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Aller au sommaire du numéro

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Résumé de l'article

Sur la base de deux études de cas approfondies, cet article étudie comment les nouvelles connaissances produites par les communautés internes s'intègrent dans les activités et les procédures de leurs entreprises. Sa principale contribution souligne le rôle clé joué par les structures frontières situées à l'interface entre les communautés et les strates managériales de l'organisation. Ces structures articulent le travail de frontière nécessaire à l'intégration des travaux communautaires : alignement à la stratégie, négociation de leur validation par la direction. Plus qu'un simple processus de diffusion, leur rôle consiste à combiner et adapter logiques managériales et communautaires tout en préservant l'autonomie et le fonctionnement interne des communautés. Le caractère collectif de ce mécanisme d'intégration le distingue de la dyade sponsor-leader.

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ABSTRACT

Relying on two case studies, this paper investigates how new knowledge produced by internal communities is integrated in the hosting firms' activities and procedures. Its main contribution highlights the key role played by boundary structures lying at the interface between communities and the managerial strata of the organization. These structures are instrumental in the boundary work underpinning integration: aligning the communities' outputs with the firms' strategy and negotiating their acceptance by top managers. Their role goes beyond a mere diffusion process and includes combining and adapting the managerial and communitarian logics while preserving the autonomy and internal functioning of communities. Due to their collective character, this integration mechanism differs from the sponsor-leader dyad found in the literature on communities.

Keywords: boundary structures, knowledge integration mechanisms, internal communities, strategic alignment

Résumé

Sur la base de deux études de cas approfondies, cet article étudie comment les nouvelles connaissances produites par les communautés internes s'intègrent dans les activités et les procédures de leurs entreprises. Sa principale contribution souligne le rôle clé joué par les structures frontières situées à l'interface entre les communautés et les strates managériales de l'organisation. Ces structures articulent le travail de frontière nécessaire à l'intégration des travaux communautaires : alignement à la stratégie, négociation de leur validation par la direction. Plus qu'un simple processus de diffusion, leur rôle consiste à combiner et adapter logiques managériales et communautaires tout en préservant l'autonomie et le fonctionnement interne des communautés. Le caractère collectif de ce mécanisme d'intégration le distingue de la dyade sponsor-leader.

Mots-Clés : structures frontières, mécanismes d'intégration des connaissances, communautés internes, alignement stratégique

Resumen

Sobre la base de dos estudios de caso exhaustivos, este artículo estudia cómo se integran los nuevos conocimientos producidos por las comunidades internas en las actividades y procedimientos de sus empresas. Su mayor contribución subraya el papel clave desempeñado por las estructuras fronterizas que se hallan en la interfaz entre las comunidades y los estratos directivos de la organización. Estas estructuras articulan el trabajo fronterizo necesario para la integración del trabajo comunitario : alineamiento con la estrategia, negociación de su validación por la dirección. Su papel va más allá de un mero proceso de difusión : consiste en combinar y adaptar lógicas de gestión y lógicas comunitarias manteniendo la autonomía y el funcionamiento interno de las comunidades. El carácter colectivo de este mecanismo de integración lo distingue del nexo entre patrocinador y líder que se encuentra en la literatura sobre comunidades.

Palabras Clave: estructuras fronterizas, mecanismos de integración del conocimiento, comunidades internas, alineamiento con la estrategia

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Internal communities, defined as informal, emergent, and voluntary groups of professionals who self-organize to accumulate and maintain knowledge concerning their practice, often develop new and creative knowledge (Brown and Duguid, 2001, 1991). Precisely because of their independence with the firm's formal managerial structures, communities can more easily explore new knowledge areas not necessarily aligned with the firm's strategy (Brown, 2004; Bucher and Langley, 2016). As such they are often portrayed as local regimes of learning, innovation and change (Schulte *et al.*, 2020; Wenger, 1998).

However, if numerous accounts explain how communities produce knowledge (Brown, 2004; Lave and Wenger, 1991; Orr, 1990) as well as the necessary contextual conditions for their emergence (Cohendet and Simon, 2007; Pyrko *et al.*, 2017), we are not aware of many works explaining how to integrate communities' outputs into the firm's operating procedures (Schulte *et al.*, 2020). Although previous research has studied the articulation among various communities (Bechky, 2003), we lack theoretical and empirical results on how knowledge, and especially new-to-the-firm knowledge, coming from internal communities is integrated in the firm's formal, managerially designed operations (Uhl-Bien and Arena, 2018). Hence the research question of the present article is: **How to integrate in the firm's activities, new-to-the-firm knowledge coming from internal communities?**

The few works specifically dealing with the question of integrating communities' outcomes in the formal organization focus on one particular arrangement: the leader-sponsor lynchpin (Anand *et al.*, 2007; McDermott and Archibald, 2010; Probst and Borzillo, 2008; Wenger *et al.*, 2002). The leader coordinates the activities of the community, while the sponsor guarantees the alignment of these activities with the firm's overarching strategy. However, this line of investigation focuses more on the monitoring of the community by the top management than on the integration process *per se*.

More generally, the question of the integration of new knowledge into established processes has been addressed in the ambidexterity (Chen and Kannan-Narasimhan, 2015; Durisin and Todorova, 2012; Gassmann *et al.*, 2012) and in the leadership (Schulte *et al.*, 2020; Uhl-Bien and Arena, 2018) literatures. From these research streams, it appears that integration needs a two-way communication between the entity proposing newness and the entity intended to adopt it. This two-way communication aims at guaranteeing the convergence of the different viewpoints, objectives and knowledge frames. (Hansen *et al.*, 2019; Uhl-Bien and Arena, 2018). Further, there must exist a social and/or physical "space" for these interactions to take place, (Bucher and Langley, 2016; Cohendet and Simon, 2007; Uhl-Bien and Arena, 2018). However, the success of integration is never guaranteed. Two major risks particularly jeopardize the integration process (Durisin and Todorova, 2012; Hansen *et al.*, 2019). The first is that the convergence does not happen, and that the entities fail to find a common ground and to align community activities and the organization's overall strategy (Schulte *et al.*, 2020). The second risk is that the entity proposing the new knowledge completely espouses the view of the to-be adopting entity, to the point that the distinctive characteristics of the new knowledge simply disappear in the process (Durisin and Todorova, 2012; Uhl-Bien and Arena, 2018).

To the best of our knowledge, most of the existing work focuses on integration processes between two formal entities (Chen and Kannan-Narasimhan, 2015; Gassmann *et al.*, 2012) or between different communities (Bechky, 2003; Carlile, 2004). Little is known about the communication mechanisms, the specific space and the way to mitigate risks associated to integration processes of the works of internal communities into the firm's activities (Schulte *et al.*, 2020).

