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Impact of IT Use on the Collective Attentional Engagement to Innovation: The Case of a Organization in The Cork Sector

Completed Research Paper

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Abstract

Organizations process a vast amount of information, therefore putting a big strain on collective attention, a limited resource in organizations. When there is poverty of attention, decision and action become erratic and subject to failures. More research addressing the impact of information systems on organizational mindfulness is needed to develop an IS mindfulness theory. By studying how a leading company in the cork industry uses a platform to support the ideation phase of the innovation process, we provide empirical evidence pointing to the contribution of IT artefacts in promoting organizational mindfulness. Collecting research information in meetings, observations and interviews for 1 year, we were able to observe that the platform was engaging the collective attention to the incremental innovation of processes in detriment of the disruptive innovation of products. Our findings are a first contribution to develop an IS mindfulness theory and to design socio-technical arrangements that expand organizational mindfulness.

Keywords: attentional engagement, information systems, IT use, organizational mindfulness

Introduction

In the digital economy, to make sense of internal and external changes, organizations collect, produce, and process a vast amount of information. The information systems deliver a varied set of visualizations, alerts, recommendations and reports to support decision. The intricate technological infrastructure of the organization exposes decision-makers to a large number of informational stimuli to which they must pay attention. Herbert Simon, Nobel Laureate economist, noted in the 1970s that when information becomes abundant, it creates a poverty of attention. By placing a huge strain on the limited attention capacity of organizations, the ability to develop shared perceptions that strongly bind collective cognition and action – collective attentional engagement (Barrick et al. 2015) – may be impaired (Green et al. 2017; Hoefer and Green 2016), therefore creating difficulties in interpreting situations and leaving organizations vulnerable to manipulation and threats (Alexander and Lyytinen 2017; Sun et al. 2017).

Through attentional engagement, organizational members, intentionally and in a sustained way, allocate cognitive resources to problem solving, planning, sense making and decision making (Ocasio 2011). Attentional engagement is required to obtain a deep understanding of situations, quickly identify unexpected events, and implement a prompt and effective response. The study of the impact of the use of IT artifacts on collective attention engagement has been the subject of some studies focusing the impact of using IT artifacts on organizational mindfulness. In Dernbecher and Beck (2017), the authors offer a general perspective on information systems (IS) research addressing the concept of mindfulness. According to these

authors, and with relevance to our study, the concept of mindfulness has been used as (1) prerequisite for effective IT use; (2) accelerator of IT use; and (3) an implication of IT use.

Dernbecher and Beck (2017) refer various knowledge gaps in the IS research that need to be addressed to gain a better understanding on how mindfulness the various levels of analysis impacts and is impacted by the use of IT artifacts. Of special interest for the discussions in this paper is the need for research addressing how the use of IT artifacts impact mindfulness at the organizational level of analysis. Organizational mindfulness can be seen as the collective ability to spot unexpected changes, counteract unrealistic expectations and remain focused on the events as they unfold, and to perform core business tasks even in the face of breakdowns or changes (Gärtner 2013).

To address this knowledge gap, this paper describes a case study carried out to answer the research question:

> *How does the collective attentional engagement enacted by the use of IT artifacts impact organizational mindfulness?*

The study is grounded on the Attention-Based View of the Firm (Ocasio 1997) and Rerup's concept of attention triangulation (Rerup 2009), together providing an explanation for the dynamic structure of the collective attentional engagement. Our study focused the use of a platform to manage innovative ideas and projects. We studied how the platform engaged its users in exchanges about innovation goals and practices, idea generation and assessment, and innovation success or failure. We sought to clarify the contextual constraints shaping those exchanges, thus establishing the border between what was considered relevant and what could be ignored. To achieve this, we analyzed documents used to communicate the innovation strategy adopted by the organization and to describe the support provided by the platform to its users; we observed the use of the platform as well as various interactions that occurred outside the platform for 2.5 years; we interviewed 13 users considered key to the success of the platform and of the innovation strategy implemented in the organization.

