

# Stakeholder requirements for goods transportation decarbonization – An examination of transportation chains

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## ABSTRACT

This study aims to understand decarbonization opportunities in a transportation chain as a collaborative effort of multiple stakeholders, each of whom have different requirements to meet. While transportation providers aim to reduce emission for their own mode, transportation customers seek to decarbonize their multi-modal transportation chain. Enablers, on the other hand, develop and supply emission reduction technologies to cater all transportation modes. We investigate stakeholders' requirements as a prerequisite for value creation at the transportation chain level. The study employs the Jobs-to-be-done theory to uncover requirements for value creation. 18 semi-structured interviews have been analyzed using theoretical coding then subsequently data-driven coding for a qualitative content analysis approach. While all stakeholders share an overarching goal of decarbonization, balancing their requirements with cooperation efforts is perceived as a necessary step to create value, benefit from reductions and share the risks and costs associated with emission reduction efforts. This study investigates the requirements for decarbonization at a transportation value chain level. By applying the Jobs-to-be-done framework in a B2B context, the study uncovered mutual reliance jobs, which extend our understanding of value creation opportunities. We derive several managerial implications for operationalizing emission reduction solutions, with an emphasis on removing barriers for purchasing low-emission transportation services.

## 1. Introduction

Transportation is considered one of the harder-to-abate sectors that requires considerable attention and effort (Energy Transitions Commission, 2018) in decarbonization. Although there are technological decarbonization solutions in the maritime and road transportation industry, the economic and societal adjustment as well as governance, institutions, and commitments are lagging (Engel et al., 2023). Especially European transportation providers are required to take steps to comply with carbon emission regulations. International Maritime Organization (IMO) aims to reduce carbon intensity by 40% by 2030 and net-zero by 2050. On the other hand, the demand for environmentally accountable transportation services will likely grow by 2025 (Ojala et al., 2013). Transportation decarbonization is in essence a transition that appears to be in a relatively early phase (Nkesah, 2023). Efforts in carbon reduction are insufficient and hence, there is an urgent need to expand the adoption of low-carbon services (cf. Dev et al., 2020).

Decarbonization of transportation induces costs; it then becomes necessary that all stakeholders pay their share (Poulsen et al., 2016).

Other methods to reduce cost include improving operational efficiency and creating additional value with novel solutions or operating models. For example, by lowering speed and thus reducing fuel consumption or buying newer, less polluting vehicles, both fuel cost and carbon emission can be decreased (Touratier-Muller et al., 2019). Compared to the cost-focused measures, sustainability remains secondary for business organizations (Cadez et al., 2019; Heikkinen, 2024). The interplay of a transportation chain may have an impact on greening the transportation sector. A traditional transportation chain consisting only of the provider and shipper represents a dyadic perspective. A chain-level perspective, a contrast to the dyadic perspective, moves beyond just provider-shipper engagement, and considers all relevant organizations and their interactions involved in the transportation network (Wilhelm, 2011). Unlike the dyadic perspective, the chain-level perspective requires a collaborative approach between the organizations in the chain that may have a value-added opportunity. However, the value-added potential has received little attention, partly because it requires a shift from the transactional transportation provider-shipper dyad to a more collaborative emission reductions effort (Jazairy, 2020). For example,

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traditional supply chain prioritizes individual actor’s CO<sub>2</sub> reduction and ignores the collaborative systemic attempt (Liu et al., 2022). This gap provides an opportunity to investigate transport emission reduction from a transportation chain, collaborative perspective instead of an individual firm basis (Randrianarisoa and Gillen, 2022). Although collaboration among transportation chain stakeholders might be challenging, it has the potential to advance sustainability (Heikkinen, 2024).

While the need to reduce transportation emissions is widely recognized, there are notable gaps on how businesses operating as part of transportation chains can address them. First, research on sustainability of supply chains has excluded the role of transportation (Björklund et al., 2024). Alongside production, transportation is an essential part of the total carbon footprint of a product (Thies, Kieckhäfer and Spengler, 2021), so it needs to be acknowledged first. Second, earlier research has identified an important tension in advancing transportation decarbonization. Logistics transportation providers are the ones realizing emission reductions in their operations, but they are dependent on the shippers, i.e. the transportation customers (Björklund et al., 2024). Hence, the transportation provider-shipper dyad is likely to undergo changes by seeking partners helping them achieve their emission targets. Third, through the twin transition lens, decarbonization efforts and CO<sub>2</sub> data governance go hand in hand. As evidenced in Lodemann and colleagues’ (2021) research, technologies are available to enable more advanced data usage than is being implemented in practice. The lack of CO<sub>2</sub> data sharing practices between transportation chain members indicates missed opportunities for value creation. For example, transport emission measurements are not a top priority requirement demanded by shippers of goods (Touratier-Muller et al., 2019). While Jazairy (2020) confirm that green criteria are not a pivotal element in contracting a long-term logistics partnership, Rasool et al. (2023) argue that firms adopting sustainability practices are more likely to have higher digitalization and collaboration levels suggesting the mutually reinforcing of sustainability and digitalization.

To address the aforementioned gaps, this paper seeks to answer the following research question: *What requirements do transportation value chain stakeholders have towards low-emission transportation services?* This paper contributes to the ongoing sustainability efforts in decarbonizing transportation chains by collating stakeholders’ requirements related to low-emission transportation services. The article presents a novel approach by uncovering multiple stakeholder groups’ requirements. Greening transportation is not a new phenomenon. Moving beyond the

transportation provider-shipper dyad, this study extends the transportation provider-shipper dyadic relationship to triadic relationship by including the stakeholder “enablers” into the discussion. (Fig. 1). Enablers, in the context of green transportation, are understood as the application of information technologies, green or alternative fuels (Shah et al., 2021; Shibin et al., 2016), policies (Shah et al., 2021), and strategic collaboration (Shibin et al., 2016) that facilitate the decarbonization in transportation industry. Thus, in this paper, we define “enablers” as organizations developing and supplying emission reduction technologies and fuels for all transportation modes. The symbiotic relationship between transportation customers and providers is built on mutual trust and communication of needs and expectations. Both work to sustain the partnership, commit long-term and seek mutual benefits in navigating the green transition. Transportation providers and enablers have previously collaborated, but the importance of the relationship is growing proportionally to the need of reducing emissions. The shift –stemming both from regulation and customer expectations – from fossil to low-emission fuels challenges providers to manage portfolios of fleets operating with different types of energy carriers. In this situation, enablers function in an advisory-role, aiding transportation providers with portfolio optimization in decarbonization. Simultaneously, enablers seek to increase transportation customers’ awareness of the feasibility of different decarbonization levels. This emergent relationship balances the need of transportation customers who seek to set ambitious yet achievable targets with what is technically feasible in terms of technologies, fuels, and energy carrier solutions. Investigating these relationships increases our understanding of the complexity of transportation decarbonization dynamics and highlights the opportunities for value creation from integrating multiple stakeholder perspectives.

The article is structured as follows. The next section conceptualizes stakeholder groups in transportation chains. It introduces customer needs theories, highlighting the importance of understanding needs as prerequisites to value and action. We describe our methodological approach in Section 3 and findings in Section 4. Section 5 discusses findings against the theoretical framing of Jobs-To-Be-Done as well as from managerial vantage point. The study ends with a Conclusions section.

