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# The affordances of technology and strategic roadmapping: An exploration of its instrumental, symbolic, and political functions☆

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ABSTRACT

Scholars agree that the roadmapping process and product both have multiple benefits for organizations in terms of strategic planning and coordination of strategic activities. However, the social and organizational aspects surrounding strategic and technological roadmapping are still poorly understood. By mobilizing the literature on strategic tools-in-use, and the theory of affordances, this paper explores the practical affordances of roadmapping. Our results, based on a longitudinal study of the development and dissemination of a roadmap within Hydro-Québec, show that the roadmapping process and product fulfill three main types of function: instrumental, symbolic, and political. We also find that the coordination and alignment benefits are highly dependent on the political affordances of the tools that individuals anticipate in the conduct and dissemination of roadmapping.

## 1. Introduction

Since the early 1960 s, technology and strategic roadmapping, defined by Kerr and Phaal (2022, p.13) as "*the application of a temporal–spatial structured strategic lens*", has become a key approach mobilized by strategy, innovation, and R&D managers (Carvalho et al., 2013; Kerr & Phaal, 2020). Roadmapping has repeatedly demonstrated its usefulness for industries affected by disruptive innovations and for assessing the impact of emerging technologies. That is why numerous authors have looked at methods for improving roadmapping's foresight potential or the success factors associated with its implementation (Siebelink et al., 2016; Vishnevskiy et al., 2015).

The benefits of technology and strategic roadmapping stem from its dual nature, as expressed by Kerr and Phaal (2012), as one can distinguish between the roadmapping process and its product, the roadmap itself. Roadmapping has been described as a very flexible tool with numerous advantages in terms of communication and alignment for strategic planning (Phaal & Muller, 2009), innovation management (Amati et al., 2020), and visual representation of strategy (Kerr & Phaal, 2017). Thus, several articles have been written on how to improve roadmapping and make it more effective for strategy making and implementation. However, much less attention has been paid to the phenomenon's social and organizational nature (Simonse et al., 2015), which can greatly influence both the design process and its adoption within organizations.

Indeed, the rather formal, operational, and processual approaches that are mobilized in the roadmapping literature tend to omit

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central aspects, particularly the dynamics that occur during roadmap design workshops, and the individual participants' motivations and behaviors regarding the roadmapping process and product. Furthermore, by overlooking the social and organizational nature of roadmapping, the literature tends to neglect certain affordances, i.e., possibilities for action afforded by material or digital objects (Zammuto et al., 2007) which can have signifiant impact on strategic practices (Siebelink et al., 2021). As Park et al. (2020, p.11) emphasize: "*Future research should also concern the behavioral, communicative, psychological, and sociological aspects that are latent in roadmapping and strategic workshops*".

While the initiators of a roadmapping process may intend to apply it by seeking to achieve certain outcomes, these intentions may or may not be realized depending on the actors' perception of the affordances of the roadmapping process and product. Indeed, the literature on the use of strategic tools in practice shows that the affordances of a tool will greatly influence the way in which actors engage in its design process and will ultimately use it or not (Orlikowski, 2000, 2010; Jarzabkowski & Kaplan, 2015), and this perspective echoes recent calls to investigate further the factors that can influence the integration, appropriation and use of the roadmapping product in practice (Kerr et al., 2019; Meydanli & Polat, 2022).

It is therefore important to investigate in greater depth the affordances of both the process of elaboration and the product of roadmapping affordances to better understand the consequences they may have on the behavior of organizational actors towards them. Drawing on the literature of strategy tools-in-use and affordances theory, this paper addresses those gaps by answering the questions: *What are the affordances of the roadmapping process and product in the making of strategy? How do those affordances influence and frame the behavior of organizational actors during the roadmapping design and dissemination process?*

Our results show that roadmapping affordances can be categorized into three main functions, each of which has its own issues and challenges that need to be managed: an instrumental function, a symbolic function, and a political function. Moreover, our analysis then highlights that the political function, which the literature often overlooks, plays a central role in the process by mediating the other two functions. Indeed, we note that both the appropriation of the roadmap content and narrative (i.e., the symbolic function) and its use for strategic purposes in the construction of innovation project portfolios (i.e., the instrumental function) were strongly influenced by political issues such as resistance in the workshops, strategies for distancing oneself from the final roadmap, and conflicts of interest between divisions.

Our paper thus provides a new conceptual framework for a broader understanding of the major affordances and issues associated with the management of roadmapping within organizations. It also seeks to better equip and raise the awareness of managers in their collective strategic approaches to designing and disseminating roadmaps.

This paper is organized as follows. The next section provides a review of the previous literature on roadmapping before addressing the literature on strategic tools-in-use. Section 3 describes in more detail the methodology deployed. Section 4 summarizes the results of the analysis and develops the three main functions that can be associated with roadmaps. Finally, Section 5 discusses the implications of those results and opens up some perspectives for future research.

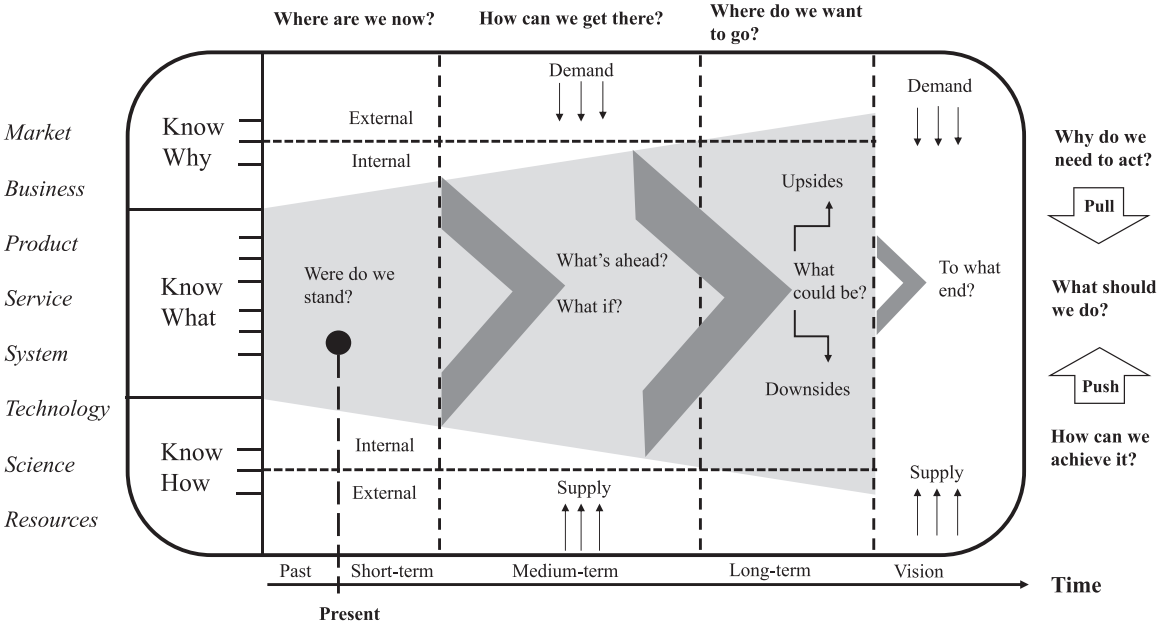



**Fig. 1.** A generic outline of the roadmapping governing framework (Adapted from Kerr and Phaal, 2022).

## 2. Literature review

### 2.1. Roadmapping and roadmaps in the literature

Kerr and Phaal (2020) identify in a recent article the early roots and forgotten history of the practice of technology and strategic roadmapping. Those authors show that although the first academic reference to roadmapping relates to the Motorola process (Willyard & McClees, 1987), one can find evidence of earlier applications of these practices at NASA, Boeing, and General Electric as early as the 1960 s. From there, use of the technique became more widespread in other large companies, notably Siemens (Lischka and Gemunden, 2008) and Lego (Kerr et al., 2019), to name but a few.