The research described in this paper aims at providing a deeper understanding of the role IT-supported/enabled collective attentional engagement play in shaping organizational mindfulness to issues and action alternatives relevant to the supported processes/activities. In our study, we aimed at understanding how the attentional engagement enacted by the studied platform contributed to the collective mindfulness to innovation challenges/opportunities, resulting in a certain degree of reliability in meeting the innovation strategic goals. Complementing the research in the Information Systems field with theoretical insights from the Management field, we intend to contribute to the development of an IS mindfulness theory. We expect that this knowledge assists managers in assessing the quality of IT-mediated organizational attention as well as to define socio-technical arrangements that expand organizational mindfulness. Furthermore, with a better understanding of the impact of information systems on collective attention, it will be possible to define effective strategies to bind human and artificial cognition in better achieving the organizational goals.

The paper is organized as follows: in the next section the theoretical insights about organizational attention and mindfulness are presented; then, we present the use of the concept of organizational mindfulness in IS research as a way to frame the case study described in the paper; the research methodology and the case study are then described. Finally, an account of the framework that emerged from the effort to answer the research question guiding the case study is offered.

Organizational attention and the assessment of its quality

William Ocasio (1997) defines attention as the "noticing, encoding, interpreting, and focusing of time and effort by organizational decision makers on issues and answers" (p. 189). Attention is a scarce and critical resource that is distributed in the organization to allow focusing on a diverse set of issues and action alternatives, collectively perceived as relevant to achieve strategic goals.

The organizational structure and communication channels allow distributing the effort of attention by the various members of the organization. The quality of organizational attention is related with the collective ability to (i) identify the information that is relevant to implement the organization's mission, (ii) sustain the attention for the time needed to interpret all relevant information, (iii) stay alert to unexpected events, and (iv) integrate the various insights produced at the various levels of the organizational structure.

According to Ocasio (2011) organizational attention emerges from the interplay of three attentional processes: attentional perspective (top-down), attentional engagement (top-down and bottom-up process) and attentional selection (attention outcomes).

The dominant strategy of the organization corresponds to the dominant *attentional perspective* in the organization. The attentional perspective may be rooted in the past organizational experience (backward-looking) or in the cognitive knowledge of the environment (forward-looking). It defines how organizations will allocate resources in understanding situations and acting upon that understanding.

Through *attentional engagement*, organizational actors, intentionally and in a sustained way, allocate cognitive resources to problem solving, planning, sense making and decision making. Vivid attentional engagement allows for the detection and discussion of non-salient cues and signals, eventually leading to changes in organizational perspectives.

The communication dynamics produced by attentional engagement, continuously creating and modifying attentional perspectives, result in the selective attention paid to issues and action alternatives. *Attentional selection* is the process that deals with the complexity and variety of available information. For Bansal et al. (2018), a detailed monitoring of all potentially relevant problems and opportunities overloads the organizational resources and can bring out contradictory information, increasing the likelihood of failures. Therefore, the proper selection of what to focus and what to ignore is of crucial importance for effective decision and action.

While the dominant attentional perspective (organizational strategy) provides the direction for the organizational attention, attentional engagement ensures that information within the collective focus of attention is processed and produces action. Attentional selection ensures the efficiency of attentional engagement over time.

Organizational mindfulness emerges from the interplay between the three attentional processes. Organizations may be engaged in dealing with events and information they deem relevant while being unable (a) to identify non-salient cues and signals pointing to changes representing threats or opportunities; (b) to remain focused on events for enough time to understand their consequences; and/or (c) to perform core business processes in the face of breakdowns or changes. In other words, organizational attention may be mindful or mindless, and we propose that it fluctuates between these two extremes over time and internally.

