



Sustainability-Related Challenges in Customer-Supplier Relationships in the Manufacturing Industry

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Abstract. In the literature, sustainability in customer-supplier relationships from the perspective of manufacturing companies has not been extensively studied, although there is pressure both within and outside of the companies. This paper studies how manufacturing companies view sustainability in their business and the sustainability-related challenges in customer-supplier relationships. We explore the theme by presenting findings from 12 recent interviews with five manufacturing companies. The interviewees saw sustainability as containing a future-oriented perspective of sustainable operations and a practical point of view. Sustainability-related challenges in customer-supplier relationships were mentioned as turning sustainability into customer value and financial profit, identifying customers' sustainability needs, managing data related to sustainability, and managing sustainability through the value chain. The paper presents practical perspectives on sustainability in manufacturing companies and a framework for identifying customer needs related to sustainability. Managerial and theoretical implications consist of clarifying scattered viewpoints about sustainability in customer-supplier relationships in the manufacturing industry.

Keywords: Sustainability · Manufacturing companies · Customer-supplier relationships

1 Introduction

The manufacturing industry has an important role in reducing resource use, waste, and emissions (see IPCC, 2014). Manufacturing and construction are responsible for a fifth of global total greenhouse gas emissions (World Bank, 2017). A drastic change toward sustainability is needed, as pointed out by the research community, industry, and governing bodies and politicians. EU-based industries are aiming for a low-carbon economy in line with the EU's climate neutral by 2050 and Fit for 55 targets (European Commission, 2021). Companies can approach low-carbon targets by incremental reductions in greenhouse gas (GHG) emissions, utilizing clean energy, energy efficiency, and new processes and technologies. For manufacturing, new processes and technologies include electrification (green electricity and storage), green hydrogen, and CO₂ capture and storage.

The EU's Twin Transition aims at utilizing digital technologies and adopting a circular economy model for an environmentally friendly and low-carbon economy. With the emergence of the twin transition, the manufacturing industry is investing heavily in new IT and green technologies such as electrification, batteries, and renewables production. However, digitalization and green technologies consume vast amounts of raw materials, several of which are considered critical (Bobba et al., 2020; Eerola et al., 2021). Furthermore, the IT sector has a considerable energy and environmental footprint (Eerola et al., 2021). In a broader sense, manufacturing companies are dependent on the availability of different raw materials, processed intermediaries, components, and end products, often excavated, processed, and manufactured outside the EU (ibid.).

The lack of a comprehensive definition of sustainability has been a fundamental challenge in moving the field forward (Tricco et al., 2016). Moore et al. (2017) concluded the following in their extensive literature search on sustainability definitions: 'A comprehensive definition of sustainability that includes five constructs: (1) after a defined period, (2) the program, clinical intervention, and/or implementation strategies continue to be delivered, and/or (3) individual behaviour change (i.e., clinician, patient) is maintained; (4) the program and individual behaviour change may evolve or adapt while (5) continuing to produce benefits for individuals/systems.' Sustainability-related actions aim to renew or improve products, services, and technological or organizational processes that deliver an improved economic, environmental, and social performance, both in the short and long term, and can generate positive sustainability impacts (Bos-Brouwers, 2010).

Sustainability has been studied from several perspectives in the manufacturing industry, e.g. drivers (see Aboelmaged, 2018) and barriers (see Orji, 2019; Koho et al., 2015), business potential (see Valkokari et al., 2014) relationships between lean manufacturing, industry 4.0, and sustainability (see Varela et al., 2019; Ejsmont et al., 2020), the lean energy-saving and emission-reduction strategy (see Cai et al., 2019), sustainability of manufacturing processes (Jamwal et al., 2021), and the role of intellectual property (Eppinger et al., 2021).

The circular economy has been identified as a cornerstone of sustainability transition, but the relationship between the circular economy and sustainability in manufacturing companies is vague. The circular economy can be used as a route to progress toward sustainable development (Shroeder et al., 2019). The Ellen MacArthur Foundation (2015) defines a circular economy as 'an industrial economy that is restorative by intention and design'. Bjørnbet et al. (2021) concluded that the research on the circular economy in manufacturing companies has moved from purely conceptual work to empirical studies and from research to implementation tools. However, in empirical studies, the impact of sustainability is mainly addressed through the environmental dimension with narrow approaches (ibid.). The authors suggested that more empirical research is still needed to create the big picture of sustainability in manufacturing companies (ibid.).

