation to the company before other competitors on the market.

The establishment of a lasting relationship with suppliers would therefore facilitate the transition to the circular economy, perhaps improving production processes, establishing an exchange of ideas on the possible reuse of products that were previously thrown away in how much waste and generating, in general, benefits to both parties. (Ketzenberg et al., 2006)

According to (Zhang et al., 2021) to achieve innovation in business and an ecological transition, it is important that there is also a close collaboration between producers and supplier even in the initial stages of the working relationship; moreover, a close

collaboration with technology providers allows to have recovery processes that are efficient and interconnected. It is also important to work together to improve efficiency on the collection, transmission and recovery of waste material created in one's own or other companies' supply chain.

Following the reasoning carried out, the exchange of information is addressed again; in this sense, the benefits deriving from this positively influence both parties, with benefits also in the long term by decreasing the supply lead time, the variability on the quantities of products needed and increasing the level of service. (Huang and Wang, 2017)

If we want to be more detailed, in (Sudusinghe and Seuring, 2022) the three types of information sharing with the supplier are grouped which are: communication with key players, product development and creation / modification of processes and daily activities.

The relationship that technological providers is developing also identifies three recurring practices: logistical integration, sharing of responsibilities and daily relationships with key actors. All these aspects improve and make possible the implementation of the circular supply chain.

To fully understand the meaning of relationships with suppliers, it is possible to divide the methods and types of collaboration into two macro-groups: external vertical collaboration and external horizontal collaboration. Sudusinghe and Seuring, 2022

As far as external vertical collaboration is concerned, we can mention several actions:

- Sharing information with key supplier
- Penalties and incentives for sustainability actions

- Sharing responsibility and risk
- Product design or modification
- Long term agreement
- Inter-organizational trust
- Continuous communications
- Technological integration
- Monitoring and data collection of performance
- Logistics and infrastructure integration
- Quality improvement with cost reduction
- Revenue sharing

There would be many others to mention, but these are the ones that are most based on the need to implement circular economy within the supply chain (Sudusinghe and Seuring, 2022).

As far as horizontal external collaboration is concerned, the most important aspects are:

- NGOs sharing knowledge and expertices, i.e., assisting suppliers with reduced economic capacity, making them grow by their side.
- Collaboration with competitors.
- NGOs acting as a bridge for funding, acting as guarantor of its suppliers to banks or credit institutions to obtain economic support.

From the following figure, it is possible to see how the relationship with its suppliers follows a continuous flow, which begins with the arrival of raw materials in the production site, and extends throughout the supply chain up to distribution to the end customer. It is therefore not only the supply of the by-product, but along the chain there can be, for various reasons, continuous contact with your supplier. (Sosnowski and Cyplik, 2022)

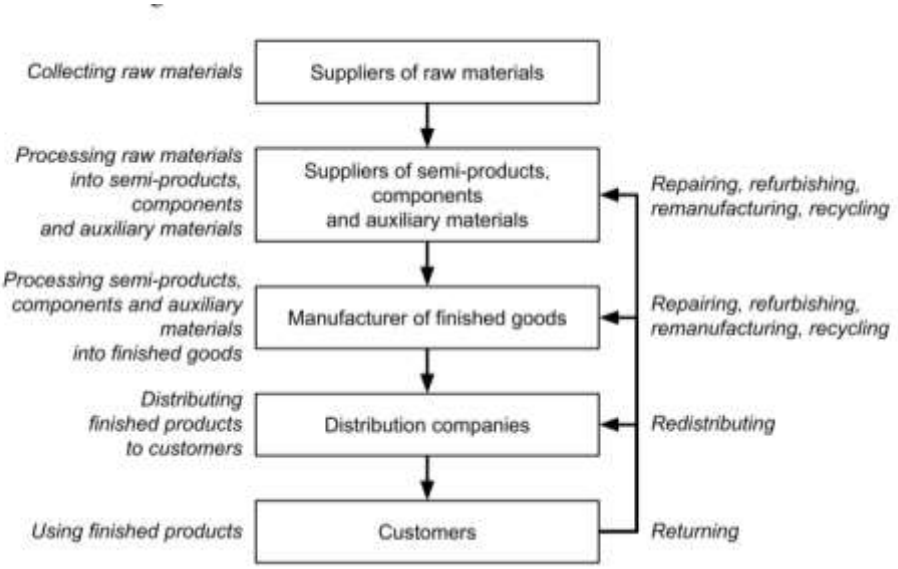


Figure 5

According to (Liu et al., 2019) if considering a supply chain, it is appropriate to consider relationships with retailers, suppliers and government when trying to configure a circular supply chain; in particular, if government agencies promoted financial subsidies for companies to promote the implementation of sustainable labor practices, both the company itself and its suppliers would benefit because they were even more motivated to improve their performance. In this way, it would reach a high level of sustainability, managing to increase its revenues and operating performance in general.

To this is added the thought of (Sancha et al., 2016) where it is stated that, in addition to the purely economic aspects, a collaboration with its suppliers would also have a positive impact on social performance, not always considered during the analysis of a company.

Also (Baden et al., 2009) states that an effort to increase social and environmental factors has a positive impact on the performance of the supplier, more incentivized to apply sustainable and social practices during their work. Some examples can be

the reduction of emissions during transport through green means of transport, a propensity towards a lasting relationship based on mutual trust, which is the basis of the implementation of the circular economy.

As quoted by (Yong et al., 2022), it is also important to understand what the consequences would be related to cooperation with its suppliers; this is because the consequences on the company's business must be understood and quantified and, perhaps, insert a managerial figure who deals with this type of tasks; to do this the proposed framework is fundamental.

It is based considering two different suppliers within a decentralized channel, both sell a certain identical item to a buyer of the company interested in developing a working relationship; The demand for the product is not always known by the supplier, and each of the two chooses its own wholesale price at the same time. The company, having the two prices offered, chooses the quantity of product to be purchased from both suppliers that will be delivered as soon as it is available. Once the product is received, the company chooses the selling price obtaining a certain demand from the market. (Yong et al., 2022)

The assumptions of the framework are that suppliers have the same bargaining power towards the retailer, there are no reserved profits, and the purchased product can be either a sold product or an assembly part compared to the final product. (Yong et al., 2022)

The results of this framework clearly state that a determining factor, which had never emerged before, is that even a collaboration between the suppliers themselves can bring benefits to the downstream business system; in particular, a Nash equilibrium is reached between the two suppliers making it possible to sell the same quantity of product at the same price, eliminating opportunistic behavior that

would disadvantage suppliers, bringing benefits only to the final supplier. This would create mutual trust both between suppliers and between supplier and retailer itself, making it possible to have a lasting relationship. This cooperation would also benefit the reseller because it would ensure that it does not suddenly lose its supplier by maintaining the network. In this way it would reduce possible deviations from the strategy, or in any case reduce its impact and remove all the elements in the company that prefer their interests instead of the collective good. (Yong et al., 2022)

According to (Van Tilburg et al., 2022) suppliers are those who must take the leadership of the relationship, elevating the companies that resell the product with their work; In other words, it is necessary to create a relationship between buyer and supplier that includes relationship management, incentive management and the development of a functional integration between top and bottom of the company, expressed horizontally at every level of the supply chain. This is a success factor for a correct circular economy.

A factor to consider when deciding what kind of supply strategy to implement is the product category that is considered between bottleneck, strategic, leverage and non-critical. These types are grouped in the so-called Kraljic Matrix, where according to the strategic importance of the product (low or high) and the difficulties of the supply market (low or high) it is possible to identify whether to establish a partnership, induce competition between suppliers on the market or even resort to vertical integration. (Caniëls et al., 2017)

In addition to this, the level of environmental, ethical, and social sustainability of each supplier must also be considered and ensure that they are consistent with their vision. This is because collaborating consistently can reduce the number of raw materials used and waste creation by increasing both production efficiency and

operational results due to savings in production and procurement costs. All this, accompanied by a fair sharing of information and knowledge, allows to achieve significant results in the circular supply chain. (Witjes et al., 2016)

This relationship between suppliers and buyers, if profitable and satisfactory, has a positive impact on all stakeholders in the supply chain, even in the managerial part of the company because it manages to have a complete idea of business processes by identifying any points of interest to improve some operational aspects. (Kohtamaki et al., 2016)

Success factors for this type of relationship are incentives for suppliers to create partnership opportunities. In this way you can seriously think about developing circular strategies because you have a clear value of market demand, improve operating and financial results. (Van Tilburg et al., 2022)

Summarizing, there are factors that are fundamental for achieving the drafting of supply contracts between buyers and suppliers:

- Availability of incentives
- Knowledge about circular practices
- Partnerships
- Stakeholder participation

Of course, from (Van Tilburg et al., 2022) these are interconnected with each other as you can see in the figure 6.

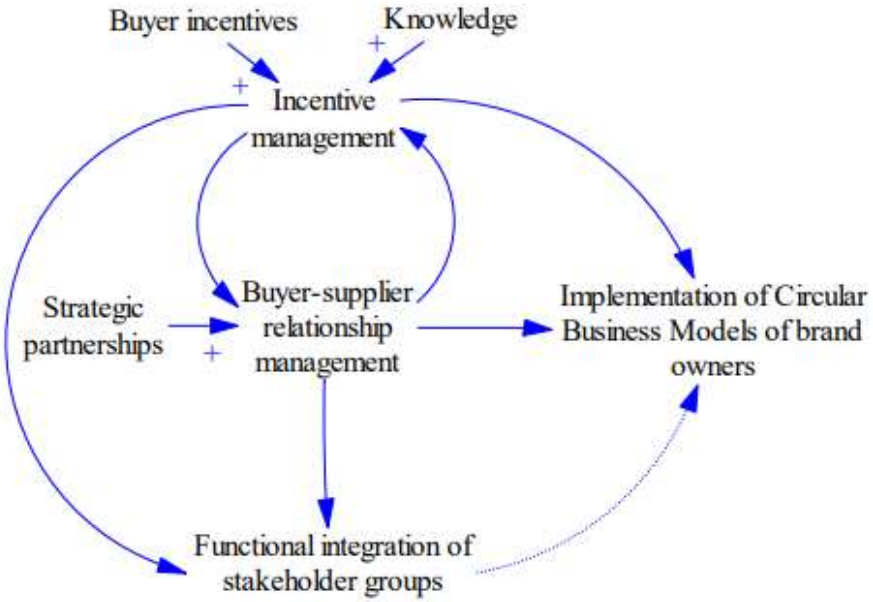


Figure 6

2.4. Contract

The events of recent years, the worsening of environmental conditions, the approach of customers to sustainability issues and the growing need to be in line with the objectives of emission reductions have influenced the birth and subsequent management of food businesses. Some practices begin to spread in this last period to be sustainable and create a reverse logistics have precisely the purpose of avoiding the creation of waste giving a second life to products that would become waste or incinerated creating pollution and carbon dioxide emissions. (Govindan et al., 2014)

Among these practices we certainly mention the creation of supply contracts; these are tools that have the task of facilitating active participation within the supply chain by acting in the collective interest of achieving corporate objectives, such as

improving efficiency, effectiveness and, in general, the final operating result. (Govindan et al., 2014)

These parameters specify some parameters to be achieved and respected such as quality, delivery time, level of service offered. Supply contracts also allow you to have a tool that protects against any opportunistic and individual behavior by some members of the organization (Cachon, 2003).

