Initiating a Dialogue and Designing a Collaborative Framework for Decarbonizing Logistics: A Concept Note

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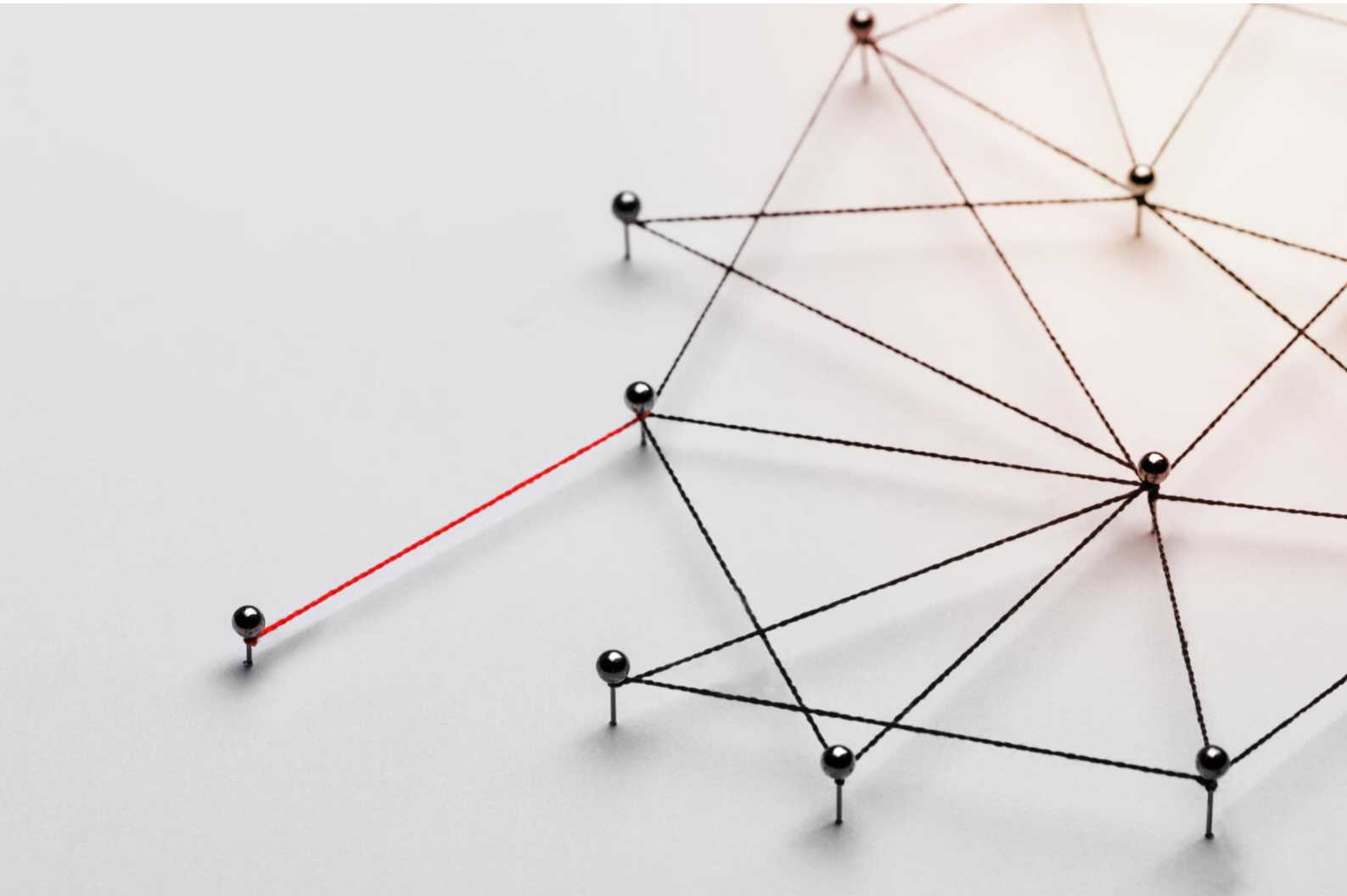
Smart Freight Centre

ALL CHIEFS



Abstract

Logistics decarbonization needs to accelerate to meet the climate goals as agreed under the Paris Agreement. Many recognize that collaboration across supply chains is a necessary ingredient to achieve decarbonization, but it is not always clear what this collaboration looks like in practice.

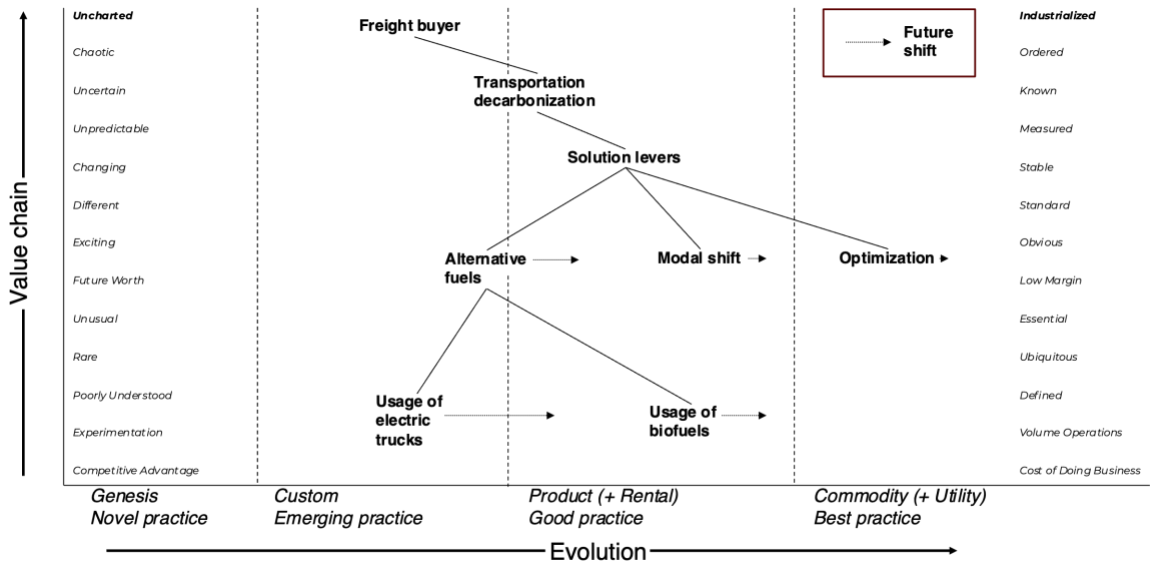
With data gathered from 20 semi-structured interviews with leading members of the Sustainable Freight Buyers Alliance (SFBA), Smart Freight Centre (SFC) has developed an approach that can help guide efforts around decarbonization roadmaps and that can shed more light on the supportive role that collaboration can play. This approach specifically focuses on three solution areas: optimization of logistics networks and increasing utilization; shifting to more sustainable transport modes and achieving multimodal logistics; and adopting zero emission technology and fuels such as battery electric trucks.