What most likely explains that popularity is the fact that technology and strategic roadmapping has repeatedly revealed its usefulness in industry contexts affected by disruptive innovations (Carvalho et al., 2013) and in assessing the impact of emerging technologies (Phaal et al., 2011). Roadmapping is particularly appropriate for justifying large, long-term investments in technology, the development of new skills, or when the need for organizational coordination is strong (Kappel, 2001). Beyond technological considerations, several studies also show the interest of using roadmapping to map market opportunities by placing the current and future needs of users at the centre of the approach (Noh et al., 2021; Kim et al., 2022). Roadmaps also enable better decisions to be made when evaluating innovation projects, thus allowing for better consideration of "*the interactions with other technologies and with the system as a whole*" (De Alcantara and Martens, 2019, p.128). And as a strategic method and tool, its general framework (see Fig. 1) gives it great flexibility in terms of temporality, unit of analysis and degree of detail that makes it easily customizable to any strategic context (Kerr and Phaal, 2022).

The overall benefits of technology and strategic roadmapping stem from its dual nature, as one can distinguish between the roadmapping process and its product, i.e., the roadmap itself (Kerr & Phaal, 2012). On the one hand, the roadmapping process allows a neutral space for knowledge sharing and collective reflection on anticipated changes in future contexts and issues (Krull and al., 2021) within a future time horizon, established in advance. On the other hand, the roadmap product is a structured visual chronology of strategic intent (Kerr & Phaal, 2022), involving multiple layers that usually include both strategic and technological perspectives. Roadmaps allow collectives to represent visually the desirable evolution over time of the objectives, capabilities, and activities of an organization, industry, or sector of activity (Simonse et al., 2015).

To better equip practitioners to develop and formulate their strategic objectives, and to improve the performance of their roadmaps, researchers have extensively studied the methods and major stages that can support their development (Carvalho et al., 2013). One of the best-known models is the "T-Plan" (Phaal et al. 2003), which involves three steps: the planning stage, the roadmapping stage, and the rollout stage. The model used by Gerdsri et al. (2009) also mobilizes three stages, but they speak instead of initiation, development, and integration phases. In both those three-stage models, the authors emphasize the key role played by strategic workshops in the constitution of roadmaps by allowing various actors to share information, knowledge, and ideas. During these different stages, recent literature also shows a growing interest in the use of data analysis and visualization technologies (Nazarenko et al., 2022), as well as the integration of digital tools (De Oliveira et al., 2022).

The roadmapping literature has therefore benefited greatly from those numerous contributions by allowing us to better understand "*how to roadmap*". However, with rare exceptions, scholars have been much less interested in the social and organizational nature of the phenomenon (Kappel, 2001; Kerr and Phaal, 2012; Simonse et al. in 2015). As a result, there is still limited understanding of the actors' motivations when engaging in a roadmapping process and the dimensions to capture the set of specific possibilities for action that roadmapping provides, which can lead to an array of sometimes unanticipated organizational outcomes (Simonse et al., 2015).

Among the few studies to have addressed that line of research is the work of Kappel (2001), who identifies three levels of roadmapping influence. The first level is realized when the roadmap serves to influence how a group or groups understand their strategic position in the organization. The second level of influence is reached when the communication surrounding the roadmap succeeds in influencing senior managers or business units to align their priorities with the roadmap. The third level consists of synchronizing at the organizational level the roadmap with the project management and portfolio management systems.

Kerr and Phaal (2012) also provide a new perspective from which to explore the social and cognitive nature of roadmapping. By considering roadmaps as boundary objects, they theorize strategic and technological roadmapping as a vehicule to cogitate, articulate, and communicate. Finally, Simonse et al. (2015), establish that the roadmapping activity allows: 1) time pacing by synchronizing the speed and intensity of future organizational efforts, 2) mapping of innovation activities and elements to a timeline, and 3) the synchronization of dialogue through a creative group conversation about future plans.

While these papers have made important contributions to begin to unveil the social and organizational nature of roadmapping, they primarily emphasize the benefits derived by the initiators of the roadmapping process. However, they have overlooked the broader anticipations and specific uses that various organizational stakeholders may the possibilities for action opened up by the roadmapping process and product. Yet, these dimensions are crucial as they significantly impact the behaviors and preferences of individuals involved, which may deviate from the original intentions of the roadmapping initiators, ultimately impacting the extent to which roadmaps are integrated and effectively utilized in practice (Meydanli & Polat, 2022). To explore those aspects further, we mobilize the literatures on strategic tools-in-use and affordances theory (Burke & Wolf, 2021; Demir, 2015; Hauge, 2018; Jarzabkowski and Kaplan, 2015).

### 2.2. The affordances of strategic tools

Strategy scholars have shown a growing interest in the material resources of strategy activity (Vaara & Whittington, 2012), thereby

indicating that material technologies and artifacts play a central role in strategy-making processes and practices. In that vein, Jarzabkowski and Kaplan (2015) recently developed a framework for understanding strategy tools as "*tools-in-use*" and pushed researchers to examine the multiple possibilities and constraints surrounding strategy tools and the social processes that produce them. They specifically argue that strategy tools come with affordances that both enable and constrain their use but are central to understanding the associated outcomes.

The concept of affordances was first used by James Gibson (1986) in explaining how individuals perceive the behavioral possibilities of an object or a context. Gibson demonstrated that affordances provide opportunities for action by encouraging certain behaviors while controlling and constraining others. Since then, the concept has been used in strategy and management to study the "*bundles of features*" (Faraj and Azad, 2012) or "*bundled action possibilities*" (Demir, 2015) of technology and strategy tools. In accordance to Jarzabkowski and Kaplan (2015), by affordances we mean like Zammuto *and colleagues* (2007: 52) say, that: "*The materiality of an object favors, shapes or invites, and at the same time constrains, a set of specific uses*". The concept of affordance is thus rooted in a relational ontology that gives an equal place to the material and the social in the study of strategy in practice (Faraj & Azad, 2012).

The literature on affordances emphasizes that tools can be used by different actors for multiple purposes. Kaplan (2011), for example, shows that PowerPoint, one of the most common tools in strategy making, can be used to negotiate the meaning of the content of certain slides, to create a space for discussion, to include or exclude certain participants from the strategic process, and to certify different ideas. Mazmanian et al. (2013) also show that the autonomy of knowledge professionals is mediated by using the affordances of mobile messaging. More recently, Burke and Wolf (2021) when studying the unintended affordances of de novo development of strategy tools, display that they enable recurrent cycles of spin-off strategizing and unfolding discovery of latent ambiguities.

Following this literature, we are encouraged to consider the ways in which strategy tools such as technology and strategic roadmapping provide interpretive and material affordances for action (Demir, 2015). As those tools can be used to realign organizational resources and serve the interests or ideas of certain people within the organization, they thus may become objects of power (Spee and Jarzabkowski, 2009). Of particular note is that the affordances of such a tool will not only affect the way managers approach discussions about strategic issues and the organization's future but also influence individuals' choices and preferences regarding the future outcomes they anticipate from the tool. As stated by Jarzabkowski and Kaplan (2015, p.541): "*These preferences may be associated with the best interests of the firm (where political action would be seen as irrational) or with the best interests of the individual decision maker (where political action can be seen as rational)*".