Considering the studies present in the literature, the effects of these contracts on the reverse supply chain in terms of possible consequences and applicability have not yet been studied. The only sector that perhaps has more numerous studies is in the field of electronics and waste created by this sector, therefore outside the scope of the study of interest.

The goal of supply contracts is therefore to obtain an alignment between the actors of the supply chain with the company objectives, to obtain an improvement in the performance of each of them, also through incentives and personal benefits (Cachon, 2003).

Over the years there have been several studies to analyze the benefits obtainable through the implementation of these contracts, especially concerning revenue sharing and buy back contracts; the result of these studies states that the best in terms of improving profit, coordination and benefits in general is the revenue sharing contract (Govindan et al., 2014).

Other studies, always focused on revenue sharing, focused on the influence that these contracts have on consumer demand (Kunter, 2012) no longer considering the price as the only decisive variable in the purchase of the product, but also focused on competition on the market, on fuzzy variables and on negotiation that, according to (Giannoccaro and Pontrandolfo, 2004) represents a very important factor for

sales because it allows the customer to get the product at the lowest possible price, pushing the seller to improve his company to stand out on the market, overcoming his competitors and getting the sale.

If we also analyze a multi-echelon context, we must certainly mention (Van der Rhee et al., 2010) who explained how the sharing of revenues and demand brings numerous advantages to both parties and (Chen, 2006) who considers risk aversion and the intensity of incentives as key factors to be considered when it comes to obtaining benefits from the use of supply contracts.

As mentioned above, coordination contracts in reverse logistics are not much studied in detail, but it has emerged that the need to focus on common objectives of cost reduction, minimization of risks and maximization of profits without ever entering the dynamics that were created with the implementation of these contracts. As for the incentives most requested to stipulate these contracts, the most recurrent one concerns the return and reimbursement of the product in stock, with particular attention to the quality, quantity, and timing necessary (Govindan et al., 2014).

Another very significant study allowed to affirm that the sharing of data on revenues and discount on quantities in a two-echelon system allows to implement a closed loop supply chain; In this case it was possible, thanks to the elimination of double marginalization, to obtain a good internal coordination between the actors of the supply chain. (Shi and Bian, 2009).

2.4.1. Type of contract

According to (Kumar et al., 2022) in recent years industry 4.0 has allowed the creation of so-called Virtual Organizations (VO); these modules have the computational capacity to align market demand with the demand forecast of companies that use it.

Using this virtual model, 4 types of contracts were created that aim to support the supply chain within the transition process towards a circular economy model for the recovery of agri-food substances. In detail:

- *Wholesale price contract*: first, the producer decides the cost-sharing coefficient of manufacturer; the retailer then decides the margin and profit he wants to obtain, the sustainability coefficient he wants to guarantee for his company, naturally considering the choices made by the manufacturer. After the seller has decided on his values, the manufacturer sets his wholesale price. In this way, the balance between the two actors involved is achieved. (Kumar et al., 2022)

- *Cost sharing contract*: in this case the producer decides the cost he is prepared to bear about technological development and sustainability; the retailer, knowing these values, decides his profit margin and accepts the remaining part of the costs to be incurred. Once this is done the manufacturer sets its wholesale price. Having now all the factors we proceed backwards by identifying the exact point of equilibrium. (Kumar et al., 2022)

- *Revenue sharing contract*: Here too, the manufacturer decides the fraction of costs that he intends to bear, having already available data about the seller; if the retailer accepts the proposal, the contract can continue. The retailer then decides his margin, the fraction of the revenues to be shared and the commitment to environmental sustainability. Knowing these values, the manufacturer decides his wholesale price and, finally, the equilibrium level is decided backwards. (Kumar et al., 2022)

- *Linear two-part tariff contract*: this model is dominated by the retailer; the manufacturer pays a "slotting" fee to the same retailer. The manufacturer decides the cost-sharing coefficient of manufacturer, the retailer its margin, also entering the slot rate. If the manufacturer accepts the conditions, he decides on his wholesale price. Here, too, we proceed backwards, solving the so-called "Stackelberg game". (Kumar et al., 2022)

2.4.2. Model result

The results obtained from this article state that these types of contracts, implemented through the tools available thanks to Industry 4.0, are a significant improvement in sustainable practices, efficiency of sales and distribution channels, improvement of interpersonal relationships and a more precise and punctual demand forecast compared to basic price and cost contracts.

The real question is to understand which of these contracts to use for your business; According to (Kumar et al., 2022), the contract that emerges as the best from several points of view is the two-part tariff contract as it generates, compared to the others:

- The highest value in terms of profit and business result
- The highest demand on the market
- Achieving the level of green and social innovation
- The highest level of retail price
- Greater channel efficiency than even revenue sharing contract
- A perfect supply chain structure when it comes to coordination
- The best performance in the field of sustainability

According to (Sharma and Singh, 2022) on the other hand, too complicated supply contracts are not necessary to obtain good coordination within the supply chain. A supply contract with wholesalers is sufficient and undertakes to be correct during the employment relationship.

This would achieve the same benefits as a centralized channel. The aspect that makes this better than the types of contracts mentioned above is the reduction of bureaucratic practices and the reduction of transaction costs.

As explained by (Cui et al., 2007) it is important that even the part of the production there is an honest work towards the retailer, also judged by some parameters that certify the achievement of minimum standards.

As proposed by (Wang et al., 2022) revenue sharing contracts can and should also be useful to avoid the interruption of coordination as it has an anti-destructive capacity to achieve a circular supply chain.

The results of this analysis can be summarized by saying that:

1. Each member of the supply chain is positively influenced using supply contracts.
2. The presence of discounts offered to the customer can be an aspect of further economic gain for the company in terms of loyalty and purchase of large quantities of products.
3. The fact of creating supply contracts shifts the modus operandi from being decentralized and without a continuous exchange of communications to having solid coordination, knowing your supplier, understanding how to act and how to deal with it.

2.5. Circular Economy Implementation Barrier

Presented now everything that can be done to create the circular economy, we must of course analyze in detail all the aspects that can slow down or make it impossible to implement these ideas, from an operational, contextual, perceptual, strategic, and managerial, and governance point of view, trying to identify possible points of work to overcome these barriers and be able to implement all the previous proposals presented.

According to (Kazancoglu et al., 2020), through a study in different manufacturing sectors, the main barriers to implementing a circular economy within the supply chain are a lack of coordination, inadequate communication structures and a lack, or very poor, exchange of information between actors in the same supply chain or even with external actors of the company.

(Mishra et al., 2018) states that between the and external barriers that slow down green purchasing practices, those that impact most on a company are certainly political conflicts, bureaucracy and civil wars that continually cause unrest around the globe.

A very important factor to overcome technical and operational barriers, thus making possible a full development of collaboration, making possible a full integration, within the supply chain, of the logistical, productive, and technological aspects deriving from this practice. (Veleva And Bodkin, 2018) (Basso et al., 2019), also theorized 31 barriers to achieve a horizontal logistic collaboration, which can be divided into:

1. Exchange of information, mainly due to a lack of adequate digital technologies.

2. Poor business model due to the lack of figures, such as a coordinator, who can guide workers in the coordination process; a difficulty in linking earnings with corresponding costs can also be mentioned.
3. Lack of integration systems.
4. Excessive regulation and little or late government support.
5. Resistance to change and past negative experiences.

Avoiding sharing information is the recurring factor in the literature, causing the creation of a large barrier to achieve vertical collaboration; this has a strong impact on the accuracy of action plans and the execution of daily tasks. This can have consequences for efforts to achieve direct contact with members of the supply chain. (Ramesh et al., 2010)

The aspect to consider is that, sometimes, the lack of communication is not always wanted, but derives from insufficient means to achieve it. (Chen, 2019) underlines once again how the lack of ICT tools can lead to a slowdown in the communication process.

This theme is taken up by (Basso et al., 2019), explaining that a communications system that does not live up to the company's expectations can be the main problem to achieve horizontal logistics collaboration. All this is also transmitted in a lack of transparency: the reluctance to share sensitive and perhaps confidential data on one's work can also cause damage to one's colleagues who could benefit from it to learn more about the facets of the work to be done.

Among the high barriers cited in the literature, integrity based on trust is also to be mentioned, a key aspect to allow the exchange of information, data, and resources with partners.

According to (Luthra et al., 2022) it is possible to contextualize and divide the barriers to implement the CE into operational, contextual, perceptual, strategic, managerial, governance.

2.5.1. Operational Barrier

The operational barriers identified are:

- Temporal dynamics of technology: differences exist in the temporal dynamics of technology among partners; this restricts ability to collaborate for CSCM. (Al-Tabbaa et al., 2019)
- Distinct operational and managerial practices.
- Monitoring performance within multiple contexts: stakeholders monitor performance in different contexts creating complexity in developing C-SC for CSCM (Shankar et al. 2018)
- Risk of information loss: employees and managers do not know what information can be shared to support collaboration for CSCM and thus worry about information loss (Loosemore et al., 2020)
- Loss of control over operations: different sectors do not collaborate as they fear losing control over their operations. Their fear is a barrier in their C-SC for CSCM (Bryson et al., 2015; Compagnucci and Spigarelli, 2018)
- Duplication of responsibility and authority: cross sectors may have duplication in responsibilities of individuals that makes them uninterested in being part of a collaborative circular network. (Heuer, 2011; Stadtler and Karakulak, 2020)
- Lack of transparency and low-quality disclosures.
- Incompatibility with the corporate “immune system”.

