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The Role of Visibility and Trust in Textile Supply Chains

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Abstract. The increasing complexity and dynamism of business environments has led to a significant growth in the risks related to the management of supply chain relationships. Trust and visibility between supply chain partners have been increasingly considered paramount aspects to manage these relationships and reduce risks. This paper aims to analyze and discuss the role of trust and visibility in supply chains, considering the complexity of multi-tier supply chains and multi-aspects visibility. Two cases of the textile sector from Portugal have been studied. After the analysis of the level of visibility and trust, a set of recommendations is provided.

Keywords: supply chain visibility, supply chain trust, information sharing, textile.

1 Introduction

Current supply chain (SC) environments are characterized by growing complexity and dynamism, challenging companies to develop effective and innovative solutions to contemporary challenges [1,2]. Besides increasingly common social, environmental, economic and political issues, the rapid evolution of digital technologies has a major influence on the way companies interact with suppliers and customers [3]. As companies increasingly share information and infrastructures with different partners, a crucial aspect to accomplish an effective management of SCs consists in developing trust; considered a fundamental aspect to build collaborative partnerships [4].

The increasing complexity of business environments has led to a significant growth in the risks related to the management of relationships [5]. Recent events and developments – such as the COVID 19 pandemic, the effects of the Russian invasion of Ukraine and the growing awareness of the impacts of climate and social crises – are recent and expressive examples of such risks, leading SC managers to seek

information that allows them to have greater visibility of the factors that affect both demand and supply [6,7]. An increasing number of authors argue that many of the problems faced by companies in these and other current issues are related to low levels of SC visibility [8].

Previous studies have highlighted that the visibility between SC partners is a crucial aspect to be managed in order to improve decision making and performance [9,10,11,12]. SC visibility is understood as the ability of companies to have and/or provide access to the necessary and relevant information, at the right time and to the right partners to support decision making [11,13]. Recent studies highlight that visibility is a critical factor for increasing the resilience and sustainability of SCs [12,14].

Although the relationship between trust and visibility is recognized in the literature, few studies have assessed the two aspects together [15]. Moreover, the visibility of SC partners is typically analyzed including two factors to be made visible, such as demand and inventory levels [11].

This paper aims to bridge these gaps by considering the relationship between trust and visibility and by including several types of information to be shared in the assessment of SC visibility. Thus, the aim of this paper is to analyze and discuss the role of trust and visibility in SCs, considering the complexity of multi-tier SCs and multi-aspects visibility. Two cases of the textile sector from Portugal have been studied. The paper contributes to theory by advancing the literature on trust and visibility; and to practice by providing guidance to managers on how to assess and manage visibility and trust in order to improve decision making.

2 Theoretical Background and Literature Review

This paper uses the Organizational Information Processing Theory (OIPT) as the theoretical basis. According to the OIPT, a company must have the capabilities to collect the necessary information, inside and outside its borders, and be able to interpret, synthesize and coordinate these information [6,16,17]. Thus, based on the OIPT, this paper considers that companies benefit from the ability of sharing information with SC partners, which has the potential to improve trust and visibility levels; and from the ability of using the information collected to inform the decision-making process.

The concept of trust plays an important role in many contexts [18] and has been studied in different disciplines over time, including psychology, sociology, management, economics and information technology. In the social perspective, trust is the basis for people to engage in any kind of social interaction, and is related to the expectation of cooperative and supportive behavior [19]. To psychology, trust results from the cognitive learning derived of past experiences with others. In the context of economics and management, trust helps to explain the behavior of companies regarding their relationships [19,20] and is based on calculated incentives for alternative behaviors [19]. In this sense, trust is related to the expectation of a certain

behavior, and the development of trust relationships reflects a judgment on the ability, honesty, and reliability of a partner to deliver expected outcomes [20].

The effectiveness of information sharing in SCs strongly depends on the level of trust between its members. Trust in SCs can be understood as the ability of a company to fulfill what was agreed with another partner [4,19]. Trust, in general, can be based on “benevolence” in personal relationships and on the capacities (intention and abilities) to create trust. However, trust between SC partners is basically dependent on: (1) the ability to generate/demonstrate commitment and (2) the ability to achieve the expected performance [4,21]. Thus, on one hand companies must invest in skills that allow them to improve performance and, on the other hand, in skills that support them to demonstrate commitment. These efforts allow SC partners to move from a limited level of trust to a level of collaborative trust [4].

From a performance point of view, companies must be able not only to deliver expected and agreed-upon performance, but also to communicate performance effectively [20]. An effort by SC partners to unify the metrics facilitates the sharing of information and ensure the effectiveness of communication.