In that vein, it may be interesting to pay closer attention to the possibilities that strategic tools offer in terms of power and influence within organizations. This is all the more true given that empirical studies on the tools of strategy in use are rather scarce (Burke and Wolf, 2021), and often focus on the applications and outcomes that senior management makes of them (Jarzabkowski and Kaplan, 2015). It is from that perspective that our study, by mobilizing the concept of affordance in the analysis of roadmapping, seeks to answer two central questions to further investigate the social and organizational nature of roadmapping:

1. *What are the affordances of the roadmapping process and product in the making of strategy?*
2. *How do those affordances influence and frame the the behavior of organizational actors during the roadmapping design and dissemination process?*

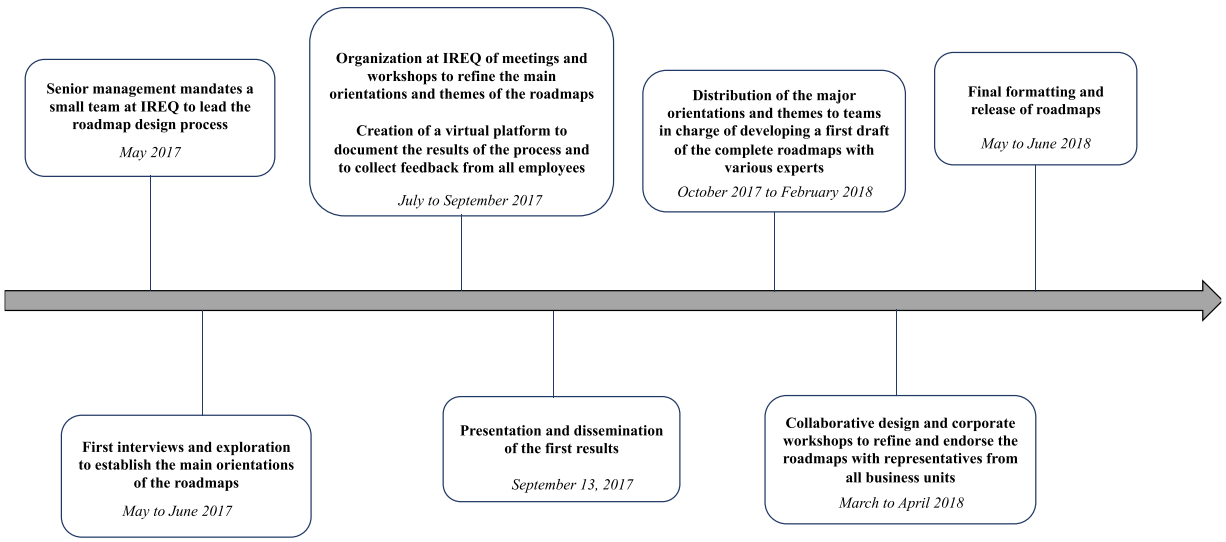



**Fig. 2.** Major roadmapping process steps at HQ from start to dissemination.

## 3. Research setting and methodology

In line with previous research on strategy as practice and roadmaps, we have used a single longitudinal study to investigate the affordances of roadmapping (Bengtsson and Lindkvist, 2017; Hussain et al., 2017). Indeed, the nature of such a study allows for a holistic, empirically rich account of specific phenomena, and is particularly suited to exploring the social nature of a phenomenon in depth, and describing the practices in use.

### 3.1. Context

This paper is based on data collected in a longitudinal study (Thomson and Holland, 2003) of the roadmap design and deployment process at Hydro-Québec (HQ), a Quebec state-owned enterprise divided mainly into three main business units, which hold a *de facto* monopoly on the generation, transmission, and distribution of electricity in Quebec. HQ is one of the largest producers of electricity in Canada and generates more than 99% of its electricity from renewable energy sources through its hydroelectric power plants. With its renewable and affordable electricity production process in place, a lack of competitors, and a relatively secure position, the organization traditionally focused on maintaining its existing activities, assets, and infrastructure. However, since the mid-2010 s, with the prospect of a profound transformation in the energy industry and an internal ambition to find new sources of value to exploit, the company has been putting more emphasis on renewing its ways of doing business and finding new growth drivers. Numerous articles attest to the energy industry's evolution in terms of the increasing spread of decentralized energy resources, the expected arrival of new players on the market, and new emerging technologies (Eklund and Kapoor, 2019).

Since that shift in emphasis, HQ's management has been putting pressure on the various business units and its research institute to place major innovation at the heart of their activities. To align those various efforts and anticipate future technological developments, a strategic planning exercise was initiated. The exercise involves designing and disseminating an organization-wide cross-functional strategic and technology roadmap covering the period up to 2035. It was first conducted by Hydro-Québec's research institute (IREQ) in 2017 then expanded to all business units in 2018. Fig. 2 describes the major steps in the roadmapping design and dissemination process.

The case of Hydro-Québec Québec is thus extremely well suited to the study of the deployment and dissemination of roadmaps. The importance of the roadmapping process for the organization, the scope that was given to the exercise involving a myriad of experts and actors from a wide variety of fields in the organization, gave us access to extremely rich data to cover different social and organizational aspects. In addition, prior understanding of underlying organizational issues, through previous research collaborations with the organization, enabled us to better understand and contextualize the nature of the exchanges that took place during the roadmapping process.

### 3.2. Data collection

In 2017–2018, we conducted a longitudinal study of HQ's strategic and technological roadmap process, from the design to dissemination stages. Our fieldwork spanned more than a year, including a total of more than 250 h of participant and non-participant observation where we were able to follow closely several contributors from the various internal teams involved in developing the roadmap. To document the research, the principal investigator was accompanied by two students who were involved in the preparation of the templates mobilized in the roadmap design workshops, and in the facilitation process.

Our roles were sometimes passive, as simple observers documenting and taking notes during meetings, activities, informal exchanges, or events, and sometimes much more active (Shani and Coghlan, 2021). For instance, we actively participated in supporting and helping the Technological Vision and Scenarios unit to plan and organize the roadmap codesign workshops with all HQ divisions. More specifically, in this active role, we helped the team capture best practices on roadmapping, organize the logistics of the event, facilitate certain teams during the workshops and synthesize the results of each workshop, bringing a particularly reflective dimension to our reports on the behaviors and interactions of participants that we had captured in the field.

In addition to the notes taken during the activities and our interactions with the field, more reflective notes were taken by the researcher in the field and the students in the form of logbooks, mainly kept during the workshops. The comparison of these different observation notes made it possible to reduce the subjectivity bias associated with the research, as well as to have access to a wider representation of the actions taking place within the different groups (Jonsen and Jehn, 2009).

Those workshops (16 half-day workshops in total) took place over two weeks, with a series of two half-day workshops held for each of the eight major roadmap orientations. The workshop participants were managers, experts, and researchers from HQ business units and IREQ. Each of the eight major orientations was associated with a particular group of participants attached to various disciplinary fields and expertise identified as relevant. Each group was supervised by a theme leader responsible for coordinating the work and making the roadmaps evolve. The orientations were based on the collective work previously carried out by IREQ to identify promising and strategic avenues for the organization. In total, nearly 166 different people, formed into 31 groups of five to seven people each, participated in the process.

In addition to our observations, we also conducted 31 semi-structured interviews (lasting between 36 and 75 min, with an average of 51 min each). We interviewed 7 senior managers, 2 directors of business units, 13 experts from different fields involved in the design process, and the 8 leaders of each of the different roadmap orientations, in order to have both a diversity of views, and to ensure that the perspectives of all actors who played a central role in the design, coordination and dissemination of the roadmaps were obtained.