To shed light on this specific research question, we analyze the mechanisms supporting the integration of the exploratory work conducted by internal communities in two middle-sized industrial companies. We identified these firms in the context of a larger research program focusing on the organizational design enabling industrial firms to benefit from their internal communities. In two of the involved firms, we identified the key role played by specific entities in the integration process as intermediaries between the communities and the firm. This unexpected observation led us to sharpen our research design and to further explore these specific entities (Stake, 1995). These entities that we refer to as "boundary structures" act as buffers and preserve communities from the bureaucratic influence of the formal rules and procedures of the firm by cognitively enriching the messages from the top-managers. Conversely, these entities articulate communities' outputs into the firm's formal codes and procedures and guarantee their strategic alignment (Chen and Kannan-Narasimhan, 2015; Gassmann *et al.*, 2012; Schulte *et al.*, 2020; Taylor and Helfat, 2009), thereby easing their issue-selling work (Dutton and Ashford, 1993) towards top management and the integration of the communities' outputs by their organization.

There are thus ongoing sense-making and sense-giving processes between the formal structure and the communities (Gioia and Chittipeddi, 1991) mediated by these "boundary structures". These continuous discussions produce a co-alignment of managers' and community members' representations.

The next section is a literature review presenting the different integration mechanisms identified so far. We then present the methodology used to build a common interpretive framework for our two cases and details the core results of our analysis. Last, we discuss the implications of our findings.

Literature review

The communication process between the firm and its internal communities

The integration of new knowledge produced by internal communities into the operations of the parent firm rests on a boundary work at the interface between the two entities (Schulte *et al.*, 2020). Integration is a boundary mechanism that facilitates knowledge exchange and combination between differentiated exploratory and exploitative units

(Kogut and Zander, 1992). At the heart of this boundary work, there is the need to adjust the schemas (representations of the world and epistemologies, aims and objectives, methods and needed resources) of both the transmitter and the receiver. Adjusting schemas can be presented as a two-way communication between the transmitter and the receiver (Uhl-Bien and Arena, 2018). On the one hand, internal communities promoting the new knowledge must convince the relevant decision-makers to accept their proposals and commit resources to implement them. To that end, communities produce codified knowledge (Cowan *et al.*, 2000). Since their aim is to produce new knowledge intended to be adopted outside the community, members dedicate some of their efforts to make explicit and articulate the knowledge produced (Perry-Smith and Mannucci, 2017). The developed corpus of knowledge can then be broadcasted to the outer world.

On the other hand, managers must align and frame the proposed new knowledge to ensure that it matches the current strategy and conduct of operations (Schulte *et al.*, 2020; Uhl-Bien and Arena, 2018). That is, managers engage in a sensegiving and aligning process towards the members of a community (Boland and Tenkasi, 1995; Carlile, 2004; Schulte *et al.*, 2020). However, this is a delicate exercise because it bears the risk of killing the newness. Durisin and Torodova (2012) observe that in several instances, the integration process could completely devitalize the innovation, and only the standard, already known part of the proposals were implemented in the operations of the firm. This danger is also underlined by Hansen *et al.* (2019) who warned against the risk of contamination of the innovative units by the bureaucracy and standards of the firm.

The social and organizational context of the boundary work

Although there is a wide agreement in the literature that adopting new knowledge and accepting to conduct the associated organizational changes rest on the communication between the entity proposing the new knowledge and the entity potentially implementing it, there is some variance in the description of the social and organizational context in which this boundary work takes place.

The literature on communities predominantly proposes that the integration of communities' outputs in the firm's activities involves designating a sponsor, in charge of validating the communities' added value to the firm, and an animator or leader, in charge of monitoring the community's activities (McDermott and Archibald, 2010; Probst and Borzillo, 2008; Wenger *et al.*, 2002). Managers can also set the community's agenda, retain decision power over the recruitment of members, or decide to equip communities with collaborative and knowledge management tools (Probst and Borzillo, 2008; Wenger *et al.*, 2002). In this setting, the leader submits the proposals emanating from the community to the management and the sponsor must guarantee the alignment of the proposals with the firm's current strategy and way of functioning.

However, it has been noted that over time, as bureaucratic features tends to crowd out self-organization, the community becomes fully aligned with the strategy and the generative tension vanishes (Dupouët and Barlatier, 2011; Thompson, 2005). Communities eventually turn into some form of regular task force or project group, losing the very interest of communities (Cox, 2005; Harvey *et al.*, 2013). The danger then is to completely lose their self-organizing aspect that warrant their potential for creativity and innovation (Nonaka *et al.*, 2016). In this paper, we refer to this phenomenon as a risk of contamination.

In the literature on structural ambidexterity, the question of integrating new knowledge proposed by one entity into another has also been addressed (Chen and Kannan-Narasimhan, 2015; Gassmann *et al.*, 2012; Hansen *et al.*, 2019). Authors in this literature stream mostly investigate the different mechanisms that can be set in order to facilitate the communication between the two entities. Such mechanisms are set to establish strong links between the two entities and ease the translation and aligning process (Carlile, 2004; Taylor and Helfat, 2009). Instances of such mechanisms are the creation of a cross-functional team (Jansen *et al.*, 2009), establishing collaborative joint decision-making (Gassmann *et al.*, 2012) or devising control mechanisms and administrative processes to monitor simultaneously the activities of the entity producing new knowledge and the entity implementing it (Chen and Kannan-Narasimhan, 2015). All these forms of control mechanisms aim at creating a communication channel between the two entities while limiting the risk of divergence. However, such mechanisms may not work (Durisin and Todorova, 2012; Hansen *et al.*, 2019; Ruiz, 2021). In particular, one of their main drawbacks is an excessive managerial control to the risk of stifling or even killing the creative thread (Hansen *et al.*, 2019). Defined by the management, these mechanisms also suppose the interaction between two formal entities: they rely for instance on the existence of formal HR policies on both sides, the ability to access resources via formal decision-making, or the possibility to have an official presence in various official meetings and events. Yet, this may not be adequate for a community which *a priori* has no formal existence.