Of these, the most influential and difficult to overcome is the second, namely distinct operational and managerial practices; this data makes us understand how the need to apply a circular economy must affect both the micro and macro levels of the company. (Kirchherr and Piscicelli, 2019)

This barrier must be overcome by the organization through mutual and continuous support to develop a circular chain; also (De Sousa Jabbour et al., 2018) takes up this aspect.

The Resource Based View (RBV) advises companies to use their resources and strengths to integrate and mutually benefit their core business. This aspect must be used by companies that want to start implementing a circular economy, as they represent a key basis on which to stratify the resource recovery strategy.

The problem is that nowadays there are managerial and operational practices that exploit non-replaceable resources, making the desire to create a circular economy unfeasible.

2.5.2. Contextual Barrier

The contextual barriers (COBs) identified by (Luthra et al., 2022) are:

- Diverse institutional logics
- Organisational norms and culture
- Inbuilt organisational resistance

According to the result of the FUZZY DEMATEL presented, contextual barriers present themselves as the strongest from a causal point of view.

These barriers consider the resistance highlighted by organizations and people to develop a circular economy; this group includes all the organizational rules and corporate culture that are established and difficult to eliminate, even if retrograde.

It can be said that these can only be overcome if the partners commit to work together to achieve the zero-waste goal.

Some studies (Babiak and Thibault, 2009) state that COBs negatively impact the acceptance of change and adaptation to the new modus operandi of the company.

2.5.3. Perceptual Barrier

The perceptual barriers identified by (Luthra et al., 2022) are:

- Misaligned interests of individuals across sectors
- Lack of social movements
- Lack of trust among cross-sector collaborators

The first is the most important one. As also stated by (Loosemore et al., 2020) most individuals within an organization have a very opportunistic behavior or otherwise focused on their own personal gain. This leads to reluctance to collaborate with partners, causing a strong barrier towards the application of circular supply chain management, a fundamental factor for sustainability and for the recovery of reusable waste substances in one's own or other sectors.

Lack of trust between cross-sector employees is also a strong barrier to consider; in general, trust has always been an important and limiting for a collaboration as it can cause the loss of partnerships and possible projects. (Heuer, 2011)

2.5.4. Strategical and Managerial Barrier

The main strategic and managerial barriers found by (Luthra et al., 2022) are:

- Internal bureaucracy
- Lack of common vision and policy framework
- Competition vs collaboration

- Absence of system standardization for performance management
- Risk management approaches
- Limited knowledge among decision makers
- Absence of commitment by organizations toward sustainability
- Poor acceptance for environmentally superior technologies

Strategic and managerial barriers include organizational areas to develop your core business, allowing you to achieve competitive advantages (Gunasekaran et al., 2017). To support the achievement of these objectives, the circular economy stands as a support tool to improve supply efficiency.

It must be clear that every company has a different way of operating from the others, so, there is no fixed rule for everyone; it must be clear, however, that the greatest effort must be made by managers, creating a work environment that encourages collaboration, be participatory also involving external actors with whom you can collaborate to improve performance.

As mentioned above, however, we are not always in favorable of this type of practice, so it is important to have a clear direction to follow, to facilitate the spread of these practices.

2.5.5. Governance barrier

The governance barriers identified by (Luthra et al., 2022) are:

- Inflexible policy and structure
- Lack of legitimacy
- Command-control government regulations
- Lack of power asymmetry
- Isomorphic institutionalism

In this case, the problem arises from the difference that exists between the powers assigned to one's partners and the level of available resources. The possibility of delegating tasks is also a barrier cause for the implementation of the circular economy, as there is no mutual trust, we rarely tend to entrust someone else with an important task.

The study of (Alkhuzaim et al., 2021) also states that due to power asymmetries and resistance to change, the possibility of operating even in sectors with strong specificity and low opportunities for substituting products with a circular economy is too difficult.

The presence of multinationals with strong bargaining power is also a cause of difficulties in operating in the market, even towards resources that are difficult to find, generating tensions and discontent with the legitimacy regarding the way of operating on the market.

2.6. Literature Recap

After analyzing the most frequent mechanisms of coordination and collaboration between actors in the supply chain, it is useful to make a small recap to summarize and better visualize the topics covered during the drafting of the analysis carried out. In this table all the variables most frequently recurring in the literature for each topic have been inserted, to compare them with what emerged during the analysis of the interviews. By doing this, it is possible to make a comparison between what is done by the analyzed start-ups with respect to the real potential.

Table 1

MECHANISMS FOR COLLABORATION AND COORDINATION	ANTECEDENT AND BARRIER	BENEFIT	DRAW-BACK
INFORMTION SHARING	•Company's vision •Vision of production process •Synchronization in decision •Lack of ICT •Territoriality (Kalverkamp) (Collier) (Cruijssen) (Agarwall) (Fawcett)	•Better Problem solving •Sharing ideas •Social relationship •Reducing operational risk and cost (Nyaga)	•Dissemination of key information •Lack of trust (Badraoui)
RELATIONSHIP WITH STAKEHOLDERS	•Mutual influence and trust •Incentives •Lack of intention to actively participate •Cultural and social differences	•Avoid excessive bureaucracy •Access to knowledge and know-how •Sharing critical resource •Ecological transition	•Mutual dependence •Different objective
PARTNERSHIP WITH SUPPLIER	•Sharing ideas •Product development •Integration of technology •Bargaining power (Articolo 6) (Article 11)	•Long-term relationship •Innovation •Process design •Efficiency and effectiveness •Level of service (Articolo 6) (Articolo 1) (Baden)	•Opportunistic behavior •Mutual dependence (ART 6)
CONTRACTS	•Risk aversion •Quality (Shi and Bian)	•Delivery time •Level of service •Profit •Differentiation vs competitors •Minimization of risks •Green and social innovation (Cachon) (Art 2)	•Opportunistic behavior (ART 2)

2.7. Conclusion and Research Gap

To conclude, it can be said with absolute certainty that there are several aspects to consider when you want to implement a collaboration in a company to allow a transition to the circular economy; the aspect that certainly prevails over the others is certainly to have a continuous sharing of information with anyone interested in every step of the supply chain, from the moment of procurement to delivery to the end customer. This aspect allows to obtain considerable benefits, also considering the possible repercussions that would have for the dissemination of sensitive data.

The relationship with each actor must therefore be regulated, considering that not everyone has the same vision of a problem, everyone has their own way of working and acting, thus trying to help each other for the common goal.

In the literature, however, some aspects that need to be addressed are missing, such as the real economic and environmental benefits due to the creation of a circular economy. To better explain, almost all the articles deal with the topic of the circular economy stating that numerous improvements can be obtained from this practice, but few manage to quantify numerically the value of this economic saving or, more importantly, the reduction of the environmental impact due to the fact of avoiding the creation of waste placed in landfills.

These aspects are fundamental for the strategic part of the company because allows to promptly visualize what are the real benefits of a collaboration between actors, giving an idea of what can be improved in your company compared to the current situation.

Another problem that emerged during the research is that many industrial sectors are not affected by this type of research; In detail, most of the research is mainly concentrated in textiles, automotive and informatic sectors. Therefore, more research should be carried out in the food sector, a sector that produces 1.3 billion tons a year of waste that could be reused in various areas such as cosmetics, construction, textiles, pharmaceuticals.

This aspect, therefore, should be more the subject of scientific studies to innovate and guide the change towards a circular supply chain that allows to reduce the amount of waste, emissions of gases harmful to health and the reduction of the use of raw materials that erode the planet day after day.

Of course, these aspects must inexorably confront all the operational, strategic, managerial and, above all, bureaucratic barriers, which nowadays are an obstacle for several companies. The food sector is the subject of various rules and laws that severely limit its operations and innovation in this area.

3 Methodology of case study

Research was carried out which included several case studies that were consistent with the initial research question. These research were therefore carried out to improve knowledge in the circular economy sector, considering companies in the cosmetics and packaging sectors, collecting information on collaboration methods and methods of coordination between actors in the supply chain.

3.1. Case study sample

After analyzing the various articles with the aim of collecting information about the coordination mechanisms and the methods of collaboration within the supply chain, some interviews were carried out with three different Italian start-ups. In this way, we wanted to compare the information obtained from the various articles with what is implemented by small companies, thus trying to have an idea of the current situation of the Italian context, then going to identify the possible future developments and improvements to be made in the various business realities.

In this way it is possible to analyze the differences between the modus operandi of these companies with what is possible to make a full transition to the circular economy.

Two companies are in the Italian cosmetics sector and one in the production of packaging, sectors that in recent years have been strongly interested in the practices of the circular economy. The reason for this choice was that, at the production level, they are two sectors that have a high environmental impact mainly due to the extraction of primary resources, the production and transformation of the same into

finished products, generating emissions and eroding the availability of primary resources.

From now on they will be called C1, C2 and P1 (cosmetics1, cosmetics2 and packaging1).

The most important aspects that emerged during the analysis of the literature were then analyzed, comparing them with the words of the interviewees.

The start-ups selected to carry out the analysis are companies that base their core business on sustainability and the recovery of food substances. The choice to focus on start-ups derives from the fact that they certainly have a leaner supply chain configuration; therefore, it would have been easier to reach the actors most affected by these practices; moreover, large companies already have a very defined and hardly malleable configuration, especially because they have short and long-term objectives that are not always consistent with this study. Finally, let's say that start-ups, as they are still in the embryonic state of their growth, make us understand on which factors they base their growth and if their focus is consistent with the study carried out.

3.2. Data collection

Information was collected in structured interviews with start-up members through a series of questions organized in general framework, supply chain configuration and governance, supply chain collaboration and Italian context.

The initial questions were focused on understanding the company's business model, to know the operational process internally, outlining their daily business and operational model; In the second part, information was collected about the working relationship with external actors, to fully understand the company

dynamics, to capture their vision of collaboration within the company. Finally, information was collected about the relationship between Italian laws and regulations; In this way, any barriers that characterize the sector could be understood. The interviews lasted 60 minutes and were recorded with the consent of the interviewees, to correctly encode the information and then transcribed later.