Sustainability in customer-supplier relationships is not widely studied in the manufacturing industry. There is a need for long-term business planning and new frameworks and models to answer customer needs for sustainability and not only from the circular

economy perspective. *This study is about sustainability-related challenges in customer-supplier relationships in the manufacturing industry. The paper presents practical findings from interviews and a framework to recognize sustainability-related customer needs in the manufacturing industry.*

2 Literature Review

2.1 Customer-Supplier Relationships in the Manufacturing Industry

In the early 21st century, companies started to search for new forms of external cooperation and opened their innovation processes in both directions in the value chain – upstream toward suppliers and downstream toward customers (Paasi et al., 2012). Customer-supplier management practices have been divergent. For example, customers may have an ‘adversarial’ attitude towards their suppliers – valuing primarily the short-term price of supplier’s wares and how much risk they are willing to take associated with variations in supply and demand. This is very different from symbiotic arrangements where customers also share knowledge with suppliers, help in solving problems, and innovate together (ibid.). Both attitudes still exist. However, digitalization, e.g. Internet of Things (IoT) applications, social media, and e-commerce, has brought customers into closer collaboration with their suppliers. Nowadays, customer experience, customer journey, customer orientation, customer value, seller-buyer interactions, and customer engagement are being highlighted, and customer-supplier relationships are more important (see Alhonen et al., 2018; Hakanen et al., 2014; Becker and Jaakkola, 2020).

Sustainability actions must respond to the needs of the present moment with a commitment to future capacity and a compromise between increasing economic gains while minimizing social and environmental consequences (Helleno et al., 2017). Organizational change management for sustainability is widely discussed and essential. Therefore, motivated industrial companies are considering the environmental, social, and economic impacts of their operations as well as changing their activities (Orji, 2019). Companies may struggle to implement effective organizational change management practices and reach sustainability goals. It is important to recognize the barriers and drivers of sustainable performance that have the highest influence on a company to foster change towards sustainability (Lozano and Haartman, 2018).

Within the manufacturing industries, customers are setting several sustainability requirements for their suppliers. Manufacturing companies must offer a higher return on investment, and, at the same time, environmental impacts must be reduced (Machado et al., 2020). Depending on the size of the customer, the requirements and sustainability goals differ. The literature suggests that large firms often focus on activities related to maximizing material efficiency, creating value from waste, and moving to renewable energy, which are all linked to cost savings (Hernández-Chea et al., 2021). In addition, sustainability is highly related to operations – for example, employee wellness, ensuring working conditions, responsible purchasing, etc. Customers may outsource many operations to their suppliers. Then suppliers provide not only raw materials and finished products but also transportation, energy, packaging, design, and recycling services (Valkokari et al., 2014). Sustainability can be part of everything firms do. Large firms, especially those listed on the stock exchanges, have clear sustainability goals and are

required to report their sustainability programs and activities. Therefore, large firms typically use different auditing methods for their supplier. Auditing methods can have different targets, depending on the focus of auditing. One example is SMETA (Sedex Members Ethical Trade Audit), which is the most widely used social audit in the world. SMETA is a social audit methodology that enables businesses to assess their sites and suppliers to understand the working conditions in their supply chain. Social audits enable businesses to assess their suppliers, monitor the health and safety of workers, and signal zero tolerance for human rights abuses such as child and forced labour. Once an audit is complete, the buyer and supplier businesses can work together to address any issues, based on a Corrective Action Plan (CAPR).

2.2 Understanding Sustainability and Value Creation in Manufacturing Companies

The main goal of sustainability is to meet current needs without compromising the ecological systems, social justice, and welfare of future generations (Brundtland, 1987; Jorna et al., 2009). For manufacturing companies, this implies that they must take into account not just economic goals, but also meet environmental and social goals in carrying out business while recognising that economic, environmental, and social impacts occur at all life cycle stages in their value network (Rantala et al., 2022). Additionally, sustainable manufacturing focuses on the efficient and effective use of natural resources by creating products and solutions that can satisfy economic, environmental, and social objectives while continuing to improve the quality of human life (Garetti and Taisch, 2012; Uusitalo et al., 2017). In manufacturing practice, sustainability has implied a focus on minimising the environmental impacts of production, following social norms, promoting well-being, and creating business benefits (Schiederig et al., 2012; Buys et al., 2014).

