

The emergence of a collaborative innovation process: following a translation process

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Abstract

Collaborative innovation processes have emerged as a force within the landscape of organizational innovation. We explore the emergence of collaborative innovation processes from an Actor-Network Theory and Science and Technology Studies perspective, focusing on the role of focal organizations. We analyze two cases: the creation of international guidelines for avoided emissions and the development of a mandatory reparability index in France. Using a processual approach, we identify three key steps in the emergence process: pioneering, negotiating and aligning. Our findings show that each step involves successive translation processes extending the network of actors both within and outside organizations. Also, innovations become Obligatory Passage Points, stabilizing knowledge and contributing to organizational legitimacy. Furthermore, collaborative initiatives lead to realignment phases within organizations. This research enriches the existing literature on collaborative innovation emergence by providing insights into the dynamics and implications of the process.

Keywords: collaborative innovation - ANT - translation process

1. Introduction

In the dynamic landscape of organizational innovation, collaborative innovation processes have emerged as a pivotal force, signifying a departure from traditional paradigms. It involves multiple individuals, actors, or organizations collaborating to innovate across traditional internal and external boundaries. This term weaves through the rich tapestry of innovation literature (Cillo et al., 2019 ; Hund et al., 2021 ; Witell et al., 2016 ; West and Bogers, 2014).

A collaborative innovation process implies diversity to foster creativity, and a common higher purpose for participants, while involving their influence in the collective process. It navigates the intricate realms of organizational coordination and decision-making (Ollila and Yström, 2016). The literature review reveals a multifaceted landscape, encompassing the collaborative development of innovation by multiple organizations (Bogers & West, 2010). Analyzing the emergence of collaborative innovation, understood as the period of time between the emergence of an idea and the launch of the innovation resulting from the collaborative process (Dedehayir et al., 2018). is an important step in understanding and characterizing the forms of collective action it implies. However, despite the growing number of collaborative innovation cases in the literature, the role of organizations in the emergence of collaborative innovation remains little studied (Autio and Thomas, 2014 ; Gawer, 2014).

An Actor-Network Theory (ANT) and Socio-Technical Systems (STS) perspective can enhance our understanding by framing innovation as a translation process. According to early ANT works, the process of translating involves moving innovation across spaces and time (Latour, 1987). This process includes problematization, interestment, enrollment, and mobilization, which are key moments that emerge as a crucial lens (Callon, 1986). This perspective is useful for understanding collaborative innovation processes, treating innovation as an active entity in the actor network designed through translation processes.

The research questions are: How can an organization contribute to the emergence of a collaborative innovation process? How can the ANT and STS perspective, which frames innovation as a translation process, account for an organization's contribution in this emergence?

To investigate collaborative innovation processes, we draw on two case studies, analyzing the role of a specific organization in the emergence of such processes. The first, of which Organization A is at the origin, focuses on the development of the Decarbonization of Clients (DoC) methodology. Organization A shifted its strategy from being an “energy provider” to an “energy saver”¹, which led to the genesis of DoC, a methodology accounting for the avoided emissions for their clients' carbon footprint. The DoC journey was a collaborative effort - first internally, then with business partners - resulting in global guidelines communicated by the World Business Council for Sustainable Development (WBCSD). The second case concerns the creation of the French Repairability Index, inspired by Organization B's initial work in response to consumer expectations. This index, driven by a private initiative, has had a significant impact on manufacturers, encouraging them to improve the design of their products, to make them more repairable (Bergmann et al., 2023). The two cases highlight the way in which these initiatives have evolved from internal methods to collective endeavors, leading to the creation of national and international standards.

The paper is organized as follows. First we review the literature on collaborative innovation and outline the theoretical framework of the paper. Then, we delve deeper into the methodological aspects, providing a closer look at the actors, processes, and translation dynamics that shaped these initiatives. In the following section, we highlight the path from

¹ We use the term “energy saver” to emphasize the strategic importance of energy solutions within the organization, and the transformation towards decarbonization (both internally and externally through the decarbonization of customers).

internal efforts to large-scale standardization, by analyzing the role of an organization in initiating and orchestrating a collaborative process. Finally, based on these case studies, we draw broader implications for organizations embarking on these processes.

2. Literature Review

2.1. Collaborative innovation

2.1.1. Collaborative innovation as a multi-organization process for innovation

The concept of collaborative innovation stems from a strategy-oriented literature, which highlights the different forms it can take : alliances (Faems et al., 2008 ; Todeva and Knoke, 2005), clusters (Cumbers et al., 2003 ; Connell et al., 2014), networks (Dittrich and Duysters, 2007 ; Tidd, 1995), open innovation (West and Bogers, 2014 ; Ollila and Elmquist, 2011), innovation ecosystems (Oh et al., 2016) or user innovation (Bogers et al., 2010 ; Baldwin and Von Hippel, 2011). Beyond these specific forms of collaboration for innovation, collaborative innovation is defined as “*innovation activities or innovation processes involving multiple actors, organizations or individuals transcending boundaries (within or across organizations) with the purpose of creating and developing new products, services, policies, processes or business solutions*” (Yström and Agogué, 2020). It is therefore a relatively broad term, corresponding to a wide range of situations in which actors combine knowledge, technologies and other resources to innovate (Davis and Eisenhardt, 2011). In line with the literature, in the remainder of the paper, we consider “collaborative innovation” as a process, and “innovation” as the result of this process.

2.1.2. Organizations’ involvement in orchestrating collaborative innovation processes

Collaborative innovation is challenging insofar as it leads heterogeneous actors, guided by different rationales, with varied and evolving preferences and agendas, to work together. Determining and achieving objectives is therefore an ongoing and uncertain process, as the participants may not be able to reach a stable consensus (Nissen et al., 2014 ; Rindova and Kotha, 2001). Ollila and Yström (2022) illustrate this well, underlining the way in which political behaviors can shape spaces for collaboration.

The literature on collaborative innovation addresses these issues by analyzing the way organizations orchestrate the collaborative innovation process (Dhanaraj and Parkhe, 2006), that is to say the processes through which actors organize the sharing of knowledge (Elmquist et al., 2016 ; Bogers, 2012), organize their collaborative endeavor, and co-design coordination and decision-making processes across boundaries (Lavie et al., 2012 ; Tihanyi et al., 2014). For example, previous research has highlighted the role of intermediaries in the transfer of knowledge and interaction between different actors, thereby strengthening coordination and cooperation (Howells, 2006 ; Himmelman, 1996). In a similar vein, other works, such as those by Ollila and Yström (2016), point to several parameters that actors put forward to manage collaborative innovation processes, including the need to be creative actors in collaboration, or the need to define a unifying overarching common goal. These works are in line with the idea that organizations manage knowledge mobility, innovation appropriability and network stability, to keep participants involved and maximize the benefits of diversity. While these papers study the role of organizations in orchestrating established collaborative innovation processes, others focus on the role of organizations in the emergence of collaborative innovation processes.

2.1.3. Organizations' role in collaborative innovation emergence

If the concept of emergence remains largely understudied (Adrot, 2023), including in the field of collaborative innovation (Autio and Thomas, 2014 ; Gawer, 2014), a few articles focusing on collaborative innovation genesis, birth, or emergence, understood as “the span of time that stretches from an initial discovery or invention, to the commercialization of an innovation” (Dedehayir et al., 2018) have been published.

These articles identify distinctive phases of collaborative innovation processes (Dedehayir and Seppänen, 2015 ; Thomas and Autio, 2013), and account for the roles of the organizations, and the key processes they implement at the different stages. Thomas and Autio (2013) define three phases: initiation, momentum and optimization, initiation corresponding to the initial idea development, momentum to the ecosystem growth and optimization to the refocus from expansion to value appropriation.

These phases echo those highlighted by Moore (1993) when studying ecosystems. He proposes that ecosystems progress through the phases of birth, expansion, leadership and self-renewal (or death), underlying the crucial position of ecosystem leaders in the birth phase, who secures the cooperation of key organizations, protects the innovation idea from competitors, while forging strong ties with channels of delivery. Dedehayir et al. (2018) who characterize the role of various organizations in the emergence of collaborative innovation also emphasize the key role of leaders in early phases : organizations that undertake a leadership role in the birth of a collaborative innovation process engage in governance related actions and are able to catalyze and accelerate the process of coalescence. Daymong and Knight (2023) analyze for their part the role played by collaborative innovation architects, that consists in deploying strategies to make actors cooperate, to help stabilize the network of organizations during the emergence process. Going beyond the identification of the roles of organizations, Thomas et al. (2022) characterize 4 processes that organizations manage : value discovery, collective governance

(regulation of participation), resource acquisition, and contextual embedding (legitimation in wider societal context).

However, in most research, the very first stages of emergence, i.e. the initiation of the process and its impact on shaping the collaborative innovation process are not studied. Indeed, most studies highlight the key roles of organizations, or key processes at work in collaborative innovation emergence, but do not trace their origin, the way they were initiated. On the contrary, when identifying these key roles and key processes, researchers often presuppose the existence of a collective. In this article, we aim to trace the emergence of collaborative innovation from its earliest stages, from the perspective of collective action. Like Chiles (2004), we consider that the interest of the concept of emergence lies in its focus on the shift from the absence to the existence of some organization, in this case, from the absence to the existence of collaborative innovation.

To document the emergence of collaborative innovation processes, this article traces the emergence of two collaborative innovation processes through an analysis of the role played by key organizations behind them. Indeed, these two cases fall within the framework of collaborative innovation, insofar as, following Yström and Agogué (2020), they correspond to innovation activities involving multiple actors, crossing boundaries, with the aim of developing new instruments, to account for avoided emissions or the reparability potential of a product. In this work, emergence is considered as the period which extends from the appearance of the idea of innovation, to its deployment on the market (Dedehayir et al., 2018), or in our two cases from the idea of a private instrument with the organization, to the deployment of the collective instrument at a national or international scale.

In order to analyze the emergence of these collaborative innovation processes, an ANT and STS perspective is adopted. Indeed, a relational perspective on emergence is taken : emergence

is considered as a process that unfolds across a network of relationships (Garud et al., 2015 ; Lichtenstein, 2016).