For another stream of literature, drawing mostly on the concept of complexity leadership, integration of new creative knowledge is made mostly via informal relationships. In this literature, these interactions take place in an adaptive space (Arena *et al.*, 2017; Uhl-Bien and Arena, 2018). Bucher and Langley (2016, p. 2) define a space as "*bounded social settings in which interactions among actors are organized in distinctive ways*". Although the specific nature of spaces remains relatively ill-defined (Arena *et al.*, 2017), they are seen as places where the boundary work leading to integration takes place (Levina and Vaast, 2005; Schulte *et al.*, 2020; Uhl-Bien and Arena, 2018). These spaces are where the boundary work occurs and where the new knowledge is progressively diffused towards decision-makers via different roles. For instance, Arena *et al.* (2017), identify brokers, central connectors and energizers as key agents facilitating the migration of knowledge from its place of elaboration to the decision-makers able to implement it in the firm at the desired scale. Within these spaces, integration is akin to a diffusion process through an informal network (Stadler *et al.*, 2014) spanning the internal formal boundaries of the firm, sometimes referred to as liaison channeling (Gassmann *et al.*, 2012). However, resorting to informal relations only cannot guarantee that existing vested interests and formal responsibilities will not thwart the idea adoption (Lô and Diochon, 2019; O'Reilly and Tushman, 2004). Moreover, integrating the new knowledge into the firm's standard processes typically requires resources and commitment to scale up the idea or implement it at a large scale (Chen and Kannan-Narasimhan, 2015; Hansen *et al.*, 2019). Consequently, informal mechanisms alone may not suffice to lead to the adoption and implementation of the new idea by the firm (Hansen *et al.*, 2019).

To sum up, there is a lack of consensus in the various research streams investigating the integration mechanisms enabling a firm to benefit from the cognitive efforts of its internal communities. Hence, although there is an agreement on the idea that integration

entails a two-way communication process made of translating, convincing and aligning, the actual organizational context and the associated mechanisms are still not fully understood. Our empirical case studies help us deepen our understanding of these issues.

Methodology

A revelatory multi-case research design

This article is based on the comparative analysis of two revelatory case studies (Siggelkow, 2007). Given the exploratory research objective, the case study method was selected because it allows for enriching existing theory regarding new and interesting phenomena through the in-depth analysis of revelatory, novel, or unique cases (Sarker *et al.*, 2013; Schlagwein and Bjorn-Andersen, 2014). Case studies are widely used as a method among researchers studying internal communities (Harvey *et al.*, 2013; Pyrko *et al.*, 2017) since they are suitable for understanding the interaction between a phenomenon and its context. In this research piece, the cases have highlighted an unexpected form of articulation between the internal communities and their parent firms that we qualified as "boundary structures". As described previously, their application to connect the activities of the firms to their internal communities remains largely unexplored. These case studies thus enabled an exploration of new and unique forms of organization supporting and accelerating the appropriation of internal community knowledge by their parent firms. In that respect, the cases are revelatory of a specific and novel phenomenon (Siggelkow, 2007).

Selection of case study firms

We identified these firms in the context of a larger research program focusing on the organizational design enabling industrial firms to benefit from their internal communities. Two of the involved firms actually created a specific organizational entity to enhance communication with their internal communities and integrate their output. This unexpected observation led us to sharpen our research design and further explore these specific entities (Stake, 1995) both at the conceptual and empirical levels. Conceptually, we reviewed existing theory shedding a light on such integration mechanisms to ground an analytical typology (see table 2, column 2) of our observations. Empirically, we revisited and enriched our original empirical data (complementary interviews) and elaborated aggregated integration mechanisms (see table 2, Column 3) to allow for cross-case comparison. The conceptual framework thus took into account the empirical findings inducted from the original research program. This approach aimed both at enriching existing concepts and at identifying new relationships between them.

The case-firms namely Spie batignolles, a French construction company, and Bürkert, a German firm operating in the sector of fluid control systems, face similar challenges in terms of innovation. As challengers in their respective markets, both firms are urged to innovate in a fast-changing and highly competitive environment. Yet, they do not have enough resources to solely rely on formal R&D structures and choose to leverage the work developed in some of their internal communities to accelerate exploration.

With nearly €2 billion turnover and 7,500 employees, Spie batignolles ranks fourth among French construction contractors. Spie batignolles has been recognized for its pioneering role in its industry, launching disruptive practices such as a unique form of partnering with its customers. Since its founding in 1946, Bürkert develops and commercializes different types of valves, actuators, and sensors for a wide array of applications (water management, hygienic processes, medical applications, gas safety). With nearly 3,000 employees across the globe, the company aims to be a technology leader in its field investing between 8% and 10% of its turnover in R&D for the development of innovative products. Its three R&D centers (200 people) are in Germany and France.

At Spie batignolles, the community studied is the *Digital Transformation Community* (DTC) which aims at exploring how to deploy digital transformation on construction sites and more specifically building information modeling (BIM). At Bürkert, the internal communities called *Technology Focus Groups* (TFGs) aim at exploring new technologies for future new product developments. In both firms, the integration of communities' outputs is mediated by what we qualified as "boundary structures" namely, the BIM Expertise Pole—BEP—at Spie batignolles and the Technology Advisory Team—TAT—at Bürkert.

Data Collection

Considering the mediating role of these boundary structures as an under-researched phenomenon (Miles and Huberman, 1994), we chose a qualitative method based on the detailed description and comparison of both their characteristics and the integration mechanisms linking the communities to the firms' activities. These boundary structures form our main units of analysis. As summarized in Table 1, our data collection process unfolded over two consecutive stages. The first stage (from 2014 to 2019) consisted of data collection in each firm based on individual interviews, observations of internal meetings as well as analysis of internal documents, presentations, and other secondary materials.

This in-depth and rich material led to detailed case studies reports and enabled us to confirm that, despite the differences in the objectives and activities of the studied communities, the integrating role of the BEP and the TAT (boundary structures) came across as comparable. It, however, highlighted the need to collect complementary data to enrich our understanding of integration mechanisms and allow for a more systematic, cross-case comparison. This second round of data collection consisted of individual interviews and collective discussions with representatives of both fields (see Table 1).

Data Analysis

In our analysis, we moved from raw data toward identification of the characteristics of the boundary structures and the mechanisms supporting the integration of the communities' outputs. Our analytical process included the iterative comparisons of case data, and two rounds of data coding in an effort to define integrative constructs (Andriopoulos and Lewis, 2009; Miles and Huberman, 1994) as detailed in Table 2.

In a first round of coding, we identified the characteristics of the actors involved in each entity: their name, their function, their hierarchical levels in the organization (governance level/top management; operational level/Business Units), and the nature of the links between their members. Concerning the integration mechanisms, we first listed the mechanisms identified in each case, and then coded them in analytical categories based on existing literature. Table 2 establishes the links between the raw data (verbatim in column 1) and the integration mechanisms (column 2) selected based on our literature review (bibliographical references in column 2). To ease-up the comparison process, a second round of coding led us to group these mechanisms into a set of five analytical categories (column 3): 1/ creating a boundary structure, 2/ setting a steering framework, 3/ expertise resourcing of the community, 4/ framing and validating the community's outputs and 5/ reporting and translating the community's outputs.

