Limits of open innovation during the organizational change: a case study of a Partner Campus

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The literature on open innovation (OI) has mainly been focused on the 'bright side' of OI, thus neglecting the limits of OI implementation influencing innovation processes during organizational change. It requires to develop a better understanding about the limits of OI. Therefore, this study explores the limits of OI during organizational change and provides approaches that drive firms to offset these limits. The empirical analysis is based on an in-depth single case study and data was collected through semi-structured interviews with the representatives engaged with Partner Campus – an OI initiative developed by a multinational manufacturing company. We have found that during the change process of adapting collaborative and absorptive capabilities, and developing organizational readiness, several internal and external challenges limit the company's drive to open up. Internal challenges arise when organizations start the change process in unfreezing stage. The traditional organizational culture and structure challenge incumbent firms to break the existing silos and utilize knowledge and resources effectively for OI implementation, hindering intra-organizational collaboration. While external challenges arise when organizations transform their endeavors across organizational boundaries and collaborate with external stakeholders. When firms lack knowledge integration and technological capabilities, OI creates collaborative complexity given the magnitude of involved diverse actors and activities at different levels, which challenges the organizations to maintain the longevity of OI practices, resulting in several risks that limit firms to open up. However, we have identified the capabilities and actions that firms can take to strengthen a collaborative environment by counterbalancing these challenges. We contribute to the literature on OI by identifying and assessing the limits of OI, embedded in the organizational change process, that hinder organizational drive for OI. We also contribute to organizational change literature by

identifying specific changes related to organizational processes, structure, and culture, and outlining approaches that can support a smooth transition.

1. Introduction

The current knowledge economy has prompted a shift from a close to open innovation (OI) approach, transforming the business logic for pressing technological issues and innovative business solutions (Chesbrough, 2003; Audretsch and Belitski, 2020; Keinz et al., 2021). OI is defined as purposeful knowledge flows across organizational boundaries to advance technological capacity and innovation processes through inbound and outbound activities (Chesbrough, 2006; Chesbrough and Bogers, 2014; West and Bogers, 2014). OI has gained significant attention in research, practice, and policies over the past 20 years. Prior research has highlighted the potential benefits of OI, contributing to technological, organizational, and societal trends (Dahlander et al., 2021) as it promotes collaboration among partners with complementary skills, harnesses their creative potential, co-creates shared values, facilitates knowledge flow commercialization, and leverages external networks (West and Bogers, 2014; Zynga et al., 2018; Audretsch and Belitski, 2020; Grama-Vigouroux et al., 2020; Loureiro et al., 2020).

Despite such transformation offering firms the opportunity to adopt novel approaches to solve problems by co-creating smart solutions, this can also result in limiting innovative activities as it relates to organizational change for adopting and integrating the flow of knowledge. OI initiatives initially yield promising outcomes, but the complex process of integrating knowledge flows involving multiple intra- and inter-organizational stakeholders during the transition from a closed to open mindset poses challenges (Chiaroni et al., 2010, 2011; Deprez et al., 2018; Bigliardi et al., 2020; Füller et al., 2021; Keinz et al., 2021). Firms, due to organizational ill-preparedness, struggle to sustain success as several challenges of OI hinder converting it into sustainable business activities (Zynga et al., 2018; Keinz et al., 2021). Some still view OI as ineffective, fearing value and knowledge leakage in external collaborations (Stefan et al., 2022), leading them to stick to their knitting and limiting their efforts to collaborate on very few peripheral tasks (Dahlander and Wallin, 2020; Keinz et al., 2021). Additionally, transitioning to innovation openness and R&D practices to external actors requires fostering a risk-taking culture, new managerial practices and learning (Parida et al., 2014; Correani et al., 2020),

and an ambidextrous mentality to combine internal and external sources of innovation and interfaces (Vanhaverbeke et al., 2008).

Recent research indicates firms' reluctance to implement OI practices (Lichtenthaler and Lichtenthaler, 2009; von Briel and Recker, 2017) and their struggle to fully realize its potential throughout the change process, leading to abandoned or delayed projects (Chesbrough and Brunswicker, 2014; Piezunka and Dahlander, 2015; Tucci et al., 2016). Scholars argue that OI disrupts internal innovation processes (Hienerth et al., 2011), including vertically integrated and closed innovation paradigms (Dahlander and Gann, 2010) and established innovative routines, thus challenging R&D activities (Alexy and Dahlander, 2013), culture, and structure. This necessitates managerial attention to adapt both internal and external R&D efforts and knowledge exploitation approaches throughout organizational change. Once an OI setup is established, it can evolve into a long-term innovation practice, allowing managers to leverage lessons learned from pilot phases and overcome future challenges (Füller et al., 2021).

Although both the concept and the practice of OI and organizational change have been adopted broadly and our knowledge has considerably enriched over time (Chesbrough, 2006; Chiaroni et al., 2010; West and Bogers, 2014; Deprez et al., 2018), the empirical evidence about the limits of openness influencing innovation processes is scarce (Van de Vrande et al., 2009; Garcia et al., 2019; Audretsch and Belitski, 2020; Purdy et al., 2022). This is due to the fact that the extant literature has been asymmetrical, focusing majorly on the 'bright side' of OI and lacking a more balanced understanding of OI limits (Dabić et al., 2023). There remains insufficient micro-level evidence on the intra- and inter-firm challenges that organizations face as they change toward adopting an OI paradigm through an in-depth case study. Even the proponents of OI have realized the discrepancy in the extant literature in documenting these challenges that hamper OI implementation (Dahlander and Gann, 2010; Chesbrough and Brunswicker, 2014; von Briel and Recker, 2017; West and Bogers, 2017) during the transition from closed to OI (Bahemia et al., 2018; Bigliardi et al., 2020). Similarly, we lack an overall understanding of how firms combine their internal capabilities in terms of people, systems, and processes with external resources to counterbalance these limits.

Against this backdrop, this research aims to empirically explore and address the limits of OI implementation (i.e. internal and external challenges) across different stages of the change process and to offer required capabilities and actions that can help firms to counterbalance these challenges. We ask the following research question: *What are the limits of OI during the organizational change process and how do firms offset these limits of OI implementation?* We present an in-depth case study based on semi-structured interviews and strategic document analysis of an OI initiative known as Partner Campus, developed by Wärtsilä Finland, a large multinational manufacturing company. Based on our results, we argue that OI implementation is subject to organizational transformation, resulting in several internal and external challenges during the process. Instead of relying on ad hoc OI practices, firms need to adapt their existing practices and routines to embrace long-term OI implementation.

Our study is one of the first contributions to the OI and organizational change literature, to our best knowledge, that assesses the OI challenges embedded in organizational change processes. We draw upon and integrate two distinct bodies of literature, i.e. Lewin's purposive model of change (Lewin, 1951) and Chesbrough's OI model (Chesbrough, 2003, 2006), that have largely remained disconnected in prior literature. We acknowledge the work of Chiaroni et al. (2010, 2011) and Deprez et al. (2018) who combined the OI paradigm and intrapreneurship perspective with organizational change. However, our research differs from their work as we advance the understanding by identifying and addressing micro-level evidence on intra- and inter-firm challenges, hindering organizational drive for OI during the unfreezing to moving stages of change for innovation openness. In addition, our study offers approaches derived from learning in implementing OI and change processes that can strengthen the OI model by offsetting the limits. Our study also contributes to the organizational change literature (Burnes, 2004; Ford and Greer, 2006; Hayes, 2018) by identifying specific changes related to organizational processes, structure, and culture, and outlining approaches that can support a smooth transition. For this, the role of top management becomes crucial more than ever in driving and sustaining the change as they strategically define and communicate new governance mechanisms, processes and practices that enable changes in mindset and attitudes to embrace new routines and to develop a shared vision. Therefore, setting-up clear goals,

allocating and utilizing the required resources effectively during the organizational change is a supporting process that can help in successful OI adoption within organizations.

2. Theoretical background

2.1. Intra- and inter-organizational challenges and boundary conditions to OI implementation

Previous research has identified that OI poses opportunities and challenges for organizations as they adopt OI principles (Parida et al., 2014). Scholars have assessed the role of co-creation in OI, arguing that co-creation is not limited to the participation of actors in collaboration (Bendapudi and Leone, 2003) but involves them in constructing a personalized experience based on active dialog, co-design, and co-production to facilitate the interaction and mutual learning (Voyer et al., 2017; Loureiro et al., 2020). However, organizational aspects related to people, processes, and technology need to align with the new OI principles, a process that may require considerable change, particularly for large organizations (Chiaroni et al., 2011).