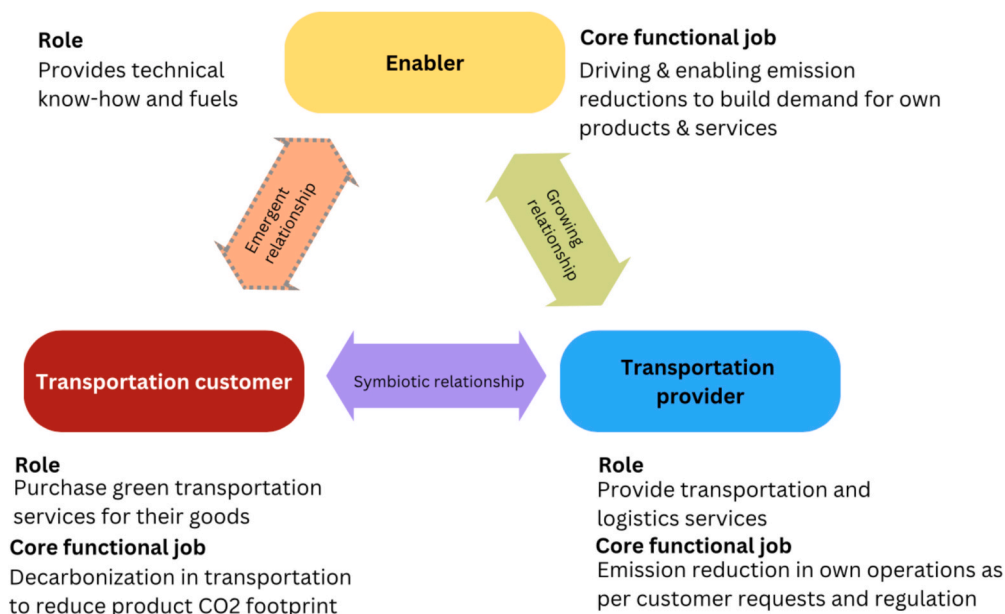


Fig. 1. Transportation stakeholders’ roles and relationships in the value chain.

## 2. Creating value from customers' jobs

A transportation chain is traditionally viewed as a collection of interlinked actors who are involved in the movement of goods (Talley and Ng, 2013). In contrast to this traditional view, we outline a value-added approach to transportation chains, where decarbonization is the shared goal. Recent research indicates that there is greater interest towards sustainability among shippers compared to the logistics service providers (Justavino-Castillo et al., 2023), which makes it all the more pressing to understand shippers' needs and subsequently, address them. Shippers are essentially transportation-buying customers in a B2B context.

The importance of customers for an organization's success is nowadays undisputed. However, it wasn't until the late 1980s when von Hippel theorized on the role of customers, eventually morphing into the customer-centric approach as we know (and experience) it today. Von Hippel postulated that companies are to rethink their relationships with users, drawing them more closely to their R&D processes (von Hippel 1976, 1978, 1986, 1988). Not only did von Hippel champion for "the voice of the customer" but he also elaborated on the management changes necessary at organizational level to capitalize on this approach. For our purposes in the transportation context, transportation providers need to develop a deep understanding of their customers' priorities to be able to offer services that meet customers' expectations and decarbonization ambitions.

Regarding customer centricity, the Jobs-To-Be-Done Theory (JTBD; Ulwick, 2016; Christensen and Raynor, 2003) is a notable example. JTBD is based on several core-tenets, which explain in detail what a customer's "job" means: 1) Products and services are bought to get a job done. 2) Jobs are functional, with emotional and social components. 3) A job is stable over time. 4) A job is solution agnostic. 5) Success comes from making the job the unit of analysis (not product or customer). 6) Understanding the job makes marketing more effective and innovation more predictable. 7) Customers want products/services that get a job done better and/or cheaper. 8) Customers seek out products/services to get the entire job done on a single platform. 9) Innovation becomes predictable when "needs" are defined as the metrics customers use to measure success when getting the job done (Ulwick, 2017).

A customer's "job-to-be-done" differs from other approaches to customer needs. JTBD focuses on what customers try to achieve and then assess the needs as they are tied to the particular job-to-be-done (Ulwick, 2017; Christensen et al., 2016). Uncovering customers' jobs calls for observing them in their context and asking customers open-ended questions about the progress they are trying to make and the objectives they are trying to achieve (Diderich, 2024). Importantly, just like the jobs-to-be-done, customer needs defined as desired outcomes are stable over time too. This allows companies to evaluate and develop products and services against a stable set of metrics to assess which one gets the job done better or quicker (Ulwick, 2017).

The JTBD framework has been primarily utilized in consumer markets, but it is equally applicable in the business-to-business (B2B) contexts (cf. Christensen et al., 2016). The JTBD approach helps business decision-makers in asking better questions regarding the firm's strategic advantage as it shifts the initial focus away from the company's product or service. The JTBD approach transforms companies' understanding of their current and future customers as it "gets at the causal driver behind a purchase" (Christensen et al., 2016, p.56). The primary principle of the JTBD framework is having the job the stakeholder tries to get done as the unit of analysis, not the product or service (Ulwick and Bettencourt, 2008).

The promise of getting customers' jobs done is communicated through value propositions, that represent a company's hypothesis of how customers wish to get the job done (Diderich, 2024). For example, Marchet et al. (2017) argue that the value creation by third party logistics providers falls in one of three categories: volume-oriented, process-oriented or innovation-oriented. Each of the three value creation

models presents a distinct hypothesis of what the customers' JTBD are. It is important to bear in mind that customers are always value co-creators (Bettencourt et al., 2014; von Hippel, 1978, 1986). Building on earlier research that found value propositions as more complex than those found in a dyadic relationship (Kowalkowski et al., 2016), we postulate that this study holds potential to identify value propositions beyond individual stakeholders, namely at the chain level. A recent study by Fracarolli Nunes and colleagues (2026) highlights the potential of green transportation to increase customer value and customer loyalty. Further, the authors argue that green transportation can be a source of competitive advantage. Hammervoll (2009) argues that logistics operations, including transportation, involve so many interdependencies that effective inter-firm coordination is necessary for success. Further, Justavino-Castillo et al. (2023) emphasize the significance of interaction between transportation chain stakeholders for value creation and conclude by highlighting the need for more collaborative approaches for innovative sustainable solutions. In contrast to the traditional cost minimization approach to logistics services, sustainable shipping management takes a value-added approach to logistics (Zhou et al., 2023). Therefore, getting jobs done in the low-emission transportation context becomes necessarily a collaborative effort.

The perceived value (co-)created guides customers' purchasing decisions. It is critical to understand that the jobs are never purely about functional aspects, but that there are other dimensions, such as social and emotional ones involved (Christensen et al., 2016). The jobs can actually be divided into five sub-categories for more fine-grained understanding:

1. core functional jobs,
2. consumption chain jobs,
3. emotional jobs,
4. purchase decision jobs and
5. related jobs (Ulwick, 2017)

It is important to note that it is the customer who defines the value, not the seller. Besides value, price together with other contextual factors play key roles in the decision-making (Diderich, 2024). The transportation provider essentially applies its' knowledge and capabilities (Bettencourt et al., 2014) to help the customer get the job done. In other words, getting the job done creates values for the customer. To create value, the service provider must be able to combine customer understanding and leverage the capabilities afforded by enabling technologies (Christensen, 1997) as well as manage the collaborative effort of value co-creators. But firms need to simultaneously consider two aspects related to value, namely value-creation and value capture, i.e. how the firm captures part of it for itself (Diderich, 2024).