An integral part of this approach is the technique of Wardley Mapping, which is often used to depict a business landscape. In a Wardley Map, the evolution of a product or service can be evaluated, and its associated uncertainty can be assessed. There are multiple stages with different levels of maturity, ranging from novel to emerging to good and ultimately, best practice.

The interviews conducted as part of this study confirm that transport decarbonization is moving from an ‘emerging’ to a ‘good’ practice. Leading companies, including members of the Sustainable Freight Buyers Alliance, are taking active efforts to make transport decarbonization a mainstream activity. Unfortunately, this is not yet common practice for the rest of the sector.

The levers to achieve transport decarbonization can be mapped in different stages as well. For example, logistics optimization to increase efficiency in logistics is already considered a best practice, whilst data sharing of logistics transport flows to optimize across organizations is only an emerging practice. Similarly, modal shift is receiving renewed interest due to the potential for emissions reduction. Furthermore, the adoption of battery electric trucks is rapidly moving from a nascent market and emerging practice to a growing market and good practice.

Effective collaboration requires the recognition of this stage of maturity of the decarbonization levers. In the novel practice stage, collaboration can take place in the form of pilot projects to validate what works and what doesn’t, whilst in the emerging practice stage, collaboration entails partnering with existing and new providers of innovative solutions to expand the offering of differentiated experiences to customers. In the good practice stage, collaboration can help bring the market to scale by, for example, pre-competitively determining the minimum standards needed in the industry for further adoption. In the best practice stage, collaboration will help to institutionalize the new rules of the game. It is important to acknowledge that this classification of the types of collaboration for each maturity stage is only meant to serve a general guideline. In practice, collaborative projects will be highly customized and heavily influenced by context.



Wardley Map of generalized decarbonization solution levers for transportation with expected future shifts. Wardley Mapping originally created by Simon Wardley, provided under Creative Commons Attribution-ShareAlike 4.0

Independent parties, such as the Sustainable Freight Buyers Alliance (SFBA), play an enabling role in these collaborative projects. SFBA, for instance, is well positioned to serve as a neutral, mediating party for other participants, thereby becoming the facilitator of confidential data sharing. SFBA can also help establish pre-competitive industry standards, provide guidance, and determine methods to accelerate collaboration.

For each of these maturity stages, a differentiated approach is needed to foster collaboration. Through its range of initiatives, SFBA will foster these perspectives and provide support in developing pilots and setting pre-competitive standards in decarbonizing logistics. By using the approach outlined in this text, SFBA will provide an analytical framework for members and other stakeholders such as the wider industry, government entities, financial institutions, and research institutes. It will also provide recommendations for action that are consistent with this perspective.

SFBA will also continue to guide and mobilize the industry towards logistics decarbonization through its collaborative initiatives and will work with selected partners on piloting new technologies and providing a trusted network to exchange confidential data that will help identify matchmaking opportunities.

Table of Contents

1 Introduction and approach

This concept note examines how freight buyers[1] can work together towards decarbonization of logistics. To gain insights, a series of semi-structured interviews were conducted with selected freight buyers who are members of the Sustainable Freight Buyers Alliance (SFBA). These members stem from various industrial sectors, such as Fast-Moving Consumer Goods (FMCG), pharmaceuticals, fashion, chemical, manufacturing, and technology sectors. The interviews focused on understanding members' progress with their decarbonization roadmaps and exploring opportunities for collaboration with other SFBA members in the European Union (EU) and USA. When discussing collaboration, the focus has mainly been on land operations (such as road freight, rail, and inland barge) rather than on air and ocean modalities. The interview process was supported by Smart Freight Centre's implementation partner, AllChiefs.

This paper analyzes several key decarbonization solutions and their varying levels of maturity through the lens of Wardley Mapping. Based on this, a general assessment of the feasibility of current sustainable logistics roadmaps is provided, as well as the function that collaboration could play within them. A recommendation on how to support collaborations is also proposed.

2 Decarbonizing logistics

In today's world, most companies accept that it is their responsibility to take action to decarbonize their own operations (Scope 1 and 2) and their up- and downstream supply chain (Scope 3). Many have determined and published overall decarbonization targets, which have cascaded down to individual business functions. In many sectors, logistics constitutes a sizeable portion of the total emissions footprint (for example within the beverage sector, transportation, and distribution amount to 10-20% of total emissions).

Furthermore, logistics is considered to be a hard-to-abate sector, one that is highly dependent on fossil fuels. Decarbonization solutions that are presently available are expensive and not very mature. In addition, the transportation market is fragmented, highly competitive, transactional, and aimed at short time horizons, hindering companies' efforts to jointly aim for holistic targets. Policy interventions are complicated by the international nature of logistics, as they often involve many jurisdictions.

Various solution levers exist to reduce Greenhouse Gas emissions (GHG). In this concept note, the following solutions levers are discussed:

- Optimization of the logistics network to reduce inefficiencies.
- Implementation of modal shift by shifting transportation towards lower emission intensity modalities.
- Adoption of low-emission fuels or energy sources.

Other ways to decarbonize the logistics industry include reducing the overall demand for freight and increasing the energy efficiency of current transport modes. These are outside the scope of this concept note. In his book *Decarbonizing Logistics* (2018) Alan McKinnon provides a comprehensive review of decarbonization solutions.

2.1 Solution levers

2.1.1 Optimization of the logistics network

While optimization of the logistics network encompasses a range of different approaches, in this concept note, we focus on optimizing the existing network, so that the distance driven (km or miles) is reduced and assets are utilized more intensively. This achieves a reduction in Greenhouse Gas (GHG) emissions and often monetary costs. Logistics players, often faced with small margins, have long relied on optimization to increase profits. Within the realm of ground operations, typical optimization activities include:

- Network redesign, the relocation of factories and warehouses to be closer to customers and/or suppliers, which can lead to lower demand for transportation.
- Optimizing routes and reducing empty backhaul by taking data driven decisions and combining flows.
- Optimizing loads. This can be achieved in many ways, such as by mixing heavy and light goods for an optimal weight/volume ratio, or by combining delivery volumes for delivery addresses in the same areas.
- Increasing the vehicle capacity, such as by employing duo trailers.

[1] companies that rely on logistics service providers to transport their goods (also often referred to as freight buyers)

2.1.2 Implementation of modal shift

Modal or intermodal shift is the act of reorganizing logistics to use transportation modes with a lower GHG emission intensity per tonne-km (CO_2e/tkm), i.e. a lower GHG emissions per transport activity. One example would be to change from road transport to inland waterways or rail, or to shift from air to ocean. If, in addition, alternative fuels are used to power inland waterways or rail, there is an additional decarbonization impact of modal shift. This can reduce GHG emissions significantly, as shown in figure 1.