Prior literature has categorized the challenges to OI implementation into *intra- and inter-firm challenges* (Chaudhary et al., 2022). Internally, OI involves a change of both mindset and practice across the board, and management support in creating a renewed organizational culture that stimulates and tolerates experimentation, risk sharing, and possible failure (Chaudhary et al., 2022). The adoption of new practices involves developing capabilities to combine different processes and promoting change management that accounts for organizational characteristics. Several studies note that firms face fundamental internal challenges as OI practices are implemented that include the efforts to effectively exploit internal knowledge, incorporating external innovation, developing motivation for it (West and Gallagher, 2006), and organizational and cultural change (West and Gallagher, 2006; Van de Vrande et al., 2009). OI disrupts crucial internal innovation processes (Hienerth et al., 2011), such as vertically integrated and closed innovation paradigms (Dahlander and Gann, 2010), as well as the developed innovative routines, thereby challenging people involved in R&D (Alexy and Dahlander, 2013). Successful OI implementation requires firms to possess sufficient capability to assimilate external knowledge into their internal processes (Grama-Vigouroux

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et al., 2020). However, existing evidence shows that this is rarely the case, which challenges firms to reconsider their strategy, values, and operations. This process can go as far as necessitating transformational, rather than mere incremental, change (Parida et al., 2014; Chaudhary et al., 2022).

Externally, several relational, inter-firm boundary conditions challenge the implementation of OI activities (Audretsch and Belitski, 2020; Pedersen et al., 2022). Sustaining OI implementation over time can be challenging as several factors, such as loss of control, competitiveness, and motivation, IPR issues, knowledge leakage, lack of mutual trust, and goals ambiguity may limit the adoption of OI as a permanent practice (Van de Vrande et al., 2009; Chesbrough and Brunswicker, 2014; Henkel et al., 2014; Parida et al., 2014; Zynga et al., 2018). In addition, managers need to consider technological aspects related to managing compatibility between goals, resources, business models, systems, and methods when using OI (Parida et al., 2014; Gurca et al., 2021). Ollila and Elmquist (2011), while exploring the managerial problems confronted by OI actors, found three types of inter-firm OI challenges: interface challenges with partner organizations, collaboration challenges, and OI arena challenges. Moreover, research has scrutinized paradoxical tensions in OI networks during the early phase of collaboration and found that expressions of boundary, relationship, ownership, and organizing are four important paradoxical challenges to OI (Järvenpää and Wernick, 2011, see also Abhari and McGuckin, 2023). Similarly,

Bigliardi and Galati (2016) identified four barriers to adopting OI related to knowledge, collaboration, organizational culture, and finances/strategy.

The existence of these internal and relational challenges calls for the need for organizational re-alignment toward adopting OI principles and practices. Table 1 summarizes the intra- and inter-firm challenges of implementing OI identified in the literature. Although research has paid increasing attention to OI challenges, there is insufficient micro-level evidence on firm-level boundaries while organizations go through the process of implementing concrete OI initiatives. Similarly, we lack an overall understanding of how firms combine their internal capabilities in terms of people, systems and processes with external resources to counterbalance these boundaries.

2.2. A dynamic organizational change perspective to OI implementation

We treat OI as a dynamic process that involves organizational change from an existing model of closed innovation to a new model that encapsulates OI practices. This approach parts ways with much of the existing OI literature, which has largely examined OI as a stable and static phenomenon. The dynamic approach to studying OI thus stems from analyzing OI in the context of organizational change. The justification for this approach lies in the observation that an internal change process is required within organizations before they can be prepared to effectively adopt and use OI

Table 1. Intra- and inter-firm challenges and boundary conditions to OI implementation

	References
Intra-firm	
Need for the internal realignment toward OI principles and practices	Chiaroni et al. (2011); Zynga et al. (2018)
Lack of readiness to acquire, assimilate, and integrate external knowledge	Chaudhary et al. (2022); Grama-Vigouroux et al. (2020); Nonaka and Takeuchi (2007)
Difficulty to recognize the value of and internalize external knowledge	Chaudhary et al. (2022)
Risk aversion, goal ambiguity, and the resistance to change	Alexy and Dahlander (2013)
Motivating and sustaining OI implementation over time	Chesbrough and Brunswicker (2014)
Inter-firm	
Insufficient compatibility in mindset, organizational culture, business models, technologies, systems, and processes	Abhari and McGuckin (2023); Gurca et al. (2021); Parida et al. (2014)
Revealing critical information to external partners	Gurca et al. (2021); Henkel et al. (2014)
Free riding, loss of control and competitiveness, intellectual property rights issues	Audretsch and Belitski (2020); Pedersen et al. (2022)
Lack of mutual trust	Henkel et al. (2014); Dahlander and Gann (2010)

principles. In following this approach, we build on the organizational change literature (Hayes, 2018) as applied to the implementation of OI initiatives (Boscherini et al., 2010; Chiaroni et al., 2011; Zynga et al., 2018).

Lewin's (1951) organizational change model posits that successful change requires going through a sequential process from unfreezing to moving and then refreezing (Lewin, 1951). The transition to an OI model necessitates changing organizational boundaries to allow knowledge to move between the external environment and the organization's internal processes (Chiaroni et al., 2011). A company's transition toward OI has significant organizational implications and may involve a multifaceted transformation in structures, processes, systems, and organizational culture (Boscherini et al., 2010; Zynga et al., 2018). Several existing studies have analyzed the implementation of OI initiatives through the lens of organizational change. Remneland-Wikhamn (2011) documented a case of the Volvo Group and showed that incorporating OI required resolving path dependencies of previous decisions, processes, and structures that significantly conditioned OI adoption. They cautioned against simplistic and overly positive accounts of 'openness' and concluded that creating and communicating a vision and mission statement and redesigning business models alone are unlikely to result in a sustainable implementation of OI. Dodgson et al. (2006), based on the views of influential managers in Procter & Gamble, reported that significant organizational change was required to integrate OI into existing innovation processes, which did not follow OI principles. Using Lewin's three-step model, Boscherini et al. (2010) investigated how a pilot project may unfreeze the status quo and move toward OI implementation in four Italian companies. They found that the design and implementation of the pilot proved instrumental to unlock the closed model of innovation while the transfer of the project results supported moving toward OI. Similarly, Chiaroni et al. (2010, 2011) developed a theoretical framework based on the same model and focused on four dimensions to explain the transition from closed innovation to OI: inter-organizational networks, organizational structures, evaluation processes, and knowledge management systems. Consolidating OI by integrating it into innovation processes over the long term is essential to ensure that companies do not revert to a closed model of innovation. Zynga et al. (2018) analyzed OI adoption in a large sample of multinational companies and focused on the factors that lead to refreezing. They argued that companies need to develop adequate OI collaborative capabilities (micro-foundations) to

move successfully from one stage of the change process to another. They found that unfreezing can result from making OI opportunities visible while building individual and network capabilities to support the change toward OI. They found that building process capability and establishing organizational routines may support this long-term progression.

Since such change is not simple and encounters several internal and external challenges, developing certain mechanisms and capabilities can help firms to strategize, reorganize, and effectively reevaluate their actions to better leverage the external input and mobilize resources efficiently (Antons and Piller, 2015; Keinz et al., 2021). Developing OI-related dynamic capabilities, by adapting the existing structure and aligning organizational readiness for matching internal and external resources and transforming innovation processes (Teece, 2012; Keinz et al., 2021), can function as important elements throughout the process of organizational change. Furthermore, recent research has explored individuals' responses to tensions and their outcomes within the context of openness (Stefan et al., 2022). Mahdad et al. (2020) found that firms use structural elements of adaptive capacity (i.e. multiplicity, redundancy, and loose coupling) to tackle internal challenges to OI implementation.

Based on this literature review, we derive Figure 1, which describes the conceptual framework of our study.

3. Research methodology

We adopted a qualitative approach to conduct an in-depth single, yet salient, case study in order to acquire an extensive understanding of this phenomenon and its context by integrating different sources of evidence (Yin, 2009). This research approach is especially appropriate for studying the complex phenomenon of OI limits underlying internal and external challenges that organizations face during the process of change toward OI implementation (Dyer and Wilkins, 1991; Siggelkow, 2007). Single case study method has also been employed by several prior empirical studies in OI context (e.g., Bahemia et al., 2018; Gurca et al., 2021; Huikkola et al., 2022; Abhari and McGuckin, 2023), thereby making this approach a suitable design for applying the proposed conceptual framework (Yin, 2009) with a great effect. Furthermore, qualitative research methodology with the case study approach is considered important for theory building as it provides novelty, testability, and empirical validity, which emerges from the intimate connection with empirical evidence (Eisenhardt, 1989).
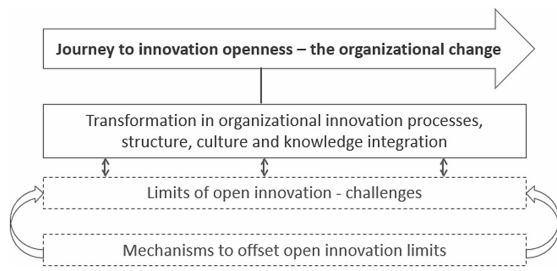
Figure 1. Conceptual framework of OI implementation during the organizational change.