2.2. An ANT and STS perspective

2.2.1. Innovation as a translation process

Actor-Network Theory (ANT) is interested in the process by which “things, people, and ideas become connected and assembled in larger units” (Czarniawska, 2017, p. 164). Callon and Latour (1981) emphasize how sociology can study the creation of actors and macro actors, by following some *actants*, which can be beings or things, like instruments or technologies. These actants come into a *network* through a series of *trials of strength* that they can win by attracting new allies. Aka (2019) and Aka and Labelle (2021) have shown how much impact ANT works still have on innovation research, especially through the concept of *translation*. Indeed, in early ANT works, innovation is developed, diffused and stabilized through a translation process entailing the creation of a network of actors (Callon, 1986b; Latour, 1987). Translation is a transformation process of moving something - in our case an innovation - over time from one space to another (Czarniawska, 2017), or a process of “creating convergences and homologies by relating things that were previously different” (Callon, 1980, p. 211). This translation process requires different actors to negotiate over the innovation (Callon, 1986a), which implies an evolution in the meanings, claims, and interests of the actors with regard to innovation (Wæraas and Nielsen, 2016). The key moments of this translation process, that do not necessarily come in a linear fashion, but are rather intertwined, are the following: problematization, interestment, enrolment and mobilization (Callon, 1986a).

Translation process key moment	Conceptualization
Problematization	“They [the researchers] determined a set of actors and defined their identities in such a way as to establish themselves an obligatory passage point in the network

	<p>of relationships they were building. This double movement, which renders them indispensable in the network, is what we call problematization.” (Callon, 1986a)</p> <p>“Efforts to convince others to subscribe to their own view by showing they have the correct solutions” (Alcouffe et al., 2008)</p> <p>“When actors offer problem statements and seek to convince others that they have the correct solutions (Wæraas and Nielsen, 2016)</p>
Interestment	<p>“The group of actions by which an entity attempts to impose and stabilize the identity of the other actors it defines through its problematization” (Callon, 1986a)</p> <p>“The construction of the interface between the interests of the various stakeholders and to the strengthening of links between various interests (Alcouffe et al., 2008, based on Lowe, 1997)</p> <p>“The strengthening of the links between the interests of various actors” (Wæraas and Nielsen, 2016)</p>
Enrollment	<p>“It designates the device by which a set of interrelated roles is defined and attributed to actors who accept them. Interestment achieves enrolment if it is successful. To describe enrollment is thus to describe the group of multilateral negotiations, trials of strength and tricks that accompany the interestments and enable them to succeed.” (Callon, 1986a)</p> <p>“The creation of alliance networks, the aim of which is to build up agreement among the stakeholders concerning their interests” (Alcouffe et al., 2008)</p> <p>“The participation of actors and their acceptance of their role in prioritizing a particular problematization” (Wæraas and Nielsen, 2016)</p>
Mobilization	<p>“A set of methods used by the researchers to ensure that supposed spokesmen for various relevant collectivities were properly able to represent those collectivities and not betrayed by the latter” (Callon, 1986a)</p> <p>“Refers to the monitoring of the various interests so that they remain more or less stable” (Alcouffe et al., 2008, based on Mouritsen et al., 2001)</p> <p>“Concerns the maintenance of the network by ensuring that spokespersons act according to its interests.” (Wæraas and Nielsen, 2016)</p>

Table 1: Conceptualization of key moments in the translation process

Based on the conceptualization of key moments in the translation process in the literature (Table 1), we consider problematization, interestment, enrollment and mobilization as follows.

Problematization involves formulating a problem and framing a relevant solution, with the aim

of establishing the initiators as an indispensable focal point in the evolving network of relationships. *Interestment* involves identifying common interests, using strategic approaches to engage actors and propose distinct roles. *Enrollment* indicates the acceptance of defined roles by actors, transitioning from conceptual acceptance to actionable participation, contingent upon the success of the preceding interestment stage. *Mobilization*, in turn, indicates the stabilization of the network through a form of monitoring and governance, ensuring the continuous re-alignment of the involved spokespersons interests with the network's.

By focusing on the emergence of networks, ANT offers us a useful lens for better understanding the setting up of a collaborative innovation process. Also, by treating innovation as an actant, ANT provides keys for tracing the translation process that took place to diffuse and stabilize this innovation.

2.2.2. Creating new knowledge through a process of framing

Innovation entails the creation of new collective knowledge, from the design of the innovation to its stabilization within an organization. From an STS perspective, knowledge creation stems from a social process. Latour and Callon work show how knowledge becomes stabilized through their embodiment in technical instruments or systems (Latour, 1984, 1987). By becoming Obligatory Passage Points (OPPs), this knowledge is institutionalized and standardized (Callon, 1986a).

The making of OPPs comes with a process of “framing”, i.e. establishing what the boundaries of the issue and its solutions are. It entails intensive work to make controversial issues like decarbonization “tractable, calculable and amenable to some form of standardized definition and solution.” (Cowell and Webb, 2021).

The process of translation is closely linked to the making of OPPs. Creating these OPPs and navigating through the controversies requires creating a network of actors and going through a translation process. The resulting OPPs are embedded into a network of actors, which will act and perform the stabilized knowledge (Czarniawska, 2017).

These concepts can contribute to a better understanding of a collaborative innovation process, by highlighting the mechanisms for translating, and creating OPPs through framing, implemented by organizations that initiate a collaborative innovation process.

3. Method

In light of our research aim to explore an organization's role in fostering collaborative innovation, particularly through the lens of ANT and STS, which conceptualize innovation as a translation process, we employed a qualitative research approach utilizing multiple case studies. While theoretically one case study suffices for constructing a logically sound argument (Yin, 2013), conducting replications enhances the reliability of findings. By slightly altering relevant criteria in subsequent replications, we aimed to assess the applicability of initial findings to slightly varied contexts (Hillebrand et al., 2001). Our methodology centered on a translation process assumed to encompass the entirety of collaborative emergence stages (as detailed in 2.2.1). Hence, we opted to examine two case studies to evaluate whether the process and the actors involved remains consistent or varies. Our selection criteria included variations in maturity levels of the innovation process, differences in industry, and the accessibility of cases for detailed interviews and document analysis.

3.1. Research Setting

The analysis of collaborative innovation processes is based on two cases, both involving the creation of a new instrument. One is about the making of international guidelines for the

calculation of avoided emissions, and the other about the creation of a mandatory repairability index in France. The emergence of both instruments spanned over several years: from 2019 to 2023 for the guidelines on avoided emissions; and from 2017 to 2021 for the French repairability index.

In both cases, a single organization drove a collective endeavor, leading to the emergence of a network of actors to negotiate the characteristics of the collective instrument. Both cases showcase an instrument being disseminated, starting from an internal innovation at an organization level, to a collective instrument recognized at a field-level. At the same time, these cases present singular characteristics (Table 2). These specificities make their joint analysis enriching for a finer understanding of the emergence of collaborative innovation processes.

	Avoided Emissions Guidelines	Repairability Index
Scale	International	National
Scope of application	Industrial, cross-sector	9 categories of products in the electrical and electronic equipment sector
Collaborative innovation participants	Business actors	Mix of business, public and civic actors
Evolution of collaborative innovation leader	Organization A, then CEO-led organization	Organization B, then public organization
Instrument	Generic industry guidelines	Product-specific standardized index
Enforcement type	Voluntary	Mandatory
Degree of discretion	Medium	Low

Table 2 : Avoided Emissions Guidelines and Repairability Index specificities

In the rest of the article, the companies involved in the making of the guidance of avoided emissions are named “Organization A” and the one involved in the making of the French reparability index “Organization B”.

3.1.1. The guidance on avoided emissions

Avoided emissions accounts for the decarbonization impact of a given solution. It is the result of a comparative assessment between a scenario including the use of a given solution, and a hypothetical scenario where the solution is not present. In other words, avoiding emissions is considered to occur when a company’s products and services are used to decrease or prevent greenhouse gas emissions.

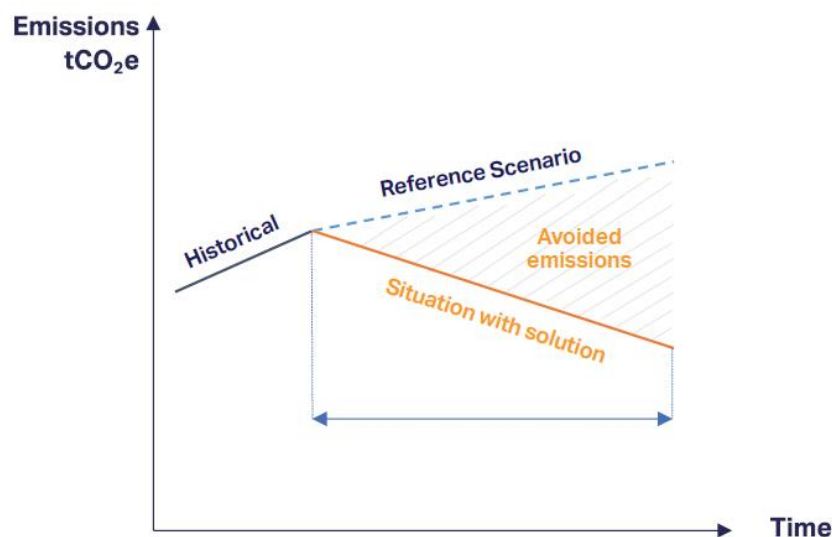


Figure 1: Avoided emissions (Guidance on Avoided Emissions: Helping business drive innovations and scale solutions toward Net Zero, 2023)

This guidance aims to provide clear instructions for companies to contribute further to global decarbonization by measuring avoided emissions through a robust and rigorous methodology. The ultimate goal is to achieve harmonization across different approaches to measuring avoided emissions.

The guidance to account for avoided emissions consists of 5 steps, the last being optional (Figure 2).