3.3. Data Analysis

To analyze the data collected, a coding process was carried out to identify and categorize the information collected by the various interviews, trying to identify possible collaborative relationships with other partner actors. Therefore, having the theoretical knowledge previously learned, the variables identified for each sector of study (summary table of the literature) were crossed with what is exposed by the various start-ups. In this way it was possible to extract the recurring methods of collaboration, identifying analogies and existing differences and, finally, proposing what can still be done to improve the transition to a circular supply chain. It's possible to see an example of the work done by the following table with the quotes collected.

Table 2

COMPANY	VARIABLE	TYPE OF SOURCES OF EVIDENCE	QUOTATION
C1	Social relationship	Primary	*"We work closely with a cosmetics company"*
	Vision of production process	Primary	*"We have continuous feedback regarding the progress of the production process"*
	Sharing ideas	Primary	*"We share ideas both from a chemical formulation point of view and from a production organization point of view."*
	Access to knowledge and know-how	Primary	*"On the product development part we rely on their chemical and R&D laboratories; therefore, the formulation part is totally up to them. This is very important to us as we are able to use their knowledge for our start-up."*
C2	Access to knowledge and know-how	Primary	*"We are very unprepared on the subject to discuss ourselves fairly, our partners have known the sector for years"*
	Sharing ideas	Primary	*"The exchange of information with our partner company are technical and vertical on the product"*
	Reducing operational risk and cost	Primary	*"It is difficult for a company to make accurate estimates of actual market demand, and we understand that this entails additional costs that erode revenues"*
P1	Vision of production process	Primary	*"We don't really share demand forecasting or orders we receive, mostly because we work with products that are always available and not seasonal."*
	Social relationship	Primary	*"We are in constant contact with our customers"*
	Reducing operational risk and cost	Primary	*"We tend to know customer requests so as to avoid an incorrect product, wasting time and money"*
	Synchronization of decision	Primary	*"The product is created in continuous collaboration"*

4 Result

4.1. Within-case analysis

Sections d to 4.1.1 to 4.1.3 serve as a description of each company analyzed and its idea of circular economy, specifying the production process and the environmental and social contribution of each one's work.

4.1.1. Organization of C1

C1 is a company that deals with recovering by-products of a line of fruit juices based on organic apples, through a supplier who is also the founder of the start-up. The product allows the extraction of antioxidant and nutritional substances, useful in the cosmetic sector; moreover, the reuse has made it possible to eliminate carbon dioxide emissions as the product was used as fertilizer. The start-up has a supplier located in Barge, where the C1 operations center is to reduce the environmental impact due to the transport of the product from the collection site to the treatment site; then the finished product reaches Turin where it is prepared for sale. This allows to erode the investment costs that are too high for a small company, mainly due to the cost of the necessary machinery and staff training.

4.1.2. Organization of C2

C2 is a company that deals with recovering the pistachio husk, a waste product that is created during processing, creating extracts beneficial for human health; this possesses oxidizing, metabolic and bacterial properties useful for human

skin. This extract is now sold in the cosmetics and food markets, but in the future, it can also be extended to other sectors. Once this by-product is obtained, it is sent to one of their partner companies in Bologna who work it again to produce the final product. This partner company was the key to the creation of their idea, as they held a patent that allowed them to implement this type of processing. At the environmental level, this practice is very positive, given that the husk produced in each harvest amounts to 1000 tons, a huge amount for a small city, which are usually burned by emitting gases harmful to the environment. In addition, it is a product that cannot be used as fertilizer because it is considered special waste.

4.1.3. Organization of P1

P1 reuses food by-products such as orange peels or remnants of beer production; These products allow the extraction of cellulose, the key product for the purpose of the company. In fact, this material is used as a component for creating paper to produce packaging. In addition, the volume produced each year allows you not to have problems on the availability of the material. The production is totally managed internally, then going to sell the final product to paper companies in the food packaging sector; the suppliers from which they procure are scattered throughout the Italian territory, while their headquarters are in Milan, ideal for logistics to reach different areas of Italy. Also in this case, the reuse of these materials allows the reduction of environmental impact, as biomass, containing a large amount of water, would generate gas emissions when used as agricultural fertilizer.

4.2. Cross-case Analysis

Once you understand how the various companies are organized, it is possible to compare what emerged in the literature with what is done by each in their work.

4.2.1. Antecedent and barrier

It gathers all the prerequisites to be respected and the initial barriers to be overcome to build a collaborative relationship that is effective for both parties. The factors that emerged in the literature are then compared with what start-ups encountered in the embryonic phase of their work; They are essential for the subsequent steps towards closer cooperation.

C1 focuses above all on the vision of the production process as a fundamental component for disseminating information; this is because *"it is important to know the way of operating of your partners to have a clear picture of the activities carried out by each actor"*. Regarding the creation of partnerships with suppliers, it emerged that at the base of this relationship there must be the sharing of ideas to be innovative, proactive in case of creating problems, without being afraid of making mistakes. Joint product development is also a key factor; This is defined as "a *four-handed collaboration that allows you to share the knowledge of both parties to achieve a common goal"*, in this way you can get *"a product that reflects the knowledge and way of thinking of different people"*.

C2 states that at the base of the collaboration between different actors there is mutual trust, as *"we have spread our idea to a beverage company to reuse our by-product in other areas"*, moreover the joint development of the product in the initial phases and a good technological *integration is also fundamental "we worked with our partner company for the development of our product, using the patent for a*

certain process difficult to obtain from a small reality like ours". Finally, quality is also an important prerogative to build a solid contractual relationship since "*we want to ensure our customers a product that meets their expectations"*.

C3 focuses on the fact that a synchronization of decisions, having clear the production process, improves personal relationships and the progress of operations: *"we are in continuous contact with the partner company for every important decision during the production progress in order to avoid unnecessary misunderstandings"*. In addition, mutual trust is an important prerogative when creating a relationship: "*we create professional relationships that are based on trust"*. *While as regards the relationship with suppliers there is a "continuous exchange of ideas to be able to create an ever-better product through innovative ideas due to the constantly expanding market"*.

We can now summarize what has emerged in the following table.

Table 3

COMPANY	ANTECEDENT AND BARRIER
C1	Vison of production process Sharing ideas Product development
C2	Mutual trust Product development Integration of technology Quality
C3	Synchronization of decision Vision of production process Mutual trust Sharing ideas Product development

4.2.2. Benefit

To analyze the benefits achievable through a collaboration between supply chain actors by implementing the circular economy, different thoughts were extracted from the interviewed actors.

C1 believes that the exchange of information is fundamental for business success because: "through a *continuous exchange of ideas and feedback during the work, we can have a vision of the process in real time*" and also "*their knowledge on the subject (referring to the partner company) is much broader than ours",* referring therefore to the possibility of accessing previous knowledge in the cosmetic field, allowing to know how to do the job correctly.

As for the relationship with its customers, it is limited only to the sale of the product in B2B and B2C channels; while considering relations with government companies: "*there are several bureaucratic and legislative problems regarding the use of these by-products; some steps forward for the ecological transition have been made, but the road is still long".*

Considering instead the suppliers and the associated supply contracts, it is clear that: "*being a start-up, we want to reduce cumbersome costs; so, we outsource most of the work, getting a better result*" and *"we develop the product and process together with our partner company".*

C2 also makes great use of the knowledge in the subjects of its partner company, always using its ideas to improve the daily work*: "we are very unprepared yet on several issues, we rely a lot on their work".* In addition, they dwell on the possibility, missed in their case, to reduce operating costs due to a good sharing of market demand*: "We still cannot have precise estimates on the demand of our customers, we are still a little behind in this field".*

Regarding relations with the various stakeholders, C2 performs: "*collaborations with university researchers to improve the extraction process*", "*collaborations with customers in the sector to exploit their knowledge of the sector acquired over the years*" and *"agreements with external companies for tests on their line products",* therefore having access to knowledge and ways of operating, leveraging mutual trust. The problem here also lies in the relationship with government agencies that *"incorporate excessively stringent laws regarding the recovery of materials".*

Finally, if we consider the relationship with suppliers and the corresponding contracts, "we *have entered into lasting partnerships with our supplier, having long-term supply contracts*" and *"we try to collaborate with a large company using their technological innovations also in our favor".*

P1 cites more an exchange of information with customers because*: "we work a lot on what customers ask us, almost weekly we receive feedback on what they would like to receive from us",* thus managing to obtain a reduction in costs due to technical inconsistencies and create daily social relationships with actors in your supply chain.

As for the relationship with customers "we *do not have written agreements, but we collaborate to co-develop the product";* here too bureaucratic problems have been encountered because *"the SOA regulation has greatly slowed down our work".*

The working relationship with suppliers is defined as "very profitable to create a product in line with our expectations" without mentioning supply contracts.

Therefore, to have clear the benefits achievable through the establishment of a collaboration between actors in the supply chain, we can summarize the recurring aspects in each company in the following table:

Table 4

COMPANY	BENEFIT
C1	Sharing ideas Social relationship Access to knowledge and know-how Sharing critical resource Ecological transition Avoid eccessive burocracy Differentiation vs competitor
C2	Access to knowledge and know-how Sharing ideas Reducing operational and risk cost Avoid eccessive burocracy Long-term relationship Delivery time
C3	Sharing ideas Reducing operational risk and cost Social relationship Accesso to knowledge and know-how Sharing critical resource Avoid eccessive burocracy Long-term relationship Level of service

4.2.3. Draw-back

As for the negative aspects that may emerge during the collaborative relationship with the actors in the supply chain, few critical issues emerged during interviews with companies.

C1 focused only on the mutual dependence that exists between company and supplier as "*it is true that we get a better product in terms of quality and saving costs,*

but we are totally dependent on the performance of the partner company and its production rate, any slowdown would cause a cascading effect on us too".