3.1. Case description and selection criteria

We conducted our research in a global industrial organization, Wärtsilä Finland, an original equipment manufacturer (OEM), which provides solutions for the marine and energy markets. Wärtsilä represents a theoretically relevant case study to analyze the change toward OI since the company has recently redefined its innovation system (Huikkola et al., 2022). We investigated their tangible OI platform, called the Partner Campus (henceforth PC) that Wärtsilä launched in 2018 as a part of their major investment in developing Sustainable Technology Hub (STH). PC (as a facility), connected to company's center of excellence globally, is an integrated co-creation and innovation platform and a research and product development campus of the STH that relies on multi-stakeholder collaboration and incorporating external knowledge into the company's internal innovation processes (Wärtsilä, 2022). It offers a quick link to a shared network of expertise and provides a physical facility (infrastructure) not just for ideation and co-creating solutions with OI partners but also enables testing and validation of different technological ideas and new sustainable product solutions in their dedicated product development and production area called ProtoZone (Anteroinen, 2022). The main purpose to create such OI platform was to develop a more agile and flexible work culture by offering a highly collaborative environment for OI to partners within and beyond organizational boundaries in response to fast pace technological development and supporting continuous learning. Wärtsilä value the importance of OI since they had internally recognized that they cannot 'develop everything in-house' and thus wanted to create a state-of-the-art OI ecosystem.

Based on theoretical convenient sampling criteria, PC as a case becomes relevant to our study as it facilitates the understanding of complex phenomena of limits of OI practices, despite its potential benefits, enables accessibility and information richness (Voss

et al., 2002), and to identify a case purposefully which supports in replicating or extending emergent theory from the case in which the process of interest is 'transparently observable' (Eisenhardt, 1989). It must stimulate the sharing of learnings and promote new ways of working by thinking outside the box together with their partners including customers, suppliers, regulators, start-ups, and universities. Therefore, PC represents a 'strong case' of OI, which we use to develop an in-depth insight into the implementation of OI (Dyer and Wilkins, 1991; Siggelkow, 2007).

3.2. Data collection

This research systematically combines an analysis of existing literature with empirical data from the case organization (Dubois and Gadde, 2002). We followed a three-step approach to conducting this research. First, we reviewed relevant research on OI, organizational change, and the challenges of OI across the organizational change process. Then, we developed a semi-structured interview protocol (based on the research objectives) and conducted 31 interviews with a wide range of respondents; from top management to directors and from general managers to chief experts (24 men and 7 women) (see the questionnaire in the Appendix A). *Internal testing* was done to pilot and evaluate the interview guide (Kallio et al., 2016). We followed a snowball approach and the information given by key informant of the PC to identify and approach these 'elite informants' (Aguinis and Solarino, 2019) and verified their involvement with the whole process of building PC from its concept development (i.e. top management) to the current stage of collaboration with several stakeholders (i.e. other managers and experts). The top management individuals are prominent, influential, and well-informed decision-makers who provide a broader view of organizational strategy and the business logic regarding OI as well as their future vision for PC. While the middle-level management and experts are actually involved with implementing and coordinating OI practices (see Table 2).

Furthermore, multiple criteria were used to select participants (Yin, 2009) e.g. characteristics of the population, objectives, and research questions. This criterion ensured that the PC has enough interactions with internal and external partners addressing the limits of OI and the ways to overcome these challenges. The purposeful sampling technique was employed to attain maximum variation (Eisenhardt, 1989), which is suitable for our research as it supported the selection of the information-rich 'critical case'

Table 2. Overview of interviews

Interviews	Position (Acronyms)	Years of experience	Duration
Top management			
Interview 1	SPM	12 years	1 h 30 min
Interview 2	GM1	11 years	1 h 15 min
Interview 3	GM2	25 years	1 h
Interview 4	MD	20 years	1 h
Interview 5	DD	10 years	1 h
Interview 6	GM3	17 years	1 h
Interview 7	GM4	23 years	1 h 30 min
Interview 8	GM5	17 years	1 h 15 min
Interview 9	GM6	17 years	1 h 15 min
Interview 10	VPS	18 years	1 h 15 min
Interview 11	VPH	15 years	1 h
Interview 12	MT	20 years	1 h
Interview 13	DR	31 years	1 h
Interview 14	DSF	30 years	1 h
Interview 15	DE	20 years	1 h 15 min
Interview 16	DL	27 years	1 h 30 min
Interview 17	TVD	33 years	1 h
Middle management			
Interview 18	SMP	16 years	1 h 10 min
Interview 19	MPS	16 years	1 h
Interview 20	CM	2 years	1 h 30 min
Interview 21	PM	16 years	1 h 15 min
Interview 22	PDC	5 years	1 h 30 min
Interview 23	OEM	6 years	1 h
Interview 24	TVM	20 years	45 min
Experts			
Interview 25	CES	4 years	45 min
Interview 26	CE	4 years	1 h
Interview 27	CEP	15 years	50 min
Interview 28	CPE	14 years	1 h
Interview 29	SE	18 years	1 h 30 min
Interview 30	SCE	4 years	1 h
Interview 31	CESF	16 years	1 h

and the identification of individuals that are particularly relevant, knowledgeable, and experienced who view the focal phenomenon from different perspectives (Creswell and Clark, 2017), which resulted in

limiting bias and risks of convergent retrospective sensemaking (Eisenhardt and Graebner, 2007). We conducted all the online interviews during 2021–2023 in English and recorded and transcribed them verbatim.

The interviews lasted for 45 to 90 min and were followed by a coding process and cross-comparison analysis of respondents' answers to categorize the recurring patterns into valuable insights. Full transcription resulted in 893 pages and 2110 min of material. During the interviews, we utilized the interview protocol to streamline the discussion around the research questions. The interviewees were asked to describe and comment on the inception and implementation of PC, organizational change management, limits of OI, and interorganizational relationship management. We then drafted a case narrative on the internal and external challenges of OI, change management process, organizational readiness, collaborative capabilities, and absorptive capacity, in line with existing research (Langley, 1999).

3.3. Coding and analysis

The transcribed data were systematically coded and analyzed by following established procedures in qualitative research. We followed the recommended data analysis approach by Gioia et al. (2013), which advocates a strategy to organize the raw data into codes and afterward develop themes, which enables the identification of different patterns in the data. To do this, we utilized NVivo 12, which is an effective tool that facilitates coding and enables to keep track of emerging concepts and their relationships. During the first stage, an open coding approach was used (Bazeley and Jackson, 2013), which facilitated the analysis and categorization of raw textual data (Schofield, 2002). The codes were compacted into first-order themes containing interviewees' original thoughts. Additional codes were added to the NVivo coding scheme during this stage as respondents cited new limits of PC. During the second stage, we employed a theoretically driven structural coding approach and grouped first-order concepts into 20 second-order themes. Finally, while further structuring the data, these 20 second-order themes were grouped into 5 main aggregated themes, namely: unfreezing for OI, internal challenges of OI, organizational change/moving, external challenges of OI and offsetting the limits of OI. These aggregated themes represent the abstract dimensions of the analysis. Figures 2 and 3 show the general data structure of our study and illustrate the coding and the process of reasoning that we followed to derive the second-order and aggregate themes.
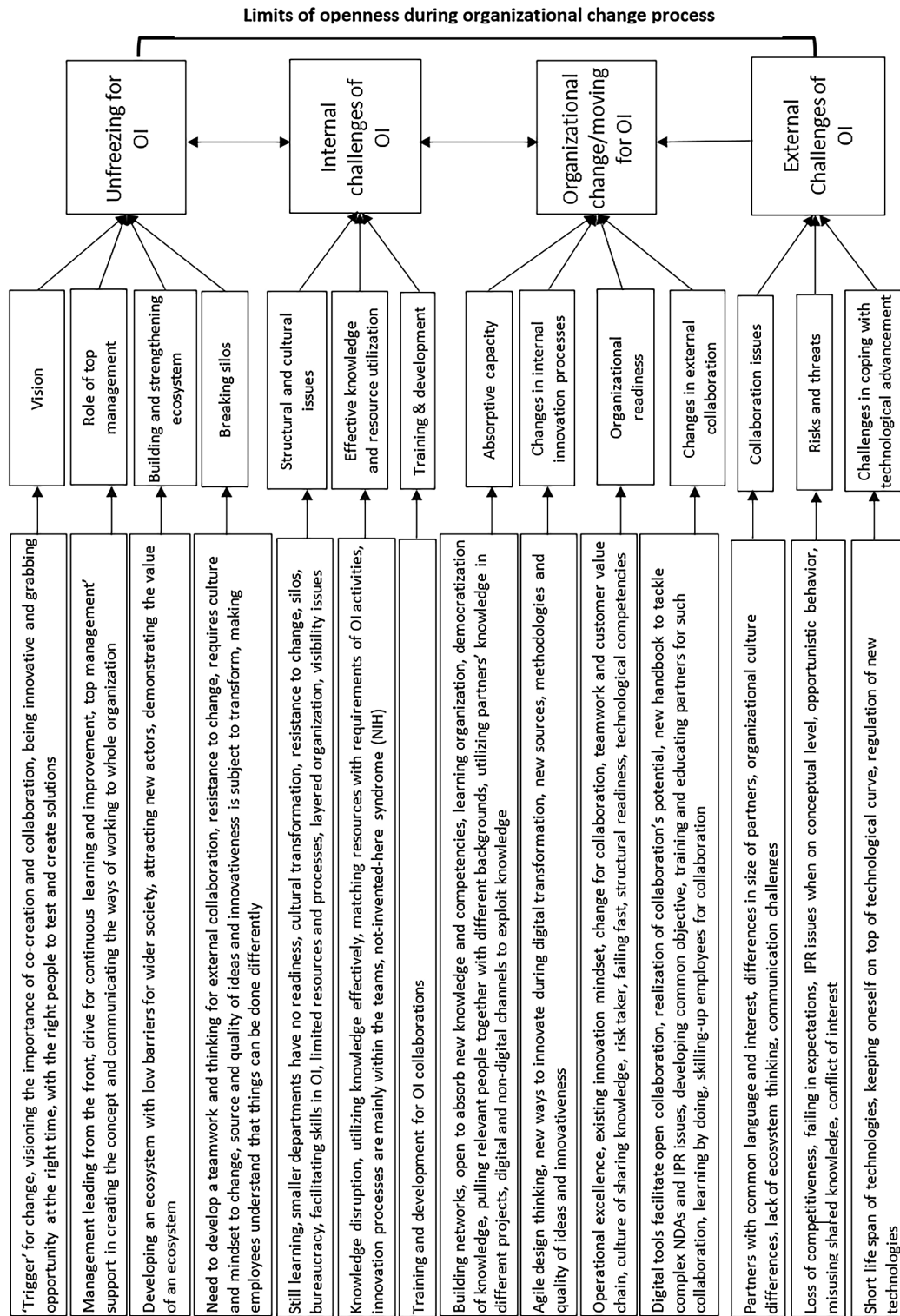
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Figure 2. Data structure for limits of OI during the organizational change.