In manufacturing, value is generated through activities and interactions between suppliers, manufacturers, customers, and other stakeholders. Sustainable value creation requires the integration of the three dimensions of sustainability – social, environmental, and economic – in a manner that balances value creation for all stakeholders, including the environment and society at all levels and through all activities of the business (Bocken et al., 2015; Badurdeen and Jawahir, 2017).

The manufacturing industry has a considerable environmental, social, and economic impact, and the transition to a sustainable operating model is of utmost importance to save ecological systems and ensure social justice and the welfare of future generations. However, measuring the comprehensive sustainability impact of companies and their value network is challenging and resource-consuming, and few reliable frameworks exist to support this task (e.g., Pande and Adil, 2022). The sustainability actions of most companies focus on certain limited indicators or trying to understand and comply with current and future legislation or pressing customer demands (Rantala et al., 2022).

2.3 Challenges and Value Creation of Sustainability-Related Actions

Stakeholders expect companies to develop and take sustainability-related actions to achieve their economic, environmental, and social goals. Challenges and barriers to sustainability-related actions can be categorized into environmental, economic, social,

institutional, technological, informational, supply chain, and organizational factors (Tura et al., 2019). Koho et al. (2015) studied challenges and the general situation of sustainability in the manufacturing industry and concluded that the objectives of sustainable development are not fully realized and the integration of sustainability and decision-making needs to be increased. They mentioned that lack of metrics, implications, demand, understanding, and awareness are the key challenges for manufacturing companies to proceed with sustainability-related actions (Koho et al., 2015). According to a literature review by Lood and Säfsten (2022), the most frequently mentioned barriers to sustainable manufacturing in SMEs include lack of access to external technical knowledge to adopt sustainable manufacturing practices, low skilled labour, lack of awareness of the benefits derived from sustainable manufacturing practices, lack of financial resources, managers' misunderstandings and pessimistic preconceptions, lack of time for planning, execution and review of sustainable manufacturing practices, little knowledge on sustainability in SMEs, difficulties accessing financial capital, resistance to change, lack of effective legislation and/or weak regulatory environment, high investment costs, and low returns of environmental technologies.

Identified barriers to sustainable manufacturing are largely in line with barriers to a circular economy in manufacturing. Barriers to a circular economy include costs (e.g. high investment or scrap material costs), measuring long-term benefits of investment, customer response and long-term demand, lack of incentives (e.g. in the form of financial support or taxes), complex and overlapping regulation, lack of appropriate partners and resources, conflict with existing business culture and lack of management support, lack of public awareness, technical skills and knowledge, and available systems or technology (Tura et al., 2019; Kumar et al., 2019).

3 Methodology

The case study was chosen as the method for this study because of its suitability for situations that include complex and multiple variables and processes (Yin, 2014). Qualitative data consists of 12 semi-structured interviews in 5 different companies in the machine-building and electronics manufacturing industry (Table 1). There were 2–4 interviews with each company to better understand the business of the case companies. The interviewees represented different positions in the company, preferably in management, sales, and R&D.

The case companies are operating in b-to-b markets. Some of them also operate in b-to-c markets, but the focus of this research is on their b-to-b relationships. The interviews were made from September to November 2021. They were recorded and comprehensive notes were taken. The duration of a typical interview was 1 to 1.5 h, and each involved 1–3 interviewers. Because the study is partly explorative and the meanings of concepts (e.g. sustainability) needed to be negotiated with the interviewees, semi-structured theme interviews were chosen as the main source of empirical material. The interviews went beyond sustainability and customer-supplier relationships to understand their business. The results have been elaborated in several discussions with researchers and in a workshop for analysing the research results with the company and researcher representatives in January 2022.

Table 1. Interviewed companies, their main products and services, number of interviewees, and interview dates.

Company	Main products and services	No of the interviewees and their roles	Interview date
A	Forestry machinery	2 (Director R&D, sales, marketing)	September 2021
B	Machine equipment	2 (Director service dev., R&D, data analyst)	September 2021
C	Packaging machinery	3 (Management plant, service dev., R&D)	October 2021
D	Glass treatment machinery	4 (Management business unit, R&D, software, product management)	October 2021
E	Sheet metal processing machinery	1 (Management, R&D, software)	November 2021

3.1 Research Question

The study aims to create an understanding of the main sustainability-related challenges in customer-supplier relationships in the manufacturing industry. Thus, we pose two research questions:

1. How do manufacturing companies understand the term ‘sustainability’ in their business?
2. What are the main sustainability-related challenges in customer-supplier relationships in the manufacturing industry?

In this paper, manufacturing refers to companies manufacturing machinery for business-to-business customers.