Innovations are argued to solve problems that have previously had at best insufficient solutions (Christensen et al., 2016). Thus, innovations that help customers achieve the progress they are seeking can have significant value potential. Earlier research shows that customer engagement on the part of the transportation provider enhances value co-creation in multistakeholder settings (Jaakkola and Alexander, 2014). Low-emission transportation may well present this kind of potential. In addition to enabling profit maximization for transportation providers, sustainable transportation has been found to contribute to the loyalty of the transportation customers towards transportation providers (Justavino-Castillo et al., 2023). However, the challenge of aligning various value co-creators' needs for the delivery of successful low-emission transportation solution remains (Kowalkowski et al., 2016).

Building on Ulwick's (2017) JTBD-framework and in synergy with the work of Fracarolli Nunes and colleagues (2026), we postulate that JTBD is particularly well suited for the decarbonisation context. First, there are several types of jobs and because of such variety, the opportunities to ease the customer jobs and create value are numerous; especially combining functional elements like price with emotional and social components. Second, the jobs are always aligned with what each

stakeholder aims to achieve and become the main unit of analysis (cf. JTBD). The jobs, not products or services, provide value creation opportunities. Products and services are “hired” to get the job done. Finally, the transportation chain perspective expands value creation opportunities further. Raising above each stakeholders’ jobs, it affords opportunities to identify jobs at the transportation chain level.

### 3. Methodology

This study examines stakeholder requirements for low-emission transportation services in Nordic transportation chains. For the purposes of this study, stakeholders are divided into three groups according to their position in the transportation chain: **transportation customers** (shippers) manufacture, assemble, and process goods and seek to purchase transportation services for materials procurement and shipping products to their clients; **transportation providers** provide aforementioned transportation services; **enablers** in turn, develop and supply emission reduction technologies such as equipment, fuel, and services. They collaborate with both transportation customers and transportation providers (see also Fig. 1). The study is done as part of a research project as part of the GreenConnect research project focusing on the potential of added value for low-emission transportation services.

Voluntary low-emission transportation chain services are only emerging at the time of this study, and therefore an exploratory qualitative approach was deemed suitable (Taylor et al., 2015). Existing theories like JTBD can be utilized to develop an understanding of the emerging stakeholder needs. After an initial review of theoretical approaches, the JTBD framework (Ulwick, 2016; Christensen and Raynor, 2003) supplemented with insights from customer-focused value creation (von Hippel 1976, 1978, 1986, 1988; Diderich, 2024) were chosen to anchor the data collection process. The methodology and interview guide support the exploratory qualitative approach of the study. Questions included *What are your company’s goals in emission reductions?; What kinds of means are used to reduce CO<sub>2</sub> emissions?; How do you estimate that your company can achieve value added from emission reductions?; How much do your customers currently want to know about CO<sub>2</sub> emissions of transportation?; Do you have a systematic process how you offer emission data to your customers?; Does the emission data have to be certified or verified by a third party?; What gains is your company expecting from offering green solutions?;*

*What bottlenecks or barriers (internal or external) do you face in offering a green solution? or What are your thoughts on the twin transition? (green + digital). What type of data-driven solutions does your company provide to support green logistic solutions for your clients?*

Empirical data was collected from 18 qualitative semi-structured interviews (Taylor et al., 2015). The interviews were carried out online (via Teams or Zoom) by four researchers; in all but one interview there were two interviewers present. One interview was done by one interviewer. All the interviews were recorded with the permission of the interviewee and transcribed verbatim for analysis (Assarroudi et al., 2018). One interview recording failed, and from that interview, there were only researchers’ notes made during the interview available. The researchers evaluated the potential data loss after the interview to determine if there is need for an additional interview. The interview in question was one of two interviews with the same company, so the company’s perspective was covered by the other interview. In addition, there are multiple other interviews from the same stakeholder group, and therefore the researchers agreed that data loss was not critical to the results of the study. Interviewees are listed in Table 1.

To build understanding of the versatility of relevant stakeholder needs, the selection of interviewees was an iterative process (Kvale, 2007). Initial suggestions of experts and relevant stakeholders to interview were received from companies participating in the research project. During the data collection, alike snowballing, additional suggestions were received from interviewees. In addition, after the initial analysis process, the research team evaluated whether saturation had been

**Table 1**

Interviewees: Type of organization, interviewee role, interview duration. (Source: Authors own elaboration).

Type of organization	Interviewee role	Interview duration
Enabler, B2B equipment provider	Sales director, Nordics & Northern Europe	50 min
Enabler, B2B equipment provider	Chief expert, environment	57 min
Enabler, fuels provider	Solution Lead, biogas	57 min
Enabler, fuels provider	Head of sustainable logistic solutions	55 min
Transportation provider	Key account manager, freight sales	ca. 45 min recording failed
Transportation provider	Environment & sustainability specialist	52 min
Transportation provider	Head of network and linehaul Management	54 min
Transportation provider	Communications & sustainability specialist	32 min
Transportation provider	Sales director & Sustainability director (2 persons)	54 min
Transportation customer, food products	Planning & logistics manager	44 min
Transportation customer, industrial products	Head of logistics	59 min
Transportation customer, industrial products	Head of environment, health & safety	50 min
Transportation customer, industrial products	VP, Responsibility, stakeholder relations	28 min
Transportation customer, industrial products	Senior manager, supply chain sustainability	50 min
Transportation customer, industrial products	Sustainability & operations development	38 min
Transportation customer, industrial products	Senior manager, logistics sustainability	39 min
Transportation customer, industrial products	Area director	30 min
Transportation customer, groceries	Logistics project manager	57 min

reached for each stakeholder group. This led to two additional interviews.

Altogether 18 interviews (with 19 informants; as mentioned, one interview had two informants) were conducted yielding 856 min of interview material. Nine interviews were conducted with informants representing transportation customers, 5 represented transportation providers and 4 enablers, respectively. Altogether, 11 companies were interviewed for the study. The distribution of the companies was determined by data saturation (Guest, Bunce & Johnson, 2006). In each category of stakeholders, additional interviews were conducted until the informants ceased to provide additional insights or dimensions to the jobs to be done. The title of the interviewees and the type of organization they work in are reported in the table below, together with the duration of the interview.

Data analysis followed the principles of qualitative content analysis that facilitate describing and interpreting the data (Assarroudi et al., 2018). Content coding has been done in Nvivo as a collaborative effort of the three authors. Content coding started once 16 of the 18 interviews have been finalized, with the remaining two interviews conducted some weeks after coding started. The coding protocol involved two steps: first, the data was coded according to the five categories of JTBD framework, namely core functional, related, emotional, consumption chain, and financial jobs. Second, content that appeared relevant for the research but did not fit under any of the JTBD codes was coded under an open code. Before starting the coding, the authors agreed on coding principles (for example coding complete sentences and including the context too). Each author focused on specific JTBD categories. In this way, each author thoroughly investigated the entire data corpus and built a strong understanding of all the empirical material. Investigator triangulation

ensured the quality of the data analysis.

After having coded the first five interviews, the authors discussed the suitability of the coding framework and ensured that their ways of coding the data were uniform. At this stage, the authors decided to add an open code to capture relevant insights of jobs that did not fit the JTBD framework categories. The open code eventually became the “Mutual reliance jobs” category. In other words, the authors added an inductive element to the analysis that supplemented the theory-based approach (cf. Assaroudi et al., 2018). The coding resulted in rich content under each theme and more specific codes. The authors identified patterns for each stakeholder group in the data and thus created an understanding of the requirements of different stakeholder groups for low-emission transportation.