When it comes to commitment, it is essential to understand that a relationship of trust can take time to be built. In this sense, the short-term view – usually based solely on costs – tends to be an obstacle to the establishment of trust relationships. If the only thing that matters is price, why should a manager invest time and energy to (1) develop the people skills needed to foster collaboration and (2) invest in building trust-based relationships with other members of the chain? Two other key aspects for increasing trust between SC partners are: the establishment of common goals, which is translated into the alignment of expectations and incentives (governance, balance of power, service level agreements); and the openness to share information [4].

The concept of visibility is closely linked to information sharing. The conditions that facilitate the sharing of information (including resources, skills and cultural aspects) are paramount to increasing visibility [9], which also contributes to foster transparency, traceability and trust between SC partners. Rogerson and Parry [22, p.602] state that “efficient supply chains require managers to have the ability to process the enormous volume of data generated to make decisions”.

Visibility is the result of the quantity, quality (accuracy/absence of errors) and “opportunity” (information made available at the right time) of information sharing. It demands the development and continuity of close relationships with all relevant partners. To have access to accurate, timely and usable information is beneficial to companies in many aspects [22]. However, the level of visibility with each partner varies depending on aspects such as: the perception of the importance of the relationship, the implementation of resources (technological and non-technological), the time spent on developing the relationship, informal / formal procedures, trust and commitment [9]. On the other hand, some aspects hinder visibility, such as: the lack of common metrics [23,24], the lack of coordination of information and collaboration between partners [9,24] and the incompatibility of the information systems used [9].

Thus, the ability to increase the level of visibility depends basically on two factors: (1) the adoption of information technology and systems that facilitate the sharing of information and the organizational capacity to implement them; and (2) the construction of value-added networks (including the adoption and development of

processes and routines that allow partners to work towards the same goals) that include internal and external partners (upstream and downstream) and, preferably, for beyond the first level of relationships [26,27,28]. The level of visibility between SC partners is often analyzed including two aspects, such as demand and inventory levels. However, several authors propose metrics to assess the level of visibility a company has over its SC, upstream and downstream, considering a broader range of aspects [13].

3 Methodology

Data were collected through interviews with multiple respondents from two companies operating in the sector of textiles and clothing in Portugal (focal firms) and through the application of an online-based questionnaire to representants of SC partners (downstream and upstream) of the focal firms. The data collected included aspects related to trust and visibility considering the relationship between the focal companies and their SC partners.

Two large companies operating in the sector of textile and clothing in Portugal were selected as the case studies. The first company (Company A) is a family-owned business, with over 50 years of experience, that exports ready-made textile products worldwide. The second company (Company B) has more than 40 years of experience and also exports to countries around the globe. Both companies are currently investing in innovation and digitalization.

The data were collected in April 2021. Representants from the focal firms and their partners were identified and contacted. The respondents of the focal firms were asked to provide information relating to a minimum of three main customers and three main suppliers. The questionnaire link could be shared and answered by different people within the company, as multiple replies were allowed. Five-point Likert scales were used for all questions. Additional information was collected through interviews with the contact persons in each focal company.

The first part of the questionnaire aimed to classify companies as customers or suppliers of the focal company, as well as to identify the duration of the relationship (less than one year to more than ten years). This part of the questionnaire allows an analysis of the type of relationship existing between the partners.

Regarding trust, companies were invited to inform, with regard to the relationship with each partner, to what extent they agree or disagree with the following statements:

1. Expectations for excellent performance in commercial transactions are high
2. Expectations for future investments are high
3. The company works towards building a stronger future relationship
4. There is a high level of trust, which is the basis for a high-intensity relationship
5. Innovative collaboration opportunities are identified and leveraged to generate collaborative advantage

Subsequently, respondents were asked to classify a set of information types that could be shared between SC partners according to their importance. Focus companies should assess the importance of sharing each type of information with each of their key partners. Companies could also inform other types of information that they consider relevant. The types of information evaluated were: (1) Production capacity; (2) Production process; (3) Inventory; (4) Buy and sell orders; (5) Traceability (track and trace); (6) Contracts (governance) - supplier, customer, logistics; (7) Alternative suppliers; and (8) Market (changes, threats, opportunities).

Following, based on the model presented by Messina et al. [13], interviewees evaluated the sharing of information with their main partners in order to allow the analysis of SC visibility. The visibility metric considers the quantity and quality of information shared [13,26]; where quality is obtained as a combination of precision (accuracy or absence of errors) and timeliness (degree to which information is available at the right time) [13,25,26]. The following questions were answered to each relationship:

- (1) How do you classify the amount of information shared with the partner company?;
- (2) How do you classify the quality/accuracy/absence of errors of the information shared with the partner company?; and
- (3) Is relevant information shared or received in a timely manner?