C2 also identified mutual dependence as the biggest risk of this collaboration, as *"our by-product suppliers have a production frequency of two years, in which only one month the starting product is harvested; In cases of extraordinary events, we would be stopped for the next two years, a big risk!"*

It's possible to summarize in the following table

Table 5

COMPANY	DRAW BACK
C1	Mutual dependence
C2	Mutual dependence

4.2.4. Information sharing

As regards information sharing, several aspects have been addressed; it's possible to see from the following table how companies exploit the sharing of information during their work in different ways

Table 6

COMPANY	VARIABLE	TYPE OF SOURCES OF EVIDENCE	QUOTATION
C1	Social relationship	Primary	*"We work closely with a cosmetics company"*
	Vision of production process	Primary	*"We have continuous feedback regarding the progress of the production process"*
	Sharing ideas	Primary	*"We share ideas both from a chemical formulation point of view and from a production organization point of view."*
	Access to knowledge and know-how	Primary	*"On the product development part we rely on their chemical and R&D laboratories; therefore, the formulation part is totally up to them. This is very important to us as we are able to use their knowledge for our start-up."*
C2	Access to knowledge and know-how	Primary	*"We are very unprepared on the subject to discuss ourselves fairly, our partners have known the sector for years"*
	Sharing ideas	Primary	*"The exchange of information with our partner company are technical and vertical on the product"*
	Reducing operational risk and cost	Primary	*"It is difficult for a company to make accurate estimates of actual market demand, and we understand that this entails additional costs that erode revenues"*
P1	Vision of production process	Primary	*"We don't really share demand forecasting or orders we receive, mostly because we work with products that are always available and not seasonal."*
	Social relationship	Primary	*"We are in constant contact with our customers"*
	Reducing operational risk and cost	Primary	*"We tend to know customer requests so as to avoid an incorrect product, wasting time and money"*
	Synchronization of decision	Primary	*"The product is created in continuous collaboration"*

Analyzing the table just above, the different companies have points in common and others that, in reality, are unique.

All three companies have shown attention to the creation of social relations, as C1 has stated that "We *work closely with a cosmetics company",* which is also followed by the thought of P1 saying that *"We are in constant contact with our customers";* both companies, therefore, tend to have a continuous dialogue with their customers, to improve business performance. C2 instead *"We are always in contact with both our suppliers and our customers",* therefore combines a frequent dialogue both with its customers and with the partner company for production.

Regarding the sharing of the vision of the process, C1 and P2 are the companies that have declared respectively that "We *have continuous feedback regarding the progress of the production process" and "We don't really share demand forecasting or orders we receive, mostly because we work with products that are always available and not seasonal."* C2 did not actually express this fact during its presentations.

Subsequently, both C1 and C2 dealt with the topic of sharing ideas, specifying as "*We share ideas both from a chemical formulation point of view and from a production organization point of view*" and *"The exchange of information with our partner company are technical and vertical on the product". P1, on the* other hand, did not dwell on the subject. It is therefore clear that both C1 and C2 have the desire to improve the relationship with the actors with whom they work, trying to obtain significant benefits for their company, also in terms of result and elimination of common problems.

As for access to knowledge and know-how, once again C1 and C2 are the companies that mention the fact of being able to learn from their stakeholders' notions or ways of doing useful for their company; in fact, C1 states that *"On the product development part we rely on their chemical and R&D laboratories; therefore, the formulation part is totally up to them. This is very important to us as we can use their knowledge for our start-up.",* while C2 *"We are very unprepared on the subject to discuss ourselves fairly,*

our partners have known the sector for years". So, both companies describe themselves as lagging behind in the knowledge and capabilities of the industry; therefore, they rely entirely on partner companies to do their work.

Both C2 and P1 analyze the possibility of reducing operational risks and costs, as C2 *"It is difficult for a company to make accurate estimates of actual market demand, and we understand that this entails additional costs that erode revenues",* thus posing the problem concerning these aspects, but without yet being able to solve them. P1 instead, *"We tend to know customer requests so as to avoid an incorrect product, wasting time and money",* thus managing to exploit the exchange of information with its customers to solve these operational risks, consequently reducing the costs associated with poor communication, due to the lack of sharing of technical specifications.

Finally, P2 can synchronize strategic decisions with partner companies by stating that *"The product is created in continuous collaboration".*

4.2.5. Relationship with stakeholders

Also in this case we can use a summary table of the results of the interviews in order to have a correspondence between the variables that emerged in the literature with respect to what emerged during the same interviews.

Table 7

COMPANY	VARIABLE	TYPE OF SOURCES OF EVIDENCE	QUOTATION	CODES
C1	Access to knowledge and know-how	Primary	*"We don't really have any relationship with our customers outside of the sale; therefore, only at the time of purchase does the customer use our online site (B2C) or through physical stores (B2B). We don't have any kind of special agreements in this regard."*	Customer relationship
	Ecological transition	Primary	*"We try every day to comply with the rules for an ecological transition of by-products"*	Relationship with government agencies
	Avoid excessive bureaucracy	Primary	*"The biggest problem when it comes to the recovery of these types of substances is bureaucracy; There are a large number of rules that make the process long and complicated."*	
C2	Access to knowledge and know-how	Primary	*"We are currently collaborating with university researchers from departments of agriculture, biometec and pharmaceutical sciences for the extraction of functional substances allowing us to integrate vertically for the production of the finished product."*	Relationship with university
	Avoid excessive bureaucracy	Primary	*"There are regulations that slow down the execution times of the project, they vary state by state, but the Italian one is certainly the most difficult to deal with"*	Relationship with government agencies
	Access to knowledge and know-how	Primary	*"We also collaborate with customers in the sector, who may have been in the business for more years than us; For example, we were advised to treat a product by one of our customers"*	Customer relationship
	Mutual influence and trust	Primary	*"We have made agreements with a company also in the beverage sector to carry out tests on their drink using our ingredient"*	Customer relationship
P1	Mutual influence and trust	Primary	*"We do not have written agreements with our customers, we base everything on respect and trust"*	Customer relationship
	Sharing critical resource	Primary	*"We work together to co-develop the product to be placed on the market"*	
	Access to knowledge and know-how	Primary	*"The contribution that our partners provide us is unquantifiable"*	
	Ecological transition	Primary	*"A big stumbling block was the SOA regulation, much more stringent here in Italy than in other countries"*	Relationship with government agencies
	Avoid excessive bureaucracy	Primary	*"At the bureaucratic level, the amount of by-product that can be used in the new finished product if in contact with food is also a strong constraint."*	

We can then analyze how thethree start-ups develop the possibility of creating relationships with actors in their supply chain, both internal and external such as government agencies and customers.

In detail, C1 states that in *reality "We don't really have any relationship with our customers outside of the sale; therefore, only at the time of purchase does the customer use our online site (B2C) or through physical stores (B2B). We don't have any kind of special agreements in this regard." ,* so they don't have benefits of this kind. C2 states that "We are currently collaborating with university *researchers from departments of agriculture, biometec and pharmaceutical sciences for the extraction of functional substances allowing us to integrate vertically for the production of the finished product"* thus collaborating with university groups to exploit the greater scientific knowledge and *"We also collaborate with customers in the sector, who may have been in the business for more years than us; for example, we were advised to treat a product by one of our customers",* thus enlisting the help of experts in the field. P1 instead limits itself to saying that *"The contribution that our partners provide us is unquantifiable",* making it clear howimportant the knowledge of its partners is in their work.

As for the ecological transition, both C1 and P1 cite the difficult relations with government agencies, as "*We try every day to comply with the rules for an ecological transition of by-products" (C1)* and *"A big stumbling block was the SOA regulation, much more stringent here in Italy than in other countries".*

Still with regard to relations with government companies, all companies have shown terror about the excessive bureaucracy present in Italy, trying to avoid too complicated fields, going to find a solution to implemenatre their ideas. In particular, C1 states *that "The biggest problem when it comes to the recovery of these types of substances is bureaucracy; there are a large number of rules that make the process long and complicated.",* C2 follows this thought by saying that *"There are regulations that slow down the execution times of the project, they vary state by state, but the Italian one is certainly the most difficult to deal with".* Finally, P1 also reinforces the thinking of the high Italian bureaucracy by stating that *"At the bureaucratic level, the amount of by-*

product that can be used in the new finished product if in contact with food is also a strong constraint."

C2 and P1 alsoexplained how mutual trust is a factor to be considered when carrying out such agreements; C2 in particular states that "*We have made agreements with a company also in the beverage sector to carry out tests on their drink using our ingredient",* thus spreading their product with companies outside theirs. P1, on the other hand, focuses on the fact that trust is a factor that replaces written agreements with customers *"We do not have written agreements with our customers, we base everything on respect and trust".*

Finally, P1 focuses on the sharing of critical resources, as "*We work together to co-develop the product to be placed on the market".*

4.2.6. Partnership with supplier

Also in this case we can use a summary table of the results of the interviews in order to have a correspondence between the variables that emerged in the literature with respect to what emerged during the same interviews.

Analyzing the different start-ups, it emerged that all three companies tend to create partnerships with suppliers, although in different ways.

Table 8

COMPANY	VARIABLE	TYPE OF SOURCES OF EVIDENCE	QUOTATION
C1	Product development	Primary	*"We outsource all the production of the product, developing the product in close contact with the experts of the partner company"*
	Efficiency and effectiveness	Primary	*"We want to avoid machinery costs and staff training"*
	Level of service	Primary	*"By partnering with our partner company, we get a better product"*
	Mutual dependence	Primary	*"This collaboration, however, makes us heavily dependent on their production pace."*
	Sharing ideas	Primary	*"There is a continuous exchange of feedback to improve the daily work of our company"*
	Process design	Primary	*"As far as product development and the production process are concerned, we collaborate through continuous feedback with our partner company"*
C2	Long-term relationship	Primary	*"Our goal is to build a lasting working relationship over the years"*
	Efficency and effectiveness	Primary	*"We aim to reduce costs to work at scale within a few years through our partner supplier"*
	Mutual dependence	Primary	*"Let's say that using a by-product created through a very seasonal and short cultivation, the slightest mistake would compromise the work for the following months"*
	Product development	Primary	*"We have been working with a large company for the production of our output for many years"*
	Integration of technology Process design	Primary	*"For the production process, we use some fundamental patents for our work"*
	Level of service	Primary	*"We have agreements with our suppliers on the quantities of dedicated product that will be our input for the next two years"*
	Innovation	Primary	*"We improve the production rate every day through research by the research and development team"*
P1	Process design Product development	Primary	*"We work closely with different suppliers to identify the best production process for the development of the product we imagine"*
	Long-term relationship Sharing ideas	Primary	*"We have been collaborating with some suppliers since we created the start-up, sharing what we think every time something can be changed in the process"*

C1, C2 and P1 state that for the initial product development and process design, they are strongly linked to the supplier companies: C1 states that *"We outsource all the production of the product, developing the product in close contact with the experts of the partner company; we collaborate through continuous feedback with our partner company"*. C2 instead "*We have been working with a large company for the production of our output for many years and we use some fundamental patents for our work"*. Finally P1 *"We work closely with different suppliers to identify the best production process for the development of the product we imagine"*.