#### 4. Findings

This section reports the findings from our empirical data on the different stakeholder groups’ low-emission transportation needs. We discovered that the **core functional job** for all stakeholders is **securing the transportation service with the lowest emission possible**. Transportation emissions are associated with different scopes (see Greenhouse Gas Protocol): for transportation customers are liable for scope 3 emission, (value chain related emissions) whereas transportation providers are subjected to scope 1 emission. Enablers’ relation to transportation emissions is two-fold: on the one hand, transportation requires the use of fuels, equipment or technologies provided by the enabler; on the other hand, enablers themselves purchase transportation services to ship their products. In this study, we focus on the former aspect. The findings of this study are summarized in Table 2.

##### 4.1. Transportation customers’ JTBD

Transportation customers are guided by their company’s environmental commitments when purchasing transportation. The core function transportation customers aim to achieve is to ensure their choices for transportation are on par with their company’s sustainability and decarbonization targets. They hold a heightened awareness that each choice contributes to reducing the carbon footprint at the product, service, and company level coupled with a high sense of urgency.

*We have customer pressure and our own goals and first movers coalition commitment; they are pushing us into this direction* (Head of logistics, Transportation customer)

One interviewee summarized the company rationale for cutting emissions in general, and transportation emissions in particular:

*Doing the right thing. Customer and consumer requirements. Reputational benefits. [...] essentially good and future-proof business.* (Senior Manager, Supply Chain Sustainability)

From their vantage point, this concerns both upstream and downstream transportation activities, as well as across all transportation modes. In fact, their holistic view reflects the consumption chain jobs they pursue; because their transportation value chains are without exception multi-modal, they critically assess each leg in the shipping journey in an effort to achieve consistency in emission reductions throughout the value chain.

*We have customers’ commitment, which is specifically about the value chain. It covers the transportation of our raw materials used in the production process. Transporting the intermediate products, if needed. And finally transportation to the end customer. Out of these [transportation] chains, achieving 30 percent [emission] reduction is definitely feasible.* (Head of Environment, Health & Safety, Transportation customer)

The interviewed companies wanted to position themselves as first movers, illustrated via their interest in decarbonization opportunities. We’ve identified such efforts as part of the emotional jobs category,

**Table 2**

Empirically identified stakeholders’ jobs (based on JTBD framework and data-driven coding). (Source: Authors’ own elaboration.).

Types of JTBD	Transportation customers	Transportation providers	Enablers
Core functional jobs	Decarbonization in transportation to reduce product CO <sub>2</sub> footprint	Emission reduction in own operations as per customer requests and regulation	Driving & enabling emission reductions to build demand for own products & services
Consumption chain jobs	Achieving consistency in emission reduction throughout the value chain Emission reduction on the transportation chain level	Need to develop the fleet, operating the fleet and emission reporting post-transportation Varying responsiveness to customer requests for low-carbon service	Cross selling in the value chain Developing business models to share benefits and risk
Emotional jobs	Building brand / company image and trust with customers Forerunner-position, future proofing, Long term partnerships	Customers' motivation for reduction as a driver Building brand image	Mission-driven: CO <sub>2</sub> emission reduction (e.g. use of cleaner fuels) Motivating employees for sustainability tasks Faster green transition
Purchase decision jobs	Making purchasing decisions easy Anticipated shortage of low-emission services Priorities for decision criteria come from the actor who pays	Managing the uncertainty regarding customer demand for low-emission services and regarding the functionality of technologies Balancing economic feasibility with emission reductions	Lowering transportation providers' barriers to purchasing through risk sharing
Related jobs	Positioning the company in market/ competitive edge Trust their customers know to appreciate offering Emission reporting	Dealing with uncertainty due to lacking infrastructure and alternative fuels Emission reporting (data use and sharing only to a limited extent)	Deriving more value from products with less emissions Use of verification and guarantees of origin
<b>Other types of JTBD</b>			
Mutual reliance jobs	Data and knowledge sharing	Awareness raising & expectation management Engaged customers	New operating models in the transportation value chain

including overall brand building. Besides brand building, several transportation customers stressed that being proactive in cutting emissions in transportation too is a way to future-proofing the business. It was anticipated that carbon intensive transportation will start facing increasing sanctions in the future and thus proactive behavior was an opportunity to build long-term partnerships with both their own customers and suppliers.

*I think we are at a point in time where actively engaging in emission reductions can still gain you sustainability differentiation from competitors. I also think that is a window that is closing in the coming few years. It will be the business as usual and a license to operate. So, now is the time to gain those frontrunner advantages from reducing emissions in the supply chain and in logistics specifically.* (Senior Manager, Supply Chain Sustainability, transportation customer)

To operationalize this, concrete purchase decision jobs had to be taken – first-mover transportation customers see that in coming years,

many more freight customers will be willing to purchase lower emission transportation services, and they anticipate that there will be shortages of such services available. Therefore, they engage already now with the transportation providers to secure the availability of low-emission services for their company in the nearby future.

*If you want to have the benefits of green transports, you need to act now. Because I'm sure that if all this comes true [...] about the sanctioning of fossil fuels ... then companies will be saying ... we need green transportation but they won't be able to have it because trucks are sold and there aren't any left on the market.* (Head Of Logistics, Transportation customer)

Interviewed transportation customers opened about the decision-making criteria in purchasing transportation services and emphasized sustainability factors like carbon emissions are entering the equation along price and operational efficiency. However, there are differences between downstream and upstream transportation. In the case of upstream transportation, it is often the company's own decision how much weight is given to emission reduction as a decision-making criterion. In the case of downstream transportation, customer's priorities and willingness to pay for lower emissions must be considered. In both cases, however, the difficulty of making such purchasing decision is significant.

*I have [...] four factors when I'm making a [ transportation purchasing] decision. Because I'm [...] making the decision, when decisions need to be done. [...] Sustainability is one of them. And then, of course, there is cost. And then, I'm a big fan of long relationships when it comes to transportation and logistics overall. And then, of course, performance. [...] I would say that sustainability weights 30 to 40% in the decision-making process. [...] That has been increasing over the years quite heavily actually.* (Logistics project manager, Transportation customer, groceries. Emphasis added by authors.)

The current market availability/ supply for low-emission transportation services is such that transportation customers bear the most costs, whether financial (lower emission transportation cost more) and/ or time-consuming (to filter partners across multi-modal transportation chains). There is an obvious barrier of inconvenience for the customer to purchase low-emission transportation services.

*It's not yet offered for the day-to-day business, but it's more like business case basis. So it's still rather time-consuming and so on... Because everything that is falling into the green transportation category needs to be discussed and agreed and so on. So it's not out there yet for the everyday usage.* (Senior Manager, Logistics Sustainability, Transportation customer)

We have also identified related jobs connected to the consumption of transport services. Increasingly, transportation customers need to report the emissions from the transportation services they consume. However, organizations face challenges in accessing and compiling the data:

*The issue, I think, with our company, but also many others, if I understood correctly from my colleagues from different industries, is that there isn't at the moment any ERP system [Enterprise Resource Planning; author's note] where to gather this information or how to use it... we are gathering these emission reports from our transportation providers in Excel files, which means that you cannot really use them in the future, or it's not really reliable in that way. This is what we want to change.* (Head of logistics, Transportation customer)

Therefore, gaining access to emission data regarding the services transportation customers have used easily and in a usable format for their own needs emerges a new type of requirement providers are expected to deliver. In this way, transportation customers channel downstream pressure to providers.