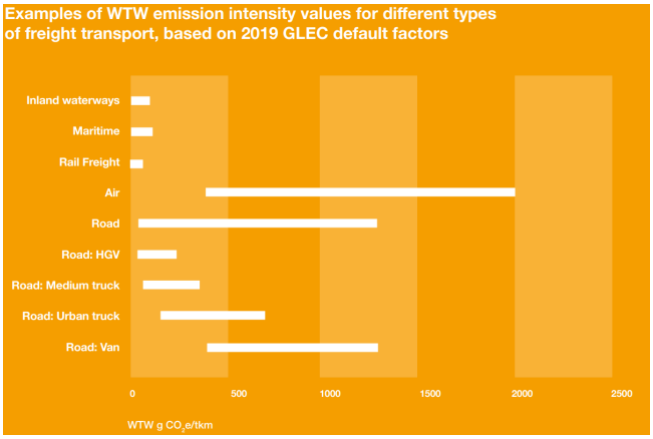


Figure 1 Comparison of emission intensity of different transport modes (Smart Freight Centre, 2023)

2.1.3 Adoption of alternative fuels

The term “alternative fuels” is often used to refer to both drop-in fuels (such as biofuels or synthetically created fuels) that burned in adjusted internal combustion engines, as well as new energy carriers that are used by different drivetrains, such as electric motors and hydrogen fuel cells. The main upside of these technologies is that they provide the same or similar transportation services while burning low emission fuels with lower GHG emissions or by utilizing renewable electricity.

Drop-in fuels are fuel types that allow for the use of existing engine types. Examples of this include hydrotreated vegetable oil (HVO) for use in trucks, sustainable aviation fuel (SAF) for airplanes, and biofuels for ocean-going vessels. Experts and critics have questioned how much of these solutions can be produced sustainably and whether there is adequate bunkering and refueling infrastructure to support their use.

Alternative drive train technologies require a different type of engine. Energy sources include methanol, ammonia, hydrogen and electricity, among others. Alternative drive train technologies are rapidly maturing and becoming more widely available. Besides a switch in drive train, they also require a change in energy infrastructure, which is complex to achieve and requires an ecosystem approach that also includes the energy sector.

For the adoption of alternative fuels, the focus of this concept note is on battery electric trucks for road freight operations, because it is the most energy-efficient and effective solution, while drop-in biofuels are a potential short-term solution. For ocean transport, there are various biogenic fuel types that seem promising. For aviation, the current focus is on scaling up production of sustainable aviation fuels (SAF).

2.2 Maturity of solution levers

The three decarbonization solution levers listed above are at different stages of maturity. This strongly impacts what a company can achieve with these solution levers today. This is demonstrated in Figure 2, where a Wardley Map depicts the value chain while mapping the evolutionary state of each of the value chain’s components. The Wardley Map is anchored by the user (in this case a ‘freight buyer’) and their need for transportation decarbonization, which in turn depends on various underlying components. Everything moves from left to right as the components of the value chain evolve, though not necessarily at the same pace. This evolution is due to supply and demand competition.

Each solution lever will have sub-components with their own levels of maturity. For example, alternative fuels (mainly focused on road freight) might be a relatively ‘good’ practice, while its subcomponent, usage of electric trucks, is only an ‘emerging’ practice. For ease of understanding, the Wardley Map has been simplified and sub-components from other solution levers have been omitted.

A Wardley Map recognizes four maturity stages (more details can be found in appendix (1):

- **Genesis, or novel practice**: in this stage, new solutions are tried for the first time. It is an area of a lot of action as well as a lot of failure, leading to a better understanding of a new solution.
- **Custom, or emerging practice**: in this stage, differentiated and tailor-made solutions are offered, based on learnings from the genesis stage.
- **Product, or good practice**: in this stage, more standardized solutions are provided than in the previous stage. There is already some consensus among market participants on what the product should look like. This is a stage of rapid growth, as standardization allows for scaling up.
- **Commodity, or best practice:** in this stage, the solutions become more standardized. The focus is on volume operations. The usage of the solutions is the cost of doing business.

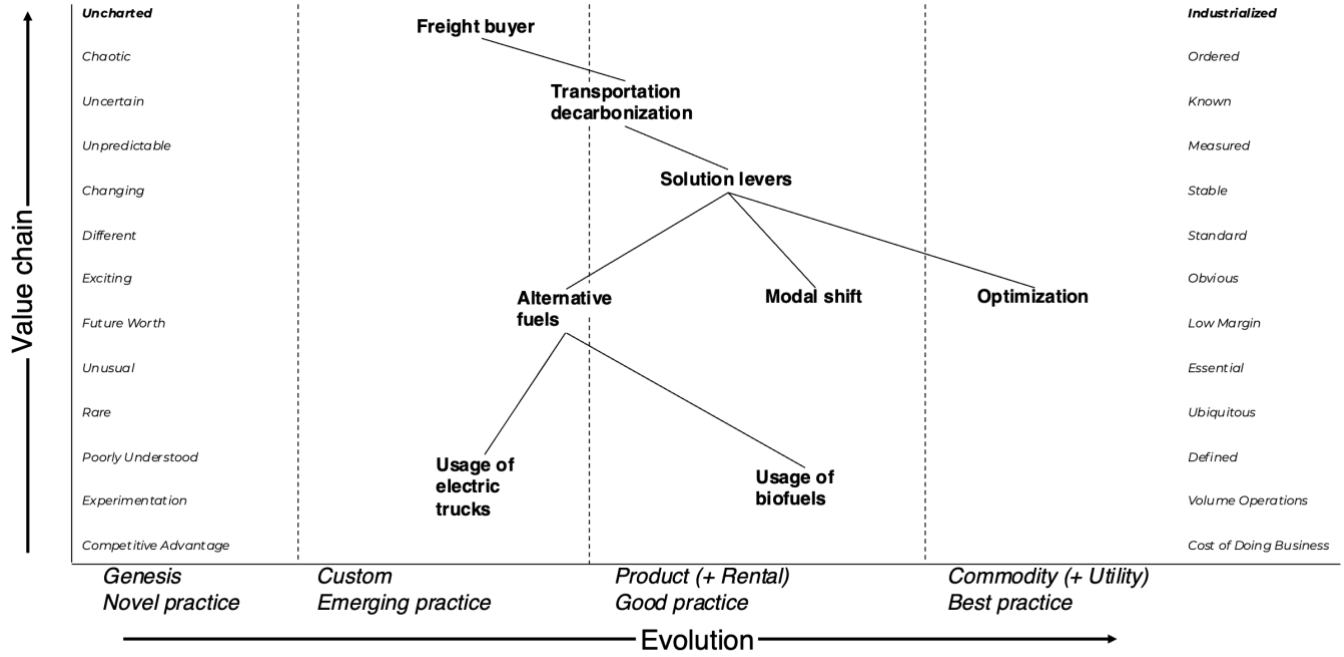


Figure 2 Wardley Map of generalized decarbonization solution levers for transportation with selected alternative fuel solutions. Wardley Mapping originally created by Simon Wardley, provided under Creative Commons Attribution-ShareAlike 4.0