C2 and P1 agreethat it is necessary to create a long-term relationship to actually reap the benefits of partnership with their suppliers. C2 in particular states that "*Our goal is to build a lasting working relationship over the years"*, while P1 *"We have been collaborating with some suppliers since we created the start-up, sharing what we think every time something can be changed in the process"*. Then P1 also focuses on the importance of sharing ideaswith its suppliers, as underlined by C1, as *"There is a continuous exchange of feedback to improve the daily work of our company"*.

As far as operational effectiveness and efficiency are concerned, C1 and C2 agree that they are fundamental aspects, achievable also thanks to the partnership with their suppliers. According to C1, *"We want to avoid machinery costs and staff training"*, thus eliminating massive costs for a start-up at the dawn of growth. C2 continues along these lines, saying that *"We aim to reduce costs to work at scale within a few years through our partner supplier"*.

A problem that has emerged with both C1 and C2 is the emergence of a mutual dependence that endangers the work done. C1 in fact is 100% based on the production of its partner supplier, so "*This collaboration, however, makes us heavily dependent on their production pace"*; C2 also follows this line of thought, as *"Let's say*

that using a by-product created through a very seasonal and short cultivation, the slightest mistake would compromise the work for the following months".

This problem is, in a sense, put in second level by the level of service proposed by the suppliers, as said by C1 and C2 because, "*By partnering with our partner company, we get a better* product" and *"We have agreements with our suppliers on the quantities of dedicated product that will be our input for the next two years".*

In addition, C2 adds that bypartnering with a large company, you can also have access to ever-changing technology market innovations; in fact, "*We improve the production rate every day through research by the research and development team*.

4.2.7. Contract

Also in this case we can use a summary table of the results of the interviews in order to have a correspondence between the variables that emerged in the literature with respect to what emerged during the same interviews.

At this part, C1 and C2 indicate how the possibility of creating contracts is a possibility to differentiate oneself from one's competitors; C1 in fact states that "We don't have trade agreements of any kind; ours is a direct investor in the startup so we have a special treatment but we do not have any written agreement ", while C2 *"We have an exclusive contract with our partner company, through two patents on the product and process".*

Both C2 and P1 focus on the possibility of increasing the level of service, since according to C2 "With the *company in the beverage sector, we are in talks to talk about volumes, sales channels and potential second buyers",* while P1 *"We don't actually have any special supply contracts. When we need the by-product for production, we ask them to*

supply it to us in accordance with their lead time". In fact, C2 already has supply contracts from which it benefits, while P1 does not.

Table 9

COMPANY	VARIABLE	TYPE OF SOURCES OF EVIDENCE	QUOTATION
C1	Differentiation vs competitors	Primary	*"We don't have trade agreements of any kind; Ours is a direct investor in the startup so we have a special treatment but we do not have any written agreement "*
C2	Delivery Time Level of service	Primary	*"We have products available to customers both in store (B2C) and in our warehouse (B2B)"*
	Minimization of risks Quality	Primary	*"We have quantity agreements with some customers"*
	Social innovation	Primary	*"We have just started conversations with a company in the beverage sector"*
	Profit Level of service	Primary	*"With the company in the beverage sector, we are in talks to talk about volumes, sales channels and potential second buyers. "*
	Differentiation vs competitors	Primary	*"We have an exclusive contract with our partner company, through two patents on the product and process"*
P1	Level of service	Primary	*"No, we don't actually have any special supply contracts. When we need the by-product for production, we ask them to supply it to us in accordance with their lead time."*

C2, adds in addition also the availability of the product intended as delivery time "We have products available to customers both in store (B2C) and *in our warehouse (B2B)"*, the possibility of minimizing the risks of stockout *"We have quantity agreements with some customers",* and finally the possibility of implementing social innovation, going to undertake new working relationships compared to the past, even in fields not purely complementary to their own, *"We have just started conversations with a company in the beverage sector"*.

5 Discussion

The cross-case analysis just presented allows us to answer our initial research question, then analyzing what the similarities and differences between the companies are interviewed and theorizing the possible future scenarios for an evolution of the research.

The research question used was: What are the coordination mechanisms and methods of collaboration between supply chain actors that allow a transition to the circular economy?

The cases analyzed brought out a certain attention regarding the possibility of creating a collaboration between actors within the supply chain, coordinating with each other to achieve a transition to the circular economy. In particular, the cases suggest the existence of four modes of action: (1) information sharing, (2) relationship with stakeholder, (3) partnership with supplier, (4) contracts.

It is possible to make a comparison between what emerged from the case studies with respect to what is presented in the literature exposition, then going to discuss at the end what are the possible future developments on the subject.

5.1. Information sharing

As far as information sharing is concerned, no company has presented entry barriers, compared to those mentioned in the literature, such as the lack of ICT or territoriality; This fact derives from the simplicity of companies at the organizational level, from the limited number of actors involved and from the proximity of companies with their partners. With the increase in the number of

people, in fact, the amount of information to be managed and transmitted would be much greater and much more frequent, thus requiring cloud or IoT systems for the maintenance and dissemination of data, as mentioned in the literature in companies already established in their respective sectors; as far as territoriality is concerned, however, the companies have declared that all business partners are located in Italy, without problems of any kind as regards reaching the production site or the reference offices.

Instead, numerous links emerged with the need to have a vision of the production process and the fact of being synchronized to make strategic decisions as prerogatives to start building a lasting relationship. These aspects, as mentioned in the literature, allow you to have clear the work of the people with whom you collaborate, going to support the work of others until you reach a final decision; so, you can say how all companies are quite aligned with what is present in the literature.

In terms of benefits and draw-back, all the companies explained how the possibility of accessing the knowledge of partner companies is the aspect that most improves their work, also through a sharing of ideas and the consequent creation of social relationships, recurring factors also in literary analysis. All start-ups, in fact, have created collaborative relationships with established companies in their sector, thus managing to use knowledge that is still lacking.

On the other hand, no draw-back was presented during the testimonies, deriving from the fact that the possible negative aspects of the story are not yet well known in the long term or more simply the actors involved did not develop opportunistic behaviors towards the other actors involved, an aspect that was presented as a recurring negative factor.

5.2. Relationship with stakeholders

As for the relationship with stakeholders, the only prerequisite that emerged during the interviews was the need to obtain mutual trust on both sides; according to the start-ups themselves, in fact, it is the basis of a working relationship of this type, generating a serene and profitable working climate.

No precursors or other initial barriers were presented. Everything that has emerged in the literature, such as the need for incentives or the difficulty in involving external actors is not taken up during interviews, and therefore should be analyzed more thoroughly by companies in the sector.

On the other hand, the benefits achievable through constructive collaboration are very clear to everyone, such as the possibility of carrying out an ecological transition naturally, given that everything is based on the recovery of waste materials, the possibility of reducing bureaucratic difficulties, perhaps favored by patents or operating lines and already in compliance with Italian laws, very meticulous and specific in this working environment.

Again, draw-backs did not emerge during interviews compared to what was detected in the literature; also in this case it would be advisable to analyze in the long term to understand if problems may actually arise during the period of collaboration.

5.3. Partnership with supplier

Regarding the analysis of the relationship with suppliers, important ideas were recorded regarding the analysis of the prerogatives to be respected to start a lasting relationship. All the factors mentioned in the literature have emerged, therefore the

fact of developing the product jointly, therefore being able to work with its suppliers to improve the final product, and the consequent need to share ideas to improve the critical aspects that may emerge during the progress of the work; In addition, technological integration was also cited as a fundamental component for achieving the final result, such as the use of hyper-specialized machinery or special processing patents. On the other hand, there were no problems regarding the bargaining power that suppliers have towards start-ups; This could be explained by the fact that, in reality, suppliers cannot do without the start-ups in question, as they are the creators of the current business idea; in addition, being realities very inclined to change and innovation, they could also help to improve certain aspects of their partner company in terms of technological and business innovation.

Also in this case, all the benefits found in the literature are found by some or all case studies. The recurring aspects are certainly the possibility of creating long-term relationships and improving the level of service offered. It is clear, from all three companies, how these factors are decisive for the growth of their company in terms of customer attractiveness, establishing themselves on the market served to reach the final maturity. Access to technological innovation and an improvement in effectiveness and efficiencies are also taken up in some steps, but they are factors that may be analyzed with the consolidation of relationships with their suppliers.

Among the negative aspects, mutual dependence certainly stands out; For start-ups, in fact, thinking of working without partner suppliers is unthinkable, as they exploit their knowledge and skills to create the final product. A division between the parties could therefore cause the failure of the start-ups interviewed, thus making all efforts to create a solid collaborative relationship useless.

5.4. Contracts

As far as contracts are concerned, however, the same barriers have not emerged in the literature for the drafting of the same; only in one case has the quality of the final product to be delivered to the supplier been clearly mentioned; this may mean, in reality, that all companies already take this component for granted, without however clearly specifying how it is a determining factor in being able to create written contracts.

Considering the benefits, however, everything that has emerged in the literature is taken up by the companies interviewed, from social and ecological innovation to the increase in the level of service proposed and delivery time. Having agreements on quantities and cadences, in fact, certainly allows to reduce the risk of stock-out, thus going to have a better relationship with customers and suppliers, also allowing to develop a competitive potential towards its competitors. In this way, some financial components would also be improved, which in any case must be considered when deciding to rely on this type of practice.

On the other hand, no testimonies are presented regarding the emergence of opportunistic behavior on one of the two parties; this, in fact, is precisely the objective of the drafting of a contract, that is, to protect the actors involved from possible negative behavior of one of the two parties, thus allowing them to be calm during their work.