4 Results

4.1 The Definitions of Sustainability in Manufacturing Companies

Sustainability as a term is seen to be very difficult to describe, and it has several different meanings for the interviewees. For example, it was seen as accelerating products and processes through data and improving communications. The interviewees considered ‘sustainability’ a challenging term. The interviewees looked at ‘sustainability’ from a future-oriented perspective of sustainable operations or a practical point of view. Examples of future-oriented sustainable operations that were mentioned by the interviewees focused on the big picture, long-term planning, persevering operations, clear goals, and brand image. Customer care, long life cycles, the durability of machines and products, safety issues, warranty matters, and well-being were examples from a practical point of view.

Below, there are examples of both future-oriented and practical perspectives of sustainability according to the interviewees:

“Long-term sustainability of operations, building our and customer’s business on long-term goals as well as right-minded actions in practice.”

“Doing what’s promised to customers, warranty matters, goodwill operations, treating staff according to all the rules of art.”

4.2 Sustainability and Value Creation

According to the interviewees, actors driving the sustainability agenda in the manufacturing industry are mainly customers or customers of large customer companies in the industry. Large companies may be the driver, but contractors are not happy about increasing cost levels. For example, decreasing CO₂ emissions will cost.

Our results show that **turning sustainability into customer value** is a challenge in the manufacturing industry. Forefront customers understand better technological development, data utilization, and the meaning of sustainability. However, the situation varies greatly. Many companies are still at a stage where they are trying to understand the meaning of sustainability for themselves in general. The interviewees identified the potential for value creation, for example, in speeding up the customer’s decision process, decreasing life cycle costs, and offering data-based services. Sustainability was seen to have a great indirect effect on business. An interviewee described the benefits of sustainability for business as follows:

‘Sustainability benefits reputation, improved reputation benefits business.’

When we asked about converting **sustainability solutions into financial profit**, the interviewees mentioned typical qualitative values. Seeing a slightly bigger picture than a machine perspective was considered important. Long-term operations, long-term customer relationships, and life cycle management were potential ways to convert sustainability into financial profit. An interviewee clarified that mutual benefits of product lifecycle management are very important, as there are economic benefits not only for the buyer but also for the seller. From the sales perspective, sales arguments might be seen as technical. This has a large effect on transferring sustainability into monetary value. The interviewees mentioned that it should be possible to concretize measurements throughout the supply and value chain and have a jointly agreed course of action. An interviewee gave an example of how challenging it is to create value from sustainability, as follows:

‘It doesn’t matter to our business yet, even though all our customers write in capital letters about their environmental policy and so on. When we’re out there trading, it’s going to mean zero. It’s like roughly saying that it’s the price that counts when you talk about something like this... If we present our life cycle there with small life cycles or sensible lifecycle costs or other things like this, then they don’t listen to them.’

4.3 Sustainability-Related Challenges in Customer-Supplier Relationships

Based on our results, **data** are a crucial part of sustainability, as they enable sustainability-related actions, measuring, and verifying sustainability. Many challenges of sustainability in customer-supplier relationships are on some level related to data and according to

our study, those can be categorized into three categories – *process, business, and change management-related challenges*. There can be process-related challenges, for example, data acquisition, quality, and security issues. Business-related challenges include challenges to identify customer needs and best collaboration partners, communication and sales-related challenges, and earning logic-related challenges. When communicating to customers the value of data that improves sustainability, it is important to focus on the right thing and have a clear message for each customer. The interviewees mentioned that customers are traditional in their industry, and it is challenging to highlight the right value to each person in the customer organization. The customer value must be negotiated at different levels of the customer organization. Change management challenges are related to acceptance issues, high expectations, and communication in the supply chain.

Sustainability perspectives in the value chain are essential for manufacturing companies. Production, operations, and after-sales depend on several actors in the manufacturing value chain. There are many different suppliers, service providers, and other actors in the ecosystem whose opinions and behaviour also affect the overall sustainability realization. However, agreed procedures or ways to collaborate from the sustainability perspective are usually missing. The challenges of customer-supplier relationships from the sustainability perspective were described as follows by an interviewee:

‘Long-term supplier relationships, there should be written instructions for suppliers in the future.’