The following can be said about the solution levers and their sub-components:

- **Optimization is the most mature solution lever.** It exhibits a high level of certainty about how to optimize. It is ubiquitous and essential to operations. It is classified as a best practice.
- **Modal shift is a less mature solution lever.** There is a lower level of certainty here than with optimization how to execute it, and it is less ubiquitous. It is classified as a good practice.
- **Alternative fuels are the least mature solution lever.** It is much more uncertain than the other solution levers, and therefore brings more uncertainty what the future will hold, what roadblocks will emerge, and how to move forward. It is classified as an emerging practice. Below this solution lever, there are two subcomponents that have been identified: usage of electric trucks (including trucks, charging and operations) and usage of biofuels (including vehicles, fueling and operations). As can be seen in the Wardley Map, these have different levels of maturity, and thus different challenges for further market development.

The evolutionary differences between the various solution levers have a large impact on the certainty of deployment of solution levers. Optimization is the most certain and alternative fuels are most uncertain of the solution levers depicted.

3 Company roadmaps for decarbonization

SFBA members who were interviewed for this study have expressed ambitious GHG reduction targets for both Scope 1 and 2 emissions, as well as substantial reduction targets for Scope 3 emissions. These targets vary by sector, ranging from -30% to -70% of their GHG emissions by 2030. To achieve these targets, members have developed decarbonization roadmaps that outline their focus areas and the aforementioned solution levers for decarbonization over time. These roadmaps provide clarity to the business regarding where to invest and deploy resources and what the intermediate goals should be.

These roadmaps are the result of a strategy process in which the freight buyers determine the optimal route to achieve decarbonization targets over time. There is a wide array of focus areas (such as geography, activity, function, modality, etc.) and solution levers (alternative fuels, modal shift, and optimization) to choose from. Choices are also made about what to do individually and what to do collaboratively. A particular challenge here is negotiating through the typical dilemma where “what is good for me in the short term (do nothing) is not good for the group in the long term (transition should start right now).”

Within these roadmaps, it is important to realize that members from different sectors have different

transportation profiles, and thus different opportunities for decarbonization. For example, a FMCG company often transports most of its goods by road due to regional production facilities, whereas a fashion company will predominantly use ocean and air shipping as its production facilities are often more remote from its customer markets. This impacts what is possible to pursue in decarbonization.

In the strategy process, there are also some complicating factors that need to be considered:

- Most members have outsourced the majority of their logistics operations to Logistics Service Providers (LSPs) or directly to carriers, thereby reducing their control over day-to-day operations. This impacts the freight buyer's ability to follow an ambitious decarbonization roadmap. Most of the members interviewed expressed a willingness to support their LSPs in making the transition towards a more sustainable way of working, with some members sharing that they have been involved in active discussions with their LSPs for years. Others indicated that they have yet to start these conversations.
- Many members expressed that at this time, they have little to no budget available to invest in sustainability, and therefore, new interventions need to pay for themselves. They often expect carriers to carry the burden, which is unrealistic with their low margins. Possible solutions include providing longer-term contracts, paying 'green premiums', or governments mandating the inclusion of externalized environmental costs.

Even though the resulting roadmaps differ according to each member, there are some striking *similarities*. For instance, most members generally tend to have similar focus areas for the short-term and mid- to long-term in their decarbonization roadmap:

- Short term:
  - Continued focus on further optimization of logistics operations, to reduce empty mileage and increase filling rates of trucks and vessels.
  - Replacing air freight with maritime freight and seeking to achieve intermodal operations using road/rail/inland waterways/short sea.
  - Small-scale implementation of biofuels and testing of alternative fuels (such as electric trucks).
- Mid to long term:
  - Focus on adopting and scaling the use of alternative fuels (electric trucks, biofuels for maritime and air freight).

In the short term, many tried-and-tested solutions, particularly optimization and to some extent modal shift, are preferred. The implementation of these often also reduces overall cost, quickly recouping the initial investment. In addition, many members are conducting trials with alternative fuels, to learn how these work and to understand what changes these could bring about in their logistics operations.

In the longer term, members see alternative fuels as the most important building block to decarbonize logistics. If it would be possible to decarbonize using just optimization and modal shift, it would have been done already. Their interest comes from the observation that the adoption of alternative fuels can lead to close to zero GHG emissions (in all modalities). They also have an incentive to help make these technologies more affordable for their LSPs and carriers, as these are the entities executing the actual transportation.

Regarding alternative fuels, many members expressed that they would like to implement new alternative technologies at scale more quickly than the market currently allows. They differ in their outlooks regarding the maturity and rate of adoption of alternative fuels — mainly electric trucks and deployment of hydrogen technology.

However, there are also *differences* between members' roadmaps and outlooks. There is significant variation in members' maturity on the topic of logistics decarbonization. Some members are at the forefront whereas others are slowly finding their footing.

Other differentiated findings amongst members include:

- Some have high-level roadmaps, but miss some of the more nuanced details. For instance, some did not have insight into which trade lanes are the biggest GHG emitters, or which lanes offer the most potential to shift to clean fuels.
- Many are in the process of an internal transformation to integrate sustainability into all parts of their business, including in their global branches.
- Many lack the data to really track and monitor progress.

All in all, a lot of progress has been made, but more effort is needed to achieve the ambitious targets communicated by the members.

4 Collaboration for decarbonization

4.1 Overview of collaboration

Collaboration is a way of working together that makes it possible to share resources, risks, capabilities, and opportunities in a joint and seamless way. This differs from cooperation, where the relationship is not as in-depth.

Companies can do a lot by themselves to decarbonize their logistics emissions. However, collaboration increases the array of options that are available. For example, using modal shift or adopting alternative fuels together can lead to reduced emissions and often, cost savings. It can also alleviate risk aversion by distributing the risk among all involved parties.

On the flipside, there are various costs associated with collaboration. There is the initial start-up cost (both in terms of time and money) associated with the process of finding a compatible partner(s) and then establishing the collaboration. There is also the cost of the collaborative solution itself (i.e., investments in warehouses, trucks, etc.). Finally, there are ongoing coordination costs once the collaboration is up and running. Members voiced concerns that collaboration could mean giving up flexibility, which many companies are reluctant to do.

Companies can choose from a wide variety of decarbonization projects, such as the electrification of their fleets or reconfiguring their supply chains. Some of these changes can be done by themselves, while others require a more collaborative effort. Examples of collaboration include participants optimizing routes by combining complementary flows, jointly purchasing electric trucks, co-locating assets, and operating semi-public charging stations collaboratively.