Transportation customers mentioned that they work with their own customers to advance the common agenda for sustainability. They saw

their efforts in emission reduction as an "investment" (increasing trust for their products with their customers) in forging long-term relationships and trusting that at least some of their customers will appreciate their efforts and commit to them over competitors.

*Those customers who are keen on [emission reductions], they have very, very clear environment policy, where they have a commitment to [reduce emissions].* (Head of network and linehaul Management, Transportation provider).

#### 4.2. Transportation providers' JTBD

The core function transportation providers aim to achieve is to decarbonize their transportation services. Transportation providers acknowledge this need and take mitigation steps. On the one hand, there are the actions which can be taken with the existing fleet such as increasing or switching to alternative fuels, retrofitting where appropriate or improving operational efficiency; on the other hand, there are acquisition of new equipment decisions to be made, many of which require investments and long-term usage to achieve capital recovery.

However, the discourse around the core function is mostly exogenous; transportation providers perceive it as a dual pressure, first coming from their customers and second as a legislative requirement. The transportation providers we examined mentioned that besides tightening legislation, customers' requirements drive their motivation to invest in decarbonization. In fact, informants stated that customer requirements precede legislation.

*Over a slightly longer timeframe, of course, it's simply a matter of staying relevant and operational within this business.* (Communications & Sustainability Specialist, Transportation provider)

*I would say that in certain cases, it's a customer driven motivation; customers ask and request.* (Head of network and linehaul Management, transportation provider)

Customers' motivation for emission reduction constitutes a key emotional job for transport providers alongside the efforts to build a positive brand image. For transportation companies, brand image is an important factor; in their view, despite the fluctuating demand from customers, they need to be able to offer lower emission transportation for both compliance reasons and gaining competitive advantages by moving first in providing such services. The uncertainty of demand for low-emission services is indeed an important challenge that transportation providers need to manage as it impacts their purchase decision jobs. Customers' sustained commitment to emission reductions and longer-term contracts was mentioned by transportation providers as an enabler of decarbonization efforts.

*To be able to order 12 ships, we also need commitment from the customer side – clients willing to agree to longer-term contracts. This provides us with the anchor customers necessary for such an order. If clients are only prepared to sign year-long agreements, it doesn't really incentivize anyone to make significant investments.* (Communications & Sustainability Specialist, Transportation provider)

The purchase decision jobs are centered around trade-offs. In practice, achieving economic feasibility means that the cost of decarbonization investments needs commitments and investments throughout the transportation value chain, with risks and benefits distributed among stakeholders.

*By committing to Science Based Targets, we naturally want to be at the forefront, not just [...] meet the minimum level that various regulations require... We definitely see that in the long run, it also improves our competitive position: we have [emission reduction] solutions to offer our customers.* (Communications & Sustainability Specialist, Transportation provider)

*[Green transportation] is seen as a "nice-to-have", but of course, we also need to have that option available. And that's precisely what we're developing. It's absolutely crucial to offer that alternative. However, it's really a shame that everyone assumes this premium service should come at the same price [as conventional transportation]. That's not very realistic when the alternative fuel costs so much more.* (Environment & sustainability specialist, Transportation provider)

Intricately linked to the same topic of economic feasibility is that of managing uncertainties related to the technologies in use. The electrification of road transportation is seen as an effective measure to cut emissions, yet uncertainties exist even here:

*Regional head office wants to know if there are huge differences across locations in Europe. Is it possible to use electric vehicles year-round? What kind of differences do we have because of our four seasons [in Finland; authors' note] compared to our colleagues in Barcelona?* (Head of Network and Linehaul Management, Transportation provider)

The execution of related jobs is also influenced by uncertainties on the technology acquisition side: it remains unclear which technologies and fuels will be adopted widely and how they'll fit with different use cases. Especially with novel fuels, the lacking infrastructure is a challenge; additionally, the lack of visibility regarding the development trajectory of the infrastructure hinders adoption.

In parallel with investments in physical equipment, the logistics service provider companies need to decide what kind of emission data they will provide their customers. In other words, there is a growing need to develop the digital component of transportation services. One interviewee explained the customers' (transportation customers) perspective:

*At the moment, we don't have a good way to collect data... currently, there is no way we can collect all the data in one place and do reports. [...] what we are doing, we are asking our partners to send us a report for a specific route and for a specific volume. And it's not actually telling us that much.* (Planning & logistics manager, Transportation customer)

From the providers' perspective too, emission reporting is still in its infancy and developing in parallel with customer requirements and expectations:

*We have a couple of standard reports, which we are capable of producing. And in most of the cases, customers are satisfied with what we are capable of providing them without [...] any modifications.* (Head of Network and Linehaul Management, Transportation provider)

In managing their consumption chain jobs, transportation providers are confronted with such reporting requirements, which is a recent addition to their job portfolio. Transportation providers report that only a limited number of transportation customers are willing to pay premiums for low-carbon transportation and feel that they need to cover a large share of the decarbonization costs themselves, including fuel and technology investments. On the other hand, some transportation providers are introducing decarbonization measures regardless of mass support from customers. This approach matches the forerunner transportation customers' notions that merely following regulation will not provide any advantage for long. Instead, decarbonization will soon be only a prerequisite for operating in the transportation market. These two approaches exemplify varied responsiveness strategies to customer requests for low-carbon service.

#### 4.3. Enablers' JTBD

Enablers are motivated by driving the decarbonization transition. The core job they pursue is building demand for their own products and services, whether renewable or synthetic fuels, technologies or consultancy services.

*We enable many companies. This is maybe the most significant aspect the handprint of our products- they help our customers seriously reduce their CO<sub>2</sub> emissions or greenhouse gas emissions.* (Head of Sustainable Logistic Solutions, Enabler)

Our interviews showed that enablers are aware of the needs of other stakeholder groups for transportation emission reduction, because they actively interact with them. The enablers appear to be well positioned to engage with both transportation providers and transportation customers. Both stakeholder groups need to gain insights into the decarbonization potential level, technological advancements in equipment, and fuel portfolio management, which enablers are able to provide.

Enablers play a crucial role in supporting transport providers in developing the trajectory of infrastructure for novel fuels. Here, the consumption chain jobs allow enablers to sell across the entire value chain.

*You have to satisfy two totally different needs. [...] there are those [customers] who want low cost. But at the same time, you want to cater to the customers who want CO<sub>2</sub> free fuels or CO<sub>2</sub> reduction. It's a dilemma for our customers most definitely.* (Head of Sustainable Logistic Solutions, Enabler)

Enablers are developing their business models to adapt to their customers' needs. In particular, benefit and risk sharing has been a central tenet of their pricing strategy, e.g. outcome-driven pricing models. By providing fuels and/or technologies that are less emitting, customers pay in accordance with product performance. In addition, the enablers appear to have a catalyst role in driving the adoption of e.g. new fuels by developing business models where they share the risks of demand fluctuation with the transportation company.

*It's not only about the regulation. It's also about the voluntary emission reductions that many companies do and offer to their customers. So there we cannot look at the regulation and see what's the optimal product.* (Solution Lead, Enabler)

From the purchase decision jobs perspective, risk sharing allows for lowering the purchasing barriers of transportation providers among the different companies in the value chain. Enablers can play an important role in tackling the adoption barriers when they help the other stakeholders in formulating a vision for fuels and technologies feasible for their use cases. Similar to transportation customers and transportation providers, enablers also emphasize the need for long-term commitment to make investments in novel technologies and production facilities economically feasible.