Collective attentional engagement and the quality of attention

Rerup et al. (2009) posit that attention is a dynamic capacity; its quality varies over time and among the various focuses of attention in the organization. *Stability of attention* refers a sustained attention to the aspects (issues and action alternatives) considered relevant in order to promote a deep understanding of situations. *Vividness of attention* implies a rich and relatively broad understanding of a set of inter-related aspects; the focus of attention is directed to the analysis of various aspects at the same time in order to generate complex interpretations of situations, even when contradictions are found in the available information. *Coherence of attention* implies that the focuses of attention at the various organizational units, functions and responsibility levels are similar, complementary and compatible; as a result, the organization pays proper attention to organizational and environmental stimuli deemed relevant by the dominant attentional perspective – the strategy.

Table 1. The extreme points of the dimensions of organizational attention		
	High	Low
Stability	Deep and undistracted attention to issues and responses.	Superficial attention.
	Attentional discipline over time.	Poor time management. Difficulty prioritizing tasks.
	Accurate analysis of situations. Enhanced ability to remember.	Difficulty in understanding situations.

	Too much adherence to routines: excessive and rigid performance.	
Vividness	Enhanced ability to detect problems and opportunities in the periphery of the main focus of attention.	Inability to detect unexpected information.
	Freedom from existing schemes and conceptual labels.	Tendency to develop naïve understandings.
	High capacity to create complex understandings and a clear insights into situations.	Difficulty in generating new answers.
	Vulnerability to distraction and manipulation.	
Coherence	Good balance between top-down attention (strategy / planning) and bottom-up attention (distributed experience).	Inability to define a common pattern of attention (strategy).
	Good balance between external and internal focuses at all levels of the organization.	Duplication of time and effort in analyzing aspects (potentially not relevant).
	High levels of motivation and cooperation.	Conflicting / uncoordinated perspectives leading to widespread demotivation.
	Difficulty in nurturing the diversity of perspectives.	

Table 1. The extreme points of the dimensions of organizational attention

Each dimension of attention produces incomplete understandings of problems and opportunities; the triangulation of the three dimensions is necessary to create a mindful attentional engagement at all levels of the organizational structure (Rerup et al. 2009; Vendelo and Rerup 2009). Table 1 presents the characteristics of attention at the dimensions' high and low. The gray cells in the Table 1 describe the negative consequences of extreme high levels of stability, vividness and coherence, thus reinforcing the need for the triangulation mentioned by Claus Rerup. Mindfulness is achieved by the triangulation of three attentional dimensions. Mindful organizations understand that their success depends on the detailed comprehension of situations, rapid identification of non-salient issues, and prompt and effective response (Weick et al. 2008). In these organizations, formal and informal communication is designed to promote adequate attentional engagement to activities.

Organizational mindfulness in the information systems literature

In Dernbecher and Beck (2017), the authors offer a general perspective on Information Systems (IS) research addressing the concept of mindfulness. According to these authors, the concept of mindfulness has been used as (1) prerequisite to effective IT use; (2) accelerator of IT use; and (3) implication of IT use. Most of the papers reviewed fall under categories (1) and (2). A smaller percentage addresses mindfulness as an implication. The authors also found that research has focused the organizational, group and individual levels of analysis, with mindfulness seen as an organizational characteristic, heedful interrelation of individual activities or a cognitive propensity of the individual.

In the last couple of years, MIS Quarterly published three articles that specifically focus on mindfulness and its relationship to the adoption and use of IT artifacts. In the Curtis et al. (2017) paper, the authors address collective mindfulness in virtual teams as the ability of team members to heedfully contribute to the team discussions and develop shared mental models. The use of a set of tools designed to promote collective mindfulness had a positive impact on decision quality. This study falls under Dernbecher and Beck's mindfulness as implication.

In Thatcher et al. (2018) paper, the authors acknowledge that mindfulness is an important emerging topic in the area of information systems. The paper describes the concept of IT mindfulness at the individual level – "as a dynamic IT-specific trait, evident when working with IT, whereby the user focuses on the present, pays attention to detail, exhibits a willingness to consider, other uses, and expresses genuine interest in

investigating IT features and failures" (pg. 833). This study falls under the category of mindfulness as prerequisite described by Dernbecher and Beck (2017).