It is therefore important to companies that collaborative projects deliver obvious benefits that exceed any investments, and that they are more beneficial than if the freight buyer were to undertake the initiative alone.

Collaborations can be used in a wide range of situations to achieve a wide scope of objectives. The exact make-up of the collaboration will be highly dependent on the context (i.e., market developments, availability of partners, maturity of objective, etc.) and internal position (i.e., whether the collaboration is more operational or strategic, the organization's maturity, available resources, etc.) and the objectives to be achieved. As a result, almost all collaborations will be tailor-made. This also means that it is relatively difficult to provide generalized criteria to determine the success of a collaborative effort. Failures in the set-up and operational phases are also a possibility. However, members did share some insights on how to set-up a fruitful collaboration:

- Start small, then replicate.
- Less players means a higher chance of success, but often a lower reward.
- Make sure early in the process that the reward is sizeable enough.
- Align early on company strategy (and accommodate for differences that arise).
- Be mindful of the effect of management-level changes.

4.2 Role of collaboration in decarbonization

The task ahead to decarbonize the global transportation ecosystem is a substantial one. It requires that all potential tools available to move forward are used. Collaboration will be a potent and necessary tool to support transportation decarbonization for a number of reasons:

- Full decarbonization of the transportation ecosystem is a challenge that is too large and impactful for any individual freight buyer to achieve by themself.
- There are several transportation decarbonization technologies that require an ecosystem approach involving many types of stakeholders to succeed (e.g., electrification), which requires collaboration.
- Numerous facets of transportation decarbonization need further development, such as scaling up production and deploying sustainable aviation fuels, where collaboration can be an immense help.
- The transport ecosystem is highly fragmented, making collaboration a useful lever to get to scale and have a more comprehensive overview of the opportunities to optimize and thus decarbonize the transportation landscape (i.e. match complementary flows).

Not only does it make sense theoretically to collaborate, a number of organizations within the transportation eco-system have shown that it is possible to collaborate successfully to decarbonize. Some examples include:

- Retailers and FMCG companies collaborating on modal shift from road to rail to transport heavier FMCG products (packaged waters) to retailer warehouses.
- A furniture retailer and a clothing company collaborating on modal shift from road to rail to transport goods by sharing an international (block) train in opposite directions.
- Multiple companies collaborating to jointly explore the option of sending a demand signal and possibly even purchasing electric trucks to help accelerate

future supply, as showcased by the activities of SFBA's Fleet Electrification Coalition (FEC)
- Multiple companies collaborating to jointly purchase sustainable aviation fuel (SAF) as showcased by the Sustainable Aviation Buyers Alliance (SABA)
- Many companies collaborating to build confidence and appetite for investment in zero-emission fuels and technologies across the maritime value chain as showcased by the Zero Emission Maritime Buyers Alliance (ZEMBA)

These examples make clear that collaboration can support transportation decarbonization. Hopefully, it will encourage many companies to explore whether collaboration for decarbonization makes sense in their situation and context.

4.3 Freight buyers' interest in collaboration for decarbonization

All members showed interest in collaboration to decarbonize. However, members indicated different levels of aggregated interest in collaborating on the various solution levers:

- Alternative fuels: high interest mainly focusing on electric trucks, coming from most members, because they see electric trucks as a necessity to achieve Net Zero goals in the future.
- Modal shift: medium levels of interest, both towards rail and inland barge, with interest mainly coming from members with heavier and/or bulkier cargo, because they see an opportunity to reduce carbon emissions in the near future.
- Optimization: medium interest, with interest mainly coming from parties with heavier loads, because they see an opportunity in the near future

In general, individual members' interests varied widely, and there were outliers from the above-stated trends. For instance, some freight buyers with the heaviest cargo profiles were very interested in working collectively on optimization even though the aggregated interest was medium.

It was striking to observe the varied experiences that members have had in collaborative projects. One stated, "*We hardly ever collaborate,*" with another saying, "*We have done many collaboration projects.*" Most members lie between these two extremes. *"We believe it is important to get better at the skill of collaboration," said one member.*

A number of members shared success stories of operational vertical collaboration (within the value chain) with their customers or suppliers. Significantly less examples were shared by members for operational horizontal collaboration (collaborating with companies at the same place in a different industry and value chain, e.g. a FMCG company collaborating with a fashion company).

These findings correspond to the trends and patterns identified in academic literature. While operational vertical collaboration is widely practiced, there are numerous untapped opportunities for further optimization. For example, studies have shown that despite decades of logistics optimization, 25% of freight vehicles in Europe run empty and 50% run with partial load (Y. Sheffi, 2020) This presents a compelling case for increased operational horizontal collaboration to reduce inefficiencies.

Even though the apparent benefits of operational horizontal collaboration seem high, their occurrence is rather low. Studies indicate that the main reasons for the perceived unattractiveness of horizontal collaboration are that in practice, "the return is too low, and it is complicated to achieve" (G. Kant, 2020). It is possible that large-scale IT solutions that have access to a significantly larger set of flows can provide further impetus here. Another possibility is to support a culture change among transportation companies. A more comprehensive overview of this topic can be found in *Cross-Chain Collaboration in Logistics: Looking Back and Ahead* (F. Cruijssen, 2020)

Some members shared an interest in an ecosystem type of collaboration where multiple stakeholders from different industries jointly work on a topic and come together in a pre-competitive setting. The typical example here is advancing the adoption and usage of electric trucks, where it makes sense for companies to jointly collaborate with freight buyers, LSPs, carriers, original equipment manufacturers (OEMs), charge point operators (CPOs), and possibly even electricity providers and grid operators.

4.4 Collaboration for decarbonization in an evolving ecosystem

There will be future developments for each solution lever impacting the state of the industry, which will impact the types of collaboration that are deemed interesting and how these collaborations can be approached.

An overview of these market advancements or evolution can be found in a Wardley Map (figure 3) which visualizes anticipated shifts in the future. An important note is that these shifts don't correspond to exact predictions, but are more generalized forecasts.

The following anticipated trends are represented in the Wardley Map:

Usage of electric trucks: Given the need to achieve ambitious decarbonization targets that can't be met with optimization and modal shift alone, a key solution lever is alternative fuels especially battery electric trucks. This seems to be widely recognized, as there are many government and private sector initiatives at play today. Furthermore, given the rapid decrease in cost for electric batteries, mainly driven by the adoption of passenger vehicles, electric trucks will likely achieve cost-parity with diesel trucks in the near future. On an ecosystem level, these developments will likely accelerate the adoption of electric trucks.