6 Conclusion and future research

This thesis was developed with the aim of analyzing the coordination mechanisms and the methods of collaboration between the actors of the supply chain to identify the possible applicable modalities for an ecological transition. First, analyzing the scientific evidence obtained through a detailed search for information in the food sector, the most recurrent methods have been selected which, theoretically, are available and used among the various companies. In fact, once the case studies of three Italian start-ups have been analyzed, it is possible to see how there is still a gap between what is theorized and what is really done in small realities. Companies focus a lot on the benefits that can be achieved through a collaborative relationship between the various actors, citing an improvement in terms of cost reduction, the finished product, the relationship with customers, the increase in sales, without considering all the problems that may arise during the progress of the work. The ideal would therefore be, through an analysis of the literature also present in other industrial sectors, to go to work on some aspects that may be the cause of future problems encountered by other companies; In this way you can be more stable during growth, managing to reach a certain business maturity.

As for possible future research, there are still many studies to be carried out for the reuse of agri-food waste, because what is done today is unfortunately limited to small quantities compared to the amount of waste generated each year. The positive aspect is that more and more people are approaching, in recent years, the issues of sustainability and the fight against waste, thus making it necessary to respond from companies, even large and international, guilty in large part of the creation of a large amount of waste.

Bibliografy

Durach, C.F., Kembro, J. and Wieland, A. (2017), "A new paradigm for systematic literature reviews in supply chain management", Journal of Supply Chain Management, Vol. 53 No. 4, pp. 67-85.

Tranfield, D., Denyer, D. and Smart, P. (2003), "Towards a methodology for developing evidenceinformed management knowledge by means of systematic review", British Journal of Management, Vol. 14, pp. 207-222.

Elaheh Ghasemi, Nadia Lehoux & Mikael Rönnqvist (2022): Coordination, cooperation, and collaboration in production-inventory systems: a systematic literature review, International Journal of Production Research, DOI: 10.1080/00207543.2022.2093681

Ardito, L., Scuotto, V., Del Giudice, M. and Petruzzelli, A.M. (2019), "A bibliometric analysis of research on Big Data analytics for business and management", Management Decision, Vol. 57 No. 8, pp. 1993-2009.

Lamba, K. and Singh, S.P. (2017), "Big data in operations and supply chain management: current trends and future perspectives", Production Planning and Control, Vol. 28 Nos 11-12, pp. 877-890.

Arunachalam, D., Kumar, N. and Kawalek, J.P. (2018), "Understanding big data analytics capabilities in supply chain management: unravelling the issues, challenges and implications for practice", Transportation Research Part E: Logistics and Transportation Review, Vol. 114, pp. 416-436.

Brinch, M. (2018), "Understanding the value of big data in supply chain management and its business processes: towards a conceptual framework", International Journal of Operations and Production Management, Vol. 38 No. 7, pp. 1589-1614.

Cao, M., & Zhang, Q. (2011). Supply chain collaboration: Impact on collaborative advantage and firm performance. Journal of operations management, 29(3), 163-180.

Liu, W., Liang, Y., Wei, S. and Wu, P. (2021), "The organizational collaboration framework of smart logistics ecological chain: a multi-case study in China", Industrial Management and Data Systems, Vol. 121 No. 9, pp. 2026-2047.

Manthou, V., Vlachopoulou, M., Folinas, D., 2004. Virtual e-Chain (VeC) model for supply chain collaboration. Int. J. Prod. Econ. 87, 241–250.

Liao, S., Kuo, F., 2014. The study of relationships between the collaboration for supply chain , supply chain capabilities and firm performance : a case of the Taiwan's TFTLCD industry. Int. J. Prod. Econ. 156, 295–304

Flygansvær, B., Dahlstrom, R., Nygaard, A., 2018. Exploring the pursuit of sustainability in reverse supply chains for electronics. J. Clean. Prod. 189, 472–484.

Kalverkamp, M., 2018. Hidden potentials in open-loop supply chains for remanufacturing. Int. J. Logist. Manag. 29, 1125–1146.

Kurilova-Palisaitiene, J., Sundin, E., Poksinska, B., 2018. Remanufacturing challenges and possible lean improvements. J. Clean. Prod. 172, 3225–3236

Basso, F., D'Amours, S., R€onnqvist, M. and Weintraub, A. (2019), "A survey on obstacles and difficulties of practical implementation of horizontal collaboration in logistics", International Transactions in Operational Research, Vol. 26 No. 3, pp. 775-793

Karam, A., Reinau, K.H. and Østergaard, C.R. (2021), "Horizontal collaboration in the freight transport sector: barrier and decision-making frameworks", European Transport Research
Review, Vol. 13 No. 1, pp. 1-22

Badraoui, I., van der Lans, I., Boulaksil, Y. and van der Vorst, J.G.A.J. (2022b), "Antecedents of horizontal logistics collaboration in agri-food supply chains", The International Journal of Logistics Management, Vol. 33 No. 1, pp. 239-260.

Collier, Z.A., Guin, U., Sarkis, J. and Lambert, J.H. (2022), "Decision model with quantification of buyersupplier trust in advanced technology enterprises", Benchmarking: An International Journal, Vol. 29 No. 10, pp. 3033-3056

Cruijssen, F.C.A.M. (2020), Horizontal Cooperation in Transport and Logistics, Springer International Publishing, Switzerland.

Agarwal, U.A. and Narayana, S.A. (2020), "Impact of relational communication on buyer–supplier relationship satisfaction: role of trust and commitment", Benchmarking: An International Journal, Vol. 27 No. 8, pp. 2459-2496.

Zhang, Q. and Cao, M. (2018), "Exploring antecedents of supply chain collaboration: effects of culture and interorganizational system appropriation", International Journal of Production Economics, Vol. 195, pp. 146-157.

Chen, C.-J. (2019), "Developing a model for supply chain agility and innovativeness to enhance firms' competitive advantage", Management Decision, Vol. 57 No. 7, pp. 1511-1534.

Olorunniwo, F.O. and Li, X. (2010), "Information sharing and collaboration practices in reverse logistics", Supply Chain Management: An International Journal, Vol. 15 No. 6, pp. 454-462

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.

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.

Badraoui, I., van der Lans, I.A.M.C., Boulaksil, Y. and van der Vorst, J.G.A.J. (2023), "Horizontal logistics collaboration success factors: expectations versus reality", Benchmarking: An International Journal, Vol. ahead-of-print No. ahead-of print. https://doi.org/10.1108/BIJ-04-2022-0274

Liao, S.H., Hu, D.C. and Ding, L.W. (2017), "Assessing the influence of supply chain collaboration value innovation, supply chain capability and competitive advantage in Taiwan's networking communication industry", International Journal of Production Economics, Vol. 191, pp. 143-153.

Fawcett, S.E. and Magnan, G.M. (2001), Achieving World-Class Supply Chain Alignment: Benefits, Barriers, and Bridges, Center for Advanced Purchasing Studies, Tempe, AZ.

Fawcett, S.E., McCarter, M.W., Fawcett, A.M., Webb, G.S. and Magnan, G.M. (2015), "Why supply chain collaboration fails: the socio-structural view of resistance to relational

Chen, J.V., Yen, D.C., Rajkumar, T.M. and Tomochko, N.A. (2011), "The antecedent factors on trust and commitment in supply chain relationships", Computer Standards and Interfaces, Vol. 33 No. 3, pp. 262-270

Badraoui, I., Van der Vorst, J.G. and Boulaksil, Y. (2020), "Horizontal logistics collaboration: an exploratory study in Morocco's agri-food supply chains", International Journal of Logistics Research and Applications, Vol. 23 No. 1, pp. 85-102.

Kotzab, Herbert, Inga Lena Darkow, Ilja Bäumler, and Christoph Georgi. 2019. "Coordination, Cooperation and Collaboration in Logistics and Supply Chains: A Bibliometric Analysis." Producao 29. doi:10.1590/0103-6513.20180088.

Mehr, Maryam Nikouei, Preetam Kulkarni, Lizhi Wang, and Guiping Hu. 2017. "Production Planning of a Three-Echelon Supply Chain with Information Sharing." 67th Annual Conference and Expo of the Institute of Industrial Engineers 2017, 1823–28.

Wang, Yi, and Sheng Hao Zhang. 2020. "Optimal Production and Inventory Rationing Policies with Selective-Information Sharing and Two Demand Classes." European Journal of Operational Research, doi:10.1016/j.ejor.2020.05.051.

Airike, P.E., Rotter, J.P., Mark-Herbert, C., 2016. Corporate motives for multistakeholder collaboration–corporate social responsibility in the electronics supply chains. J. Clean. Prod. 131, 639–648.

Fontana, E., 2017. Strategic CSR: a Panacea for Profit and Altruism? an Empirical Study Among Executives in the Bangladeshi RMG Supply Chain. European business review.

Padilla-Rivera, A., Russo-Garrido, S., Merveille, N., 2020. Addressing the social aspects of a circular economy: a systematic literature review. Sustainability 12 (19), 7912.

Agyabeng-Mensah, Y., Afum, E., Baah, C., Essel, D., 2022. Exploring the role of external pressure, environmental sustainability commitment, engagement, alliance and circular supply chain capability in circular economy performance. Int. J. Phys. Distrib. Logist. Manag. 52 (5/6), 431-455.

Wong, C.W., Wong, C.Y., Boon-itt, S., 2020. Environmental management systems, practices and outcomes: differences in resource allocation between small and large firms. Int. J. Prod. Econ. 228, 107734.

Gebhardt, M., Kopyto, M., Birkel, H., Hartmann, E., 2022. Industry 4.0 technologies as enablers of collaboration in circular supply chains: a systematic literature review. Int. J. Prod. Res. https://doi.org/10.1080/00207543.2021.1999521.

Gebhardt, M., Kopyto, M., Birkel, H., Hartmann, E., 2022. Industry 4.0 technologies as enablers of collaboration in circular supply chains: a systematic literature review. Int. J. Prod. Res. https://doi.org/10.1080/00207543.2021.1999521.

Sosnowski P.C., Cyplik P., 2022. Closed loop supply chains and circular economy – the possibilities of interplay. LogForum 18 (4), 413-420, http://doi.org/10.17270/J.LOG.2022.784

Freeman, R.E., 1994. The politics of stakeholder theory: Some future directions. Bus. Ethics Q. 4 (4), 409–421.