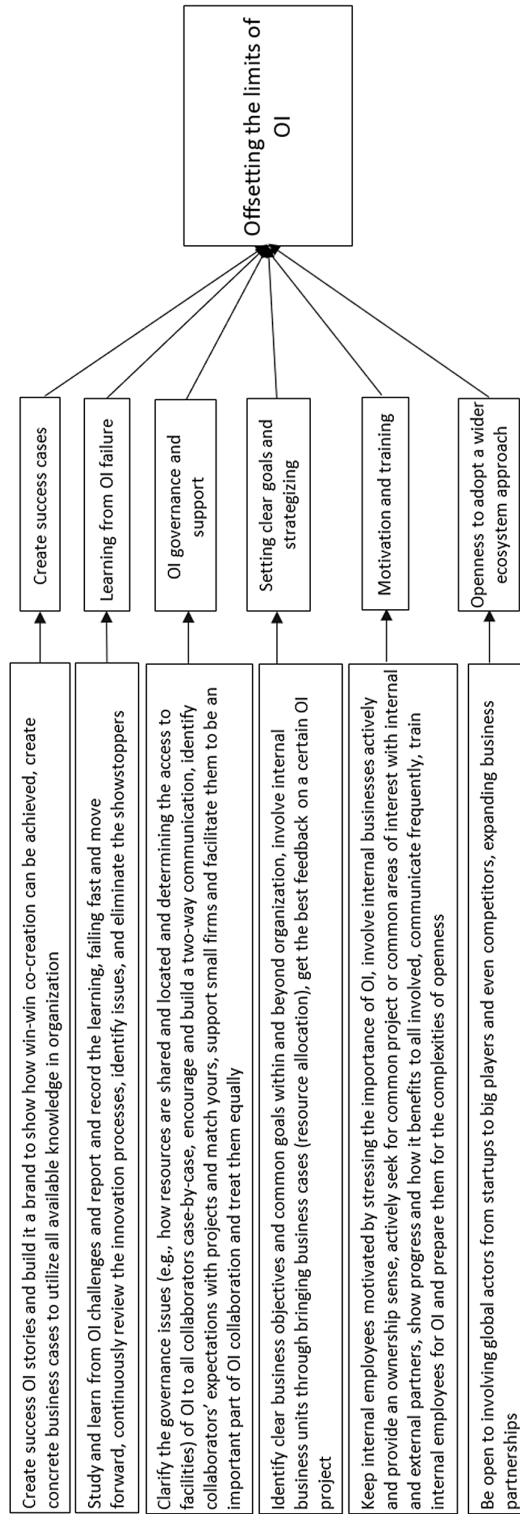© 2024 The Authors. *R&D Management* published by RADMA and John Wiley & Sons Ltd.

Figure 3. Data structure for offsetting limits.

Figure 3 describes in detail the identified approaches with our interpretation of interviewees' statements on offsetting the limits of OI.

In addition, the authors were involved in triangulating the interview data with secondary data based on several sources (Yin, 2009), which included organizational webpages on PC, blogs, organizational reports, and a jointly drafted PC 'Playbook' that supported refining the theoretical setting. This helped us to build the narratives of our findings, good understanding of the case from different perspectives and with the facts. It also has supplemented our interview data and resulted in strengthening our standpoint as well as more informed findings with an increased level of knowledge. We then cross-verified the analysis and findings among the authors and a key manager from PC to develop a shared interpretation of the collected information. Furthermore, one of our co-authors had been actively involved in developing and strategizing PC from its concept development stage, which provided us with a profound insight into the case in the analysis.

4. Findings

4.1. *Unfreezing for OI*

Our analysis of the organizational change captured the transition from unfreezing existing innovation practices to moving toward OI. First-hand information from the top management regarding the vision of PC and its 'trigger' sheds light on why the company launched PC in the first place. The point of unfreezing triggers Wärtsilä to aim to build and develop a more agile and flexible work culture that is responsive to change and supports continuous learning. The interviewed management (e.g., VPS, MD, SPM, TVD) was consistent on the 'trigger' of PC and emphasized the role of the internal recognition that 'we cannot develop everything alone'. They noted that the idea of building an ecosystem already existed within the management team for some years. The company wanted to brand itself as a 'model of future technological innovation' and create an efficient and 'state-of-the-art' ecosystem where several partners can work together to do what they are best at doing (Wärtsilä, 2023; top management such as VPH, TVD). Furthermore, Wärtsilä's Digital Acceleration Centers which aim to speed up innovation and co-creation for business model innovation, smart solutions, and intelligent manufacturing systems, also fed into this 'trigger' and represented one of the drivers to shift action toward OI principles (Kliger, 2017) (see Table 3 for additional quotes on unfreezing for OI).

Although during the unfreezing stage, progress was made to start the PC initiative, opening up the organization to external partners was not smooth as it took time for Wärtsilä to embrace the OI paradigm. In the following section, we highlight the identified internal challenges during unfreezing to moving

Table 3. Direct quotes on unfreezing for OI

Unfreezing for OI	
Interviewees' quotes on unfreezing	Regarding the vision of PC, SPM stated, 'our vision was to become an OI platform where we offer tools, methods, network and facility that can help in colliding people from different organizations, companies and different parts of the world to drive the co-innovation and co-creation'.
	Similarly, as a steering group member of PC, MD highlighted, 'PC, as a part of our digital transformation, is an open possibility to further build and strengthen the ecosystem … changing mindset and open-up with a very low barrier where PC play its role as a facilitator by using OI principles'.
	Furthermore, for the journey from unfreezing to moving, VPS emphasized that '…PC is the embodiment of the desire of having more structured and new ways of working and co-creating with customers, suppliers, and competitors and demonstrate the value of an ecosystem'.
	In the same vein, TVD highlighted that 'the idea was to start a change within the organization that never existed before…beyond a new factory building, rather extended ecosystem and setup to facilitate deeper collaboration with several partners'.
	Similarly, VPH highlighted that '… we want to be faster, better, and more open to making three plus three equals twenty-five'.
	Opening up for OI, however, creates uncertainties, in terms of finance, resource, and change that the company needs to consider early during the unfreezing stage. For this, SPM mentioned, '… there were still some uncertainties during organizational changes related to how will this PC look like? Will this be actually an organization that has its own budget and resources and how would it support the internal businesses?'

stages of organizational change process that are found to limit the organizational drive for OI.

4.1.1. Internal challenges leading to limiting organizational drive for OI

For a large and historically established company, a new change could bring several internal challenges related to *existing silos*, routines, and embracing new ways of working as the workforce is already loaded with traditional tasks, leading to *resistance to change*. Similarly, if the idea is not communicated well within the organization during unfreezing, it ends up in visibility challenges and ambiguity of the whole purpose of the initiative leading to lack of self-awareness, which was confirmed by the interviewees (e.g., DSF, GM4, GM2; GM1). For *changes in structure and culture*, our data suggested that such changes belong to internal challenges as Wärtsilä has been facing during this transition toward OI. Several top management interviewees (e.g., DSF, GM2, DL, DD, TVD) highlighted these foreseen challenges of 'culture for decades' and uncertainties for IP ownership during unfreezing. It was found that the organizational readiness in terms culture for such a change was hanging in the balance. Although, there exists an established culture of collaboration and sharing information, that majorly remained project-based endeavors in a rather controlled environment, thus OI challenged the culture of being secret to be open (highlighted by GM4 and TVM). Uncertainty about IP ownership was also found to be the most pressing issue raised by some respondents. They highlighted that the discussion around IP has always been important even before the collaboration as it requires careful evaluation to make sure all stakeholders are on the same page (e.g., TVD, GM2).