From the answers to the questions, a visibility indicator is calculated by averaging the visibility index of each of the evaluated aspects and is classified as:

- High visibility greater than or equal to 4),
- Medium (visibility greater than or equal to 3 and less than 4), and
- Low (visibility less than 3).

4 Results and Discussion

The focal companies, as well as their main customers and suppliers, were interviewed and answered the questionnaire made available on the online platform. The focal companies provided information on 20 SC partners, nine related to their main customers and 11 related to their main suppliers. 22 responses were received from the partner companies.

The responses indicated that most of the relationships evaluated are long-term. 70% of the partnerships are more than five years old, and 20% of these are more than ten years old. Only 10% of the partnerships evaluated has less than one year. These numbers show that companies consider the partners with whom they interact over extended periods of time as the main ones, indicating that trusting relationships take time to build.

Regarding the types of information considered most relevant to companies, the information related to routine trade operations and exchanges are the most valued.

100% of respondents say that sharing purchase and sales order information with their partners is critical to their business. Information regarding the production process, contracts and product traceability are considered important by 95% of respondents and production capacity by 90%. On the other hand, information regarding alternative suppliers, inventory and market information are considered less important.

The relevance of track and trace of goods is highlighted by the respondents, even though this type of information is still seldom shared and with great opportunities for improvement – especially with the application of new digital technologies. Track and trace have been aspects widely valued by companies for their potential operational management impact, but also by customers and other stakeholders due to social and environmental aspects of supply chains.

4.1 Company A

Company “A” evaluated its relationship with its four main suppliers and three main customers. Among the partners evaluated by the company, only the relationship with one client (client 3) is less than 5 years old, which shows that the company values building long-term relationships. Regarding the degree of visibility with partners, the answers indicate a high degree of visibility with all three customers evaluated, as well as a high overall index of visibility with the main customers (4.56). On the other hand, company “A” has a medium level of visibility with three of its main suppliers (the global index of visibility with the main suppliers is equal to 3.58).

These numbers can be interpreted from the point of view of the companies' technological “maturity”, often directly linked to size. In a traditional sector such as textiles and apparel, smaller companies tend to have lower investments in technology, a factor highly related to the level of visibility, as demonstrated in section 2. Thus, the larger size of company "A" customers compared to its suppliers helps to explain the levels of visibility presented and indicate the need for investment in technology as a way of strengthening SCs, especially upstream.

Table 1. Visibility assessment Company A

Partner	Relationship duration	Visibility level
Supplier 1	More than 10 years	4.00
Supplier 2	5 to 10 years	3.67
Supplier 3	5 to 10 years	3.33
Supplier 4	More than 10 years	3.33
Client 1	5 to 10 years	4.33
Client 2	5 to 10 years	4.67

High visibility level
 Medium visibility level
 Low visibility level

The SC of company “A” presents high levels of trust, both in the relationship with suppliers and with customers, as shown in table 3. The numbers may reflect a company's strategy of investing in the relationship with a reduced number of partners

(the company evaluated the relationship with a relatively low number of customers and suppliers), but with a high degree of trust and a long-term strategy.

Table 2. Trust assessment Company A

Partner	Relationship duration	Trust level
Supplier 1	More than 10 years	4.20
Supplier 2	5 to 10 years	4.40
Supplier 3	5 to 10 years	5.00
Supplier 4	More than 10 years	5.00
Client 1	5 to 10 years	5.00
Client 2	5 to 10 years	5.00

High level of trust
 Medium level of trust
 Low level of trust

4.2 Company B

Company “B” evaluated its relationship with its top five suppliers and its top eight customers. Only one of the suppliers has had a relationship with the company for more than ten years, while two relationships evaluated are less than one year old. The relationship with most of the analyzed clients is between five and ten years.

The analysis of visibility in the supply chain of company “B” (table 4) clearly demonstrates the need for improvement in two “nodes” of the chain: supplier 1 (2.67) and customer A (2.00). The answers indicate that the company is not satisfied with the quality, quantity and “opportunity” of exchanging information with these two partners. There are also average levels of visibility in three suppliers (two of them in the lower limit, 3.00) and four customers (one of them in the lower limit of 3.00). The exchange of information is satisfactory in the relationship with one supplier and three customers.

The global visibility indicator with the main suppliers is equal to 3.20 and the global visibility indicator with the main customers is 3.58. As with company “A”, the numbers demonstrate a greater need for improved visibility with suppliers, although there are also problems in exchanging information with some of the main customers.