The purpose of these interviews was to openly explore the motivations, issues, and affordances associated with the roadmapping

process and product. For example, we asked them about their expectations regarding the roadmaps, how they had been able to contribute to or experience the design and dissemination process, the challenges they had identified, and the opportunities that the roadmaps opened up for them and their teams. Those interviews were also designed as a way for us to delve into phenomena we had observed during the meetings and workshops, in particular on the tensions, the misunderstandings or the strategies of influence that we had the occasion to observe. As none of the participants objected, all interviews were recorded and transcribed. Finally, to complete and triangulate our data (Yin, 2014), we also had access to a lot of internal secondary data (virtual discussion forums, official announcement, team reports, presentations, etc.) which were particularly useful in capturing the traces of successive evolutions of the roadmaps, and the comments added by the actors as the process unfolded.

### 3.3. Data analysis

To analyze our extensive data set, we used a grounded theory approach to gradually generate robust theoretical constructs from the first-hand material collected in the field (Corbin and Strauss, 2014; Corley and Gioia, 2011). To ensure more objectivity, one of the co-authors of the paper, who was not involved in the data collection, was involved in the analysis to uncover the different categories and themes. Based on the observation notes and interviews, we began by building the first data-derived categories by focusing our attention on the different affordances of roadmapping, which were refined throughout the course of our analysis into researcher-induced categories (Van Maanen, 1979). At that stage, it appeared interesting to separate the categories according to those emanating from the roadmapping process and those that derived from properties of the final product.

We then tried to cross-reference the categories by looking for similarities and differences between them to bring out different themes offering an intermediate level of theorizing (Gioia et al., 2013). During this process, we used a form of constant comparison (Glaser and Strauss, 2017) to triangulate data from different informants and at different times to discern different key themes. Apart from prolonged engagement in the field allowing us to establish a better fit between our representations and those of the respondents, what Lincoln and Guba (1985) call credibility, we also tested with some of our field respondents our emerging themes to some to validate the accuracy of our interpretations and enhance the trustworthiness of our analysis (Tobin and Begley, 2004). Finally, we consolidated our various themes into three main aggregate dimensions (see Fig. 3).

## 4. Results

Our interviews and observations led us to identify and clustered the different affordances of roadmapping into three main functions associated with roadmapping. We detail those broad results by separating for each function the affordances associated with the roadmapping process from those derived from the product.

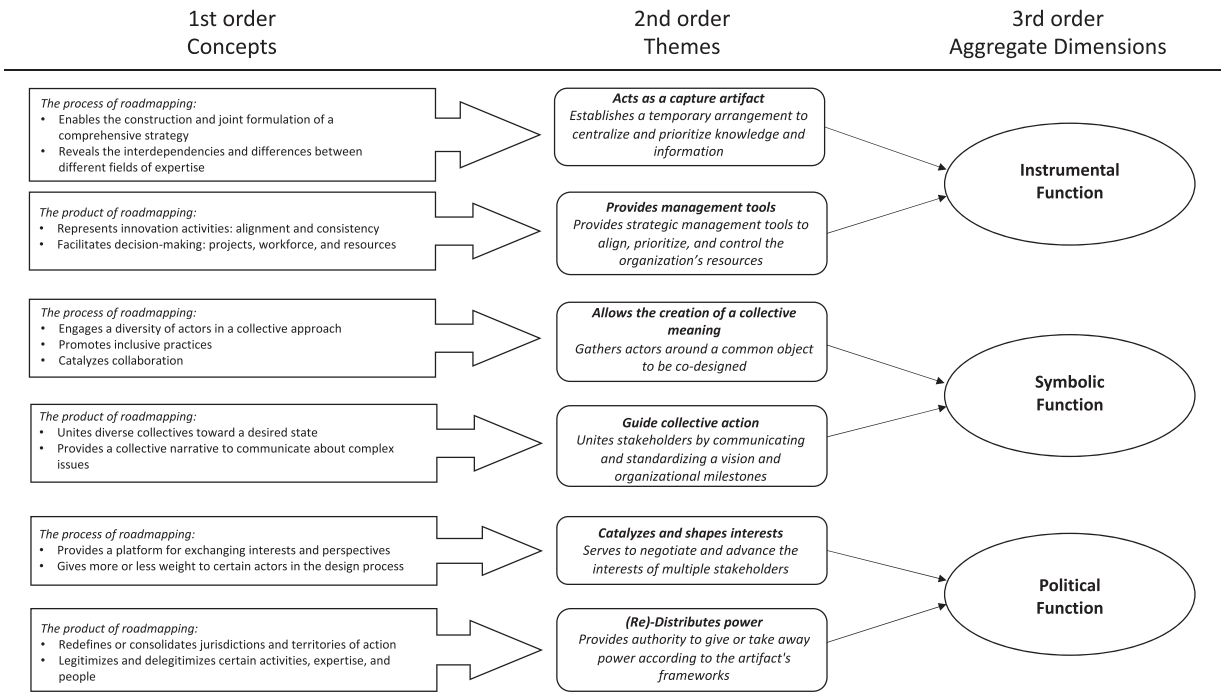



**Fig. 3.** Data Structure.

### 4.1. An instrumental function

In line with the representation given in the literature, we noted that the first affordances of roadmapping can be grouped into a function that is of an instrumental nature (Kerr et al., 2012; Vishnevskiy et al., 2015). As a strategic tool, the roadmapping process first takes a central role in acting as a capture artifact. By this, we mean that the process of roadmapping establishes a temporary arrangement that allows collectives to reveals, translate, centralize and prioritize a broad array of knowledge and information. Indeed, what we found was that the workshops and meetings to design the roadmaps create dedicated spaces that directs the interactions among the individuals and teams for the construction and formulation of new comprehensive strategies. Furthermore, it is through those interactions that the roadmapping process offers the possibility of uncovering the differences and interdependencies that may exist between groups or units. Our observations of the workshops particularly highlighted that point (see Table 1).

If we begin by focusing on the way in which the tool reveals and clarifies the differences between the groups, the semantic nature of some of those differences needs to be acknowledged. Indeed, the words used in the roadmap template did not have the same meaning for actors from different divisions or even business units, thus forcing the groups to clarify their knowledge and enter into a debate to establish a new, more acceptable formulation (Carlile, 2004). As one of our respondents put it:

> *These are really basic language questions. Often, we thought we understood each other in the workshops when we weren't talking about the same thing. On a technical level, I can give you lots of examples of words that don't mean the same thing for other business units. We had to be careful with this. I've fallen into this trap many times, and it took us some intense discussions to come to a common statement on the roadmap.*

However, more intense debates focused on the very conception that different people had of the value associated with this or that aspect in the roadmap. Thus, several trade-offs between the modularity, efficiency, or reliability of HQ's future electrical network emerged at the center of those debates and discussions (Logbook, April 24, 2018). Whatever the topic, be it the implementation of microgrids, network operations, or the management of unplanned events, those trade-offs were crucial. As dispensing with one or other aspects would automatically close the developmental route to some alternatives for future innovation projects, those trade-offs were key for many of the participants. The roadmapping process was instrumental in overcoming those differences, forcing actors to have these debates and to make these trade-offs to jointly formulate the future strategy.