TABLE 1

Data collection in both companies

Data type	Date	Description	Content
Data collection at Spie batignolles			
Initial field interviews	August 2018 - September 2019	15 semi-structured interviews with the corporate innovation manager (three interviews), CEO, two technical managers of the BEP steering committee; two founding members of the DTC (separate interviews); a founding member of the BIM Expertise Pole (BEP), individual interviews with members of the Digital Transformation Community (DTC)	- Corporate and innovation strategy. Key data. - Origin, membership and functioning of the Digital Transformation Community (DTC). - Origin, role, membership and functioning of the BIM expertise pole (BEP).
Collection of secondary data	April 2018 - June 2019	One article in the internal magazine (interviews of DTC and steering committee members), presentations to the board of directors, internal strategy memos, minutes of meetings and internal workshops, training consultation (tender) document, training programs.	- The interactions between the BEP and the DTC. - Structure of the community. - DTC's outputs and their perceived internal value for the firm. Description of a pilot project.
Data collection at Bürkert			
Initial field interviews	2014 - 2019 + May 2020	20 semi-structured interviews (including a follow-up interview in May 2020) with community members, R&D managers, the founder of the Technology Advisory Team (TAT) as well as the current sponsor and manager of the TAT.	- Corporate strategy, key data. Knowledge management and innovation strategy. - Origin, membership and functioning of the Technology Focus Groups (TFG communities), - Origin, role, membership and functioning of the Technology Advisory Team (TAT).
Collection of secondary data	2014 - 2019	Internal reports, meeting reports, internal and external communication supports, and documents of general information about the company.	- The general organization of the company (organization chart, roles and responsibilities) and its innovation process (validation of product development, technology roadmap, ...)
Common data collection			
Boundary Meeting	19th of June 2019	Common workshop between representants of Spie batignolles and the Innovation manager of Bürkert.	- Detailed information on the role and functioning patterns of the BEP and TAT looking for similarities and differences. Complementary information on coordination and integration mechanisms with both top management and other operational or functional entities within the two firms.
Semi-structured Interview	25th of July 2019	With one member of each boundary structure (BEP & TAT).	- Validation of case study reports and the minutes of the common workshop (actors involved and integration mechanisms).

TABLE 2

Our coding process

Verbatim of mechanisms in the two cases	1st round of coding—Link to the literature:	2nd round of coding—Definition of dimensions: Aggregated integration mechanisms
- *"We initially had a community working on BIM. But it was not sufficient as it was reflecting on new practices but could not deploy and execute them (at a larger scale)"* (Steering Committee member) - *"The greatest strength of this group is to be transversal and to be rooted in field issues. Their scope is wide, large, [and] directed towards staff members, customers, and projects. At Spie batignolles, procedures are not sufficient to be enacted in the field. We need action. [...] Our CEO was looking for a new, method to develop innovation: more open and less formal. [...] The BEP enables to channel something that is in the making"* (Corporate Innovation Manager) - *"After a certain time, we didn't know anymore what we could tell each other once everybody has had his turn. From the moment that there are no new projects or anything else, it becomes even boring. Some focus groups persisted over time; others were stopped as soon as the motivation decreased. "* (Mentor, Bürkert) - *"It was the intention of the board to design the [TAT] as a community, because this correlates with our flat hierarchies* (Technology Portfolio Manager, Bürkert)	An **organizational entity** specifically designed to orchestrate the links between the formal structure of the firm and its internal communities	**Creating a boundary structure** The creation of a hybrid entity existing in the firm's organization chart, using both formal and informal mechanisms to align the firm's internal communities to the firm's strategy and integrate their work in the rest of the firm, while preserving their autonomy.