1. Determine the timeframe for evaluating avoided emissions: The timeframe should align with the anticipated lifespan of the solution and the reference scenario. This step necessitates establishing the duration by which the avoided emissions will be evaluated.
2. Specify the reference scenario: This step involves defining the reference scenario that serves as a basis for comparison of the solution's emissions. The baseline scenario should depict the most probable outcome if the solution were not implemented.
3. Next, evaluate the life cycle emissions of the solution and baseline scenario, encompassing all emissions related to production, usage, and disposal of the solution.
4. Lastly, evaluate the avoided emissions. This stage requires calculation of emissions avoided by finding the difference in life cycle emissions between the solution and the reference scenario.
5. Optional stage 5 involves aggregation of avoided emissions across various solutions and geographies to estimate total avoided emissions for the company. This step is optional, but its inclusion can provide useful insight for decision making.

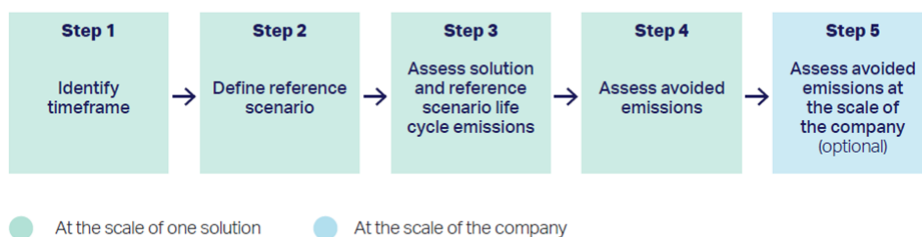


Figure 2: The five steps of the guidance to account for avoided emissions (Guidance on Avoided Emissions: Helping business drive innovations and scale solutions toward Net Zero, 2023)

The development of this guidance is the result of collaborative efforts between diverse actors. It implicated the World Business Council for Sustainable Development (WBCSD) - a CEO-led organization gathering over 225 members working together to shape a path towards a sustainable transformation of businesses - and the Net Zero Initiative (NZI) - a French project initiated by a consulting firm and supported by various public and private organizations aiming at proposing a frame accounting for companies' action towards carbon neutrality - alongside an expert advisory group formed by academics and 19 companies. They have engaged in working groups since July 2021 to publish the guidance in March 2023.

Prior to this guidance coauthored by WBCSD and NZI, avoided emissions calculations were driven by a private initiative. In 2020, Organization A, a leading energy provider, developed a private methodology to account for the emissions avoided for their customers, the "Decarbonization of Clients – DoC". In January 2021, Organization A founded the Leadership group composed of three industrial partners, to set guiding principles on how to decarbonize clients. The initiative came as a response to fill in a void as no international standard was identified. The aim of the group was thus to have common principles and measurable standards of accounting for decarbonization. Simultaneously, the group called for the support of the WBCSD, Solar Impulse Foundation, and the Entreprises pour Environment, and started lobbying to create a working group at WBCSD. It resulted in the establishment of a working group led by WBCSD in July 2021.

3.1.2. The French repairability index

The French repairability index is a product rating of electronic and electrical equipment (EEE), designed to inform consumers about the ease of repairing their products. This measure is a strategic part of the French government's efforts to prolong product lifespans and promote a circular economy. As per article 16 of the AGEC² law, manufacturers are mandated to calculate this index for selected products and provide it to sellers without charge. Sellers are similarly required to share this information with consumers at no cost at the point of purchase and offer detailed sub-criteria when requested (LegiFrance, 2020). This initiative not only assists consumers in identifying products that are easier to repair but also supports their right to repair. Furthermore, it encourages manufacturers to incorporate repairability into their product designs, aligning with consumer demand for more repair-friendly products (Ministère de la transition écologique et solidaire, 2021).

The index evaluates products based on five equally weighted criteria:

1. Availability of Technical Documentation: This measures the producer's commitment to providing free technical documents for a certain duration.
2. Ease of Disassembly: Assessed by the steps required to disassemble key spare parts, the types of tools needed, and the nature of fasteners for spare parts.
3. Spare Parts Availability: Scored based on the producer's commitment to ensuring spare parts are available over time and their delivery speed.
4. Price of Spare Parts: Determined by comparing the cost of the most commonly replaced spare parts to the product's price.
5. Product-Specific Criteria: Involves product-specific sub-criteria, including access to a usage counter, free remote assistance, or software reset capabilities.

² *La loi anti-gaspillage pour une économie circulaire (AGEC)*: a French law to combat waste and promote the circular economy

The criteria, sub-criteria and calculation method are detailed in a summary form (Figure 3).

The calculation results in an overall index ranging from 1 to 10, 10 meaning the highest reparability level.

Critère	Sous-critère	Note du sous-critère	Coefficient du sous-critère	Note du critère	Total des notes des critères
1. Documentation	1.1. Durée de disponibilité de la documentation technique et relative aux conseils d'utilisation et d'entretien	█/10	2	█/20	█/100
2. Démontabilité et accès, outils, fixations	2.1. Facilité de démontage des pièces de la liste 2*	█/10	1	█/20	
	2.2. Outils nécessaires (liste 2)	█/10	0,5		
	2.3. Caractéristiques des fixations entre les pièces de la liste 1** et de la liste 2	█/10	0,5		
3. Disponibilité des pièces détachées	3.1. Durée de disponibilité des pièces de la liste 2	█/10	1	█/20	
	3.2. Durée de disponibilité des pièces de la liste 1	█/10	0,5		
	3.3. Délai de livraison des pièces de la liste 2	█/10	0,3		
	3.4. Délai de livraison des pièces de la liste 1	█/10	0,2		
4. Prix des pièces détachées	4.1. Rapport prix des pièces de la liste 2 sur prix de l'équipement neuf	█/10	2	█/20	
5. Critère spécifique (exemple avec 3 sous-critères)	5.1.	█/10	1	█/20	
	5.2.	█/10	0,5		
	5.3.	█/10	0,5		
Note de l'indice					█/10
*liste 2 : liste des 3 à 5 pièces détachées au maximum (selon la catégorie d'équipements concernée) dont la casse ou les pannes sont les plus fréquentes					
**liste 1 : liste de 10 autres pièces détachées au maximum (selon la catégorie d'équipements concernée) dont le bon état est nécessaire au fonctionnement de l'équipement					

Crédits : MTE

Figure 3: Summary of the French reparability index (Ministère de la transition écologique 2021)

Visually, the reparability index is represented by an official logo, showing the score resulting from the calculation, associated with a color code to reflect the more (green) or less (red) repairable nature of the product (Figure 4).



Figure 4: Visual of the French repairability index (Ministère de la transition écologique, 2021)

The development of the French repairability index is the result of an extensive, collaborative effort involving a diverse group of stakeholders: industry federations, manufacturers, distributors, repair professionals, other entities from the repair sector, and NGOs, all under the leadership of public authorities. Over 18 months, these actors engaged in working groups to meticulously define the criteria and the entire calculation methodology for the index. Since January 2021, the application of this index has been mandatory for a range of products including smartphones, laptops, televisions, lawn mowers, and front-loading washing machines. In November 2022, the index scope was expanded to encompass four additional categories: top-loading washing machines, dishwashers, vacuum cleaners, and high-pressure cleaners.

Before the French repairability index, supported by the French public authorities, the objectification and quantification of the repairability potential of products were a subject of work within Organization B. Consumer surveys carried out by this organization showed customers' interest in more information regarding the repairability of products. This is why, in 2017, this organization began to develop a private repairability index, on laptops, and later on smartphones. Enrolling public authorities and other stakeholders such as civic actors and industry members, Organization B instigated a process to make this index a mandatory instrument on a national scale, initiating a process of collaborative innovation.

3.2. Data Collection and Analysis

To understand the way organizations initiate and engage in collaborative innovation processes, we chose to use a processual approach. In particular, referring to our two cases, we studied the

role of focal organizations in the emergence and stabilization of collective endeavors aiming at developing innovative instruments, on a large scale and with many stakeholders. We used a variety of sensemaking strategies, like narrations, temporal bracketing and visual mappings of both cases, showing the different steps of the translation process (Langley, 1999 ; Dana and Dumez, 2015). We also analyzed our cases through an ANT perspective. These strategies allowed us to highlight the framing of the perceived issue - accounting for avoided emissions and repairability - done by the actors, and the emergence of a collective action.

3.2.1. Data collection

To grasp our case studies, we used a variety of sources (Gehman et al., 2018) in order to enrich our set of data and contrast various perspectives (Langley and Tsoukas, 2016). Table 3 sums up the data collected on both case studies.

Two of the researchers worked on the case of avoided emissions, and two on the repairability index. This distinction made sure that, at all times of the research process, at least two team members were external to the case study and could provide a counter-perspective on the data (Gioia, 2021).

	<i>Primary data</i>		<i>Secondary data</i>
	<i>Observation</i>	<i>Interviews</i>	<i>Archives</i>
<i>Avoided Emissions Case</i>	Position in Organization A's Research & Innovation department	Within Organization A to account for its private initiative, its role in the collective endeavor and its integration into internal processes	<ul style="list-style-type: none"> - Communications from Organization A and B - Press releases - External reports - Meeting minutes - Email
<i>Repairability Index Case</i>	<ul style="list-style-type: none"> - Research intern at HOP, involved in the collaborative innovation process - Observation during working groups 	With Organization B, to account for its private initiative, and with members of the French repairability index working groups and public authorities, to reconstruct the index development process	

Table 3 : Synthesis of data collected for Avoided Emissions and Repairability Index cases

Observation

Avoided Emissions Case

During the five years of research, at least one of the researchers held a position in Organization A's Research & Innovation department. They were not directly involved in the instrument-making process, but some of their departmental colleagues were, allowing for informal discussions, especially when Organization A developed its private methodology, between September 2020 and December 2021. This position facilitated the access to internal data, and the conduct of interviews at the very start of the research project. Access to these contextual data allowed the researchers to reflect on the emergence of the collective endeavor within Organization A, and its embeddedness within internal transformations, while ensuring the possibility to collect complementary data throughout the analysis phase.

Repairability Index Case

To gain insight into the French repairability index (FRI) construction process, one author joined the non-profit organization Halte à l'Obsolescence Programmée (HOP), actively involved in FRI development. Operating against planned obsolescence, HOP uses legal actions, consumer campaigns, and policy lobbying to extend product lifetimes. Employed as a research intern from July 2021 to February 2022, the author studied stakeholders' FRI understanding, deployment, and displayed scores for initial product categories. HOP published the results of this study in a report (HOP, 2022). As part of this study, the author visited Organization B, interacting with engineers and managers central to constructing both the organization's private index and the French repairability index mandated by the French government. The discussions encompassed the history, deployment, and potential impact of these indices.