Addas and Pinsonneault (2018) studied the impact of incongruent and congruent e-mail interruptions on individual performance. The authors conclude that congruent email interruptions - interruptions containing information that is relevant to primary activities - have a direct positive effect on performance and an indirect positive effect through mindfulness. The study falls under the category of mindfulness as accelerator described by Dernbecher and Beck (2017)

It is not our intention to present an exhaustive list of studies using the concepts of organizational attention and mindfulness in the IS field. The studies presented in this section are useful to position our study. Considering the increasing digitalization of organizational processes and business models, it becomes evident the need to better understand the influence of IT use on organizational mindfulness of events and circumstances.

Our study falls under the category of mindfulness as implication, the less researched category according to Dernbecher and Beck (2017), and focuses the organizational level of analysis. It aims to reduce the identified knowledge gap by providing empirical evidence for the role played by IT artifacts in engaging collective attention with relevant issues and alternative actions. We propose that IT artifacts promote the triangulation of attentional dimensions and, therefore, contribute to the degree of mindfulness displayed by the organization.

Studying the impact of IT use on the organizational mindfulness: research framework

Given the definition of organizational attention offered by Ocasio (1997) as "noticing, encoding, interpreting, and focusing on time and effort by organizational decision makers on issues and answers" (p. 189) it is possible to say that IT artefacts play a central role in channelling organizational attention. Since this attention emerges from 3 processes: perspective, engagement and selection, it can be said that IT artefacts contribute to enact attentional engagement in organizations, therefore shaping cognition and action. Therefore, e formulated the following broad research question:

> How does the collective attentional engagement enacted by the use of IT artefacts impact organizational mindfulness?

Our in-depth study was conducted in an organization that is the world's largest cork organization – Cork S.A. (fictitious name) – which remains the industry leader for more than 145 years. The organization currently has about 4 000 employees, more than 25,000 customers and a presence in 70 countries. Its turnover reaches 702 M € / year of which 7.5 M € are invested annually in R & D. The US National Aeronautics and Space Administration - NASA - and the European Space Agency – ESA - are among its best-known clients.

Cork SA was selected because of its representativeness in the national / international market as well as its heavy investment in innovation, expressed in reports and public contents. Innovation is considered a structuring part of its organizational strategy. We used the case study method (Yin 2017) since our goal was to gain an in-depth understanding of the phenomenon unfolding within the context being studied (Darke et al. 1998; Tsang 2013), namely the impact an idea management tool – CORK.IN – on the organizational mindfulness about the innovation demands and opportunities

The case study lasted for 1 year (December 2014 to December 2015) and included research activities in all business units, the Holding and the R&D unit. The study was performed according to the principles of qualitative research (Cavaye 1996) and its design was guided by the principles of interpretative rigor stated by Klein and Myers (Klein and Myers 1999; Myers and Klein 2011).

Theory driven decisions

In line with the theories that guide our study, we decided to focus on four dimensions of innovation in the organization: (i) innovation strategy defined by the holding company (dominant pattern of attention), (ii) the communication within and between the business units, (iii) the innovation process implemented, and (iv) the collective attentional engagement enacted by the idea management tool (CORK.IN).

We started by understanding the elements of discourse inserted in the innovation strategy defined by the Holding and the R & D Unit. The information used to disseminate the innovation strategy was analyzed and employees contributing to its internal and external promotion were identified and invited to the interviews phase. The analysis of gathered documents included the identification of their intended audience, structure (style of the language, chain of ideas, incentives and authority implicit in the text) and the rhetoric used (vision, objectives, values, statement of urgency). The communication practices defined in the strategy were also identified and analyzed (sanctioned interactions and resources – with particular emphasis in the communicative role of the CORK.IN Platform). Other aspects that were analyzed included the approaches defined for decision and negotiation, and the incentives and rewards available (including those aimed at promoting the use of CORK.IN).