On the other hand, by providing a temporary layout and a visual representation tool to build a strategy, the roadmapping process revealed the interdependencies that could exist between the organization's various fields of expertise. For example, it became clear to researchers interested in the integration of renewable energies and the emergence of new services that such developments would not be possible without the support of the group in charge of renewing network automatisms. They realized that the system's calculation and data capacities would also offer the possibility of monitoring and reacting appropriately to variations introduced into the network

**Table 1**
The instrumental function of roadmaps. Excerpts from quotes.

| | | | |
|---|---|---|---|
| Enables the construction and joint formulation of a comprehensive strategy | *"The vision serves to give oneself a horizon, to give yourself long-term targets. It doesn't mean that they are the best and that they won't move. The roadmaps will serve to operationalize all that. It becomes medium and long-term planning for Hydro-Québec R&D."* | *"The roadmapping process helps to ensure consistency. It allows decisions to be made and explained in a coherent way."* | *"The roadmapping process provides an analysis of the fragility of our current model and the robustness of future directions. What we're doing right now is determining what the most robust path is. Maybe not the most optimal, but the most robust."* |
| Reveals the interdependencies between different fields of expertise | *"It allows us to have a form of coordination in the major fields, which gives us a very global vision of the company and to have common questions that we would not have had otherwise."* | *"The roadmap must allow us to have a global vision of the company, and of the interdependencies that exist in the network in order to correctly build the major orientations for the company. We must ensure that together there is a line that takes us in the right direction."* | *"We thought we had thought enough about the roadmaps, but there were so many things we hadn't thought about! Now, after the workshops we can see better where things might get stuck and who we need to discuss our progress with."* |
| Represents innovation activities: alignment and coherence | *"I'm very satisfied with the technological alignment the roadmaps give to the company."* | *"We talk about value in isolation, but we must succeed in showing that there is a chain not only in time on an axis, but also transversally. The roadmaps show each person, each division in its mission, where this mission is located in the overall organization."* | *"It is above all a tool for scientific coordination and project prioritization. It aligns resources with the major issues of the vision in the roadmap."* |
| Facilitates decision-making: projects, workforce, and resources | *"It's a central tool for orienting our expertise over time. In 15 years, a good part of the cohort will have left and a good part will return. So, we have the margin to reorient our expertise and our strengths in the company. Will 1/3 of the company be working on AI? Maybe, but it's going to be a very important tool for our human resources plan."* | *"We see that there are things that naturally become essential and that we don't have the resources internally. Do we at least have people who are qualified to do a bit of monitoring or to be trained in certain areas that we will miss? There are places where we don't have the resources now and which become central with the roadmap."* | *"At the moment, at the research institute, we have mainly a technical expertise. Perhaps we need people in social sciences and economics. For the moment, we haven't touched on this, but the roadmap will help change that. We see that we need to renew our expertise if we want to properly attack the targets, we have set ourselves, based on what we project as a company."* |

by renewable energy sources, while also limiting the field of possible decisions. Conversely, the renewable energy group came to understand how its own best interests would be served by communicating its research and advances regarding the relevant data to be considered to best adjust future automatisms.

The instrumental function of the roadmapping process itself can thus act as an artifact of capture that makes it possible to clarify, centralize, transform, and prioritize the knowledge and information of actors spread across different teams, domains, divisions, and even companies. In the words of one of the experts responsible for one of the eight roadmap orientations: "*It allows us to have a form of coordination in the major domains which gives us a very global vision of the company and helps us to have common questions that we would not have had otherwise*".

Once the roadmapping product has been agreed, the instrumental function takes on a second form serving the interests of the organization's senior and middle managers as it provides and feeds strategic management tools that align, prioritize and coordinate organizational resources towards the strategic intentions stabilized on the timeline. First, the roadmap provides a visual representation tool for presenting innovation activities over various timescales that give the organization direction and cohesion. As such, it allows everyone to better understand the overall value chain and how transformations align across the organization, beyond just their team, unit, or division.

However, the instrumental value of the roadmap is primarily important to the organization's senior managers, especially those in the project office, as it guides and directs technological innovation efforts and decision-making. For example, many managers at IREQ were waiting for the roadmap to be finalized before starting other activities, such as initiating new innovation project portfolios, assessing medium- and long-term skills and staffing needs, and identifying the most promising and critical expertise for the organization. In doing so, roadmaps not only provide a powerful strategic tool for the organization, but also feed into and serve as a starting point for other strategic management tools. Roadmaps thus offer the possibility to facilitate decision-making for innovation and resource alignment to the extent of reorienting the very criteria for evaluating the company's projects (Siebelink et al., 2016).

### 4.2. A symbolic function

Our analysis also highlights another major function played by roadmapping which has surprising symbolic properties by incarnating a change in culture, by symbolizing an evolution of praxes, by representing a vision and a desired state that engages stakeholders in working together to achieve common goals. It became clear that, beyond the knowledge shared during the roadmapping process, the inclusive and collaborative dimension of the process had allowed various stakeholders to engage in a collective sensemaking process regarding the organization's future around a common strategic object to be codesigned, and that the roadmapping product also made it possible to federate and convey meaning to organizational actors by providing a powerful collective narrative to communicate on complex issues (see Table 2).

Thus, in looking at the way the roadmapping exercise was conducted at HQ, the inclusive dimension of the process appeared to be

**Table 2**
The symbolic function of roadmapping. Excerpts from quotes.

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|---|---|---|---|
| Engages a diversity of actors in a collective sensemaking process | *"The advantage of the roadmap is to say: 'I'm wondering.' I just thought about some issues and I have a structured activity to think with other people about where we're going, what it's going to be, what are the best choices."* | *"I think it also helps people internally to build a common vision and to increase the interaction between the various stakeholders, to know a little more about what the neighbor is doing, because it's not necessarily obvious. Traditionally we had discussion only in the circle of our team. This is completely different."* | *"The exercise is as important as the content; it brings together people who never meet."* |
| Promotes inclusive practices | *"The roadmapping process is bringing about a cultural change in the company. It's been very positive in that respect. I hope that this type of approach will continue with several iterations."* | *"It's really an inclusive process that we tried to implement. Anyone could be a contributor to the roadmap."* | *"The roadmapping process empowers the staff. In a way, it makes decision-making power much more accessible, and it decentralizes management decisions."* |
| Unites different collectives toward a desired state | *"Roadmaps can help us to quietly change the culture by carrying a long-term strategic vision."* | *"The roadmap is a journey to move the company to where we think it should be. The vision is the direction, and the roadmap is the path and the steps that must be climbed to reach that direction."* | *"The technological roadmap brings people together. Today, it already challenges senior management because it gives them a vision, that of a profound transformation of the organization."* |
| Provides a collective narrative that allows communication on complex issues | *"Business units don't have the resources or time to look ahead. They have constraints and the window of opportunity to talk to them is very short. Attention is very limited. We need to have a clear message, to be quick and to have something that sticks. That's where the roadmap will help me do my job in the short term."* | *"I was told that there were discussions between the managers who really appreciated being told a story through the presentation of the roadmap."* | *"Through the process you realize that you have to come up with very general terms. Phrasing is very important. The question is, how do I broadcast this afterwards without coming up with hyper-generic titles? People will look in particular at the themes and titles. But what we want them to do is ask questions, look and see where they think they're going to get attached, and to be able to better design and prioritize new projects accordingly."* |

quite remarkable thanks to the great diversity of stakeholders (more than 350) able to contribute to it. As the organization's first collective initiative of such magnitude, many people felt that it promised a more inclusive culture change through the decentralization of decision-making power. By promoting inclusive practices, the roadmapping process thus became a symbol of an internal culture change for many employees. And by catalyzing collaboration on the organization's future transformations, the roadmapping process also engaged many stakeholders in a collective sensemaking process aimed at building a desired and desirable organizational state over various timescales.