In addition, under the research internship with HOP the author spent 35 hours in the working groups constructing the FRI for new product categories. Observations during working groups and other HOP activities, including informal interactions, were meticulously documented in over 200 pages of field notes.

Interviews

Avoided Emissions Case

Thirteen interviews were carried out within Organization A in 2023 (see Annex A), focusing on the role of Organization A in the collective endeavor and its integration into internal processes. All the interviews were conducted in a pair, offering advantages in terms of notetaking. The interviews were all fully transcribed.

Repairability Index Case

Between 2019 and 2022, eleven interviews were conducted with members of Organization B, and five with organizations involved in the construction of the repairability index and public authorities (see Annex B). These interviews covered the development of Organization B's private initiative, but also the activities of the working groups involved in creating the French repairability index. In particular, they enabled us to account for Organization B's role in the collective dynamic. The interviews were fully transcribed, or were the subject of detailed notes.

Archival data

Archival data ensured that the process was built on time-authentic and natural data. A variety of documents were collected, including communications from Organization A and Organization B, press releases, external reports, meeting minutes, and email exchanges. In the case of avoided emissions, numerous internal documents were collected within Organization

A, while technical documents from working group meetings and HOP were compiled for the reparability index case.

3.2.2. Data analysis

To analyze our data, we built on the ANT perspective. We understood collaborative innovation as a translation process, which could enlighten us on the emergence of the collective. We followed an inductive approach with a processual lens, employing sensemaking strategies proposed by Langley (1999). Narrative techniques, temporal bracketing, and visual mappings were utilized to comprehend actors' activities and decision-making.

First, we made a problematized narration of our case, combined with temporal bracketing. Key stages and mechanisms - the drivers of change - were highlighted based on our observations and analysis of the interviews. Three steps were identified in the collaborative innovation process: pioneering, negotiating and aligning. Pioneering corresponds to the internal work done within our focal organization to design and internally stabilize an innovative instrument. Negotiating to the external collective endeavors set up around the innovative instrument. Finally, aligning refers to the re-integration of the collectively built instrument within the focal organization. To help visualize this temporal bracketing, we created a figure showing the three-step process of collaborative innovation for each of our cases (Figure 5 and Figure 7).

Then, we identified the key moments of the translation process: problematization, interestment, enrollment and mobilization in relation with the temporal bracketing. The key moments are often intertwined and their perimeters blurred. Based on our narration, we broke down each step of the collaborative innovation process into various actions and associated these actions with one or several key moments (see Annex C and Annex D). Finally, we created a visualization linking our temporal bracketing with the translation process, making clear the dynamics of the translation process, and its intertwinement with collaborative innovation

process (Figure 10). This visual mapping helped us conceptualize the contribution of the ANT perspective in understanding collaborative innovation processes, from the point of view of a focal organization.

4. Findings

4.1. Narrations of our two cases

4.1.1. From Decarbonization of Clients at Organization A to a Guidance on avoided emissions by the WBCSD and Net Zero Initiative

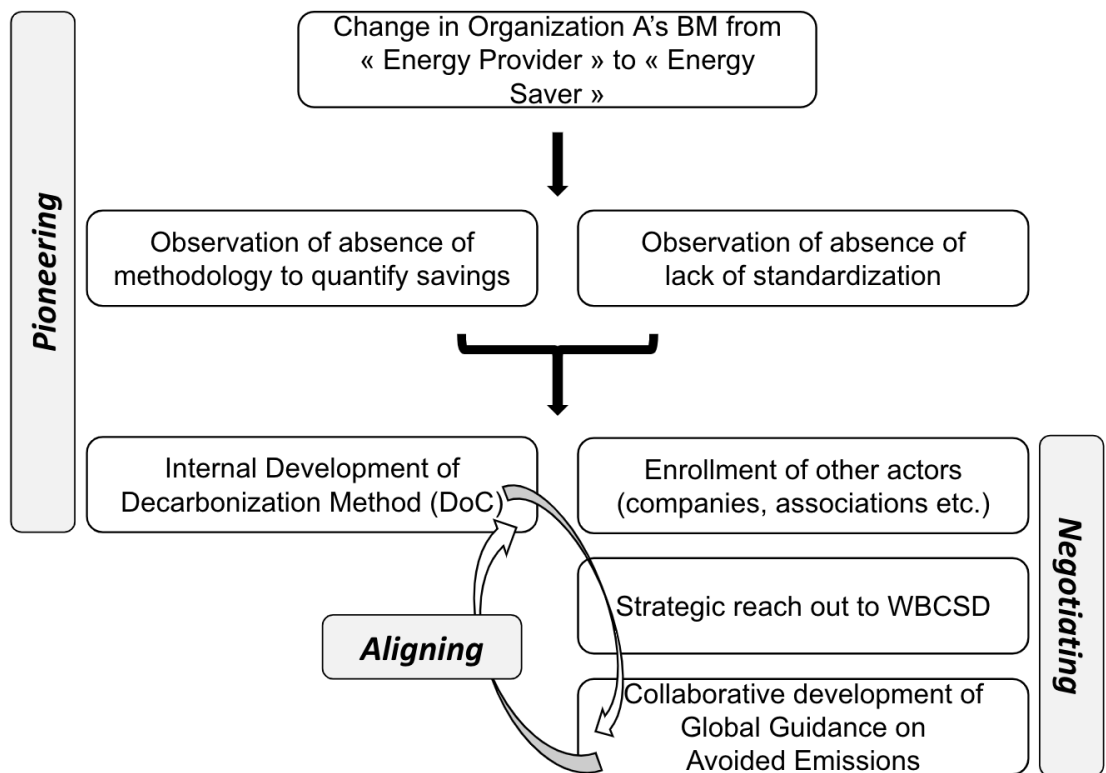


Figure 5: The three-step process of collaborative innovation - Decarbonization of Clients

Pioneering the initiative on decarbonization (2019 - 2023)

The initiation of the DoC methodology internally was a strategic move to quantify and communicate Organization A's contribution to reducing greenhouse gas emissions through its products and services for its clients. The objective was to operationalize the company's purpose "to act to accelerate the transition towards a carbon-neutral economy, through reduced energy consumption and more environmentally-friendly solutions." Indeed, the company was shifting its business model from "energy provider" to "energy saver" as confirmed by an executive from the company during a roundtable on its decarbonization strategy " *Our job, our business, was to be an energy producer. We were the biggest independent producer of energy in the world, and of fossil energy, so our job was to get paid the more energy people consumed, and we realized that this was not a sustainable model, that it was a model in which there was a growing awareness of the importance of the energy transition, and of the importance of sobriety, and we said to ourselves, we can't carry on like this. So we said to ourselves, rather than being part of the problem, we're going to try and be part of the solution and we're going to completely change our business model. So we've gone from "we make money by selling as much energy as possible" to "we're going to try to have a business model where the more we help our customers to save energy, the more money we're going to make"* (Executive from the strategy department - internal roundtable, author's translation).

In 2019, due to the absence of established benchmarks, Organization A took the initiative to develop a method for measuring the Decarbonization of Clients (DoC) from scratch. This was done in order to create an authentic and cohesive approach, as there were no external standards available at the time, as mentioned by an interviewee : "*Because if you're all communicating in a disparate way about things, if Google is doing that and Meta is doing that, it didn't seem very relevant to us*" (I8, author's translation). This internal development allowed Organization A to be a pioneer in creating a methodology for measuring DoC in 2019.

Organization A's foray into DoC began with crafting internally a narrative around avoided emissions. The company mobilized an internal consulting entity to design and develop the DoC method. From its initial design, the DoC aimed to both report and prospect. Reporting entails quantifying the "avoided emissions" allowed by ongoing projects and operational infrastructures annually at the group level. In an attempt to become accountable for its commitment on decarbonization, Organization A officially communicated in 2021 its objective to avoid 45 million tons of CO₂eq by 2030. Reporting is conveyed through the DoC Key Performance Indicator, publicly reported yearly. At the project level, business developers employ prospecting to assess the avoided emissions of upcoming projects through the comparison of various scenarios. Organization A has created calculation tools to standardize estimates. Both reporting and prospecting leverage the DoC methodology. Organization A defined the perimeter of products and services participating in DoC (Table 4).

Products/Services	Description
Green Power Production	Owning and/or operating assets using renewable resources (solar, wind offshore, wind on shore, hydro, geothermal, biogas, biomass and renewable hydrogen)
Green Gas Generation	Owning and/or operating assets to generate green gas (biogas or renewable hydrogen)
Onsite Generation	Owning and/or operating assets producing heat, cold, power on a client's site
On site Cogeneration or Trigenation	Owning and/or operating assets producing at least two of the following outputs heat, cold power on a client's site.
District Heating & Cooling	Owning and/or operating assets and infrastructure to produce heat or cold
Mobility	Owning and/or operating green mobility assets and services, green vehicles.
Public Lighting Installations	Owning and/or operating lighting assets and infrastructure
Installations	Installing materials, assets, equipment and infrastructure (energy generation assets, public lighting, mobility assets, building retrofits, mechanic and electrical equipment, heating and cooling, residential solar, energy storage systems)
Operations & Maintenance	Services of maintenance and/or operation for energy savings improvements.

Purchasing & Sales of Green Power, gas, heat	Selling green energy (electricity, gas, biomass or heat) purchased from suppliers (external or other Engie entities)
Financing or Purchasing and Sales of white certificates	Supporting customers to earn energy efficiency certificates under a White Certificates Scheme.
Financing or Purchasing and sales of carbon certificates	Selling carbon credits from regulatory markets to customers

Table 4: Organization A's products and services to decarbonize its clients (adapted from DoC Accounting Guidelines Summary, Organization A Consulting Entity, 2020)

Negotiating towards global standards on decarbonization (2021-2023)

In January 2021, in an attempt to fill in the gap of the absence of an internationally recognised standard as underscored by I3, I6 and I10, Organization A established the Leadership group. The absence of benchmarks represented an opportunity for Organization A to establish a legitimate and coherent method, emphasizing its commitment to sustainability beyond conventional emission boundaries. The aim was to build on the internal work to craft shared principles and common standards for measuring decarbonization. Organization A approached noteworthy and interested entities such as a multinational specialized in water and waste management, or a manufacturing industry.