To support this accelerated adoption of electric vehicles, organizations can choose to invest time and money both by themselves or together with others. In this context, the benefit of collaboration with other organizations is that it allows for quicker learning about the underlying technology and its usage. This sentiment was echoed by members who expressed an interest in collaborating on the adoption of electric vehicles. This is especially relevant for members with large portions of total emissions coming from road freight.

Usage of biofuels: this is also expected to advance. Given the expected additional demand in the near future, not in the least driven by EU legislation demanding sizeable decarbonization results for road freight by 2030, the market will continue to develop. Collaboration can help to further scale the market and is especially relevant for those members which will be impacted by EU legislation. Sustainable aviation fuel (SAF) is also expected to advance as a result of rising demand.

Alternative fuels solution lever: the effect of accelerated electric truck and biofuel usage is that the alternative fuels solution lever will also advance.

Modal shift solution lever: there is also some evolution to be expected here, especially in Europe with the EU trying to elevate the state of rail, as well as some technological innovation such as digital (de)coupling so that no humans are required to (de)couple rail cars. There are also opportunities to harness the power of demand signaling through collective action, including when it leads to the opening of rail depots at favorable locations. For members who might be looking for a (more pronounced) intermodal shift, it makes sense to focus their collaborative efforts here.

Optimization solution lever: there will be some advancement here. There are also some opportunities for innovation, such as jointly creating end-to-end visibility of the entire supply chain to be able to further optimize flows through the use of better algorithms powered by Artificial Intelligence (AI). Companies

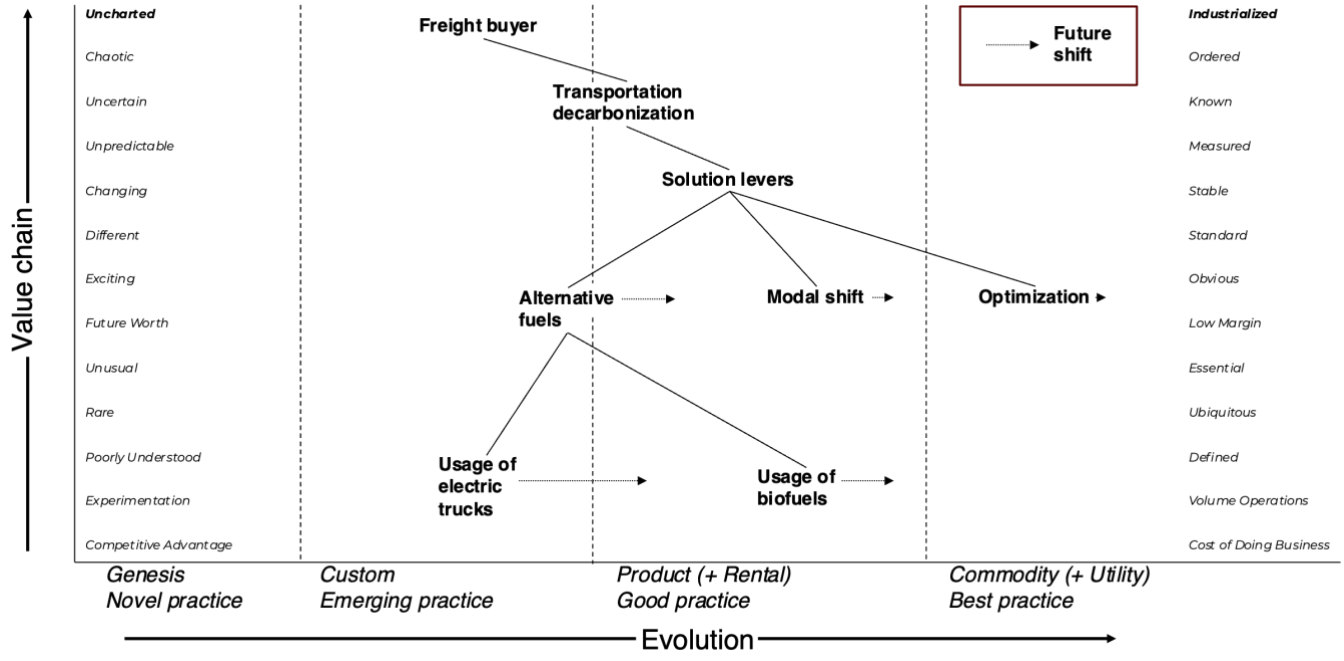


Figure 3 Wardley Map of generalized decarbonization solution levers for transportation with expected future shifts. Wardley Mapping originally created by Simon Wardley, provided under Creative Commons Attribution-ShareAlike 4.0

looking for decarbonization gains from optimization might want to collaborate here.

When looking at opportunities for transportation decarbonization from an ecosystem perspective, it is important to focus (collaborative) attention on advancing alternative fuels, especially electric trucks. However, this should not be done at the detriment of the other solution levers: modal shift and optimization.

4.5 Characteristics of collaboration on decarbonization

Given the different maturity profiles (see Figure 3) of the solution levers for decarbonization, collaboration will look different in each case, as illustrated in the Wardley Map. Obviously, as components shift to another stage, the characteristics change (see Appendix 1). It is important to note that below each listed component there will be many sub-components at various stages of development, which will need tailored approaches to collaboration, if and when used. One such example is the different approaches required for the electric trucks and biofuels sub-components.

Another inspiration on the topic of collaboration is the book *Changing the Game* (L. Simons, 2021). It offers an interesting perspective on what type of actions actors (industry, government, NGOs, financial institutions, and research institutes) can take to accelerate the evolution of sustainability-related solutions within an ecosystem. This approach is based on a four-stage model of market evolution that is similar to the one used in Wardley Maps. All these supportive actions are listed by stage and by actor in Appendix 2.

Using the insights from both Wardley Mapping and the book, *Changing the Game*, the following can be stated about different types of collaboration (where an NGO can play a role) for each maturity stage:

- In the **Genesis stage,** the focus is on conducting lots of experiments to gain some understanding of the field. This translates into the opportunity to collaborate on pilot projects to validate what works and what doesn't.
- In the **Custom stage,** the focus is on offering tailor-made solutions based on the insights gained in the Genesis stage. Many market players will offer competing solutions. Collaboration entails partnering with existing and new providers of innovative solutions to expand the offering of differentiated experiences to customers.
- In the **Product stage**, the focus is on offering more standardized solutions that allow the industry to achieve scale. Collaboration can help to pre-competitively determine the minimum standards needed for further adoption and scaling. Another example is to jointly purchase goods or services.
- In the **Commodity stage**, the focus is on achieving and maintaining volume operations. It is important that everyone plays by the same rules. Collaboration can help to institutionalize the new rules of the game.

It is important to acknowledge here that this classification of the types of collaboration by maturity stage is only meant to serve as a general guideline. The use of collaboration is always highly customized and heavily dependent on context.