TABLE 2

Our coding process

Verbatim of mechanisms in the two cases	1st round of coding—Link to the literature:	2nd round of coding—Definition of dimensions: Aggregated integration mechanisms
- *"Without a sponsor at the highest level, there is a problem as we cannot fill the gap between the field and the decisions"* (Corporate Innovation Manager, Spie Batignolles) - *"Our sponsor wants us to play the role of an elevator going up or down the various hierarchical levels. Our role is alignment in both directions"* (BEP member, Spie Batignolles). - *"We take each opportunity to re-align the group's vision to what is produced in the field". We have to make sure that we do not lose focus"* (BEP member, Spie Batignolles) - *"Our Steering Committee is made of 5 Board members; it diffuses the corporate strategy to the BEP, proposes a budget and financial resources for the BEP to the Board and validates its roadmap"* (SC member, Spie Batignolles) - *"Still, only exchanging information is not enough. [...] Our [TAT] objective is to provide a roadmap. It's not only about exchanging information. This roadmap considers the next 5 years, and we know therefore today on which technology we need to focus in order to integrate it into our future projects"* (Technology Portfolio Manager, Bürkert) - *"We have one person in charge for the technology roadmap [technology portfolio manager, authors] and one for the product roadmap [head of R&D, authors] who validate both roadmaps together at the end of the project"* (Mentor, Bürkert)	- **Sponsoring** (Probst and Borzillo, 2008; Wenger *et al.*, 2002) - **Objective setting** (Schulte *et al.*, 2020) - **Financial resourcing** (Wenger *et al.*, 2002) Contrarily to the literature, we observed in our cases that these mechanisms do not apply to the communities analyzed, but to the new organizational entities observed. Existence of a Steering Committee at Spie batignolles and at Bürkert	**Setting a steering framework** Mechanisms through which top management attempts at indirectly aligning communities' activities to their corporate strategy through the setting of objectives, financing, sponsoring of a boundary structure reporting to a Steering Committee.
- *"We produce quantitative and qualitative studies. We have met 60 colleagues in France. We provide them (DTC) this feedback"* (a BEP member, Spie Batignolles) - *"People in the community lack time. We bring dynamism; we motivate the community"* (BEP member, Spie Batignolles) - *"Each TFG member is allowed to spend 20% of their time on community activities"* (Mentor, Bürkert) - *"We only check what the person can contribute to the specific circle and what his motivations are and if somebody wants to participate, why not? Frontiers have to stay open."* (Technology Portfolio Manager, Bürkert)	**Equip communities with** material resources (Brown and Duguid, 1991; Schulte *et al.*, 2020) The BEP and TAT do not provide material resources to the communities but expertise by providing them with expert knowledge. As community members, these entities have both the expertise and the repertoire to transmit knowledge.	**Expertise resourcing** Gathering, processing & providing immaterial resources in particular expert knowledge to support the community's activities.
- *"We manage experiments applying BIM processes on a wider scale. We share concrete cases of what really happened on projects.... We need the deliverables of the working groups (of the DTC community) to inform our work agenda and deploy them at the firm level."* (BEP member, Spie Batignolles). - *"We are complementary. They (the DTC) feed us with their production, and we start from that to make it all come true. We convert the sketch into detailed specifications and implement the plan."* (BEP member, Spie Batignolles) - *"For the moment, we only had to slightly adapt priorities, but no project proposals have been completely refused so far".* (TAT member, Bürkert) - *"This [boundary role, authors] increases our chances of market acceptance. [...] This also allows us to react rapidly and change priorities if the technology is not efficient enough"* (Mentor, Bürkert)	**Issue-selling** (Dutton and Ashford, 1993) The issue-selling activities of the two communities towards top management are mediated by the BEP & TAT. The latters work with community members to frame and obtain proofs of the value of the community work.	**Framing and validating the community's outputs** - Elaborate prototypes showcasing the feasibility of the community's innovation - External validation: Test the innovation and document its value with external customers, key stakeholders (experts), or strategic members of the firm
- *"We feed Technical Directors with information on the BIM. We attend the Innovation Committee where we explain what we are doing and what we have achieved so far"* (BEP member, Spie Batignolles) - *"I have to admit that we still have this hierarchical aspect ... Lately our sponsor asked us for more frequent reports. I can feel that he needs us to play this role, otherwise the information is not going up and reaching him..."* (BEP member, Spie Batignolles) - *"When they (BEP) estimate that their idea is mature, they help prepare the teams (DTC) to present it to the Board .... It is a virtuous circle enabling to raise transformation barriers"* (Corporate Innovation Manager, Spie Batignolles) - *"The [TFGs] know what's happening within the company and they can transport it if something emerges that is interesting for others. This is a very efficient tool to share information"* (Technology portfolio manager, Bürkert)	**Translating** (Carlile, 2004) The BEP and the TAT use work done to test and validate the value of community's outputs that they will later use to report to their sponsor and steering committee (top management). This activity involves translating to convince top managers	**Reporting & Translating the community's outputs** - Internal reporting of community's agenda and outputs to top managers to limit the risk of divergence - Translate the work of the community in a language and format that can be understood by top management to facilitate their integration.
- *"When I started, I was able to create a strong internal network. [...] It is important to have something like that because it's people who make a company's success."* (TFG member, Bürkert) - *"It's not only about exchanging information. It's our motivation to monitor and push interesting technologies and to do networking"* (TAT member, Bürkert). - *"They have created a network that act as the key lever for the firm's transformation and strategy"* (Corporate Innovation Manager, Spie Batignolles)	**Liaison channeling** (Perry-Smith and Mannucci, 2017; Stadler *et al.*, 2014; Uhl-Bien and Arena, 2018)	**Channeling** Connect, test and diffuse the outcomes of the community with the rest of the firm

Results

We first report individual case studies and then provide a cross case analysis based on the detailed verbatims gathered in Table 2.

Individual case study reports

Spie batignolles

The DTC—Digital Transformation Community—emerged in 2014 out of the initiative of three technical managers willing to develop *"the Spie batignolles BIM and instill a common BIM culture"*. This community quickly federated several colleagues from different subsidiaries and functions (technical managers, technical experts, lawyers, managers of construction sites, human resources) and included 30 members at the time of the first interviews. The DTC is autonomous and sets its own organizing principles and can work with external partners. Community members focus on the systematic integration of digital tools throughout the firm's value chain.

The BIM Expertise Pole (BEP). Mid-2018, the DTC members identified the need for support from the top management to accelerate, harmonize and scale up the production and deployment of BIM centered practices. The community convinced the top management to bring its support on this key subject. However, the CEO requested the creation of a dedicated entity, clearly positioned in the firm's organization chart and reporting directly to a board member (sponsor) and a Steering Committee. This request stemmed from a previous experience with communities then perceived as uncontrollable and unaligned with the top management's strategy. The BEP was thus formally created in September 2018 with the following functioning rules and mechanisms.

Missions and work agenda (BIM 2022). To accelerate the digital transformation and BIM deployment, to act as permanent technical support, and to develop "the firm's BIM Fundamentals" (set of common practices). To have 100% of the construction projects at level 3 BIM by 2022.

Membership and Organization. Financed on the corporate innovation budget (for at least 20% of their time), the BEP is a light structure of six members. Its leadership is distributed across members with horizontal communication flows and joint decision-making: *"At the BEP, we do not have any boss. We have found our functioning pattern [among] the six of us"* (a BEP member). The chief operational officer (COO) acts as the BEP sponsor, legitimizing its role internally, setting its work agenda, and ensuring alignment with the strategic objectives. The BEP reports to the COO through monthly *"postcards"* (short, factual information) and face-to-face meetings. The BEP also reports to a steering committee of technical managers that guarantees the application of the BIM 2022 agenda set by the COO.

A boundary role. All BEP members belong to one of the firm's subsidiaries to ensure optimal representation of operational practices and issues. They have direct access to the DTC community, the formal operational business units (BUs) and top managers.

Link with the Community. The BEP closely cooperates and interacts with their fellow members of the DTC, and they are actively involved in the community's activities. The BEP supplies the DTC with various resources and information. BEP members select the relevant strategic information regarding innovation and digital transformation and articulate it to make it useful and operational for DTC members. For example, they explain what the firm's strategy involves for the community in terms of exploration of new technical standards and contractual risks. This cognitive work helps community members prioritize and plan their work agenda. The BEP also feeds the DTC with large internal surveys that they conduct on the firm's BIM maturity level and research about the solutions and contractual clauses of the various BIM software providers. These operational data inform the creation by the DTC of various documents (BIM charters, training programs, group presentations, methods, and rules of collaboration). All these BEP activities energize the production capacity of the DTC community by helping its members focus on the most value-adding tasks.

Link with the firm's activities. The DTC community feeds the BEP with results and new knowledge that the BEP can then test within the firm's operational units. Thanks to their internal network of contacts among construction and project managers in their own business units, BEP members are in a privileged position to launch pilot projects and articulate this work with the "proofs of concept" (POC) provided by DTC members to convince top management of their value and feasibility. The BEP also coordinates the integration of the DTC's recommendations on construction sites. To that end, they rely on a network of 40 managers from various geographical units that they animate. These referent contacts constantly give feedback to the BEP on the needs and reactions of operational staff.