Therefore, the roadmapping process is part of a collective process of sensemaking, deconstruction, and reconstruction that allows for several alternative futures to be discussed and debated (Maitlis and Christianson, 2014). The roadmapping meetings and workshops in fact offer a temporality dedicated to a form of collective reflexivity on the future that can provide new outlets for further explorations and allows for the reimagining of what could be. This affordance is based on mechanisms of projection, imagination and hybridization of visions that allow discussions to take place to reveal the latent preferences for the future of the stakeholders involved in the roadmapping process. The challenge remains, however, of reconciling the various perspectives into a common vision.

That provides a link to the roadmapping product's symbolic function, which incorporates the collective reflexivity and establishes a narrative at a given moment that can then guide collective action. By this we mean that roadmaps have the affordance of federating collectives toward a desired state by communicating and standardizing a vision and organizational milestones. Indeed, one of the major aspects of the roadmapping product is also to be a formidable internal communication tool around complex issues concerning the organization's future, it thus helps to align instrumentally innovation activities and make future changes more acceptable by acting on the interpretive schemas of individuals and groups (Fiol, 2002; Kupers et al., 2013). As one HQ manager told us, "*The roadmap brings people together. It gives them a clearer vision of the profound transformation that we must accomplish together and to better prepare for it*". Nonetheless, to generate buy-in around the roadmap, managers must rely on convincing communications and mobilizing the right level of detail for the target audiences.

Moreover, we noticed later, once the roadmap had been communicated and disseminated throughout the organization, a great capacity to federate and coordinate groups through the establishment of a common language. The standardized language of the roadmap has thus enabled HQ employees to better coordinate their areas of expertise, particularly in the deployment of new projects. However, as Phaal et al. (2004) put it, it may take several iterations before a truly shared language and categorization emerge.

**Table 3**
The political function of roadmapping. Excerpts from quotes.

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|---|---|---|---|
| Provides a platform for exchanging interests and perspectives | *"It's an exercise that forces us to talk to each other to give ourselves a common vision. Because traditionally we had a vision for each team. This is completely different."* | *"The roadmapping process needs to be collaborative, but the first iteration needed to be done here in the research institute. Business units don't have time to step back and see the big issues. The first iteration is never perfect, but after consulting so many experts in different fields, we have more than a skeleton of the roadmap. We have a first draft which allows us to set the table with the others to discuss."* | |
| Gives more or less weight to certain actors in the design process | *"There are people who wanted to be involved in the development work and who were not mobilized."* | *"There are several experts and researchers working on the roadmap. For the moment it's going well, but I have a fear when everyone will want to put their current activities in it. The arbitration is not that easy to do. I don't want to tell my colleagues that your project is not a priority in relation to the vision that we have given ourselves."* | *"The people who led the work on the roadmapping process are people with a lot of experience, but they are not necessarily the people with the best ideas."* |
| Redefines or consolidates jurisdictions and territories of action | *"We see that there are areas that naturally become essential even if we don't have all the resources internally. There are other areas that are missing from the current vision."* | *"I can see managers looking at the long term vision of the roadmap and saying to themselves, 'My staff is only qualified in two areas and I'm not going to be able to turn the corner'. It doesn't matter that we don't see exactly what we want to do in the short term, we have to adapt. If we see that digital jobs are coming, then I need staff in automation and digitalization."* | |
| Legitimizes and delegitimizes certain activities, expertise, and people | *"Ultimately, what I expect is that each senior manager will be able to say, my mission is this, my master plan, my scope of activities is this, it exists in and of itself, but it ties into the roadmap at a high level and that's where it ties in, and that's why I'm delivering a mission that's compatible with the rest of the company. So, everyone can defend and legitimize their activities using the roadmap."* | *"Does the project fit into the target of the roadmap? If so, it is legitimate, and therefore prioritizable."* | *"There is a risk of falling into the notion of a small empire, of controlling the mission. At IREQ, we have people who will tell us: 'I know what I'm talking about, you're not going to tell me'. We have to see how to take these experts by the hand and tell them with the roadmap that we are going in such and such a direction, what does that mean for your field?"* |

### 4.3. A political function

Finally, the analysis of our empirical observations also uncovered that roadmapping has a political function that is often overlooked in the existing literature. Both in the roadmapping process and once the final product has been agreed, roadmapping can serve to negotiate and advance the interests of certain stakeholders, legitimize new activities and expertise, or consolidate jurisdiction over a particular territory of action by allowing actors to assert their authority through the artefact's framework. Technology and strategy roadmapping therefore has a strong political dimension that can greatly influence the instrumental and symbolic functions (see Table 3).

Our observations allowed us to note that even though the process of designing the roadmap was conducted in a very open and inclusive manner at HQ, it was extremely tainted by political aspects and issues. On the one hand, since the request came from senior management, many researchers sought to be actively involved in the relatively small team piloting the initial process at IREQ. That huge interest manifested itself explicitly in some people's desire to have more influence on the design process. They saw it as an opportunity to advance their interests and research fields. Such a reaction was also particularly visible when participants were being recruited for the workshops. Those who had not been included often expressed a strong desire to participate (by going to plead their case to the themes leaders or by having their messages and requests passed on by their manager) or sought to share their insights and interpretations through work colleagues who were involved.

Even when the process is collaborative, that does not mean that all stakeholders have the same voice. Our field observations tend to show that certain skilled actors can influence the design of such artifacts to a large extent through framing and reframing practices (Bjerregaard, & Jeppesen, 2023), even though they do not formally have hierarchical power or the most recognized expertise. Such practices can be illustrated by the example of Jules, a researcher who, during a preparatory session to extend the roadmap to the various business units, succeeded in convincing the various theme leaders responsible for the major roadmap orientations to reformulate them and change their layout. As exemplified by Jules' success in convincing the roadmapping pilot group, such political strategies and practices embody some actors' efforts to establish the legitimacy of their frameworks or to realign existing frameworks to influence the way others perceive the future organizational reality. The roadmapping design process therefore appears to be one of the organizational areas where major competition will take place for the frames that will become dominant in the future organization (Kaplan, 2008).

Moreover, political issues were widespread in the workshops in which we participated. Some people, anticipating the highly political character of the roadmaps as a driving force for the organization's future strategy, arrived at the workshops with several pages of projects and representations that they wanted to pass on. By the second workshop, they had even prepared corrections to the statements initially worked on by the group (Logbook, May 8, 2018). This highly political dimension was also apparent in the attitudes of the various roadmap orientation theme leaders. For example, despite the participants' comments on and improvements to the themes and orientations, some theme leaders were less open than others during the second workshop and did not want to make changes that they anticipated could limit or weaken their influence on future activities within the roadmap.

Thus, the process of designing strategic tools like roadmaps catalyzes and shapes organizational actors' interests and perspectives. It actually opens up the possibility for organizational actors to engage in a competition to control the meanings and frames that will become legitimate (Jarzabkowski and Kaplan, 2015). Competition at the level of the political function is thus directly mobilized here to influence both the instrumental function, i.e., being sure to have innovation activities aligned in the future organization, and the symbolic function, i.e., asserting a narrative that enhances one's interests. From this perspective, we can better understand why intensive negotiations can take place regarding slight semantic nuances. We have indeed observed empirically that actors anticipate the instrumentalization of the roadmap and that changing the meaning or phrasing of a passage can lead to a loss of legitimacy for the activities of an occupational community or an internal team.