Taking their commitment a step further, Organization A internal consulting entity showcased the DoC methodology in the prestigious project SOS 1.5 hosted by the WBCSD, amplifying its visibility on a global platform. Further stressing the need for a unified international approach, the Leadership group advocated for the formation of a working group dedicated to developing an international methodology for calculating avoided emissions. This advocacy resulted in the launch of the working group in July 2021 chaired by WBCSD and NZI. Organization A's decision to contact the WBCSD was a strategic move aimed at enrolling as many companies as possible. This was confirmed by an employee of the internal consultancy

entity who participated in the initial work on DoC: *“At the end, there were a huge number of companies in the Working Group. It was impressive. And that's all very good, because that's why we went to see them (WBCSD). A lot of companies joined the Working Group to work on it, to comment on it, and so on.”* (I8, author’s translation)

Evidently, such efforts not only contributed to building the WBCSD’s guidelines, but also conferred Organization A legitimacy and integrity in front of its clients. Indeed, Organization A aims to adhere to established sustainability principles and reference methods, such as those outlined by the WBCSD, have helped them to develop new businesses with clients. They have developed a new service, proposed by their consultancy entity, to help clients create and perform their decarbonization roadmap, including the calculation of avoided emissions. As stated by a member of the internal consulting entity I5 : *“ What I can tell you is that we [...] are working with a big tech player on this subject”*. (I5, author’s translation).

The alignment to a global guidance on avoided emissions starting 2023

In March 2023, the WBCSD communicated global guidelines for avoided emissions in a guidance report. Interestingly, Organization A has taken a step backwards in communication. According to an interviewee: *“We didn't want Organization A to appear too obviously, because if it was to be accepted by the majority, it shouldn't be seen as the company's method. So it's a bit of a trade-off in fact, between them and what we want, do we want to be in the light or do we want the method to be used, so we chose the second option instead”*. (I8, author’s translation).

Within the working group, a representative of Organization A - a member of the Research & Innovation department - participated in all the discussions. While the working group unfolded, Organization A also remained active internally, ensuring that its internal methodology remained aligned with the evolving international framework established by the WBCSD. Once

the WBCSD’s guidelines were issued, the Corporate Social Responsibility department at Organization A, responsible for DoC, asked the internal consulting entity to launch regular workshops and meetings to facilitate this alignment. According to a member of the internal consulting entity “it’s translating, it’s rather that the WBCSD is a guideline, so it gives a number of methodological guidelines, so to speak, but then it’s up to us to say how it impacts us and if it impacts us how to change things” (I5, author’s translation). Entities began appropriating DoC in projects, with plans for transversal sponsorship and additional functionalities aligned with specific activities.

This double engagement - internally and externally - demonstrated Organization A's commitment to coherence and alignment with global standards. This dynamic underscores the interplay between internal initiatives and global standardization efforts.

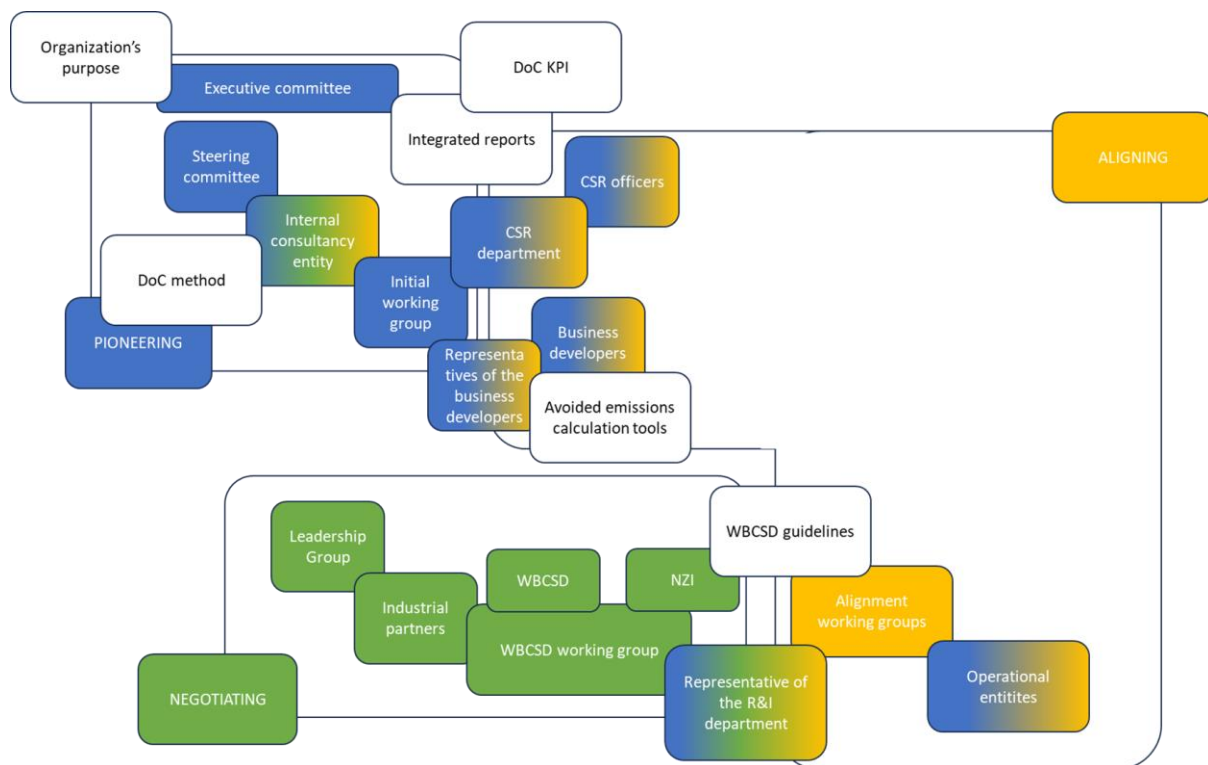


Figure 6: The actor-network for the Decarbonization of Clients

This whole process is strongly linked to a wide actor-network, connecting various organizations, departments within the organization and a variety of non-human actants (Figure 6).

4.1.2. From a private repairability by Organization B to the implementation of a mandatory repairability index in France

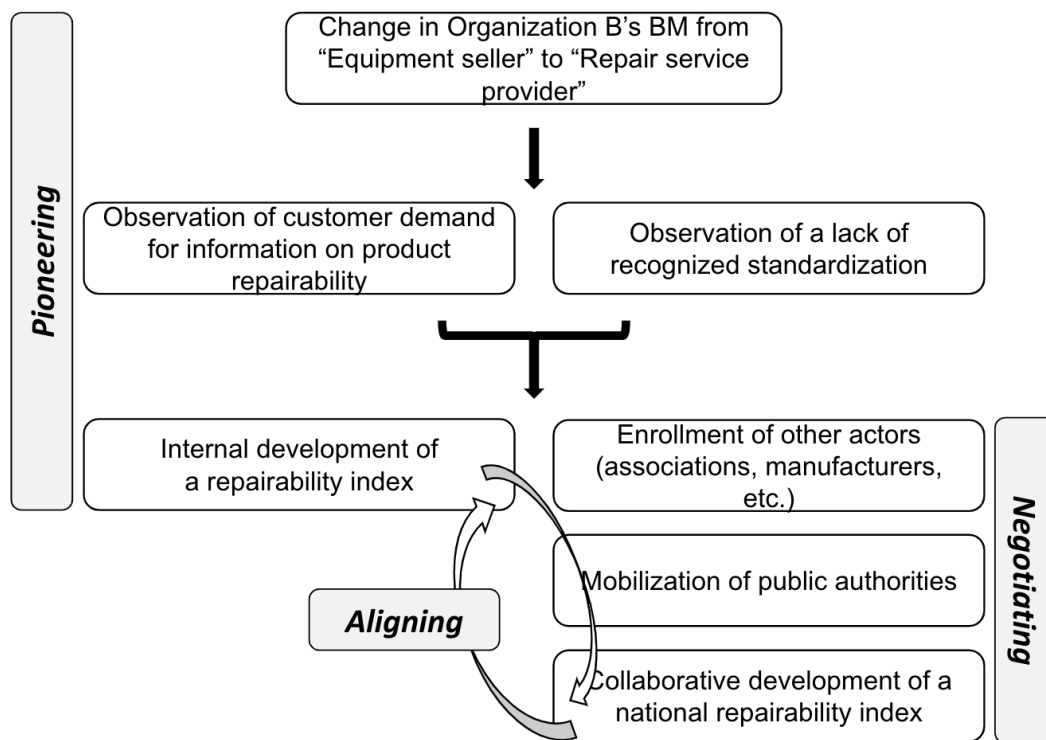


Figure 7: The three-step process of collaborative innovation - Repairability index

A pioneering repairability index for laptops (2017 - 2019)

In 2017, Organization B, a French retailer and manufacturer specializing in entertainment and leisure products, consumer electronics, domestic appliances, and services, recognized a consumer need for more information on product repairability. This insight emerged from their own research into consumer demands and product life extension: *“The story began in 2017, when we carried out the first studies which revealed a real need on the part of customers for*

information on extending the life of products. [...] We said to ourselves, we're going to go one step further, we're going to try and express to the customer the repairability of a product by saying: what does it take to repair a product? [...] So we thought, what would it take to inform the customer that this product is more repairable than another?" (I21, author's translation).

Organization B's strategy was to pursue the development of its service offering, a major vector of differentiation and value creation, marked by the company's determination to be a major player in the circular economy and a promoter of longer product life cycles. Capitalizing on its after-sales service, and its position of leader in repairs in France, the company used its expertise and its data reliability to develop an instrument. *"So, we said to ourselves, we know the products, we repair a lot of them because we're the leading repairers in France. We repair 1.5 million products a year. So, we have data and the data is reliable because there's a lot of volume, so the figures we can come up with are reliable"* (I21, author's translation).

In mid-2017, an internal team of engineers and managers, helped by Organization B electronics product testing laboratory began crafting a repairability index, designed to enlighten customers about the repairability of products in-store, and encouraging them to consume more responsibly.