The communication and collaboration practices established within and between the business units define the context for the implementation and use of the CORK.IN Platform. Therefore they were object of thorough investigation, both through the analysis of documents disseminating the strategy and communicating procedures and the observation of employee participation in innovation activities. We studied the innovation process implemented transversally to all business units, from the ideation phase to the final phase of commercialization of innovative products or internal adoption of the developed innovations. We gathered information about local innovation strategies and their alignment (or lack of it) with the dominant innovation strategy.

Regarding the CORK.IN platform, we studied the supported language, the enacted communication (vertical and horizontal), the roles its users played in the innovation process, the way information produced (reports, visualizations and alerts) was being used and the legitimation of decisions endorsed by the platform. In this way we aimed at understanding the engagement with issues and action alternatives enacted by the platform (stability, vividness, and coherence).

To analyze the data gathered in documents, observations and interviews, we used 3 main concepts derived from the theories that support our study: (1) the three dimensions of collective attention to innovation (stability, vividness and coherence), (2) IT use and (3) organizational mindfulness. The categories that emerged from the content analysis were grouped in these concepts. The grouped categories were linked to allow for the contextualized description of the concepts and their interrelations.

From the performed analysis emerged a contextual explanation for the impact of the CORK.IN on the collective mindfulness about the innovation demands and opportunities. To create a generalization of this explanation, we looked for constructs used in other studies that could be considered similar to the identified categories. It was decided to use the literature listed in Ocasio et al. (2018), Ocasio and Joseph (2018) and Dernbecher and Beck (2017) papers because they are two very recent, comprehensive and systematic literature reviews; we included all papers by Claus Rerup, the scholar who proposed the three dimensions of attention. In total, 87 papers published in management and information systems top journals were analyzed. From this analysis, slight adaptations were made to the categories.

Gathering and analysis of research information

Research information was gathered by reading documents, observing participants performing their tasks, and carrying out semi-structured interviews.

The documents analyzed included various technical reports, internal documents and informative materials, as well as public contents about the organization and its innovation strategy. A total of 59 documents and more than 3 220 pages were analyzed, including the consolidated organizational reports and internal annual reports of each business units (2005-2017), to understand how the organization's innovation strategy evolved over time and the technologies have been integrated to support it.

In order to clarify the insights that emerged from the analysis of the documents, four meetings were held with the top management of the organization. In the first meeting, the facilities of two business units were visited and a general presentation of the entire organization was offered to the research team. The second meeting was attended by some managers and a general manager directly responsible for the implementation of the CORK.IN Platform to discuss our research proposal and facilitate access to key people. Interviews were scheduled in order to also allow for observations in all business units and in the Holding; visits to the facilities of some of the factories were planned to introduce the researchers to employees that would be later observed. The two other meetings allowed to gather the perspective of the

managers responsible for the decision to adopt the CORK.IN Platform. In these meetings the external team that developed the platform was present. In this way, we were able to develop a first understanding about, on the one hand, the CORK.IN's functionalities and, on the other hand, the rationale behind the platform's design and the way it was actually used in the various business units.

When visiting the various facilities, notes were taken at the place of observation or within the two hours immediately after leaving the visited facility. A total of 22 pages of observation notes were produced and later subjected to content analysis, further contributing to the identification / consolidation of theoretical categories; they also helped in making small adjustments to the interview guide to make the best possible use of the profile of each interviewee.

A total of 16 semi-structured interviews with directors and employees were held; at least one director of each of the business units and of the Holding was interviewed. The interviewees were selected due to their management positions, the power they held in shaping decision-making, and / or because they were championing the use of CORK.IN in their business unit. The interviews had an average duration of 45 mn. Emphasis was placed on the experience with innovation, the ideas the interviewee helped to implement and the use of CORK.IN. When the interviewee was a top manager, the interview would also focus the strategies adopted to stimulate the platform's use, the mechanisms adopted to foster engagement and motivation, his/her perspective about the usefulness of collaborative tools for the organization, and their direct and indirect involvement as a CORK.IN manager / user.