Wang, J.X., Burke, H., Zhang, A., 2021. Overcoming barriers to circular product design. Int. J. Prod. Econ. 108346.Friedman, A.L., Miles, S., 2002. Developing stakeholder theory. J. Manage. Stud. 39 (1), 1–21.

Brown, P., Von Daniels, C., Bocken, N.M.P., Balkenende, A.R., 2021. A process model for collaboration in circular oriented innovation. J. Cleaner Prod. 286, 125499. https://doi.org/10.1016/j.jclepro.2020.125499.

Kania, J., Kramer, M., 2011. Collective impact. FSG, pp. 36–41

van Tilburg, M., Krikke, H., & Lambrechts, W. (2022). Supply Chain Relationships in Circular Business Models: Supplier Tactics at Royal Smit Transformers. Logistics, 6(4), 77.

Choi, T.M.; Li, Y.; Xu, L. Channel leadership, performance and coordination in closed loop supply chains. Int. J. Prod. Econ. 2013, 146, 371–380.

Ciarnien ˇ e, R.; Vienažindien ˙ e, M. Critical issues for compensation and incentives management: Theoretical approach. ˙ Manag. Theory Stud. Rural Bus. Infrastruct. Dev. 2010, 5, 15–23.

Arshinder; Kanda, A.; Deshmukh, S.G. Supply chain coordination: Perspectives, empirical studies and research directions. Int. J. Prod. Econ. 2008, 115, 316–335.

Baah, C., Agyabeng-Mensah, Y., Afum, E., & Kumi, C. A. (2023). Do circular economy practices accelerate CSR participation of SMEs in a stakeholder-pressured era? A network theory perspective. Journal of Cleaner Production, 394, 136348.

Zhang, A., Wang, J. X., Farooque, M., Wang, Y., & Choi, T. M. (2021). Multi-dimensional circular supply chain management: A comparative review of the state-of-the-art practices and research. Transportation Research Part E: Logistics and Transportation Review, 155, 102509.

Ketzenberg, M.E., van der Laan, E., Teunter, R.H., 2006. Value of information in closed loop supply chains. Production and Operations Management 15 (3), 393–406. https://doi.org/10.1111/j.1937-5956.2006.tb00253.x

Huang, Y., Wang, Z., 2017. Values of information sharing: A comparison of supplier-remanufacturing and manufacturer-remanufacturing scenarios. Transportation Research Part E: Logistics and Transportation Review 106, 20–44 https://doi.org/https://doi.org/10.1016/j.tre.2017.07.015

Sudusinghe, J. I., & Seuring, S. (2022). Supply chain collaboration and sustainability performance in circular economy: A systematic literature review. International Journal of Production Economics, 245, 108402.

Liu, Y., Quan, B.T., Xu, Q., Forrest, J.Y.L., 2019b. Corporate social responsibility and decision analysis in a supply chain through government subsidy. J. Clean. Prod. 208, 436–447. https://doi.org/10.1016/j.jclepro.2018.10.121.

Sancha, C., Gimenez, C., Sierra, V., 2016. Achieving a socially responsible supply chain through assessment and collaboration. J. Clean. Prod. 112, 1934–1947. https://doi. org/10.1016/j.jclepro.2015.04.137.

Baden, D.A., Harwood, I.A., Woodward, D.G., 2009. The effect of buyer pressure on suppliers in SMEs to demonstrate CSR practices: an added incentive or counter productive? Eur. Manag. J. 27 (6), 429–441. https://doi.org/10.1016/j. emj.2008.10.004

He, Y., Zhao, X., Krishnan, H., & Jin, S. (2022). Cooperation among suppliers of complementary products in repeated interactions. International Journal of Production Economics, 252, 108559.

Caniëls, M.C.; Gelderman, C.J. Power and interdependence in buyer supplier relationships: A purchasing portfolio approach. Ind. Mark. Manag. 2007, 36, 219–229.

Witjes, S.; Lozano, R. Towards a more Circular Economy: Proposing a framework linking sustainable public procurement and sustainable business models. Resour. Conserv. Recycl. 2016, 112, 37–44

Kohtamäki, M.; Partanen, J. Co-creating value from knowledge-intensive business services in manufacturing firms: The moderat ing role of relationship learning in supplier-customer interactions. J. Bus. Res. 2016, 69, 2498–2506.

Govindan, K., & Popiuc, M. N. (2014). Reverse supply chain coordination by revenue sharing contract: A case for the personal computers industry. European Journal of Operational Research, 233(2), 326-336.

Cachon, G.P., 2003. Supply chain coordination with contracts. In: Graves, S.C., de Kok, A.G. (Eds.), Handbooks in Operations Research and Management Science: Supply Chain Management: Design, Coordination and Operation, vol. 11. North Holland, Amsterdam, pp. 227–339.

Kunter, M., 2012. Coordination via cost and revenue sharing in manufacturer–retailer channels. European Journal of Operational Research 216 (2), 477–486.

Giannoccaro, I., Pontrandolfo, P., 2004. Supply chain coordination by revenuesharing contracts. International Journal of Production Economics 89, 131–139

Kumar, P., Sharma, D., & Pandey, P. (2022). Coordination mechanisms for digital and sustainable textile supply chain. International Journal of Productivity and Performance Management.

Van der Rhee, B., Van der Veen, J., Venugopal, V., Vijayender, R.N., 2010. A newrevenue sharing mechanism for coordinating multi-echelon supply chains.Operations Research Letters 38, 296–301.

Chen, J., 2006. Study of revenue sharing contract in virtual enterprises. Journal of Systems Science and Systems Engineering 15 (1), 95–113.

Shi, C., Bian, D., 2009. Closed-loop supply chain coordination by revenue sharingcontract and quantity discount contract. In: 2009 International Conference onInformation Management, Innovation Management and Industrial Engineering,December 26–27, 2009, Xian, China, vol. 2. ICIII, pp.581–584.

Sharma, A., & Singh, S. (2022). Coordinating socially responsible supply chain with fairness via simple wholesale price contract. Journal of Cleaner Production, 376, 134131.

Cui, H.T., Raju, J.S., Zhang, Z.J., 2007. Fairness and channel coordination. Manag. Sci. 53 (8), 1303–1314. https://doi.org/10.1287/mnsc.1060.0697.

Wang, Q., Chen, K., Wang, S., Cao, X., 2022. Optimal decisions in a closed-loop supply chain: fairness concerns, corporate social responsibility and information value. Ann. Oper. Res. 1–28 https://doi.org/10.1007/s10479-021-04456-8

Kazancoglu, I., Kazancoglu, Y., Kahraman, A., Yarimoglu, E. and Soni, G. (2020), "Investigating barriers to circular supply chain in the textile industry from Stakeholders' perspective", InternationalJournal of Logistics Research and App

Mishra, J.L., Hopkinson, P.G., Tidridge, G., 2018. Value creation from circular economy led closed loop supply chains: a case study of fast-moving consumer goods. Prod. Plann. Control 29, 509–521. https://doi.org/10.1080/09537287.2018.1449245

Veleva, V., Bodkin, G., 2018. Corporate-entrepreneur collaborations to advance a circular economy. J. Clean. Prod. 188, 20–37. https://doi.org/10.1016/j. jclepro.2018.03.196.

Luthra, S., Sharma, M., Kumar, A., Joshi, S., Collins, E., & Mangla, S. (2022). Overcoming barriers to cross-sector collaboration in circular supply chain management: a multi-method approach. Transportation Research Part E: Logistics and Transportation Review, 157, 102582.

Ramesh, A., Banwet, D.K. and Shankar, R. (2010), "Modeling the barriers of supply chain collaboration", Journal of Modelling in Management, Vol. 5 No. 2, pp. 176-193.

Chen, C.-J. (2019), "Developing a model for supply chain agility and innovativeness to enhance firms' competitive advantage", Management Decision, Vol. 57 No. 7, pp. 1511-1534.

Al-Tabbaa, O., Leach, D., Khan, Z., 2019. Examining alliance management capabilities in cross-sector collaborative partnerships. J. Bus. Res. 101, 268–284.

Ashraf, N., Ahmadsimab, A., Pinkse, J., 2017. From animosity to affinity: The interplay of competing logics and interdependence in cross-sector partnerships. J. Manage. Stud. 54 (6), 793–822.

Shankar, R., Gupta, R., Pathak, D.K., 2018. Modelling critical success factors of traceability for food logistics system. Transport. Res. Part E: Logistics Transport. Rev. 119, 205–222.

Loosemore, M., Bridgeman, J., Keast, R., 2020. Reintegrating ex-offenders into work through construction: a case study of cross-sector collaboration in social procurement. Build. Res. Inform. 48 (7), 731–746.

Bryson, J.M., Crosby, B.C., Stone, M.M., 2015. Designing and implementing cross-sector collaborations: Needed and challenging. Public Administration Rev. 75 (5), 647–663.

Compagnucci, L., Spigarelli, F., 2018. Fostering cross-sector collaboration to promote innovation in the water sector. Sustainability 10 (11), 4154.

Heuer, M., 2011. Ecosystem cross-sector collaboration: conceptualising an adaptive approach to sustainability governance. Bus. Strategy Environm. 20 (4), 211–221.

Stadtler, L., Karakulak, O., ¨ 2020. Broker Organizations to Facilitate Cross-Sector Collaboration: At the Crossroad of Strengthening and Weakening Effects. Public Admin. Rev. 80 (3), 360–380.

Kirchherr, J., Piscicelli, L., 2019. Towards an education for the circular economy (ECE): five teaching principles and a case study. Resour. Conserv. Recy. 150, 104406.

de Sousa Jabbour, A.B.L., Jabbour, C.J.C., Godinho Filho, M., Roubaud, D., 2018. Industry 4.0 and the circular economy: a proposed research agenda and original roadmap for sustainable operations. Ann. Oper. Res. 270 (1), 273–286.

Babiak, K., Thibault, L., 2009. Challenges in multiple cross-sector partnerships. Non-profit Voluntary Sector Quarterly 38 (1), 117–143.

Gunasekaran, A., Subramanian, N., Papadopoulos, T., 2017. Information technology for competitive advantage within logistics and supply chains: A review. Transport. Res. Part E Logistics Transport. Rev. 99, 14

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