Bürkert

The Technology Focus Groups (TFGs—Communities). The TFGs seek to explore emerging technologies and increase the technology readiness level in each of the company's seven core technology fields before entering product development. Some communities emerged spontaneously in 2005, but the formal organization lost track of them after their appearance. Some interviewees argued that in their first years, they enjoyed a high degree of autonomy, but lacked a clear mission: *"After a certain time, you have nothing new to tell to your colleagues and this is why some communities felt asleep"* (member). In 2013, the technology portfolio manager—who is close to the company's decision-makers even though he is not a directory board member—revitalized the TFGs. Each TFG includes 12 to 15 members—experts from different departments (R&D, production, industrialization, marketing, product managers)—and is facilitated by a *"mentor"* (moderator) who has no hierarchical power over other members. Those experts dedicate about 10% to 20% of their time to the TFGs and freely decide its allocation to activities such as technological intelligence (e.g., secondary research, attendance to conferences and trade fairs), technology monitoring, feasibility studies, and new idea descriptions. Each TFG sets its own objectives e.g. gain technological knowledge or identification of applications for a mature technology.

The Technology Advisory Team (TAT). When the technology portfolio manager revitalized the TFGs in 2013, he was convinced that the autonomy of the TFGs correlates best with the firm's culture to increase the company's technology leadership through an efficient knowledge management: *"The [TFGs] know what's happening within the company and they can transport it if something emerges that is interesting for others. This is a very efficient tool to share information"* (technology portfolio manager). To ensure, however, the communities' sustainability over time, he also created the TAT. The idea was not only to protect and support the communities' activities, but also to facilitate cooperation between the mentors of the TFGs.

Mission and work agenda. The TAT coordinates knowledge of the company's core technology fields, screening the communities' inputs (new project proposals), and providing strategic recommendations about the firm's technological development through the elaboration of a technology roadmap. This roadmap aims at ensuring alignment of TFGs' activities and the firm's strategy and summarizes all ongoing and future technology projects. Project proposals listed on this roadmap are provided by the TFGs.

Membership & organization. TAT members are the mentors of the seven TFGs and the technology portfolio manager. Some of the mentors have a hierarchical position as middle-manager in the firm's formal organization, but this activity is decorrelated from their work within the TAT and the TFGs. As is the case at Spie batignolles, TAT members are financed by the firm for 20% of their time. They consider the company's roadmap process to set their work agenda: *"We have one person in charge for the technology roadmap [technology portfolio manager, authors] and one for the product roadmap [head of R&D, authors] who validate both roadmaps together at the end of the project"* (mentor). Hence, the technology roadmap is synchronized with the roadmap for new product development projects. This is necessary to make sure that the developed technologies may be integrated into current or future products. The technology portfolio manager is a member of the formal decision-making process supervised by an interdisciplinary steering committee which validates those roadmaps.

A boundary role. Due to their role as mentors of the TFGs, TAT members have direct access to the communities. At the same time, they have their respective responsibilities within the formal structure of the firm: *"This increases our chances of market acceptance. [...] This also allows us to react rapidly and change priorities if the technology is not efficient enough"* (a mentor). Also, the technology portfolio manager is not only the moderator of the TAT and thus close to the work of the TFGs, but also a member of the steering committee that validates that roadmap. Hence, TAT members have access both to the communities and corporate decision makers (as is the case at Spie batignolles).

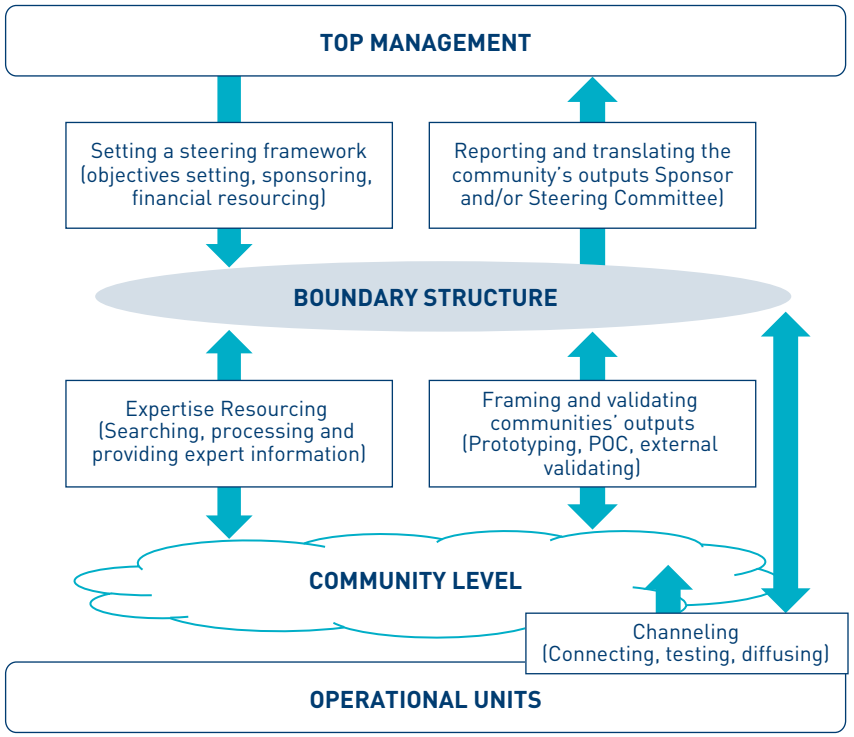
Link with the community. Through regular meetings, TAT members are in charge of summarizing project proposals coming from the TFGs, identifying potential synergies with other projects, and integrating this knowledge into a coherent strategy (roadmap). At the same time, the TAT makes sure that ongoing technology projects have all necessary resources at their disposal and in case of resource conflicts, negotiates with the steering committee to find a solution.

Link with the firm's activities. The technology roadmap provides a consistent communication tool for the TAT to create a link between the TFGs and top management. It serves as a basis to negotiate with corporate decision makers for a formal go/no-go on technology projects. This process generates transparency and alignment between the firm's strategy and the issues of the communities. Once the approval obtained, the TAT communicates the results to the TFGs (creation of technology projects or integration into already existing ones). Once a project is finalized, the corresponding TFG discusses whether and how to integrate the results in ongoing or future product development projects. This decision is communicated via the mentor to the TAT and synthesized within the roadmap process.