Regarding related jobs, enablers are in a strategic position to leverage product specific properties. Renewable fuels already require enablers to have guarantees of origin in place. Therefore, the enablers can well meet demands for increasing use and sharing of data for transparent emissions data. Together, these aspects increase the value of enablers' products and services, allowing them to derive more value from lower emitting products.

*What we are trying to achieve with renewables, because they are obviously more expensive than fossil fuels, is that the extra cost wouldn't be an issue only for the one in the middle of the value chain, but it could be sort of the value-added from the end of the value chain. Could it then be seen earlier? It would make things possible, because if you try to sell renewable energy to the man in the middle, they only see the extra cost and don't directly see the benefit.* (Solution Lead, Enabler)

In addition, enablers play a critical role in upcycling and retrofitting of transportation equipment, thus extending the life cycle amidst tightening requirements and providing know-how to transportation providers.

*The customer [transportation provider; authors' note] also needs to figure out what to do with the vessels already in operation. How to turn those to, first of all, consume less energy. Less energy consumption means less fuel*

to be burned. And then how to maybe burn fuels that are cleaner than today. (Sales director, Nordics & Northern Europe, Enabler)

On the emotional jobs side, accelerating the low-emission transition is seen as goal worth pursuing. This mission-driven approach is made operational both at the product and service level (creating low-emission fuels and technologies) as well as in skills development (e.g. sustaining employees' motivation to work on sustainability related tasks).

#### 4.4. Empirically identified JTBD: Mutual reliance jobs

In addition to the five types of jobs identified in the jobs-to-be-done framework, our analysis uncovered an additional job category that is rooted specifically in the B2B context of examination: mutual reliance jobs, with defining characteristics such as knowledge sharing, expectations and commitments, and risk mitigation. This job category emphasizes how transportation chain stakeholders reconfigure relationships more dynamically, co-creating value through reciprocity alongside contractual interdependence. Value is created by ensuring offerings in the transportation chain are complementary to each other (see below end-to-end services and data sharing) but also through emergent operating models where risks and benefits are shared in non-linear ways. Similar to the other job categories in JTBD framework by [Ulwick \(2017\)](#), mutual reliance jobs share the same focus on the job as the opportunity for value creation as well as stability over time. In contrast, compared to the other jobs, this category places a greater emphasis on first, the role of enabling technologies for data sharing and secondly, the collaborative effort of value co-creators. From the transportation chain perspective, contracts and agreements around data and knowledge sharing must still be in place to protect proprietary assets and competitive advantages. However, incentives to cooperate at the entire chain level and sharing models advance cooperation alongside formal contractual agreements. Taken together, mutual reliance jobs are about co-creating new value.

**Transportation customers** call for data and knowledge sharing. In particular, emission data transparency and comprehensive knowledge of end-to-end services with lower emissions were mentioned by multiple transportation customers as exemplified in the following quote:

*“those kind of complete solutions... with the right information [...] and then elaborate further with the provider... and also that they would have the CO<sub>2</sub> emissions [data/ reports; authors' note] ready and transparent calculation. I think that would help a lot”* (Sustainability & operations development specialist, Transportation customer)

While it is important to enforce data transparency and sharing, transport providers highlighted trade secret concerns in the data sharing process. **Transport providers** consider educating customers and managing their expectations as a solution to this challenge, as illustrated by the following example:

*“Perhaps the challenge lies in how to make the emissions calculation transparent for the customer without having to reveal our trade secrets, like load factors.”* (Environment & sustainability specialist, Transportation provider)

In addition, they mentioned risk sharing of decarbonization investments from the mutual reliance perspective. Engaged customers were seen as a necessity in the decarbonization transition to enable providers' sizable investments into novel technologies and equipment (as mentioned by the transportation providers previously).

**Enablers** seem to emphasize the need to collaboratively find new, suitable operating models, where risk and benefits are shared in the entire transportation chain. They mention building relationships with both transportation providers and transportation customers.

*“The price is always the same, but the emission reduction which the customer gets may vary. [...] What we're planning on launching is a pricing model where we guarantee a minimum emission reduction level with the basic price and then, if and when we deliver fuel to the customer*

*with a higher emission reduction, there would be an extra price on top of the basic price; then the pricing would reflect the actual value the customer gets”* (Solution Lead, Enabler)

[Table 2](#) below synthesizes all stakeholder groups empirically identified jobs-to-be-done.

As [Table 2](#) shows, each stakeholder group has some unique jobs in relation to transportation decarbonization, which highlights the diversity in their perspectives. Importantly, each stakeholder's perspective reveals some bottlenecks that hinder progress in decarbonization. For instance, transportation customers struggle with managing emission reductions at the transportation chain level; transportation providers report emissions for their specific transportation mode yet, in case of multi-modal transportation, their integration is left to the transportation customers. Transportation customers are seeking end-to-end solutions requiring data sharing across discrete transportation modes, but such services were unavailable at the time of this study. The main bottleneck encountered by the transportation providers is managing the uncertainty and economic feasibility of emission reductions. From the transportation providers' vantage point, demand for green transportation is just emerging albeit for some anchor customers. Here, long-term partnerships and commitments are key drivers for overcoming the bottlenecks. For enablers, developing new operating models and implementing cross selling solutions in the value chain are activities they are engaging in to accelerate the adoption of green transportation. The primary reason behind the bottlenecks appears to be the prevailing immaturity of the market and the green transition. On the other hand, the bottlenecks may offer fruitful opportunities for innovative solutions such as enablers' new operating and pricing models for risk sharing.

## 5. Discussion

This study seeks to answer the following research question: *What requirements do transportation value chain stakeholders have towards low-emission transportation services?* In the transportation decarbonization and sustainability context, the previous section outlined each stakeholder's jobs-to-be-done, and in doing so, illustrated the opportunities and challenges present when the investigation covers the entire transportation chain (see also [Table 2](#)). Next, the discussion of results centers around customer requirements and value creation within the transportation chain and their managerial implications.

### 5.1. Customer requirements and value creation within the transportation value chain

Customers purchasing low-emission transportation services (transportation customers) must deal with a very immature market as described in [Section 4](#). The availability of low-emission transportation services remains limited and purchasing them requires an extra effort from the customer. Thus, there appears to be a tension between the transportation customers' job for making easy purchasing decision and the transportation providers capacity to offer services packages at this stage of transition. To resolve this early-phase transition tension, the transportation providers could collaborate with enablers, but also with transportation customers, to develop services packaging.

In addition to the immaturity of supply, there are internal challenges too: transportation customers lack at times know-how and understanding of the compatibility between what transportation providers offer and what their company needs. In other words, customers are unable to evaluate the value proposition (cf. [Diderich, 2024](#)). The JTBD analysis reveals that simplifying the customer's purchasing decision is one of the most critical customer requirements for low-emission transportation services.

[Bettencourt et al. \(2014\)](#) indicates that suppliers' use of capabilities help customers to get jobs done. Building on this and our findings, we argue that transportation providers can drive the adoption of low-

emission transportation services by offering and communicating clear value propositions with tangible outcomes for the customer. The JTBD analysis demonstrates that during the current development stage of the low-emission transportation services market, it is essential to communicate the expected outcomes, i.e. the anticipated emission reductions achieved, to the customer. Instead of focusing on the technological solution, transportation providers can gain competitive advantage by communicating clearly the results their customers can expect. An additional dimension in simplifying the customer’s purchasing decision is anticipating future availability of the low-emission services and their reliability. As many transportation customers voiced concerns about the future availability of low-emission services, there is an apparent opportunity for transportation providers to help their customers in managing this uncertainty in the near future.