In conclusion, the following can be stated:

Usage of electric trucks: Given its position in the emerging practice stage, many uncertainties exist around the technologies and their applications. Existing solutions are often tailor-made. A lot of innovation needs to take place, with participation of multiple stakeholders. By approaching this work jointly, risks can be reduced, and possible outcomes can be enhanced. A lean approach is necessary to be able to quickly integrate new findings. In combination with the general difficulties of setting up any collaboration, it can be challenging to participate in this kind of innovation, if the willingness to accept failure is low.

An ecosystem approach is needed, where collaboration is likely to include many different parties, such as charge point operators, OEMs, carriers, etc. Many different types of projects can be initiated to further the adoption of EVs. Several areas can be identified:

- To increase the supply of trucks, a collective demand signal can be provided to the vehicle manufacturers, with the possibility of doing a joint tender, which would ideally deliver better trucks at lower cost.
- To boost the availability of charging, it is possible to collaborate with infrastructure entities and providers and other transportation parties to set up charging infrastructure, either in a public, semi-public (also known as shared) or private manner. Semi-public charging requires in-depth collaboration.
- To enhance knowledge on how to operate electric trucks and enable adequate infrastructure in a seamless manner, collaborative pilot projects can be initiated to learn about the best operating models.

Usage of biofuels: given its position in the good practice stage, it holds that this component is already more mature than the usage of electric trucks. This causes less uncertainty about outcomes and thus warrants a different approach, more aligned towards creating the conditions for further scaling of the market.

Alternative fuels: This component is situated in the emerging practice stage, but is transitioning to the good practice stage. This is the least certain of the

collaborative solution levers and consists of two sub-components: usage of electric trucks and usage of biofuels.

Modal shift: This component is situated in the good practice stage. Compared to other solutions, the challenge is mainly in finding partners with complementary flows to make a compelling business case. Modal shift also has infrastructure challenges, which can be tackled jointly. There is less certainty here than in optimization, for which collaborating partners need to prepare. Most collaborations in modal shift will be about supporting further scaling of the market. Given its maturity, one possibly interesting type of collaboration is to review whether the lack of common standards in certain areas is holding back further adoption.

Optimization: This component is situated in the best practice stage. Given its maturity, a lot is known about its application. There is a lot of certainty about how to execute projects in this realm. The main challenge compared to other collaborative solutions is finding companies with complementary flows and successfully navigating the potential pitfalls of any collaboration process between separate organizations. Most of the collaborations in this space will be about optimizing volume operations, resulting in additional volumes, or unlocking more degrees of freedom to optimize upon.

4.6 An independent intermediary can foster collaboration

As stated before, collaboration is generally not easy. There are many dimensions to be aware of in creating a fruitful collaboration. There are a number of hurdles to overcome in the overall collaborative process:

- There is the challenge of matchmaking, which is the act of finding suitable potential partners who are interested in exploring collaborative opportunities.
- Collaboration can only be done when there is trust between parties. As the saying goes, “Trust is hard to gain but easy to lose.” Parties often have to consciously work on building trust. One workaround can be to focus initially on collaboration initiatives that require little management of continuous decision making (i.e., install joint charging infrastructure).
- There is an inherent difficulty in the need to align various actors who might not have complementary ambitions, interests, flows, etc. When designing a collaboration, great care needs to be given to operational, financial, and human concerns.
- A collaboration often lasts for a longer period of time, and many things can happen in the outside world that can possibly affect the collaboration (i.e., management changes, supply shocks, etc.). It is important to design a collaboration that can withstand these external and possibly internal shocks.
- Some actors might be operating in the same competitive space, making it very difficult to share information amongst the participants of a potential collaboration due to anti-trust laws. Practical concerns need to be taken into consideration when designing a collaboration.

An independent and neutral party can help alleviate or even overcome some of these hurdles. This was reiterated by many members during the interviews. It could help with building trust. Such an entity can play a role as a neutral party during negotiations and facilitate the confidential sharing of data in accordance with anti-trust laws.

5 Conclusion

The logistics sector has a challenge in the years ahead to decarbonize further. This paper explored three potential solution levers for decarbonization: optimization, modal shift, and alternative fuels (with the selected sub-components of usage of electric trucks and usage of biofuels). These solution levers are at various levels of maturity, with optimization being the most developed and alternative fuels the least mature. Of these three solution levers, alternative fuels are the lever that has the potential to bring the most GHG emission reduction in the years ahead, as modal shift and optimization can only provide so much in terms of reduction potential. The roadmaps drawn up by the members show similar thinking, with the majority of reductions coming from alternative fuels. The expectation is that within alternative fuels, the usage of electric trucks will rapidly expand in the near future, as significant resources from both government and private sector are flowing into the solution lever. Attention has also been directed, especially in the EU, to further developing rail, which will likely result in further development of the modal shift solution lever. Optimization will also likely progress with data technology advancing.

Members’ decarbonization roadmaps indicate that, in general, there is consensus about the way ahead. In the short term, the focus is on optimization, modal shift, and testing of alternative fuels. And in the mid- to long-term, it will be on the adoption of alternative fuels, especially electric vehicles, at scale. However, there are major differences in maturity among members. Some are further ahead and actively trying to push the ecosystem forward. Others have recently started on their journey to decarbonize. All of these are positive contributions to the decarbonization ambition, but it is likely that more

efforts from everyone in the ecosystem is needed to achieve zero emission logistics.

Collaboration can accelerate the achievement of members' roadmaps, as it expands the number of opportunities made available by sharing resources, and capabilities with each other. However, it should not be undertaken lightly as it also bears a cost. Transportation decarbonization is conducive to collaboration for a variety of reasons, the most important being that many developments need an ecosystem-wide approach. There are some appealing examples of successful collaboration in transportation decarbonization.

Looking at the solution levers and their likely evolutionary trajectories, it is important to adjust the approaches to collaboration depending on the maturity of the solution levers. Collaboration on the deployment of alternative fuels is most promising as these collaborations will not only benefit the individual freight buyer but the ecosystem at large, as it accelerates the rate of collective learning.

The nature of the collaboration is heavily influenced by the maturity of the specific components under consideration. In the beginning, pilot projects allow participants to jointly discover what does and doesn't work. Subsequently, partnering with innovative solution providers allows for the offering of differentiated solutions. In the next stage, it is vital that the differentiation is reduced to certain standards, which can be done pre-competitively. This helps with scaling. In the last stage, joint efforts will lead to institutionalization of the 'new normal. These guidelines can help determine the most valuable type of collaboration, keeping in mind that collaborations are always tailor-made and highly dependent on context.

Despite the complexities involved in making a collaboration successful, it is possible to navigate the uncertainties and ensure that the collaboration is off to a good start. The first step is to identify how mature the solution lever is, and the amount of uncertainty involved. This can be done using a Wardley map. The second step is to identify common needs and connect partners and solutions. A trusted intermediary, such as SFBA, can play a pivotal role in facilitating this collaboration, by not only acting as a neutral and confidential platform for sharing data among stakeholders, but also by providing access to a wealth of deep industry knowledge about decarbonization strategies, sharing of examples and best practices, gained through their community and network of industry partners.