Cross-case analysis

In contrast to existing literature, these two case studies illustrate that the appropriation of the emergent knowledge by the formal organization is not carried out directly by the communities with the support of enabling leaders, but rather rests on specific boundary structures created to that end. These structures have close connections with both the firm's governance and operational units and the communities, thus placing them in a privileged position to act as the central coordination mechanism to integrate the communities' outputs into the firms' processes. Figure 1 highlights the five main coordination mechanisms observed in our cases.

FIGURE 1
The coordination mechanisms identified to integrate the communities' knowledge into the firms' activities



Originally, each community emerged spontaneously with the goal of exploring new knowledge (new technologies, new construction practices). At first, none of the firms studied had a formalized community management program; this meant no direct support or funding of internal communities by the firm. This point constitutes one of the key triggers leading to the creation of boundary structures: it is only when the formal support of top management came across as critical for the communities' development that the **need for the creation of a boundary structure** emerged. In the case of Spie batignolles, the DTC community requested more resources from the firm to help them standardize their innovative practices through the conduct of internal surveys and pilot projects for example. In the case of Bürkert, the support of top-management was requested to revitalize existing communities considered as important for the firm's technological development and innovation strategy.

Setting a steering framework— In both cases, before the emergence of communities and these boundary structures, the firms' corporate resources were only allocated to formal units i.e., not to communities. This was either due to the firm's internal processes in place that were not historically based on communities (Bürkert) and/or to a negative experience with other internal communities (Spie batignolles) leading top management to fear a progressive loss of alignment with the firm's strategy. To reduce this risk, both firms implemented several coordination mechanisms. Firstly, the setting and negotiation of clear objectives and reporting processes with the boundary structures' members; secondly the creation of a steering committee to which both boundary structures report. In the case of Spie batignolles, this also required the attribution of a sponsor. However, instead of sponsoring the community, the firm sponsored the boundary structure, thus clearly exhibiting its coordination and mediating role between its formal and informal entities. In both cases, the financing of formally recognized boundary structures was thus a means to acknowledge and support the value of the communities' work for the firm. It legitimized the boundary structures as resource-providers for the communities, in particular of expert knowledge. This mechanism protected the communities from direct interference of the managerial structure and enabled them to remain autonomous. This autonomy, in turn, gave community members freedom to pursue their own line of work and to remain self-organized.

Expert resourcing— In both cases, the boundary structures enacted the alignment process of the communities with their firm's agenda through the collection and provision of various expert resources both internal and external: internal research surveys, pilot projects and suppliers' qualification for the BEP; the comparison of the performance of various technology suppliers, the competitive and technological intelligence gathered in technology fairs and the structuring of core technology fields for the TAT. Thanks to their position and expertise, the boundary structures could feed the communities with value-adding knowledge and, hence, fuel and energize the reflection of their members. This community resourcing activity gave the boundary structures an increased capacity to negotiate the alignment of the communities' agenda with the firms' strategic priorities. First because they positioned themselves as internal service-providers supporting the communities. Second, because the alignment of the communities' outputs increased communities' members engagement who saw in it a better guarantee that their work could be actually exploited by their firm at a global level, or in other words, that they were not wasting their time. In both cases, the boundary structures were thus less perceived as a control mechanism than as a value-adding mechanism.

Framing & validating the community's outputs— In both cases, communities' members seemed happy to let the boundary structures play the role of "spokespersons" towards top management. They shared and often co-produced with their members of the BEP or TAT, several documents, product specifications, prototypes or pilot projects that could document the quality and value of their community work. At Spie batignolles, the boundary structure actually carried out some pilot projects with customers in an effort to obtain and accelerate the *external validation of the innovation*. These projects represented the communities' perspective on how to implement BIM in construction projects by exemplifying and showcasing their innovative approach to key external stakeholders. Their results could then be framed and used as boundary spanning "objects" to give sense of the community's approach towards top managers. But they also served the community to improve their knowledge base through customer feedback.

Reporting and translating— The external validation of the community's outputs cumulated with the POC (Proof of Concept) provided by community members enabled the boundary structures to frame a good and plausible narrative towards top managers. Thanks to their regular *reporting* to their sponsor (BEP) and steering committee, BEP and TAT members enjoyed close connection to administrative leaders—knowing the language codes and routines to articulate and give sense to the communities' productions. The cases thus show various formats used for this reporting process: from informal monthly postcards to their sponsor (BEP) to formal roadmaps or reports for their steering committees (BEP and TAT). The boundary structures thus act as the official voice of the communities towards formal leaders referring sometimes to this sensegiving activity as their "elevator role." In turn, the sponsor and steering committee members engage in similar sensegiving activities towards the Board of Directors to negotiate and obtain final validation of the community's emergent knowledge. Thanks to this discursive work, top leaders could then formalize the adoption and integration of the new knowledge crafted by their communities through their existing routines and procedures. The key feature of the so-called elevator role is that it enables the appropriation process of the knowledge generated by the community through intense communication and alignment of the different objectives and representations existing within the firms.

Channeling— The case of Spie batignolles highlights that while top-down processes proved useful to formally validate the innovation, they could remain insufficient to enforce their rapid adoption at operational level due to the drastic change of practices required. This is where the liaison channeling carried out both by community members and by the boundary structure towards their internal network proved very useful. The Spie batignolles case shows in particular how the BEP favored the creation of a network of referent contacts to relay the actual deployment of the innovative practices previously approved by top management in field operations. The boundary structure kept a constant liaison with these network members. In the case of Bürkert, this relay was ensured by the dual membership of community members as both TFG and R&D staff members, thus ensuring regular connections to their colleagues in charge of new product development. It is quite common that community members are also members of product development projects which enables them to remain close to the operational field, learn more about current problems and identify potential interfaces with their ongoing technology projects.

Discussion

Our results emphasize two key findings regarding the integration of knowledge coming from internal communities into their hosting firm: first, the central position of boundary structures and second, their key role in knowledge integration thanks to the various mechanisms identified (cf. Figure 1).

The central position of boundary structures

The most striking finding is that the boundary work (Bucher and Langley, 2016) guaranteeing integration of new knowledge coming from the communities into the rest of the organization is carried out in what we termed "boundary structures". Based on our observations, boundary structures can be characterized has having both a formal, rigid frame defined in a clear roadmap and position in the firm's organizational chart and overlays of informal coordination emerging from their self-organizing principles and interaction patterns. As such, they enjoy a legitimacy on both sides, the community as well as the formal structure, and are thus in a unique position to act as lynchpins between the managerial decision-making processes and the communities (Biancani *et al.*, 2014). The boundary structures act as specific spaces where managerial and communitarian logics can meet and dialogue (Furnari, 2014).