On the other hand, also the transportation providers need to manage risks and uncertainties in the decarbonization process that relies on various investments. Although both the transportation providers and the customers can derive benefits from mutual commitments to decarbonization efforts, both are also aware of potential harmful lock-in with the early-stage choices made. This tension calls for dialogue between the stakeholder groups; also, the enablers can bring important insights into the discussion and collaboration.

Finally, providers are somewhat struggling to make the business case for low-emission transportation services if they only follow the current logic of operating. Thus, our results from the JTBD analysis encourage providers to adopt novel pricing models and contract types. There are mutual benefits to be achieved, for instance, longer term commitments with customers and distributing decarbonization’s benefits and investments and risks throughout the value chain. This finding is aligned with [Justavino-Castillo et al. \(2023\)](#) results on customer loyalty.

Against the JTBD analysis presented in [Section 4](#), we propose two types of requirements for value creation, namely creating coalitions around shared goals for emissions reduction and development of coherent value propositions.

Throughout the transportation value chain, stakeholders expressed the need to **create coalitions around the shared goals for emissions reduction**. Stakeholders are well aware, that the sustainability transition and decarbonization efforts are systemic, beyond the agency of any single organization and requires alignment around shared goals. Although stakeholders’ vantage points are different and they all have progressed differently in decarbonization, each of them stressed the

importance of long-term commitments to tackle the desired outcome of low-carbon emission transportation. This resonates with earlier research on the multistakeholder approach to value creation (e.g. [Jaakkola and Alexander, 2014](#); [Kowalkowski et al., 2016](#)) and provides evidence of an integrative view approach ([Hohn and Durach, 2023](#)).

Reflecting on the transportation providers’ need for long-term customer commitment to manage the investment risks for decarbonization technologies, it is important to note that transportation customers also expressed their needs to build long-term relationships to secure access to low-emission services when demand for them will increase and there will be availability shortages. Enablers in turn, require transportation customers to set a high level of ambition for decarbonization and for the providers long-term commitments – for which they have devised targeted pricing and risk sharing strategies. Hence, there is similar need from all stakeholders, although the underlying motivations differ greatly (see also [Fig. 2](#)). At the same time, achieving economic feasibility is linked to the distribution of cost and rewards in the transportation chain.

Chiefly, each stakeholder *provides* much needed input around attaining the shared goals (see also [Fig. 2](#)). Enablers and transportation providers possess technical know-how, which lower emissions from transportation either through energy efficiency measures (lower emitting fuels, efficient transportation equipment) or energy conservation measures (e.g. operational efficiency when equipment is in use). Enablers, in particular, play a catalyst role in coalition building, as they have demonstrated the capacity to develop commercial models for distributing the risks and benefits of long-term commitments as well as advice both transportation customers and transportation providers regarding sustainable solutions appropriate to their needs. Conversely, transportation customers and transport providers create demand for low-emission services; transportation customers as part of their value proposition to their own end-customers and providers through the acquisition of low-emission fuels and technologies.

The collaborative efforts towards shared goals could be supported with data sharing and transparency, which is lacking in the sector. Especially the transportation providers are very protective of their data due to the fierce competition in the market and emission data is being shared only scarcely (cf. [Lodemann et al., 2022](#)). Moreover, emission data reporting is relatively new in the sector and hence the standards for emission data and routines for using the data are only developing. Building on publicly available information on the lessons learned in

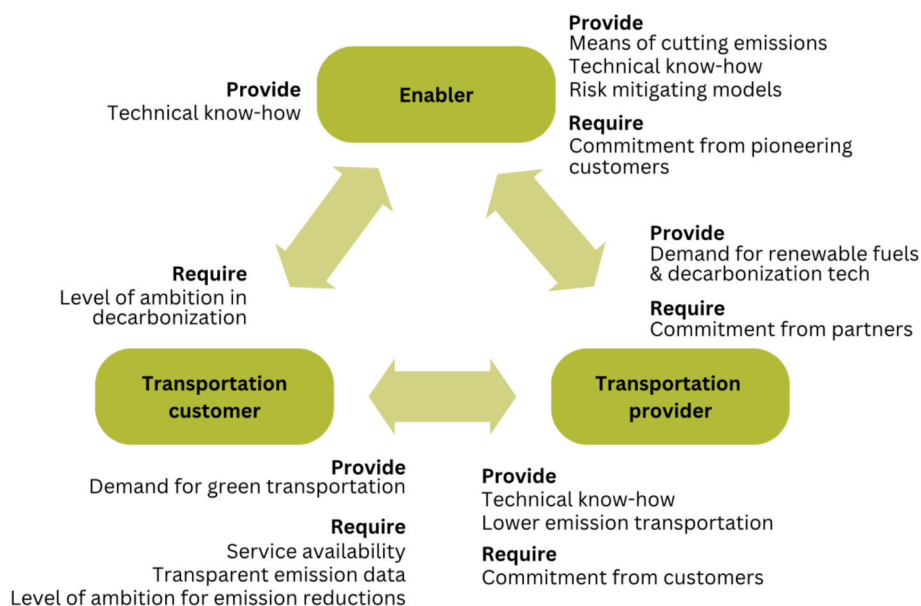


Fig. 2. Interdependencies between transportation chain stakeholders for value creation. (Source: authors’ own elaboration).

other contexts, the transportation sector actors could get started with data sharing by utilizing data governance frameworks with tiered access. Opening some data to public access, while limiting most to restricted and/or private access can serve as the initial step in data sharing.

Building on Christensen et al. (2016) notion that innovations solve problems that do not yet have a good solution, the second type of requirement is developing **coherent value propositions** for the entire transportation chain. Based on our analysis, it appears as an underlying requirement to promote decarbonization and implement concrete actions. The mix between functional, economic, and emotional value propositions dimensions reveals development opportunities in the following areas: (1) service bundling by identifying and packaging complementary services to transportation, which respond to customers' needs and aid them in their purchase decision-making, while accounting for progress in decarbonization (e.g. digital solutions for emission reporting, emission data verification); bearing in mind this might be a collective effort by multiple stakeholders (Kowalkowski et al., 2016). (2) Develop pricing strategies by aligning prices with customer value perception (cf. Bettencourt et al., 2014), making low-emission services the default option for selected customer segments (e.g. outcome-based pricing). (3) Scalability and availability by ensuring that transportation services are available and scale with increasing demand for low-emission transportation (e.g. providing reliable access as increasingly more customers will be eager to purchase low-emission transportation solutions). (4) Comparability of services by enabling customers to easily and transparently compare offerings to make informed decisions (e.g. transparency in emission calculation and explicitly communicating the expected outcome for the customer, such as 65% reduction in service CO<sub>2</sub> emission). Finally (5) emotional appeal by strengthening brand image, emphasizing futureproofing and enhancing employee engagement (e.g. to build a meaningful connection with customers around sustainability themes) (Ulwick, 2017). These insights corroborate the findings of Fracarolli Nunes and colleagues (2026) on the potential of green transportation to function as a source for value creation.

These dynamics discussed above are synthesized in Fig. 2.