The finalized product of roadmapping, on the other hand, has an entirely different political function. Once agreed, the roadmap is invested with a new authority that can transform or reaffirm power relations in the organization depending on how the actors mobilize them in practice. The fields of expertise and the activities underlying the territories of action that the roadmap designates can acquire legitimacy through it. It is this characteristic that gives a roadmap such an interesting instrumental value, because decision makers can refer to it not only to design but also to legitimize and support their decisions. In a similar way to an organizational chart, a roadmap thus helps to redefine or consolidate territories of action. It is because of this central affordance of the roadmapping product that the organization's actors can react strongly, employ strategies to distance themselves from it, and not recognize it as a legitimate strategy tool for their group or unit.

In this context, the roadmap really becomes a strategic object that allows certain actors, activities, and expertise to acquire or lose legitimacy (Bourgoin et al., 2020). Roadmaps draw trajectories that induce, facilitate or make more difficult, and limit or broaden a set of possible actions. As such, they can be mobilized by some actors in speeches, presentations, or documents to explain the alignment, scope, or value of their activities. Some groups and expertise may, however, suddenly become less legitimate through being of reduced strategic significance under the organization's new selected frameworks. Such groups may then realign their activities and domains, dispute content interpretations, or try to distance themselves entirely from the roadmap. This central affordance, which is largely anticipated by stakeholders as soon as the roadmaps are designed, can thus result in active resistance (rejection, opposition) or passive resistance (pretending to comply, disregard, etc.) towards the finalized version of the roadmap (Ybema and Horvers, 2017; Pachidi et al., 2021).

It was particularly clear that stakeholders who took ownership of the roadmap or participated in its design process were much more likely to use it to legitimize their projects and activities. Conversely, many people in the business units who were not mobilized during the exercise did not want to take ownership of the roadmapping product or to use it in their management tools. That was notably the

case for many in the company's business units who, after the tool had been disseminated widely across the organization, mobilized strategies either to avoid the roadmap, for example by redirecting attention to other strategic tools such as their division's business plan, or to distance themselves from it by using phrases such as "*It is primarily a roadmap for our research institute, not for all Hydro-Québec business units*" in order to avoid recognizing it as a legitimate object of strategy.

It is clear from those strategies that the roadmap becomes both an object of power, capable of generating strategic conflicts and resistance, and a tool that people use while anticipating its potential for future political action. That then has a significant influence on whether they will appropriate (or not) and use in practice (or not) the contents of the roadmap. The political function plays a major role here by making technology and strategic roadmapping an authoritative tool (Bourgoin et al., 2020). This perspective suggests reconsidering the casting of the people involved in the design of such strategic objects as the roadmap, who should not just be involved as bearers of relevant knowledge, or just be focused on top and middle managers (Kappel, 2001), but also include people deemed key to being ambassadors for the roadmap, or even essential for its future use.

### 4.4. Toward an emerging model of the affordances and functions of roadmapping

From our empirical analysis, we derive an emerging model of the six major roadmapping affordances linking its instrumental, symbolic, and political functions (see Fig. 4). Our model primarily reaffirms the importance of the roles that roadmapping can play in an organization. It can support the strategic management of expertise and forms of value (instrumental function), be one of the organs of cohesion which allows the emergence of a common meaning to orient collective action (symbolic function), and finally it can catalyze and shape new power relationships which allow for the redefining or consolidation of an organization's territories of legitimate action (political function).

The model thus develops a framework for better understanding how roadmapping can act as a mediator between the informal, i.e. the myriad of individuals, teams and communities scattered throughout the organization; and the formal, i.e. the set of systems, processes, activities and structures that are formally established in an organization, by offering a space of instrumental, symbolic, and political possibilities for action. We found that it is mainly the six major affordances put forward that influence the use of a roadmap in practice, but also individuals' choices and behaviors during the process and after the tool has been finalized.

By anticipating, for example, that the tool will be able to provide other strategic and management tools, individuals can employ micropolitical strategies to influence the roadmap frameworks and phrasing so that it will better serve their or their group's future interests. Similarly, individuals and groups may have varying levels of skill at influencing the collective sensemaking process through their vision of technological or strategic developments and by anticipating that the roadmap will serve to guide the organization's future collective actions. The model can thus help to better frame the social and organizational aspects presented by the affordances of roadmapping.

Finally, our model also demonstrates the central role played by the political function, acting as a mediator of the other two functions. Indeed, far from being automatically achieved, the instrumental and symbolic affordances of the roadmap will be largely influenced by the competition at the level of the political function. Taking or not taking into account the issues associated with the

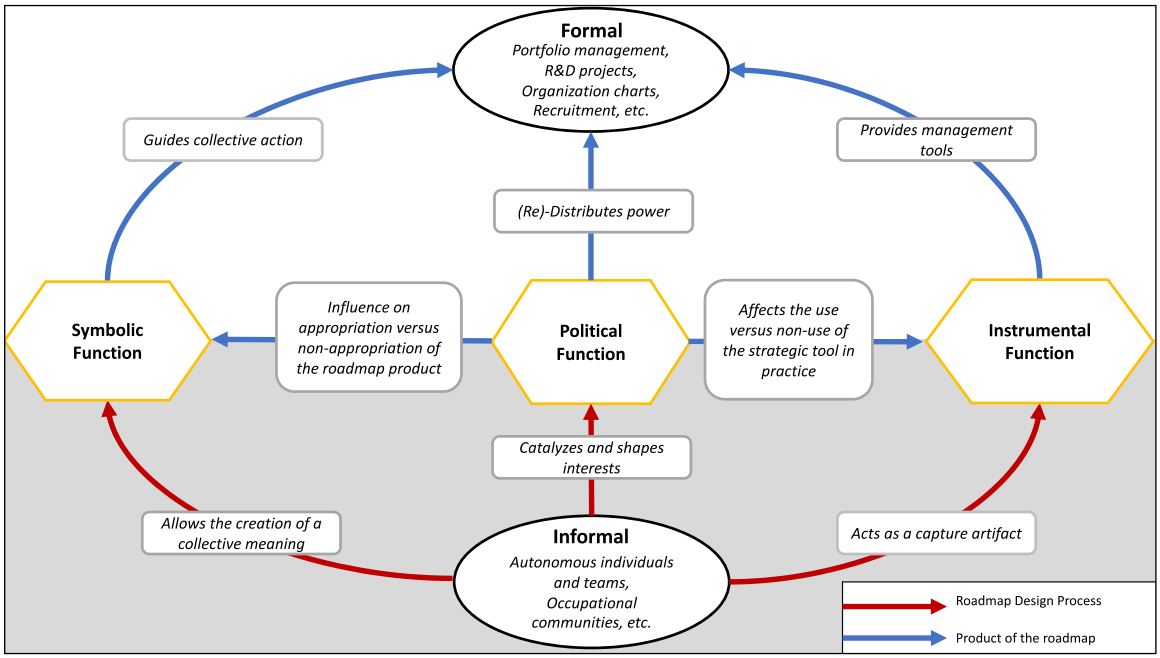



**Fig. 4.** An emerging model of roadmapping affordances linking its instrumental, symbolic, and political functions.

affordances of the roadmaps' political function will therefore largely influence the use versus non-use of the roadmaps in practice, as well as the appropriation versus non-appropriation of the narrative aimed at guiding the organization's collective action.

## 5. Discussion

Our research thus allows us to deepen the social and organizational nature of roadmapping through a systematic study of the set of specific action possibilities opened by the roadmapping process and product. Having characterized more precisely the three main functions performed by roadmapping, as well as the six major affordances of its process and product, we first discuss some important implications of the results for the study of strategy tools-in-use and for understanding the sociomaterial dimensions of roadmapping. We then present some limitations and directions for future research.