Each interviewee, in her or his respective position and organizational unit, described his / her role in the organization, his or her professional career, and his / her career in the organization over the years. After this introductory part, the interviewee was encouraged to reflect on how, in her/his day to day work, CORK.IN interfered with / adjusted to / supported the performed tasks, interactions and communication. Interviewees that were responsible for championing the use of CORK.IN were asked about the motivation of employees to use the tool. The interviews provided interviewees with an opportunity to reflect on their experience of using CORK.IN to support the organization's innovation and its impact on communication and innovation practices over time and up to the present.

The observations were designed to understand (i) which tools were used in the day to day work and how employees felt towards using CORK.IN in comparison with the use of other collaborative tools existing in the organization; (ii) how CORK.IN supported the innovation process across the business units; (iii) how this platform influenced communication and decision in the organization; and (iv) how organizational strategies and routines directed the attention of decision makers.

All interviews were transcribed and later coded. A total of 143 pages were produced. The insights gained with the analysis of interviews and observations transcriptions guided the next stages of documents' access, interviews and observations. The results were then integrated in successive reports made available to participants for validation and feedback. The supporting theories – attention-based view of the firm and attentional dimensions - guided the research's design and content analysis; they facilitated the assessment of the relevance of emerging codes, categories and explanatory themes (Gioia et al. 2013). From these themes emerged the larger narrative that provides a situated account on how the attentional engagement enacted by the use of CORK.IN impacts organizational mindfulness of innovation demands and opportunities.

Attentional engagement in collaborative ideation: a case study

Synopsis of the study

At present Cork S.A. consists of a Holding company, 5 business units and a strategic unit exclusively dedicated to support the R & D and Innovation efforts of the group. These 5 business units are consolidated in their sector of activity, namely:

- Raw Materials ensures the optimization of the flow of raw materials. This business unit holds the responsibility to prepare, study and decide the company's multi-annual supply policy. Its innovation focuses on the promotion of the quality of cork and the best practices of cork oak forest management

- Cork Stoppers supplies wine producers and distributors worldwide. The innovation of this unit focuses the quality of stopper, that must be both safe (non-detectable TCA) and benefit the wine. The unit produces natural and technical stoppers. The latter category includes a stopper that combines cork with glass for easier handling and reuse.
- Coatings produces and distributes cork floor and wall coverings. It is internationally renowned for the quality and innovation of its products. Innovation in this unit focus the aesthetics and durability of the coatings.
- Composite Cork is the most technologically advanced business unit. It reuses the surplus cork from the rest of the cork industry and develops high performance materials for multiple industries - such as aerospace, panels and composites, automobile, gaskets and seals, electricity industry, construction, sports surfaces, flooring, consumer goods, furniture and footwear. For NASA and the European Space Agency (ESA), the unit produces spacecraft shielding materials.
- Insulation business unit produces acoustic and thermal insulation agglomerates that are 100% natural. The innovation in this business unit focuses the development of new products and applications to be used where environmental protection and the conservation of natural resources are an ongoing concern.

The five business units have an independent operational management. Yet, these units are linked by a common organizational strategy, including the innovation strategy. The organization considers as its main strategic challenges to bring added value to cork, developing innovative solutions for the market through a strong investment in Research, Development and Innovation (R&D+I). To address this challenge, Cork SA incorporated an autonomous unit, entirely focused on Research, Development and Innovation (R&D+I) activities; this unit was consensually considered as one of the main strategic pillars of the organization.