Though, several structural changes were adopted during the overall digital transformation of Wärtsilä. However, as the PC initiative started some years back, it is still considered a local platform for OI. Therefore, different departments within the company need to adapt their structures as they will have to collaborate with PC at certain points in its progress. Furthermore, resource constraints and several organizational layers have also found to be the barriers to structural changes as it has to deal with involving more people, communication and share information, and the processes to support it (SE, GM2, CESF). Interviewees acknowledged the difficulty in terms of *utilizing the knowledge and resources effectively*. The concerns about exploiting knowledge were also highlighted as the case company sometimes struggles in utilizing the knowledge effectively due to finding the right resources within the organization,

not-invented-here syndrome and matching with the requirements of OI activities. MD and DE also shared the same views on this and emphasized that it requires having a concrete business case, a proper business logic or a customer need to exploit the knowledge effectively. These respondents were consistent that it is difficult to engage the endless resources (experts) and share the learned knowledge on each identified OI project in PC and as DSF questioned that if the new knowledge is scalable to our products. Similarly, GM4 acknowledged that workload challenges to bring in the know-how within the organization (see Table 4 for additional supporting quotes).

Regarding *training and development of internal and external partners*, we found that unless training and development is offered, it limits the openness in collaboration, it requires investing time and resources. Similarly, DR, GM2 and SE emphasized having internal training for such OI collaboration as partners might collaborate on different dimensions where existing skills might not be enough.

4.2. Organizational change/moving

Firms usually differ in their capability to integrate external knowledge, thereby contributing to innovation and learning differently (Tsai, 2001; Audretsch and Belitski, 2020). SPM emphasized on building the network to enhance the absorptive capacity. Developing absorptive capacity depends upon prior and existing related knowledge which tends to develop cumulatively (Tsai, 2001). There exists a culture of sharing knowledge in networks and well-organized knowledge management practices in Wärtsilä where people are considered 'knowledge-holders' (Wärtsilä, 2022). To *absorb the new knowledge* through PC, SMP, and VPS shared their views and highlighted that they have to be a learning organization where they can demonstrate an openness to adopt new knowledge and competencies toward the digital and data-driven project. Wärtsilä is already experienced in working with the extended network (Wärtsilä, 2023). However, for PC, it needs to ensure that they utilize the right skills, data, and research to absorb and exploit new knowledge (Wärtsilä co-creation playbook, 2023). Regarding *knowledge exploitation*, interviewees highlighted the importance of digital and non-digital channels in such OI practices. For example, VPS and MT pointed out Yammer and Teams and how they are being utilized to share knowledge and inspire everyone to be a part of OI practices.

SPM, DSF, and CM shared their views on *changes in internal innovation processes* and

Table 4. Direct quotes on limits of innovation openness – internal challenges

Limits of OI	
Internal challenges	
Structural and cultural issues	DR highlighted that, '…internally, smaller departments have no readiness towards it yet, however, they can learn through PC from the more advanced areas of the organization'.
	CESF highlighted that, '… our organization would benefit of a broader than taller organization… the pyramid with plenty of layers result in slow speed and unclear responsibilities… so I would like to have more flatter organization'.
	Regarding the culture, SPM and DL shared the same views, '…due to our long history and its embedded values, it's difficult to transform organizational culture for a change and therefore, from time to time, we are not fast enough which hinders us moving forward'.
	DD mentioned that: 'there is always resistance to change, but it's about how we as management create the concepts and ways of working'.
	MD highlighted that: 'culture wise there is definitely a need for a change for collaboration, teamwork and thinking more about the whole customer value chain and OI instead of being in their own organizational silo'.
Effective knowledge and resource utilization	SMP acknowledged that 'although we are open for new knowledge and competencies of the digital and data-driven project but it's very tricky when we have to explore something new'.
	DSF acknowledged that they have the ability to absorb and utilize new knowledge, however, '… in some cases there might be an issue of not-invented-here syndrome, that it was invented somewhere else and why should I look into this, but that's quite rare'.
	MD addressed the challenge to absorb disruptive knowledge and mentioned that, 'we are good to absorb knowledge which is close to our core competencies but it's a bit challenging when we need to absorb disruptive knowledge'.
	DE highlighted that: '…as we are not well equipped with absorbing everything, some ideas remain on hold and there is a potential risk that we might lose good opportunities due to this limitation'.
	GM4 stated that, '… for instance, we have been developing simulation tools, in some cases we have been able to take that modeling and know-how into use when it's needed. But very often, we don't have time, we know about the new knowledge created but we don't take into use'.
Training and development	Regarding training and development, SPM highlighted that 'we need to educate and make clear what can be disclosed and what cannot, without an NDA'.
	VPS explained it as, 'PC is not a training facility but to set clear goals and expected outcomes, you have to go through the training phase. Training doesn't mean any hard skills, but to explain what it means to collaborate with partners'.

highlighted that PC seems to be resulting in bringing agile design thinking into the process of innovation. While embracing organizational change processes, firms need to ensure their *readiness* for such transition as it requires to change in organizational culture (openness for a change), organizational structure, and digital/technological and innovation-related competencies (Lokuge et al., 2019). The interviewees also shared this view and identified their readiness in terms of existing operational excellence, innovation mindset, teamwork, and customer value chain, the culture of sharing knowledge, risk-taking, and failing fast capability as well as technological capabilities in the firm. Transformation in *external collaboration models* (Imran et al., 2021) is a prerequisite for OI. Based on the interviews and secondary data analysis, we found that Wärtsilä has a developed culture

of external collaboration on several existing projects (Wärtsilä, 2022). Several interviewees emphasized the importance of such collaboration for OI and highlighted that digital tools, the realization of collaboration's potential, a Playbook to tackle complex issues of NDAs and IPRs, skilling-up employees, and learning by doing, facilitate collaboration (See Table 5 for additional support quotes).

During the moving phase, Wärtsilä had to go through several adaptations concerning organizational readiness, collaborative capabilities, absorptive capacity, and changes in innovation processes which put pressure on existing systems, processes, routines, and ways of working. Top and middle management had to communicate and coordinate extensively to address these issues. In the following section, we highlight the identified external challenges during the moving stages of organizational

Table 5. Direct quotes on the organizational change/moving phase

Organizational change/moving	
Building absorptive capacity	SPM defined it as, '…it still comes back to building a network, or being part of the network, acting in the network sharing…'. VPS, emphasized the democratization of knowledge and mentioned that: 'we are creating and adopting a team's kind of mentality where you pull people together from different backgrounds to address an opportunity and then report and share findings within the organization'. DE stressed that '…we have to make sure that the right competencies (experts) are participating in PC projects in order to retain the learnings'.
Changes in internal innovation processes	For changes in existing practices of innovation, MT mentioned that 'we have introduced new ways of innovating during the digital transformation phase. But now it's the right time for the businesses to open up and drive this innovation'. DR put up the view of the intellectual quality of the innovative ideas, '…I do not see that the innovation process will be too much modified, because the process has been there, but source and quality of ideas and innovativeness are probably that we target to change'. While DE highlighted its impact as product specific: 'innovation processes are within the teams who have their own ways of working that are very product specific… it also varies team to team as when you use PC, a co-creation model does impact on processes through joint solutions'. Regarding the methodologies and ways of working for OI, CM mentioned about the Playbook: 'one biggest change in the innovation process is that we have created a co-creation Playbook. We are now sharing with the entire world, methods, and stuff that we have used as our best practices inside the company'.
Organizational readiness	DE emphasized the individuals' role, 'the fundamental question of organizational readiness boils down to individuals. We have already been working globally, co-innovating along different teams across the globe, so in that sense we are ready, but then it depends on the individuals that how they are ready for it'.
Changes in external collaboration	DE compared the current collaboration model with the past and mentioned that '… in past, we used to collaborate with huge piles of NDAs, but in PC, we have a Playbook, where the rules have been defined how to be opened and creative right from the start'. CM stated that 'we need to get our internal businesses to realize the potential of collaboration with others, taking support of PC and utilizing partners from the network'. VPS defined the changes in external collaboration as, 'for PC, we start the collaboration with lower barriers. We first engage on mutual understanding, but as soon as we find an opportunity to produce something together, the discussion turns into the Playbook where all the issues related to IPR and NDAs are specified'.

change process that are found to limit the innovation openness.