### *5.1. Contributions*

The results of our study allow us to make three central contributions to the literature. First, our study contributes to the roadmapping literature by exploring the possibilities for action afforded by the sociomaterial aspects of the roadmapping process and product (De Alcantara & Martens, 2019; Kerr et al., 2012; Siebelink et al., 2021; Simonse et al., 2015). The emerging model from our results allows us to better understand and describe the links and relationships that exist between the different affordances of this strategic tool, which can act as an intermediary between autonomous individuals, teams, and communities and the organization's formal structures and activities.

1. The process of roadmapping, as a boundary object, allows for the translation and transformation of information and knowledge disseminated among several individuals, teams, and communities. The process also has the potential to highlight or reconfigure interdependencies between several fields of expertise and to connect previously unconnected actors. In doing so, roadmap development and design also give individuals and communities the opportunity to engage in a collective process of construction, deconstruction, and reconstruction of meaning that allows alternative representations of the future to be discussed and debated in order to establish common frameworks (Bjerregaard and Jeppesen, 2023). Finally, it also provides a formal platform that catalyzes informal competition for new frameworks and meanings that will become legitimate for the organization.
2. Once finalized, the roadmapping product acts like a strategic object that relies on knowledge and information integration to feed into and update management tools for reconfiguring the organization's formal structures and activities. Moreover, the roadmap allows for a meaningful narrative that aligns and federates collective action, thus giving coherence and a certain alignment to innovation activities. Finally, the roadmap also helps to redistribute power in the organization. Organizational actors claiming interests in the new territories of action defined in the roadmap can invoke or mobilize it to acquire more resources or legitimize their expertise and activities (Bourgoin et al., 2020).

It is therefore necessary to take all those affordances into account to have a successful roadmapping practice and to pay attention both to the methods deployed and to the way in which the political and symbolic issues are addressed. Our paper invites greater attention to be paid to roadmapping process participant recruitment and not to reserve this tool for senior or middle managers (Burgelman et al., 2018). Anticipating the questions of use and appropriation of strategic objects, the initiators of roadmapping should then not limit their attention to the purveyors of relevant knowledge (Kerr and Phaal, 2019; De Oliveira et al., 2020). Beyond questions of expertise, it is important to consider stakeholder influence and representativeness within the organization to better address the power dynamics and interpersonal tradeoffs imply by the use of this strategic tool. In the same way, options should be considered for managing groups' and individuals' resistance strategies regarding a new strategic tool. Strategies for managers to explore in order to address resistance issues could include having roadmap champions or owners in different units and using other groups than those initially mobilized for the first design phase to update the roadmap.

Second, another key contribution of this paper is to shed light on the central role played by the political function and affordances of roadmapping. Our observations and interviews in the field have led us to understand that the political function, far from being independent of the other two, also plays a role in mediating the symbolic and instrumental functions. What our paper shows is that beyond the methods used to make roadmapping more efficient (De Alcantara & Martens, 2019), managers must particularly consider how to deal and manage with the political issues that will have a great influence on the outcomes of roadmapping.

Our study highlights the fact that individuals and collectives in the organization anticipate its influence as a guide for collective action in the organization (symbolic function), and its impact on management tools for strategic purposes such as the construction of innovation projects portfolios (instrumental function), and consequently deploys political microstrategies to try to influence the roadmap frameworks and phrasing so that it will better serve their or their group's future interests (Bourgoin et al., 2020). By reinserting these political affordances into the relationship between the roadmapping process and product and the actors who enact and mobilise it, our study allows us to refocus managers' attention on power dynamics that can lead to forms of manipulation, coercion, domination or subjectification which could divert the primary intentions of roadmapping (Fleming and Spicer, 2014).

Achieving the organizational benefits of roadmapping, notably in terms of coordination and alignment (Park et al., 2020; Simonse et al., 2015), is therefore extremely dependent on the anticipations made by individuals of the political affordances of roadmapping. This means that as Jarzabkowski and Kaplan (2015, p.545) argue, during the process of designing such a strategic tool, managers must "*navigate these social dynamics while at the same time working to develop strategic insights*". In addition, this also means that managers must take into account the micro-strategies that individuals and groups will put in place in the organization to distance themselves from or

resist the diffusion and mobilization of the roadmap so that the roadmap can actually be mobilized in practice in management tools and guide collective action.

Third, on a broader scope than for roadmaps, the functions revealed by our study, which have the potential to be applied to other strategic management tools, also open up interesting perspectives for the literature on strategy as practice to better understand the relationships mediated by the affordances of such artifacts with the individuals and collectives of the organization. In particular, our study invites scholars investigating strategic tools-in-use (Burke and Wolf, 2021; Hauge, 2018; Paroutis et al., 2015) to look more closely at the interactions between the affordances opened up by these strategic objects and the political microstrategies deployed by actors to influence the meanings and frameworks that will become relevant in the organization's future strategy.

### 5.2. Limitations and future research

One of the limitations of our study is being based on a single case study. While we believe that our emerging model of the affordances of roadmapping is valid in a wide variety of contexts, particularly when the roadmapping process is done collaboratively. Another limitation of our model is that the symbolic and political affordances rely in part on the collaborative nature of roadmapping work. It is certain that the scale of the roadmapping process presented in the case, both in terms of duration and the number of people mobilized, helped to accentuate certain affordances outlined. This applies, for example, to the promotion of inclusive practices in the symbolic function, or the revelation of interdependencies in the instrumental function, which are only transferable to contexts where many different actors are involved in the design process. While the deployment of roadmaps is generally based on physical or virtual meetings and workshops (De Oliveira et al., 2022), these affordances are less prominent in the case of a centralized process (Cosner et al., 2007) where a dedicated team develops the roadmaps alone using information provided by the business unit content owners. Moreover, our study is based on the observation over time of the establishment and dissemination of an internal roadmap. However, the symbolic and political functions and issues are likely to be different when, as in the case of the semiconductor industry, roadmaps are developed by different entities (universities, companies, public organizations, etc.). Investigating this phenomenon in collaborative contexts at the sector or industry level could shed light on this issue.

Finally, our work opens up two major avenues for future research. One is that our study could lay the foundations for developing new indicators to better account for the success of the roadmapping process and product by considering the different affordances that the tool allows, particularly in terms of measuring the appropriation and use of the tool in practice by different groups within the organization. Second, we believe it would be interesting to study political microstrategies in greater depth in the study of strategy tools (Burgelman et al., 2018). That area is still relatively unexplored, yet it is central to understanding the sociomaterial aspects associated with the use and mobilization of such objects in organizations.

## 6. Conclusion

Our paper explores the functions and affordances of roadmapping, especially in terms of its three main functions in an organization. The first is an instrumental function where the roadmapping process acts as a capture artifact that enables actors' knowledge and information to be clarified, centralized, transformed, and prioritized for distribution to different teams, domains, and divisions. The roadmapping product provides and feeds into management tools that can facilitate decision-making for innovation and resource alignment. The second is a symbolic function where the design process, by its collaborative and inclusive nature, engages stakeholders in a collective process of sensemaking regarding the organization's future around a common strategic object to be codesigned. Once agreed, the roadmap product has the potential to federate groups toward a desired state by communicating and standardizing a common vision. The third function is political, with the roadmapping process catalyzing and shaping the organization stakeholders' interests and perspectives. Through this political function, the roadmap product participates in redistributing power in the organization, because the actors in the new territories of action can invoke or mobilize them to acquire more resources or legitimize their expertise and activities.

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