Lastly, it is important to acknowledge that every collaboration is unique and is often accompanied by challenges. Therefore, participants must be ready to embrace the uncertainty that might follow. The SFBA is designed to help participants navigate this uncertainty together.

The journey ahead towards a decarbonized logistics ecosystem may be complex, but collectively, we can achieve our decarbonization goals through collaboration, collective determination, and commitment.

About Smart Freight Centre: Smart Freight Centre is a globally active non-profit organization for climate action in the freight sector. We are enablers for those who believe in united action to reduce logistics greenhouse gas emissions. Through creating a single, international methodology for tracking

freight emissions we drive transparency to enable emission reductions. Smart Freight Centre brings together multinationals, forwarders & carriers, NGOs, and governments in our collaborative initiatives, trainings, and programs. Together, we help solve the business challenges behind reducing freight emissions and impact the industry standards. Our goal is to guide the industry to track and reduce its GHG emissions by 1 billion tonnes by 2030 and reach zero emissions by 2050 or earlier.

About AllChiefs: AllChiefs is a B-Corp consultant specialised in sustainable logistics. It has the ambition to accelerate the path towards net-zero logistics by helping companies from strategy to execution. It strongly believes that people are the key to the success in this journey. It brings people together, challenges, supports and accelerates. AllChiefs supports companies in logistics emissions calculation and reporting, logistics sustainability strategy and target setting, roadmap creation, change management programs and GHG insetting.

Appendix (1) Wardley Map characteristics by evolutionary stage overview

Wardley Mapping originally created by Simon Wardley, provided under Creative Commons Attribution-ShareAlike 4.0

Phase/stage	1	2	3	4
Activities	Genesis	Custom	Product (+rental)	Commodity (+utility)
Practices	Novel	Emerging	Good	Best
Data	Unmodelled	Divergent	Convergent	Modelled
Knowledge	Concept	Hypothesis	Theory	Accepted
Ubiquity	Rare	Slowly increasing consumption	Rapidly increasing consumption	Widespread and stabilizing
Certainty	Poorly understood	Rapid increases in learning	Rapid increases in use/fit for purpose	Commonly understood (in terms of use)
Publication type	Normally describe the wonder of the thing	Build / construct / awareness and learning	Maintenance / operations / installation / feature	Focused on use
Market	Undefined market	Forming market	Growing market	Mature market
Knowledge management	Uncertain	Learning on use	Learning on operation	Known/accepted
Market perception	Chaotic (non-linear)	Domain of experts	Increasing expectation of use	Ordered (appearance of being linear) / trivial
User perception	Different / confusing / exciting / surprising	Leading edge / emerging	Common / disappointed if not used or available	Standard / expected
Perception in Industry	Competitive advantage / unpredictable / unknown	Competitive advantage / ROI / case examples	Advantage through implementation / features	Cost of doing business / accepted
Focus of value	High future worth	Seeking profit / ROI?	High profitability	High volume / reducing margin
Understanding	Poorly understood / unpredictable	Increasing understanding / development of measures	Increasing education / constant refinement of needs / measures	Cost of doing business / accepted
Comparison	Constantly changing / a differential / unstable	Learning from others / testing the water / some evidential support	Feature difference	Essential / operational advantage
Failure	High / tolerated / assumed	Moderate / unsurprising but disappointed	Not tolerated, focus on constant improvement	Operational efficiency and surprised by failure
Market action	Gambling / driven by gut	Exploring a “found” value	Market analysis / listening to customer	Metric driven / build what is needed
Efficiency	Reducing the cost of change (experimentation)	Reducing the cost of waste (learning)	Reducing the cost of waste (learning)	Reducing the cost of deviation (volume)
Decision drivers	Heritage / culture	Analysis & Synthesis	Analysis & Synthesis	Previous experience

Appendix (2). The transformation stakeholder activity matrix

To effectively support the development of sustainability-oriented solutions, stakeholders need to consider the solutions' evolutionary maturity, when deciding what action to take (Changing the Game Lucas Simons, Andre Nijhof 2021).

Phase/stage	1	2	3	4
Focus	Inception	Competitive advantage	Pre-competitive collaboration	Institutionalization
Stakeholder/ Activity				
Industry	Stop denying the issue	Develop sustainable business models	Communicate a non-competitive agenda	Lobby for the new normal
	Partner with NGOs or other stakeholders	Differentiate by introducing new business models and labels	Form or join platforms	Recognize leading politicians
	Pilots, CSR projects, support or partner with foundations	Engage value chains	Be inclusive when others want to join	Comply with legislation
	Identify solution principles	Participate in rankings and benchmarks	Develop a sector strategy	Take on subsequent issues
Government	Embrace the crisis	Emphasize long-term vision	Develop policy goals and measures	Show political leadership
	Communicate a long-term vision	Challenge market actors on principles	Support platforms and coalitions	Announce legislation
	Make space for experiments and fund projects	Be a launching customer	Influence behavior of consumers	Create the new normal
	Identify solution principles	Recognize market leaders	Change tax incentives	Remove the laggards
NGOs	Raise awareness about the crisis	Reward first movers	Support frontrunners, pressure laggards	Lobby the government
	Be involved in projects	Support pro-active corporate strategies	Join platforms	Communicate with policy developers
	Campaign against the laggards	Name and shame the laggards	Be a watchdog	Monitor progress
	Set agenda for the next step	Emphasize that it is time to move on	Create transparency about the desired future	Shift attention to new issues
Financial institutions	Donate to charity projects	Provide funding to frontrunners	Join platforms with tax and finance expertise	Lobby the government
	Finance projects via foundations	Provide financial benefits for sustainable business models	Collaborate with other financial institutions	Integrate new criteria in investment policies
	Apply negative screening to end relationships with high-risk clients	Engage with all clients, especially the laggards	Create financial solutions for scaling	Exclude unwilling clients
	Be clear about the strategic positioning of the financial institute	Apply best-in-class screening	Link long-term investments to the new normal	Communicate potential risks linked to new issues
Research institutions	Prioritize urgent issues	Showcase good practices in education and research	Continue to put pressure on change agenda	Provide overview of various policy instruments
	Study system loops to create awareness about the underlying problem	Study best practices and investigate failures	Be objective in studying the arguments for and against a new normal	Argue for specific evidence-based policy instruments
	Learn from emerging practices and disseminate knowledge	Develop benchmarks and communicate periodic results	Calculate the potential impacts of the new normal	Monitor impact of the new policies
	Identify good practices and showcase them	Define research agenda that could lift the entire market	Support lobbies with scientific evidence	Identify new and emerging issues

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