While working on its own, the company additionally established a specialized committee, spearheaded by their technical laboratory. This committee included not only internal experts but also external authorities such as the Ministry of Ecological Transition and ADEME, as well as pioneering manufacturers like Group SEB, known for their extended availability of spare parts. Environmental organizations like HOP and Les Amis de la Terre also contributed their insights. This diverse team explored and debated various methodologies to assess the repairability of laptops, chosen as the initial focus due to prevalent issues of material and

software obsolescence in the market. The committee aimed to create a methodology that was straightforward for consumers to understand, replicable, and beyond dispute. Ultimately, Organization B’s repairability index was built on four central pillars: (1) availability of repair documentation; (2) modularity and accessibility; (3) availability of spare parts; and (4) software reinstallation capabilities (Figure 8).

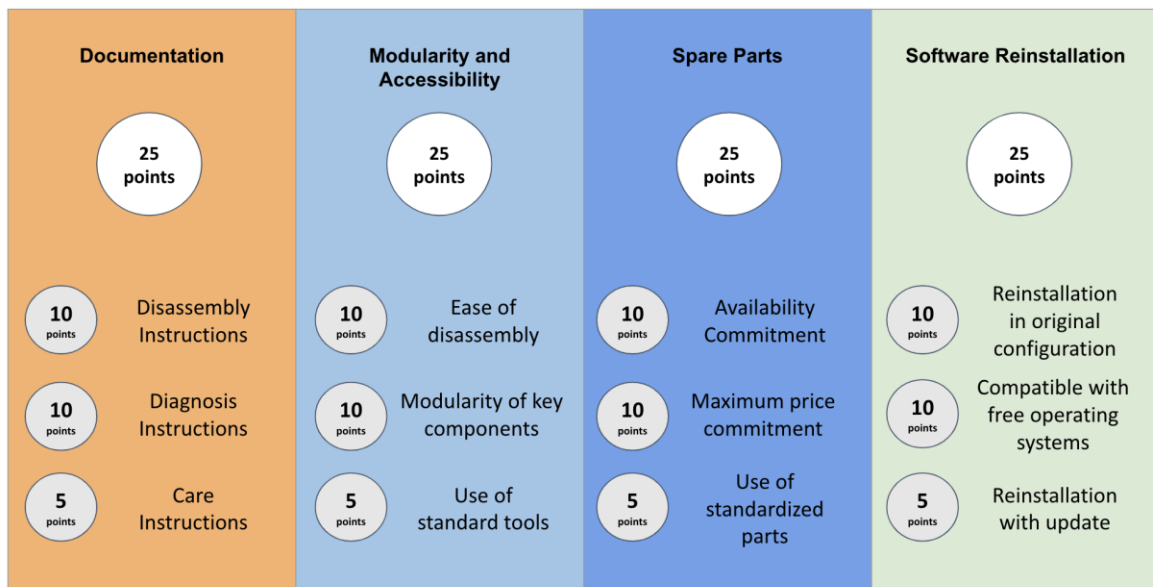


Figure 8: Organization B’s repairability index

In June 2018, Organization B unveiled its pioneering repairability index for laptops, a significant initiative accessible both in-store and online. This innovative index, integrated with other key product features, took the form of a score out of 10. The launch was marked by a high-profile media event, which included the notable presence of the former Minister of Ecological Transition, Brune Poirson, thereby underscoring the index's significance in promoting sustainable consumer practices. In June 2019, the scope of the repairability index was extended to smartphones. Following the launch of the repairability index, Organization B observed a significant impact on manufacturers, who recognized the influence of this tool. Concerned about the possibility of low scores that could be conveyed to consumers, manufacturers feared potential reputational damage and a subsequent impact on product sales.

Reflecting on this, the Manager responsible for Durability and Product Lifetime noted:

“We very quickly saw the leverage we could have on this [encouraging manufacturers to change their production]. Because a major brand that had a very poor rating, because it had glued its product, it doesn't want to be left behind. So, there are several examples. I'll give you another example: we've had other brands that came with poor ratings and asked us: why do we have a poor rating, so that they could improve their product. But this happened indirectly. We didn't go to the brands and say this is what needs to be changed. We published the indices and the brands reacted, because they are well aware of what we say.”

Negotiating a mandatory repairability index (2017 - 2019)

While working on its private repairability index, Organization B played a pivotal role in shaping the French Circular Economy Roadmap (FREC). From October 2017 to April 2018, the Ministry of Ecological Transition (MTE), in collaboration with the French Environment and Energy Management Agency (ADEME), conducted public consultations involving businesses and NGOs to identify the most relevant tools for moving towards circularity. Organization B pushed for a mandatory repairability index in France, as underscored by I14 : “We were at the forefront: we worked on the repairability index, and pushed for this element to be included in the law. It’s also why we created the repairability index, because we hoped it would serve as a model. We’re very credible, and this was an opportunity to get everyone on board, especially since we were able to get the support of other players like HOP.” (I14, author’s translation). Indeed, Organization B’s experience has convinced other players with similar ambitions to press for such an index to be enshrined in law : “We’ve rallied together with Organization B and others, to campaign for an index in the law. It was important to ally with a manufacturer with clout and the legitimacy of the index” (I17, author’s translation).

Finally, the FREC has imposed the mandatory inclusion of a repairability index on electronic and electrical equipment. Organization B's expertise, political support for this initiative and ongoing experiment with a private index were pivotal to get there. Organization B's experience has shown that the development of such an index was possible and feasible: "I think the FREC adopted this measure because we knew that *[Organization B] was a pioneer in this field [...]*. (I28, author's translation).

In June 2018, the development of the methodology of the French repairability index commenced. Stakeholders with a technical expertise in repairing EEE were invited by the public authorities. For each product group, working groups were created. Due to limited resources, public authorities were unable to actively participate or lead all product-specific working groups. In an attempt to delegate this responsibility, public authorities extended an invitation to all stakeholders to volunteer as working group leaders, expected to serve as impartial mediators, overseeing coordination of working groups meetings, developing agendas, and disseminating general information. Organization B was group leader of the working group for laptops and in addition actively participated in the smartphone working group. This position has enabled the organization to contribute to a strong dynamic: "Not only their repairability index, but also Organization B's position as working group leader boosted the work and gave an important impetus to the working group dynamics" (I17, author's translation).

Overall, despite their commitment to neutrality, working group leaders hold a powerful position within the working group, moderating the dynamics of working group discussions and crafting the meeting minutes. Organization B was able to take advantage of this position to present its previous work, and guide the working group's discussions : "*And well, we're going to get there because [Organization B] is going to be a pioneer and, what's more, Organization B took over the laptop group and they explained their model to us, which served as a real*

blueprint and foundation for the first proposal we had on the repairability index.” (I28, author’s translation).

Alignment with EEE repairability in 2020

The criteria and visual aspect of the French repairability index, for the first 5 categories of EEE concerned, were defined by decree in December 2020, under the AGEC law. The link between the methodology of the Organization B’s index and the official French repairability index is obvious, if we consider the nature of the criteria, and their final outcome (a score between 1 to 10). As a civil servant from the Ministry of Ecological Transition recalls: *“So we’ve added the price to the four criteria used by [Organization B]. [...] [Organization B] had 4 large branches, we have five large branches” (I20, author’s translation).*

Since January 2021, manufacturers have been obliged to calculate the repairability index of their products and make it available to distributors on the French market. Organization B demonstrated leadership during the market introduction of the French repairability index. As both a retailer and producer, the company undertook the dual responsibility of calculating the index for their own devices and gathering index scores from other producers. Furthermore, they proactively developed a dedicated website for the index, promptly showcasing it. Because government sanctions for not displaying the index were not enforced in the initial year of its mandatory implementation, many companies opted to exhibit the index only by the end of 2021. By introducing early index displays, Organization B not only adhered to regulations but also proactively enhanced the visibility of the instrument.

Thus, the transition from a private initiative to a national reparability index mobilized a wide range of actors, both within organization B and beyond, as shown in Figure 9.

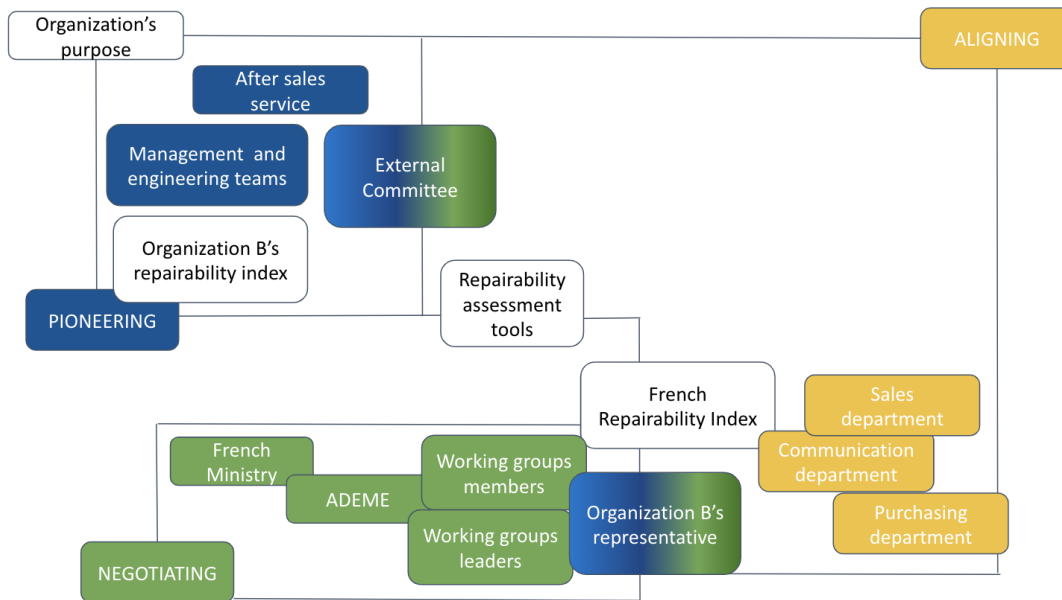


Figure 9: The actor-network for the Repairability index case

4.2. Collaborative innovation as translation processes

From these narrations illustrating the evolution of the instrument from a pioneering internal approach to a recognized international standard (Figure 10), we identified the key moments of the translation process. The detailed breakdown for each case study is presented in Annex C and Annex D. These tables align the development process steps and their actions with the corresponding stages of the translation process. This analytical approach aims to clarify how the organization initiated, engaged, and translated its pioneering methodology into globally acknowledged standards, by stimulating a collaborative innovation process.