Another challenge was the **negotiation position** of smaller companies. Smaller companies may not have the power to influence sustainability aspects. The interviewees mentioned the difficulty in identifying **customer needs**. For example, customers request measures to protect the environment, minimize environmental impact, and improve energy efficiency. Additionally, a regular procedure is to ask about liability issues, conformity to the law, no use of child labour, safety, and health issues. An interviewee clarified the situation as follows:

‘Customers ask about safety, environment, quality issues. For example, have you committed an environmental crime for which you have been convicted?’

Based on our research results, customer needs related to sustainability are valuable to identify already in the early phases of the company’s path toward sustainability. This could be done through a straightforward table, where the customer segments and their characteristics, sustainability needs, auditing requirements, required skills and resources, and responsible person are identified (Table 2).

Table 2. Example of a tool for identifying customer needs related to sustainability in the manufacturing industry.

Customer segment	Sustainability needs	Auditing requirements	Required skills and resources	Responsible person
Segment A	CO2 emission limits and special requirements for the supply chain	SMETA	SMETA auditing content understanding and resources	Person N.N

5 Discussion and Conclusions

The COVID-19 pandemic and Russia's invasion of Ukraine are creating short-term disruptions and provoking long-term changes in how the world lives and does business. At the same time, companies need to cope with sustainability-related aspects in a very volatile business environment. Increasing awareness of life cycle impacts of human activity on nature, climate change adaptation and mitigation, biodiversity loss, social impacts of production and energy and raw materials availability are just some examples of perspectives that manufacturing companies must consider in their actions.

According to our findings, the manufacturing companies' operating environment may not be ready to accept new kinds of operating models with a sustainability focus. The situation hasn't changed so much since Koho et al.'s study in 2015, and our findings are in accordance with the authors. There is, for example, a lack of metrics, demand, understanding, and high costs still based on our findings (Koho et al., 2015; Tura et al., 2019; Kumar et al., 2019). In addition, there is a need for informing the whole value chain (internally, delivery chain, sales partners, private dealers, and customers) when changing the operating mode towards sustainability. When the company focuses on improving its sustainability, it might not be that easy. As one interviewee mentioned:

'The idea is very easy, but practical implementation more difficult.'

The results show that challenges of sustainability in customer-supplier relationships can be related to the whole value chain, although the actual purchase is done between two companies. Sustainability is such a multifaceted concept that it relates to several different aspects, e.g. raw materials, components, value chain, customer-supplier relationship, subcontractors, and life cycle.

There are many methods and frameworks available for sustainability assessment and reporting, which helps practitioners to select development areas for realizing sustainability in their internal operations. In an ideal situation, the whole supply chain supports common sustainability goals. Auditing methods (like SMETA) can be used for ensuring suppliers' sustainability and responsibility concerns. Optimally, the firm has perfect visibility of the key sustainability metrics of its operations and optimizes its operations from a sustainability perspective. However, in practice, there are many obstacles and challenges when developing sustainability. Companies focus on a limited view of sustainability that could be low-hanging fruit due to easily available data through existing reporting processes. There is a clear need for a sustainability framework that guides the formulation of sustainability strategy in manufacturing companies and supports the

strategy implementation process. A holistic sustainability transition framework should cover the relevant part of the company value chain and key aspects of sustainability. It should also provide companies with a tailored sustainability transition roadmap, or at least goals for reaching sustainability.

Many manufacturers are still in the learning phase of what sustainability could mean for their operations. Sustainability is perhaps measured using metrics from sustainability reporting standards and is an essential part of the brand image but does not yet translate to the level of operations and product or service design. Forerunner companies measure sustainability through multiple comprehensive standardized reporting principles or audits and modify their products, organizations, and strategies to improve their performance.

Investments in sustainability might be hard to turn profitable. In some industry sectors, firms are forced to invest in sustainability to reach the minimum standards required by owners, customers, legislation, or other stakeholders. If customers are requesting sustainable solutions, then it is easier to turn investments profitable. Manufacturing industries are mostly on the right track nowadays, as they are investing in and implementing sustainability in their operations. The entire industry can be changed, and transition needs steps of every size.

The paper presents practical findings from interviews of manufacturing companies and a framework to recognize sustainability-related customer needs in the manufacturing industry. These are valuable for company managers to plan their sustainability actions in the future. Our explorative study with its limited sample only scratches the surface, but it opens up several interesting paths to take in the future. More in-depth studies are needed to develop a holistic sustainability transition framework. Thus, more in-depth studies on the sustainability of customer-supplier relationships in different industry sectors and company sizes may provide a better understanding. Formulating a sustainability transition roadmap for companies would support both focusing on the right and valuable actions as well as making better decisions.

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