Boundary structures are distinct from other integration contexts and supports envisioned in the literature. This specific integration arrangement differs from the sponsor-leader dyad mechanism (Wenger *et al.*, 2002) because the boundary structure hosts several actors who interact with a steering committee, itself made of several persons. The integration is here a collective mechanism that implies, consensus building and deliberations over the different opinions. Consequently, the communication channel becomes "thick", i.e. involving several links and interactions, which facilitate the circulation of messages (Centola and Macy, 2007; Obstfeld, 2005). This also differs from the social network view (Uhl-Bien and Arena, 2018) as it shows that the integration process does not amount to a diffusion process. Developing and actually implementing new knowledge via innovation or organizational change rely on two different logics (Obstfeld, 2005; Tortoriello and Krackhardt, 2010). Consequently, a mere diffusion of knowledge through informal social networks is not enough to guarantee implementation. New knowledge must be transformed and further equipped with strategic and operational considerations prior to implementation and this transformation cannot be achieved via the sole knowledge diffusion (Perry-Smith and Mannucci, 2017). Finally, it also differs from the structural ambidexterity view (Hansen *et al.*, 2019), as our five mechanisms devised for functioning between two formally defined entities cannot be directly used for harnessing communities (Cox, 2005; Thompson, 2005). The boundary structure here acts as an interface within which managerial and communitarian logics can be meshed.

The overall knowledge integration cycle

As already identified in the literature, integration requires a communication channel from the entity proposing new knowledge to the entity supposed to adopt that knowledge and a communication channel from the adopting to the proposing entity (Arena *et al.*, 2017; Schulte *et al.*, 2020; Uhl-Bien and Arena, 2018). The specificity of our empirical observation is that the interactions between the firm and its internal communities are intermediated by boundary structures that play an active role in both communication directions.

In communications going from the top management of the firm to the communities, boundary structures play an instrumental role that goes beyond that of simple conveyor belts that would transmit unchanged the requests of the managers to the communities' members. By reformulating, enriching and articulating the demands of the managers, members of these boundary structures actually shield the communities from a direct intervention of the managers, thereby preserving their autonomous and self-organized nature (Bucher and Langley, 2016; Uhl-Bien and Arena, 2018). In addition, it is worth noting that, as members of the communities, members of the boundary structures are willing to keep the communities informal. Moreover, the fact that members of the boundary structures come from different functions and background ensures that all the viewpoints are represented during the reformulation process, increasing the credence of their recommendations (Obstfeld, 2005).

Regarding the communication from communities to the top management, the presence of a boundary structure entails that communities are not forced to themselves adapt and integrate managerial considerations in the production of knowledge. Communities can work as they want on the topics that they chose because the reporting and translating of their outputs to top managers' language and requirements are carried out by the boundary structures. This contributes to maintaining their autonomy with respect to the rest of the organization (Cox, 2005; Hansen *et al.*, 2019). Members of the boundary structures take in charge the framing and validation by adapting the knowledge coming from communities to managerial requirements. This activity does not reduce to brokering or translating (Uhl-Bien and Arena, 2018) because it is necessary to articulate the communities' knowledge with strategic, operational and financial considerations, constituting a cognitive work of its own.

Interplay between the different mechanisms

The above described organizational mechanisms underlie socio-cognitive processes, in particular sensemaking (Maitlis and Christianson, 2014) and sensegiving (Gioia and Chittipeddi, 1991). Sensemaking is the process "in which individuals attempt to interpret and explain sets of cues from their environments" (Maitlis, 2005, p. 21) while sensegiving is the "the process of attempting to influence the sensemaking and meaning construction of others toward a preferred redefinition of organizational reality" (Gioia and Chittipeddi, 1991, p. 442). Sensegiving and sensemaking imply one another and have broad overlaps (Rouleau, 2005).

Surrounding the core activity of knowledge production by communities, the different mechanisms identified in Figure 1 intertwine different sensegiving and sensemaking processes that nurture one another. When the managers set a steering framework, they engage in a sensegiving process aiming at providing guidelines and constraints to the boundary structure. This is a type of leader sensegiving aiming at partly controlling the behavior of the boundary structure (Maitlis, 2005). Members of the boundary structure can then articulate the steering framework for each community. This sensemaking process aims at reconciling the steering framework with the objectives of the community. This process leads to the identification of the expertise that needs to be provided to the community. At that stage, however, this is also negotiated with the communities.

The communities then produce new knowledge that is framed and validated by the boundary structure. This is another instance of sensegiving, this time in a bottom-up

dynamic (Maitlis, 2005). Also, the communities negotiate with the boundary structure, mixing their production with the boundary structure's cognitive frame (that has been built in part from the steering framework). The boundary structure reports and translates the new knowledge produced to the top managers, engaging in a sensegiving process to the top management. In turn, the top management makes sense of these new inputs to adapt and reframe the steering framework and to organize the integration of innovative practices in the firm through their formal processes and routines.

Lastly, and specific to the case of Spie batignolles, an additional sensegiving mechanism (channeling) guarantees that the knowledge produced by the community and validated by top-managers is properly implemented in the organization. One potential reason why this mechanism is observed at Spie batignolles and not at Bürkert, is that the former case deals mainly with process change while the latter addresses product development.

Conclusion, limits, and further research

The key idea developed in the present work is that integration of explorative outcomes generated by internal communities can be achieved thanks to specific, boundary structures. The distinctive advantage of such entities is that they can monitor both managerial and communitarian integration mechanisms and ensure the overall consistencies of negotiating sense and aligning processes.

Our results are based on two qualitative studies and the usual caveats of such methods apply. Additional studies in firms of different sizes and industries would be necessary to refine the proposals made here. Nonetheless, we believe that the results presented here make some interesting contributions to the broader question of integrating and valuing the outputs of internal communities in their hosting firm's routines.

Specifically, we contribute to the literature on communities as an essential driver of innovation and change in organizations. As entities usually emerging at the fringe of the core competencies, escaping the formal constraints of designed units, communities are likely to be ideal vehicles for innovation and change. Yet, the way these innovations can be adopted by the organization at large is still little studied, and the present work is an invitation to pursue the investigation of this issue.

Therefore, we believe that a crucial question in organization theories and studies of innovation is the interplay between a firm's organizational structures and their internal informal networks. Indeed, a full understanding of the dynamics of organizations must account for the relationships, interactions and co-evolution of these two dimensions that have been hitherto studied in isolation. We see this question as an important path for future research on innovation and organizational management.

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