Table 3. Visibility assessment Company B

Partner	Relationship duration	Visibility level
Supplier 1	Less than 1 year	2.67
Supplier 2	5 to 10 years	3.33
Supplier 3	More than 10 years	4.00
Supplier 4	Less than 1 year	3.00

Supplier 5	5 to 10 years	3.00
Client 1	5 to 10 years	2.00
Client 2	5 to 10 years	3.00
Client 3	5 to 10 years	3.67
Client 4	5 to 10 years	3.67
Client 5	5 to 10 years	4.33
Client 6	5 to 10 years	4.33
Client 7	5 to 10 years	4.00
Client 8	5 to 10 years	3.67

■ High visibility level
 ■ Medium visibility level
 ■ Low visibility level

Analysis of the trust levels of company “B” (table 5) helps to demonstrate the relationship between trust and the development of long-term relationships. Two of the company's suppliers (supplier 1 and supplier 4), whose relationship has existed for less than a year, have low levels of trust (2.80 and 2.40 respectively). The same occurs with supplier 5, even though the relationship has been in existence for over 5 years. The relationship with four of the eight clients analyzed shows medium levels of trust, showing the opportunity for improvement in existing relationships.

Table 4. Visibility assessment Company B

Partner	Relationship duration	Trust level
Supplier 1	Less than 1 year	2.80
Supplier 2	5 to 10 years	3.40
Supplier 3	More than 10 years	4.00
Supplier 4	Less than 1 year	2.40
Supplier 5	5 to 10 years	2.60
Client 1	5 to 10 years	3.60
Client 2	5 to 10 years	3.20
Client 3	5 to 10 years	3.00
Client 4	5 to 10 years	4,20
Client 5	5 to 10 years	4,00
Client 6	5 to 10 years	4,40
Client 7	5 to 10 years	4,20
Client 8	5 to 10 years	3,40

■ High level of trust
 ■ Medium level of trust
 ■ Low level of trust

4.2 Discussion

Both companies present higher degrees of visibility with customers than with suppliers. These results can be interpreted from the perspective of the technological maturity level. In a traditional sector such as textile, smaller companies tend to have lower investments in technology. Thus, the larger size of customers compared to suppliers helps to explain the levels of visibility presented and indicates the need for investment in technology as a way to strengthen visibility. In terms of trust, one company presents high levels in the relationships with suppliers and customers, reflecting the company's strategy of investing in close relationships with a reduced number of partners, with high degrees of trust and with a long-term strategy. In the other company, the suppliers whose relationships last for less time present the lowest levels of trust.

The diagnosis of the levels of visibility and trust can be analyzed and used by the companies for the development of actions to improve trust and visibility. Specific action for each partner (according to the results of the assessment) or general action can be developed.

Additionally, based on the information collected and the theoretical analysis, a set of recommendations can be developed to companies seeking to improve trust and visibility with their SC partners, such as:

- (1) implementing a tool for the self-assessment of trust and visibility with SC partners;
- (2) adoption of a SC visibility index as an indicator of the companies' strategic performance;
- (3) development of action plans to implement improvements in information sharing practices with the partners with indexes classified as "medium" or "low";
- (4) automation of processes and the integration of information systems in order to improve the sharing of information in the necessary quantity, with the necessary quality (accuracy/absence of errors) and at the right time;
- (5) standardization of performance metrics between SC partners;
- (6) adoption of a routine of benchmarking among suppliers.
- (7) involvement of strategic partners in the decision-making; and
- (8) definition of the end-to-end visibility as a vision for the future.

5 Conclusions

This paper uses cases from the textile sector in Portugal to analyze the role of visibility and trust in the management of SCs. Based on the OIPT, this paper considers that companies benefit from the ability of sharing information with SC partners, which has the potential to improve trust and visibility levels; and from the ability of using the information collected to inform the decision-making process.

The analysis of the two cases suggests that trust is closely related to the duration of the relationships and to long-term strategies, while visibility reflects the capacity of companies to share information; which is directly related to their technological maturity level and to companies' size. The results also suggest a relationship between trust and visibility, as many of the partnerships that present lower levels of trust also tend to have lower visibility. This paper shows that carrying out trust and visibility level assessments can help companies to improve their practices but also to improve their relationship with specific partners based on their characteristics. In the long run, companies must seek visibility across the entire chain - end-to-end.

The paper contributes to theory by analyzing and discussing the role of visibility and trust in SCs and by highlighting the relationships between: trust and the duration of partnerships; visibility and technological maturity level and companies' size; trust and visibility. This paper also contributes to practice as it shows that carrying out trust and visibility level assessments can help companies to improve their practices and their relationship with specific partners based on their characteristics and by presenting a set of recommendations for companies seeking to improve trust and visibility with their SC partners.

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