The emergence of this process can be broken down as three translation processes, each with a different angle of problematization.

First, a single organization problematizes an internal innovation issue. Finding a solution to this issue entails organizational, social and technological work at the organizational level. During this first translation process, the issue is translated into the organization, in our cases

through the design of an instrument and the enrollment of various internal actors within a dedicated project. However, the internal solution is not enough to stabilize the instrument. The problematization of the innovation issue comprises an external outreach from the start.

This leads to the formulation of a second problematization revolving around the need for common agreement around the instrument, at the national or international level. It is during this second translation process that the internal instrument is submitted to external trials of strength. The interestment and enrolment of partners allow negotiations to happen, which come to the design of a collective instrument, benefiting from the experience of the pioneering organizations. This second translation process, carried out on a collective scale, ensures that the knowledge mobilized and generated is shared and contributes to the stabilization of these instruments, bearers of this knowledge.

Linking these two processes, the organization also problematizes the alignment of instruments, with the aim of incorporating the collective instrument back into its organization, and encouraging other players to implement the instrument. This third translation process defines and strengthens the roles and governance of the instrument within the organization, while helping to disseminate it beyond organizational boundaries, both nationally and internationally. These three translation processes co-exist and interact throughout the whole collaborative innovation process. These translations are by no means a linear dynamic, but are inherently intertwined. Within each translation process, back and forths between the different moments of translation happen. They shed light on the activities taken by an organization to participate in the emergence and stabilization of collaborative innovation processes. They also give insights on the stabilization - through the network created - and incorporation - through a translation process - of a new collective knowledge within an organization, and beyond its frontiers.

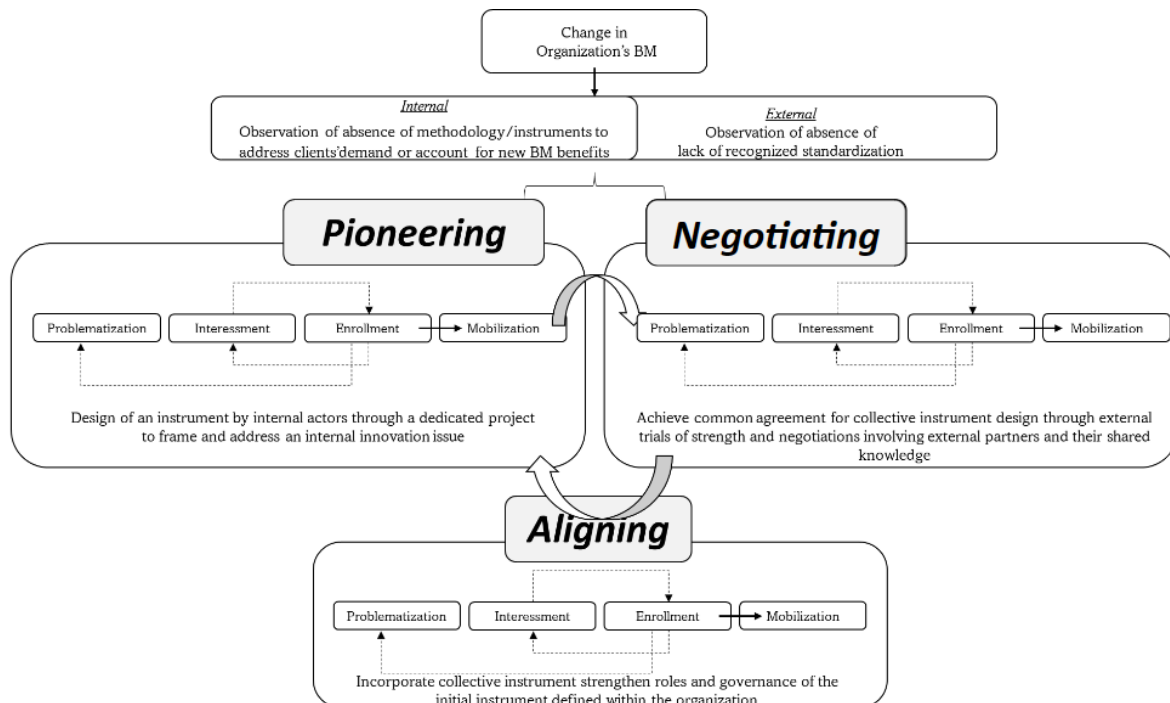


Figure 10: Translation processes within a collaborative innovation process

5. Discussion - Conclusion

In this communication, we follow the emergence of a collaborative innovation process in two case studies, taking an ANT and STS perspective for their analysis. In particular, we look at the role of a focal organization in the emergence of a collaborative innovation process. Such a process requires social and technical work from the focal organization to 1) internally problematize an issue, 2) design a solution and 3) stabilize this solution through a network of actors. In both cases, the will to engage in both an internal and external innovation process stems from global transformation and diversification of the organization's business model.

We conceptualized three steps in the emergence process: pioneering, negotiating and aligning. These steps enrich the existing literature on the emergence of collaborative innovation ecosystems. They complement the phases analyzed by Thomas and Autio (2013), but give insights on the activities taken by a focal organization in each phase. This work aligns with the ones of Moore (1993) and Dedehayir et al. (2018) highlighting the key role of leaders in the

early stages of collaboration innovation. We here show how a focal organization can engage in a process of translation (Callon, 1986a) to enroll various partners in a collective process and shed light on the internal work entailed within the organization when engaged in such a collective endeavor.

We show that a collaborative innovation process entails a dynamic of successive problematizations, which extend the network of actors both at the intra-organizational and inter-organizational levels. Through these successive translation processes, the innovation – here instruments – become Obligatory Passage Points (OPPs) (Callon, 1986a). The OPP stabilizes the innovation and the boundaries within which it can be used. Indeed, the OPP acts as a gateway and plays a crucial role in securing the knowledge generated through collaborative innovation (Latour, 1984). It also makes the organizations part of the actor-network accountable for their use of the innovation. Moreover, as the innovation becomes embedded in organizational practices, it contributes to the legitimacy of the organization's new business model. This also elevates the organization's standing within its industrial sector.

The collaborative innovation process leads to a subsequent phase of realignment, which can take distinct forms based on the nature of the output. Organizations can choose to substitute existing instruments (as exemplified by Organization B) or make strategic adjustments to align internal processes (such as within Organization A) with the collaborative innovation framework. This adaptive approach ensures the sustained relevance and effectiveness of collaborative initiatives within the organizational context.

In future iterations of the paper, we plan on refining our contributions by focusing on what specific aspect of the emergence of collaborative innovation. One interesting aspect of our phenomenon lies in the construction of legitimacy around the instruments that are disseminated beyond the boundaries of the pioneer organization. Literature on collaboration has a historical

interest in legitimacy, as a constituent of power which can help understand power dynamics within networks (Purdy, 2012). The emergence of legitimacy and its role in understanding collaboration development (Huybrechts and Nicholls, 2013) has also gained interest in the last decade. Among this literature stream, legitimacy “as-a-process” (Johnson et al., 2006; Thomas and Ritala, 2022) looks like a promising avenue to refine our theoretical positioning and frame our contribution.

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7. Annexes

Annex A: List of the semi-structured interviews - Avoided Emissions Case

Code	Entity	Function	Date
I1	Research Department	Head of team	14.03.2023
I2	Entity in charge of energy solution provision	CSR officer	17.03.2023
I3	Consultancy Entity	Analyst	23.03.2023
I4	CSR department	Former DoC project leader at Engie Impact	27.03.2023
I5	Consultancy Entity	Leader of Engie’s DoC methodology revision	28.03.2023
I6	Entity in charge of energy solution provision	Marketing department	29.03.2023
I7	Energy Retail Entity	CSR officer	30.03.2023

I8	Consultancy Entity	Former leader of the DoC methodology development project	31.03.2023
I9	Entity in charge of energy management & sales	CSR officer	19.04.2023
I10	Entity in charge of energy generation and retail	CSR officer	19.04.2023
I11	Entity in charge of energy solution provision	Project leader – contact point for DeClic	19.04.2023
I12	Energy Retail Entity	Marketing department	24.04.2023
I13	Entity in charge of energy network management	CSR officer	03.05.2023

Annex B: List of the semi-structured interviews - Repairability Index Case

Code	Entity	Function	Date
I14	Organization B	Service policy manager	11.12.2019
I15	ADEME	Environmental engineer	17.12.2019
I16	ADEME	Eco-design manager	23.01.2020
I17	GNO (working group member)	Co-founder	25.03.2021
I18	Organization B	Data Analyst	16.04.2021
I19	Organization B	Technical Director in charge of product life extension	16.04.2021
I20	Ministry of the Ecological Transition	Project manager "sustainable products and consumption"	11.05.2021
I21	Organization B	Director of sustainability	23.08.2021
I22	Organization B	Technical Director in charge of product life extension	23.08.2021
I23	Organization B	Repairer and product quality manager	10.11.2021
I24	Organization B	Director of the laboratory	10.11.2021
I25	Organization B	Repairer and IT test manager	10.11.2021
I26	Organization B	Repairer and IT test manager	10.11.2021
I27	Organization	Repairer en product quality manager	10.11.2021
I28	Industry federation	Sustainability and communication manager	31.03.2022
I29	Organization B	Director of sustainability	28.06.2022

Annex C: Key moments of the translation processes within Organization A

	Actions taken within Organization A	Translation Process Stage	Explanation
P I O N E R I N G	The executive committee crafted an internal narrative around avoided emissions and gave to the internal consultancy entity the leadership in a work stream on avoided emissions	Problematization	Organization A formulated a problem statement around avoided emissions and the lack of recognized methodology to account for it and created an internal work stream around it to create a solution.
	The executive committee defined the governance of the work stream on avoided emissions, with the creation of a steering committee	Interestment	The governance strengthened the links between internal actors who shared interests in avoided emissions.
	Participants of the initial working group agreed on quantifying "avoided emissions" through DoC methodology	Enrollment	Actors accepted their role in prioritizing the problem of quantifying avoided emissions through the design of the DoC methodology.
	Participants of the initial working group established a Key Performance Indicator for reporting	Problematization	The initial methodology entailed a re-problematization around the reporting of these emissions.
	The CSR department established a reporting process and the CSR officers report the avoided emissions	Interestment, Enrollment	The reporting process defined the role of the CSR officers who accepted their role by participating in this reporting.
	Participants of the initial working group created trainings for business developers to assess prospective avoided emissions	Problematization	The initial methodology led to a re-problematization around the use of the method by new actors - business developers.
	The internal consultancy entity along with representatives of business developers created a calculation tool and gave training sessions to support the business developers' assessment	Interestment, Enrollment	The creation of a calculation tool aimed at facilitating the use of the DoC method by the business developers, and stabilized the role of the consultancy entity and the representatives.
	A governance stabilizing the links between all the actants of DoC was established by the network	Mobilization	The governance secured the implementation of the DoC methodology and defined spokesperson for each use of the method.
N E G O T	Participants of the initial working group searched for other organizations interested in establishing a common standard on avoided emissions.	Problematization	By searching for partners, Organization A framed the problem of the absence of internationally recognized standards, seeking to enroll entities in common principles.