4.2.1. External challenges leading to limiting innovation openness

From our data, we identified that OI can also result in collaborative complexity as organizations are required to embrace capabilities through internal changes and to prepare for collaboration with partners that have entirely different business objectives. We have identified several *collaboration challenges* in our data. While addressing the issue of differences in size and culture of OI partners, several respondents (e.g., CM, VPH, PDC, OEM, DSF) shared their views and mentioned that finding partners with knowledge is challenging and small companies do not have enough resources and an army of lawyers who can settle the agreements and NDAs as compared to larger organizations, it sometimes makes challenging to put two different cultures together. Interestingly, MD considered collaboration as a complex process with big companies. We also found that when organizations move toward opening up to external stakeholders, a lack of clear communication and transparent information sharing restrict partners to develop the common language and interest in collaboration (CESF and SE). Furthermore, our data pointed out several *risks and threats* that limit OI activities. SMP and VPH shared their views and highlighted that there is always a risk if partners do not live up to the expectations and act according to the agreement or if the conflict of interest arise between partners.

Further, IPR issues always remain on the top of the discussion with external stakeholders, also reflecting

in our findings as it is related to the questions of 'can we talk openly?', 'how much can we share?' and 'would someone misuse the shared knowledge in OI?'. Similarly, several respondents shared their fear of partners' drop-out during co-creation process (MT) or the tendency of people move to another organization (CESF, TVM). Interestingly, we have identified some challenges in coping with *technological advancement*. These include the short life span of technologies, keeping oneself on top of the technological curve, and regulation of new technologies. The respondents were consistent in highlighting that although technological innovations are emerging with a great speed, we cannot jump into every horse as our businesses take long time to invest in and implement new technologies, due to its nature (CES,

GM4) (see Table 6 for supporting quotes on external challenges).

Table 7 summarizes our findings on the limits of openness during the organizational change process. Our findings highlight that internal challenges arise when organizations start the change process and these challenges are linked with unfreezing and moving stages of organizational change. While external challenges arise when organizations transform their endeavors across organizational boundaries and collaborate with external stakeholders.

4.3. Offsetting the limits of OI

Several approaches to offset the limits of OI emerged in our data. PC seems like the perfect

Table 6. Direct quotes on limits of innovation openness – external challenges

Limits of OI	
External challenges	
Collaboration challenges	For external collaboration, DR mentioned that 'sometimes we don't find a common language that we can start a new project with our partners in OI'.
	For a lack of ecosystem thinking in OI collaboration, VPS pointed out that, the 'ecosystem needs to stay true, sometimes partners start with the open conversation but when it comes to something concrete to decide about, then they want to have a separate conversation, and take the advantage (first mover advantage) of the situation. It might lead to IPR issues as well'.
	GM4 highlighted that, 'In some cases, when we work with partners, for instance universities, on predevelopment type of research, there might be some questions of why to work with this as this does not contribute to our success today'.
	SE mentioned that, '…communication and information sharing remains the issue in collaboration… then we need to figure out the process how to pay for acquired services, for instance, collaborating with university students, we need to figure out how do we pay to them… a sandbox or a secured environment is needed to share information'.
Risks and threats	SPM highlighted the issue of loss of competitiveness, 'collaboration is done in a bilateral manner. So, if one supplier is supplying both of us and to our competitor, then the risk is there obviously'.
	DD addressed the issues of expectations failure, 'one clear risk is failing in expectation management. if I'm a partner, and I woke up at the PC, what can I expect?'.
	DE highlighted that, '… regarding the IPRs, if you are at the component level, then it's obvious who owns IPRs. But on a concept level, it becomes a risk, and it depends on your partner then'.
	VPH shared that, 'there is always a risk of misusing the shared knowledge in OI'.
	SMP shared an experience where a competitive rift among partners emerged, 'because of the conflict of interest, one of our partners stepped down from the collaboration when one of its competitors joined the same project'.
	Importantly, MT shared a fear of partner drop-out in co-creation, 'there can be people or businesses joining in and then suddenly dropping out due to any reason which can leave us alone'.
Challenges in coping with technological advancement	'We would never go into developing a solution for two years out of which you would commercialize it for one and a half years… we hope to keep ourselves on the top of the technological curve, but sometimes it's challenging due to the pace of technological advancement' (DE).
	'The technology is moving forward so fast today that if we create a solution, a system, software, or a component used in that solution, so it actually becomes obsolescent after three to four years. That's an issue…' (DL).
	'New regulations are emerging for different technologies such as artificial intelligence (AI) on an EU level but when we have to deal with partners in other countries such as Asia, China, or the USA, it's not clear how to operate from the regulation framework point of view' (DL).

Table 7. Summary of OI limits during organizational change

Limits of OI	Unfreezing	Organizational change/moving
Internal challenges	Resistance to change within the firm	Utilization of knowledge and internal resources effectively remains a challenge as it deals with finding the right resources to match with OI implementation requirements
	Time taking process to embrace OI due to internal issues related to existing organizational silos	
	Organizational structure and cultural issues such as readiness, cultural transformation, and mindset restrict to adopt innovation openness	Several adaptations in developing collaborative capabilities, absorptive capacity, and changes in internal innovation processes can put pressure on existing incumbent systems, processes, and routines
	Training and development of internal employees to embrace the OI model require time and costs	
External challenges		OI collaboration issues since OI partners are of different sizes, and cultures and with different organizational objectives. Similarly, communication challenges emerge due to OI external partners' complexities
		Risks and threats of dropping out OI partners due to the lack of commitment, loss of competitiveness, IPR issues, misusing share knowledge, and conflict of interest
		Challenges in coping with technological advancement since the pace of technological advancement in the market is quite fast and new technologies emerge quickly, it is difficult for the case company to cope with such a pace due to its nature and particularly if they collaborate with small firms for jointly co-created solutions

OI platform due to the ways they are operating with different partners for innovation openness (Wärtsilä, 2022). While PC encountered several internal and external challenges in implementing OI practices, the respondents also acknowledged the steps and actions that must be taken to address these challenges. For example, some respondents (e.g., DE, CM) emphasized the importance of highlighting the success stories of OI and creating concrete business cases to brand it as an effective way to achieve innovations. This helps in utilizing the relevant knowledge and resources in the organization as well as convincing external partners to remain committed and attract new partners (see Table 8 for additional supportive quotes on offsetting OI limits).

Further, learning from the failures and envisaging potential risks and threats require careful analyses, future planning, and decision-making that can diminish possible errors and facilitate firms to address the limits of OI (MD, CM, DE). Regarding OI governance and support, the respondents emphasized the importance of clarifying these issues in advance with external partners in order to avoid any future ambiguity in OI partnership. Although PC has developed a Playbook helping in clarifying

the standard operating procedures with partners, it still ends up discussing governance-related issues case-by-case (DR, CE, SPM, DE, CM). For this, two-way communication becomes pertinent as it can also help in managing expectations in such interactions. Furthermore, the respondents (VPS, CE) addressed the role of setting clear goals and strategizing OI practices internally as well as motivating employees and providing training in clarifying the main purpose of OI and keeping internal businesses and employees committed (Wärtsilä co-creation playbook, 2023). For this, CM iterated that, '*We have to show our internal businesses how we can bring value through PC. We need good use cases to attract our internal businesses to contribute*'. We also found that opening up to wider ecosystem would help Wärtsilä to attract new partners for co-creation and to create an environment where partners can develop trust and ecosystem-based dynamic interactions (VPS, DD).

5. Discussions and implications

This research makes three main original contributions. First, it brings together two distinct bodies of

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Table 8. Direct quotes on offsetting OI limits

Offsetting the limits of OI	
Create success cases	'We have to create success stories out of PC in order to show that we are having economic gains due to PC collaboration'. DE highlighted.
	CM stressed that: 'There can be very interesting ideas to work on, but we have to think that is there any concrete business case behind it? Is there actually a demand for it in the market?'.
	'There should be a concrete business case and customer need in order to make this happen so where we can make use of this knowledge. If we have concrete business cases, we can utilize our knowledge with business reasoning to settle our score'. (MD)
Learning from OI failure	'It comes gradually by having pilot projects and learning by doing'. (MD)
	'We are a big and very hierarchical organization, but from the management side, there is a drive for continuous learning, continuous improvement, and more pushing towards agile thinking, and thinking about the business case'. (CM)
	'We have set rules of engagement in the playbook. But we will need to keep reviewing the issues and eliminate the showstoppers'. (DE)
	'If you fail, you must acknowledge that you had a good attempt but this didn't lead to any discontinuation, we should come up with something new and then we go again'. (DE)
OI governance and support	'Clarify the governance issues as the more partners you have, the more issues emerge and they also might want to know about how resources are located and how their access to facilities is determined'. VPS highlighted. While DR emphasized that 'governance-related issues are defined in the playbook already. But we also need to discuss it case by case as one solution cannot fit all'.
	CE highlighted that 'there needs to be two-way communication between us and partners because it's important to keep in touch regularly. It should not be like you suddenly forget about it and then return after half a year'.
	Regarding expectation management, respondents emphasized that 'It's super important to identify expectation of partners before going into partnership with them'. (SPM). While DR highlighted that 'it needs to be made in an early phase clear for all the participants what they can expect'.
	To support small companies, respondents said that 'we need to eradicate the impression that small companies do what big companies tell them. We need to support and treat them equally'. (DE). Similarly, CM highlighted that 'due to lack of resources, small companies might need extra help from PC in order to understand the agreements'.
Setting clear goals and strategizing	'There has to be a clear business objective for the partners to come together'. VPS. While VPS further highlighted that 'We need to bring business perspective and then connect it with the potential internal business units'.
	'PC initiatives should be very close to businesses (internal business units). They can help in providing valuable feedback on certain OI projects with different partners'. (CE)
Motivation and training	'We need to actively seek for common projects or common areas of interest in order to keep high motivation for employees as well as for other parties'. (CM)
	'Mainly thing that keeps people motivated is progress, small or big, but progress'. (SMP)
	'It's a cultural and mindset change, so some sorts of refresher trainings and refresher courses have to be there continuously'. DL highlighted. Similarly, DR mentioned the diverse partners' backgrounds, 'I am sure that we need training. Because the partners are coming from different dimensions so we might need to learn new skills'. DR
Openness to adopt a wider ecosystem approach	'It's a place that involves global actors and will be the place that will attract new startups and suppliers that we not working with currently'. (DD)
	'I would say that PC is the embodiment of the desire of having a more structured way of collaborating and co-creating with customers and suppliers. And, and not stopping there, I mean, really having being able, we must demonstrate the value of an ecosystem and open it up to everyone'. (VPS)