Based on our analysis, the need to develop commitment and longer-term collaboration are evident in all stakeholder groups. In the case of transportation decarbonization, it is still unclear which technologies will become dominant and how quickly the demand for low-emission services increases. Hence, all parties involved need to balance between the costs, timing, and potential value-added from decarbonization investments. Earlier, Justavino-Castillo et al. (2023) stress the longevity of investment decisions in shipping. In the current highly uncertain situation, some transportation providers make purchasing decisions on ships that will operate for the next 30 years. To implement decarbonization and the sustainability transition, there is an evident need to develop the collaboration culture in the transportation sector. There is an established period of uncertainty typical for any transition, especially in the early phases; demand for low-emission services remains low beyond early movers and supply is developing slowly. Collaboration, commitment, and transparency seem to be key mechanisms for accelerating efforts.

## 5.2. Managerial implications

Based on our findings, we derive several managerial implications, which should be of interest to logistics and sustainability professionals alike.

*Make it simple and easy for the customer to purchase low-emission transportation services.* Instead of thinking about the minutia of emission reductions, transportation customers should be able to communicate the emission reductions outcomes they strive to achieve. Naturally, transportation customers need to understand the realities of emission reduction while setting their goals; here is where both transportation

providers and enablers provide the know-how of what can be achieved. Especially the enablers are able to play an important role in advancing transportation customers' understanding of the feasibility of decarbonization goals and the potential strategies in achieving the emission reductions. Enablers can educate the transportation customers in what they can require from transportation providers and where to realistically set the level of ambition. Transportation providers in turn, need to combine fuels and technologies coherently into their offerings and communicate the expected outcomes to the purchasing customer. Finally, transportation providers need to create service bundles combining emission data elements (e.g. dashboards) alongside their physical transportation services, thereby enhancing anticipatory carbon emission decision-making by the customers. The enablers are potential advisors and collaborators for novel service models.

*Ensure the reliability and availability of the transportation service.* Customers must receive relevant information for decision-making regarding the service before, during, and after delivery. As mentioned above, anticipatory but also post-service elements become increasingly important as customers seek providers who can provide value at different points in the journey: here, emission data verification and reporting post-service was stressed. Some transportation customers foresee a scenario in which demand for low-emission transport solutions will surge; hence ensuring these services are available for them in the near future is impetuous to start purchasing them already now. Transportation customers communicate the need for added visibility into the availability of decarbonized transportation services, which opens an opportunity for enablers that are perceived as neutral third parties to offer market insights that drive transparency. Building on their in-depth understanding of the availability of fossil-free fuels and/or the availability of decarbonization technologies, the enablers can find new advisors and collaborator roles in the market.

*Aim for long-term, joint commitments.* In addition to demonstrating own commitment to decarbonization, engage your customers and other stakeholders in a dialogue about the progress and the concrete plans on decarbonization. As seen, commitments to the decarbonization efforts are absolutely crucial as they require actions beyond any company's immediate control. This point is equally relevant for all the stakeholder groups examined in this study. In particular, the enablers are in a position where they can facilitate the formation of mutually beneficial collaboration models in the transportation value chain.

*Build flexibility into the pricing strategy.* Long contracts, which seem to be a preferred option for many stakeholders, call for mechanisms for dealing with fuel price fluctuation. Servitization of offering and outcome-based pricing are viable options to consider. Sharing risks and rewards has proven an effective strategy for pricing.

*As a customer, communicate the needs of your company.* Transportation customers' requirements are an important driver in transportation decarbonization. Transportation providers too need to develop an understanding of the transportation customers' future goals and ambition levels and develop their service offerings accordingly. Fostering such partnerships requires a deep understanding of what organizations can pursue together. Compared to consumers, business customers have more negotiating power in relation to the service providers.

## 6. Conclusions

This study applied the jobs-to-be-done approach in the context of transportation chain decarbonization. By investigating the B2B context, the study uncovered different stakeholders' needs and requirements, while also identifying obstacles to be removed for developing low-emission transportation services. As discussed, such services hold great potential for creating value through inter-organizational collaboration thereby amplifying decarbonization efforts at the transport chain level.

Our study contributes to logistics research in multiple ways. First, taking the value-added perspective to low-emission transportation adds

versatility to understanding innovation avenues for low-emission transportation. Second, the transportation chain level examination is rare, and as our analysis reveals, for transportation decarbonization to get implemented it is critical. Hence, our study makes an important contribution in highlighting the areas where collaborative and innovative approaches can accelerate decarbonization efforts. Third, introducing JTBD as a lens to advance low-emission transportation adoption shifts attention to the progress the examined stakeholders seek to make in decarbonization.

Our study also contributes to the discussion on customer and stakeholder needs and especially to the JTBD-framework. First, the identification of the “mutual reliance jobs” as an additional category of the jobs-to-be-done is an important contribution that extends the framework to the B2B context. Mutual reliance jobs are a distinct category of the jobs to be done as they differ from the categories in the original framework in two important ways that are highly relevant in B2B contexts: 1) business customers’ are nearly always reliant on other actors for creating value, and 2) mutuality is present in B2B relationships in different ways than in the B2C relationships. Therefore, the application of the framework in this study adds value to future B2B applications.

The study has limitations that need to be acknowledged. As this is an explorative qualitative study, our aim has been to create versatile contextual understanding. Hence, the findings are not widely generalizable. We have striven for detailed descriptions of the study process and research design choices to enable other researchers to replicate the study, which we see as particularly valuable given global supply chains. Our results are limited by the assumption that the identified jobs and requirements will hold at least in the short to medium run. When the business environment changes, stakeholders are expected to adapt their needs and requirements to seek a better fit. Our study was conducted in the Nordic context in the logistics sector. In logistics, the sustainability transitions appear to be at a relatively early stage and the market for decarbonized transportation services is immature. Therefore, our study uncovers multiple challenges that are typical in early stages of a transition. Due to the complexity of the decarbonization challenge in transportation value chain, solutions that have proven successful in other sectors might not be sufficient, which underlines the need for this and future studies.

The Nordic context on the other hand, means that EU emission regulation applies and thus the regulatory context is similar to many other sub-contexts within the EU. At the time of the study, the emission regulations were tightening and required actions also from the less engaged companies. Moreover, in the Nordics, goods are transported relatively low volumes over long distances in quite varying conditions. All in all, this implies that if emission reductions can be achieved in this context, those are probably feasible in several other contexts as well. Hence, the insights generated here need to be interpreted in their context.

Inspired by the findings of this study and the aforementioned limitations, we propose multiple avenues for future research. Most importantly, further examination of the mutual reliance jobs in other B2B settings is needed to validate the concept. In addition, transportation decarbonization context is in a flux due to various external forces including fossil fuel prices and uncertainties in regulation. Therefore, besides building on these findings, future research needs to update the contextual insights and dynamics.

In this study, the needs of the stakeholders are analyzed at the organizational level. Future research could further dissect needs depending on the interviewee’s position in the organization (e.g. logistics vs. Sustainability departments). Such in-depth examination could facilitate understanding of the adoption of decarbonization solutions for goods transportation within and across organizations. With this exploratory study, we have identified elements of value propositions including communication strategies, pricing, and service availability, which would benefit from further research and interdisciplinary analysis from communication, strategy, and business model development for

low-carbon solutions. Finally, the data sharing aspects and especially the data governance mechanisms that remain beyond the scope of this study are very relevant theme for future research to investigate.

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## CRediT authorship contribution statement

**Taina Eriksson:** Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Titiana Ertiö:** Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Fuad Khan:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

The data that has been used is confidential.

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