I A T I N G	The partners who agreed in participating established the Leadership Group	Interestment, Enrollment	The establishment of the group defined the roles and objectives of the partners. The participants of the Leadership group had accepted their role of advocating for common standards.
	Organization A and the Leadership group advocated for coherent industry standards and international methodology, for instance by showcasing the DoC methodology in WBCSD's SOS 1.5 project.	Problematization, Interestment	Avoided emissions are re-problematized as a collective issue that needs to be tackled through common standards.
	Organization A and its partners advocated for the formation of a working group at the WBCSD	Interestment, Enrollment	Through the enrollment of new partners, Organization A could persist in expanding its network by advocating for the formation of a working group.
	Organization A engaged in the working group chaired by WBCSD and NZI through its representative from the R&I department	Enrollment, Mobilization	The working group secured the collaboration to draft and propose a standard. Its composition ensured that the partners' spokespeople could negotiate.
A L I G N I N G	The CSR department asked the consultancy entity to create internal working groups to align the internal methodology with external standards	Problematization	This action framed the alignment - or re-integration of the collective standards - as a problem that needed to be solved at the organization level by the CSR department, experts and various users of the DoC methodology.
	Participants in the working group adapted the WBCSD standards for Organization A	Interestment, Enrollment	Adapting the standards gathered various internal actors within the working group that accept their role as they participate in the different meetings.
	Participants of the working group deployed the adapted DoC methodology within their entities.	Interestment, Enrollment	Working on the deployment of the adapted methodology extended the pool of actors working with the adapted methodology.
	Operational entities of Organization A appropriated DoC in projects and continued to plan additional functionalities	Mobilization	Entities adapting DoC in projects and planning additional functionalities marked the translation of the methodology into practical applications, and showed that the network is maintained.

	Actions taken within Organization A	Translation Process Stage	Explanation	Framing
P I O N E R I	The executive committee crafted an internal narrative around avoided emissions and gave to the internal consultancy entity the leadership in a work stream on avoided emissions	Problematization	Organization A formulated a problem statement around avoided emissions, created a work stream around it, and sought to convince others of the need for a solution.	A lack of recognized methodology around avoided emissions created the need to design an
	The executive committee defined the governance of the work stream	Interestment	The governance strengthened the links between internal actors who	

N G	on avoided emissions, with the creation of a steering committee		shared interests in avoided emissions.	internal methodology
	Participants of the initial working group agreed on quantifying "avoided emissions" through DoC methodology	Enrolment	Actors accepted their role in prioritizing the problem of quantifying avoided emissions through the design of the DoC methodology.	.
	Participants of the initial working group established a Key Performance Indicator for reporting	Problematization	The creation of a reporting indicator involved maintaining the network's focus on avoided emissions, and framing another issue around the reporting of these emissions	This internal methodology could be used to report emissions and be accountable for decarbonization objectives.
	The CSR department established a reporting process and the CSR officers report the avoided emissions	Interesment, Enrolment	The reporting process defined the role of the CSR officers who accepted their role by participating in this reporting.	
	Participants of the initial working group created trainings for business developers to assess prospective avoided emissions	Problematization	The deployment of the DoC methodology participated in stabilizing the network, while framing the use of the method by new actors - business developers.	This internal methodology could be used by the business developers to assess prospective avoided emissions of their future projects.
	The internal consultancy entity along with representatives of business developers created a calculation tool and gave training sessions to support the business developers' assessment	Interesment, Enrolment	The creation of a calculation tool aimed at facilitating the use of the DoC method by the business developers, and stabilized the role of the consultancy entity and the representatives	
	A governance stabilizing the links between all the actants of DoC was established by the network	Mobilization	The governance secured the implementation of the DoC methodology and defined spokesperson for each use of the method.	
N E G O T I A T I O N G	Participants of the initial working group searched for other organizations interested in establishing a common standard on avoided emissions.	Problematization	By searching for partners, Organization A framed the problem of the absence of internationally recognized standards, seeking to enroll entities in common principles.	To gain legitimacy on the methodology, it needed to be recognized externally by other partners.
	The partners who agreed in participating established the Leadership Group	Interesment, Enrolment	The establishment of the group defined the roles and objectives of the partners. The participants of the Leadership group had accepted their role of advocating for common standards.	

	Organization A and the Leadership group advocated for coherent industry standards and international methodology, for instance by showcasing the DoC methodology in WBCSD's SOS 1.5 project.	Problematization, Interestment	Advocacy for standards aligned with the problem of the absence of benchmarks and encouraged entities in crafting common standards.	Avoided emissions was a collective issue that needed to be tackled through collectively established standards.
	Organization A and its partners advocated for the formation of a working group at the WBCSD	Interestment, Enrolment	Through the enrolment of new partners, Organization A could persist in expanding its network by advocating for the formation of a working group .	
	Organization A engaged in the working group chaired by WBCSD and NZI through its representative from the R&I department	Enrolment, Mobilization	The working group secured the collaboration to draft and propose a standard. Its composition ensured that the partners' spokespeople could negotiate.	
A L I G N I N G	The CSR department asked the consultancy entity to create internal working groups to align the internal methodology with external standards	Problematization	This action framed the alignment as a problem that needed to be solved internally by the CSR department, experts and various users of the DoC methodology	The WBCSD standards had to be re-integrated at the organization level
	Participants in the working group adapted the WBCSD standards for Organization A	Interestment, Enrolment	Adapting the standards gathered various internal actors within the working group that accept their role as they participate in the different meetings.	
	Participants of the working group deployed the adapted DoC methodology within their entities.	Interestment, Enrolment	Working on the deployment of the adapted methodology extended the pool of actors working with the adapted methodology.	
	Operational entities of Organization A appropriated DoC in projects and continued to plan additional functionalities	Mobilization	Entities adapting DoC in projects and planning additional functionalities marked the translation of the methodology into practical applications, and showed that the network is maintained	

Annex D: Key moments of the translation processes within Organization B

	Actions taken within Organization B	Translation Process Stage	Explanation
P I O N E E R I N G	Identifying an emerging consumer demand and potential business opportunity thanks to the development of an instrument	Problematization	Organization B's after-sales service formalizes a problem statement around the issues of an increasing demand for product lifetime information, which raises the need to align the company's strategic response with their business model innovation. Developing a performance measurement instrument is considered as a solution
	Spreading this information internally and involving both technical and managerial actors	Interessment	The problem statement spreads within Organization B, engaging both engineers and managers at different managerial levels, through the creation of an internal team
	Considering and drafting different performance measurement instruments	Enrollment	The internal team considers several performance measurement tools focused on reparability, durability, lifetime, including their technical feasibility, and their alignment with business model innovation
	Identifying a reparability index as a pertinent solution	Problematization	The reparability index emerges as a pertinent solution in line with the business model innovation focused on new repair services, and responding to consumer demand
	Drafting a reparability index methodology	Enrolment	Based on their technical expertise, after-sales service experience and reliable data, the internal team identifies different repair barriers which they consider as criteria for the reparability index methodology
	Calling on external experts to enhance reparability index methodology	Mobilization	Organization B invites several stakeholders with an expertise in repairing such as civic actors, businesses and public bodies to create an expert committee to help improving their methodology
	Finalizing the methodology and bringing the reparability index to market by holding an event	Mobilization	Organization B's internal team defines 4 criteria for the reparability index for one product category. The index is revealed during a mediatized event in the presence of the French Minister of Ecological Transition
	Advocating for a mandatory reparability index in France	Problematization	Following the invitation of the Ministry of Ecological Transition to the development of the French Roadmap for a Circular Economy (FREC),

	Actions taken within Organization B	Translation Process Stage	Explanation
C O L L A B O R A T I O N G			Organization B advocates for a mandatory repairability index based on the experience of their private index
	Succeeding in making a mandatory repairability index one of the 50 measures of the French Roadmap for a Circular Economy (FREC)	Interestment, Enrollment	A mandatory French repairability index emerges as one of the 50 FREC measures, among other things thanks to Organization B, which showed the technical feasibility of developing a reliable repairability index and promised to share its experience while taking on a leadership role in the future working groups
	Participating as key player in technical working groups developing the mandatory French repairability index	Interestment, Enrollment	Organization B participates in two technical working works for two different product categories, sharing their experience and data. In addition, Organization B becomes the leader of one working group, orchestrating the technical discussions
A L I G N I N G	Advocating for a quick introduction and implementation of the mandatory repairability index	Problematization	During the working groups, Organization advocates for a mandatory introduction of the repairability index, immediately after the promulgation of the repairability index, and the quick enforcement of sanctions in case of non implementation
	Preparing a quick internal implementation of the French repairability index	Interestment, Enrollment	Organization B prepares consumer communication on the repairability index, trains technical staff for the index calculation, and informs suppliers about their obligations to submit their index scores.