literature, i.e., Lewin's purposive model of change (Lewin, 1951) and Chesbrough's OI model (Chesbrough, 2003, 2006), that have largely remained disconnected in prior literature. This helps to understand the intertwined dynamic practices that involve OI principles and organizational change process.

Second, identifying the limits of OI (West and Gallagher, 2006; Van de Vrande et al., 2009; West and Bogers, 2014; Audretsch and Belitski, 2020; Chaudhary et al., 2022; Stefan et al., 2022) during the organizational change process (Chiaroni et al., 2010, 2011; Deprez et al., 2018) has long remained an open question in the literature. Our study is one of the first contributions to the OI and organizational change literature, to our best knowledge, that assesses the limits of OI embedded in organizational change. By taking

this dynamic approach anchored in the organizational change literature, this article differs from existing research, which has examined OI as a stable and static phenomenon (e.g., Chiaroni et al., 2010, 2011; Deprez et al., 2018). We advance the understanding of how these limits hinder organizational drive for innovation openness during the unfreezing to moving stages of organizational change. Our findings result in a multi-stage process framework capturing internal and external challenges of OI implementation. This also responds to the call for further research by Bahemia et al. (2018) and Bigliardi et al. (2020) to explore the challenges and boundaries of OI during the transition from closed to OI.

Third, we unpack the organizational actions and capabilities derived from the learning in implementing OI practices during the change that can strengthen OI model by offsetting the identified limits. This was done by providing micro-level evidence on the nitty-gritty of people, systems, and processes involved in OI implementation. Thus, this research takes a critical approach to OI and shows that organizational challenges as well as challenges from the environment of the organization can constrain the effectiveness of OI practices. The article contributes to the organizational change literature (Burnes, 2004; Ford and Greer, 2006; Hayes, 2018) by identifying specific changes related to organizational processes, structure, and culture, and outlining approaches that can support a smooth transition. For this, the role of top management becomes crucial more than ever in driving and sustaining the change as they strategically define and communicate new governance mechanisms, processes and practices that enable changes in mindset and attitudes to embrace new routines and to develop a shared vision. Therefore, setting-up clear goals, allocating and utilizing the required resources effectively during the organizational change is a supporting process that can help in successful OI adoption within organizations.

Our study shows that opening up to the external world by using OI practices is not a simple 'plug and play' activity. It requires a 'trigger', a strategic and clear vision (Abhari and McGuckin, 2023), and a powerful drive within the organization combined with management support to prepare the whole organization to unfreeze for a change (Chiaroni et al., 2011). This change may require a radical departure from existing incumbent systems and arrangements. However, the role of top management is central as they strategically define the OI implementation processes, pathways for ecosystem collaboration, and clearly communicate to entire organization, which is an effort to break status quo and existing silos (Chiaroni et al., 2010; Deprez et al., 2018;

Grama-Vigouroux et al., 2020; Imran et al., 2021) and change in mindset to embrace new routines and knowledge democratization. Established firms remain a step ahead as their prior experience of collaborating with the extended network helps them to adopt new approaches for cross-functional, intra- and inter-organizational collaboration (Bogers et al., 2017; Grama-Vigouroux et al., 2020). However, innovation openness is still considered a complex process and challenging task for many organizations, given the magnitude of involved diverse actors and activities at different levels (Chaudhary et al., 2022; Purdy et al., 2022; Abhari and McGuckin, 2023; Saura et al., 2023). Firms are required to analyze the extent to which they are ready to embrace such change in terms of structural and cultural transformation for OI implementation (Lokuge et al., 2019). This is the case since OI principles require them to develop cross-functional collaborative practices that match up with the dynamic nature and speed of innovation (Huikkola et al., 2022). However, ill-preparedness for a change makes firms to struggle in sustaining the success of OI practices (Zynga et al., 2018; Keinz et al., 2021). It is also important to note that OI poses collaborative complexity due to the differences in business objectives, types (e.g., knowledge-intensive or non-knowledge-intensive), size of partners involved (Parida et al., 2014; Audretsch and Belitski, 2020), structure and culture, and a lack of ecosystem thinking which results in risks and opportunistic behavior (Van de Vrande et al., 2009; Grama-Vigouroux et al., 2020; Keinz et al., 2021).

Although co-creation with external partners in OI projects offers an opportunity to share costs and risks through clear discussions and agreements, the large number of investments carried out over several years for OI can create several threats such as loss of competitiveness, partners' expectations, IPR issue, misusing the shared knowledge and partner dropout (Parida et al., 2014) that hinder firms to open up. Similarly, collaboration with external and new partners entails the costs of searching, validating, compliance, and developing relationships. Further, the inter-organizational coordination issues such as consensus and clarity on the collaboration goals throughout as well as maintaining the OI consortium agile and the fear of knowledge leakage influence the longevity of OI practices (Dahlander and Wallin, 2020; Keinz et al., 2021). Moreover, utilizing disruptive knowledge and technologies, that are far away from the core competencies, can be seen as a challenging task as firms sometimes struggle to employ relevant resources and advanced technological applications, unless they have a concrete business case to exploit them effectively. It results in trashing innovative ideas

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and a compromise on the technological curve due to the lack of 'a right person for the right job'. Therefore, enhancing only absorptive capacity and collaboration intensity does not necessarily result in more benefits (Audretsch and Belitski, 2020). Although OI model helps firms to get benefits from technological advancements through co-creating disruptive technological solutions with OI partners (Chesbrough and Bogers, 2014; Chaudhary et al., 2022), the lack of internal technological capability or co-creating OI projects with partners, lacking technical resources or issues related to disruptive technologies and their regulatory issues, can restrict firms to follow and adopt emerging technological trends.

These limits require managerial attention to offset the challenges of OI by developing approaches through learning from these challenges that can help firms to lead toward the routinizing the OI practices. Our study reveals the importance of developing new governance mechanisms, instruments, and practices (Keinz et al., 2021) that can help in strategizing, organizing, and effectively evaluating and adapting current innovation processes and capabilities (von Briel and Recker, 2017) to better leverage the external input and mobilize the resources efficiently. Even if firms have defined the objectives of OI, they can still struggle with effective OI implementation in the absence of setting-up clear goals and strategizing the whole process and implementation. Well-thought-out goals and strategies for OI implementation help firms to utilize the required resources effectively, enhance open communication and keep the employees committed (Stefan et al., 2022; Abhari and McGuckin, 2023). Such approaches may also overcome organizational resistance to external networks and inputs, for example, organizational inertia or the not-invented-here syndrome (Antons and Piller, 2015; Keinz et al., 2021). Learning from failures and creating an environment of encouraging knowledge exploration and exploitation (Naqshbandi and Tabche, 2018), and branding OI success to attract partners with complementary knowledge (Chaudhary et al., 2022).

Figure 4 proposes an empirically driven, integrated research framework that captures the limits of OI across different stages of organizational change and offers offsetting actions to counterbalance these challenges.

6. Conclusions

The exploration of the limits of OI during the organizational change process has long remained an open question in the literature. Therefore, the purpose of this research was to empirically explore and address the limits of OI implementation and to offer required capabilities and actions that can help firms to counterbalance these limits across different stages of the organizational change process. Based on our findings, we distinguish between internal and external challenges. The internal challenges concern organizational knowledge flow and resource utilization, structure and culture, the need for training and development on OI principles and practices, and silos that hinder intra-organizational collaboration. Externally, our empirical evidence suggests that firms are confronted with challenges regarding collaboration with external actors, difficulties in overcoming risks and threats, setting clear OI goals, and especially keeping external partners focused throughout the collaboration. Additionally, we have identified the approaches, derived from learning in implementing OI and change process, that offer an opportunity to strengthen OI implementation by offsetting the OI challenges. We also highlight the role of top management in driving and sustaining organizational change. Moreover, our empirical analysis has provided evidence of the need to change mindsets and attitudes regarding innovation management and create cross-departmental synergies to develop a shared vision and plan. Therefore, organizational change is a supporting process that can help in successful OI adoption within organizations.

6.1. Managerial implications

While some of the limits of OI have a wide impact across industries, others are context dependent and specific to each organization. Therefore, managers need to consider both internal and external factors in their assessments. Implementing OI is a process that often requires a significant, possibly 180-degree departure, from existing innovation arrangements and processes. It also involves a new attitude toward risk, considering that OI poses risks, especially over the short and medium term, of a loss in intellectual property rights, control, and possibly competitiveness. Free riding and uneven contribution across partners may pose additional limits to OI. Thus, managers need to take a proactive stance toward continual change in terms of adapting their ways of working. This will require several adaptations related to organizational readiness, collaborative capabilities, absorptive capacity, and changes in innovation processes. Learning from the failures and envisaging potential risks and threats require careful analyses, future planning, and decision-making that can diminish possible errors. Furthermore, managers need to brand OI's success to attract
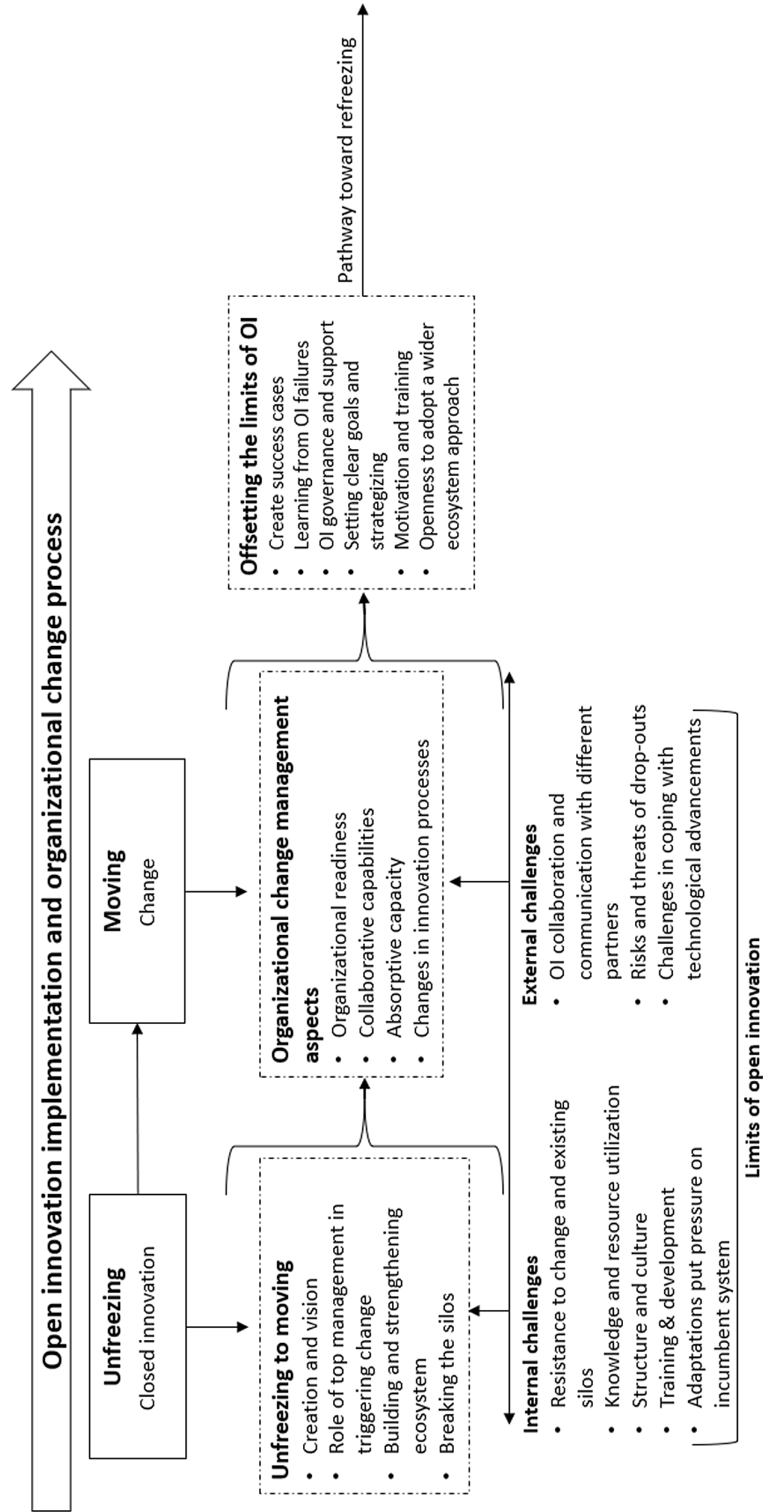
Figure 4. Empirically driven, integrated framework.

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more partners with complementary knowledge. OI learning through a continuous review process of issues can be integrated into internal innovation processes and R&D which can result in nurturing progress toward enhanced absorptive capacity and OI maturity pathway. Building a strong relationship with internal and external partners, clarifying the objectives and expectations, supporting up-skilling employees to enhance their motivation, and implementing sustainable values in strategy can facilitate firms to offset the limits of OI. Importantly, incentivizing internal and external collaborators, embracing new partners with complementary skills and perspectives, agility in transformation, and looking beyond crises to create value will help firms toward smooth transformation.

6.2. Limitations and future research perspectives

This research presents the results of a single case which is a high-tech global manufacturer, which limits the generalizability and external validity of the research. Thus, multiple case studies from different industries as well as exploring small firms' dynamics for OI implementation would advance the understanding of OI implementation from different perspectives. Further, we carried out interviews with 'elite informants' and aimed to capture managerial perspectives across different functional areas as well as strategic views and valuable first-hand insights based on the views of the informed top and middle-level managers who were directly involved in the design or implementation of PC. However, we have omitted the perspectives of employees working at the operational level or other internal businesses and customers whose views may be different and who may experience the challenges of OI implementation differently. Similarly, although the number of interviews is relatively good in our research (31 interviews), we miss the voice of external stakeholders. Future research can conduct interviews from external partners to get a more comprehensive picture as they might have difference opinions in such OI collaboration. Furthermore, our proposed framework needs to be further tested and validated empirically in other settings in the manufacturing as well as the service sector. It can function as a reference model to collect further evidence and analyze the limits of OI at the operational level of innovation processes, routines, and practices and develop an argument for generalization. Future research can investigate the OI limits in institutionalizing such OI practices since we believe there will be several internal and external challenges effecting the process. Similarly, future research can take on our assumptions i.e. approaches for future development to further validate if they are true in consolidating these practices, in a longitudinal setting. We encourage researchers to conduct quantitative research by building on relevant theoretical foundation such as institutional theory and/or dynamic capability view and investigate firm-level boundaries at different levels of analysis such as individual level, intra- and inter-firm level, and community level.

Conflict of interest statement

We confirm that there is no conflict of interest associated with this publication.

Data availability statement

The research data supporting the study's findings are not shared as it entitles to the GDPR including data privacy signed between authors and the respondents.

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APPENDIX A

Semi-structured interview template

Background Information of respondent(s)	1. Participant's name and position in the company 2. Years of experience in the company 3. Which unit (organization/business unit) are you from? 4. In what capacity are/were you part of developing/designing and being implemented in PC? 5. How much have you contributed toward it, and in what role?
General questions about the Smart partner campus	1. What is PC all about in the context of your organization, how do you see it? 2. What do you expect from this initiative? 3. What kind of challenges were you expecting to face while starting this OI initiative? 4. What have been the three main lessons learned during the process of developing PC?
Vision/drivers of unfreezing	1. When and how did the idea of PC come about? 2. How has this vision of developing PC evolved? 3. What have been the key arguments for and against developing PC? 4. What have been the key sources of inspiration for such an initiative?

Organizational change	1. In what ways is PC changing innovation processes in Wärtsilä?
	2. How ready were you to implement PC in terms of organizational culture, structure, processes, and digital/technological and innovation-related competencies?
	3. In your view, how will collaboration with external stakeholders be changed?
	4. How would you evaluate your organizational ability to absorb new external knowledge?
	  a What was the process of gaining external knowledge earlier before starting PC?
	  b What kind of change are you expecting to see PC bring in terms of absorbing new external knowledge?
	  c How are you expecting the new external knowledge absorbed by PC will affect Wärtsilä?
	  d What kind of channels do you have for recording, storing, utilizing, and exploiting new external knowledge?

Challenges and opportunities of OI	1. What kind of internal and external challenges have you faced while moving from the closed innovation model to the OI model i.e. developing and implementing PC? How have you been managing these challenges? 2. What are the potential benefits and opportunities of PC and how would PC contribute toward such OI model success?
Other	1. How did you choose your partners and what were the criteria and what is your vision in terms of future partners? 2. What kind of expectations do you have for your partners in terms of concrete collaboration? 3. How do you manage the issues related to trust among partners, communication and information sharing, and engagement and commitment? Please elaborate on any approaches you follow.