The strategic decision to incorporate this R&D+I unit produced some changes, both in processes and communication. These changes were viewed positively by all the directors in the various business units. Everyone understood innovation as the key to business success. In the interviews to top managers, the concern with **product innovation** and the organization's **ability to lead the market** stood out:

> "*Today we have a team that enables us to be constantly in innovation and presenting new solutions to our customers.*" (E01)

At the level of top management in each of the business units, the concern for innovation was fuelled by the cross-cutting strategy in this area as well as the need to see innovation aligned with the business strategy of the organization. Here, too, there is a concern for product innovation, while at the same time a tension with the focus on the innovation of production processes:

Since the implementation of the CORK.IN Platform was transversal to the entire organization, this implementation lead to structural and procedural changes in the organization and its acceptance depended on the success of a transversal innovation culture. CORK.IN was another initiative considered instrumental to reinforce a cross-cutting innovation culture. The practices that the platform institutionalized in the organization were considered as the most appropriate to a successful innovation.

Research results

Ocasio (1997) proposes that the organizational strategy is the dominant pattern of attention in the organization. The strategy provides the ground upon which to integrate activities and achieve consistency between functions and units (Porter 1986); it defines the issues and action alternatives with which organizational members should engage to perform their tasks. Our study focused on the innovation strategy adopted by the organization as well as the existing interactions to implement or question it.

Collective attentional engagement with innovation

The pattern of attention defined by the organization-wide innovation strategy clearly promoted engagement with product innovation in order to increase the organization's market value. Since 2011, Cork S.A. had been implementing initiatives to promote collaborative innovation and to make communication between the business units easier.

The organization maintained a continuous and intense internal communication about the importance of innovation and the central role of the creativity of employees at all organizational levels. The innovation manual used to communicate the innovation process had been developed collaboratively by representatives of the various business units. This formalization of the process was seen as fundamental to ensure a consistent collective engagement with innovative ideas, projects and results.

The communication of the strategy and process of innovation was not limited to the internal context. This communication was also happening with its environment by disseminating the investments in innovation on the organization's website and on social networks. The most innovative projects were annually presented to stakeholders and the market in general. The discourse to external stakeholders communicated the organization's pride in the number of patents it has been able to develop over the past six years (40 patents) and in its constant presence in international innovation and technology events. Integrating one of the most traditional industry sectors, this information showed an innovative and non-conforming corporate culture, at the forefront of the industry in which it had few competitors to match.

The value of innovation was being promoted internally to encourage the adoption of concepts and practices, engaging all employees in discussions about common innovation challenges. This engagement was seen as fundamental to capitalize on internal knowledge and experience and, from there, to obtain results that promoted the external image of the organization: patents, innovative projects, investments. Innovation governance channels were already well-established and able to consistently integrate the efforts of key players in the various business units. Our interviews showed a good understanding of the innovation routines being implemented to engage the attention of organizational members at the various units with the well-defined issues (routinized engagement with innovation) and alertness to the emerging issues, methods and responses (vivid engagement with innovation).

Using CORK.IN to leverage ideation in the business units

Over the years, innovation has also emerged as a specific effort of each business unit, focusing on the particular needs of the niche markets they addressed.

CORK.IN was emerging as a collaborative tool, transversal to all the units, with the potential to advance the sharing of innovative ideas and to facilitate communication. It was expected to help institutionalizing concepts and practices, sharing knowledge and discussing the perspectives of different internal experts; it supported the evaluation and selection of ideas and projects.

> *"*Within the scope of an Idea Management Program for which I am responsible, we identified the need to have a platform that responds in areas such as: (i) workflow for approving ideas which includes different levels of access; (ii) a scoring / reward system of these ideas; and (iii) a channel of knowledge sharing among users.*"(E14)*

Ideas shared on the platform would go through a process of commenting and improvement before being submitted to a formal evaluation performed by a technical team integrating managers from the various business units. If selected to further development, the authors of the ideas were awarded with points. The sum of the points received over time was a source of internal reputation, indicating the degree of creativity and expertise of the various participants in the organization's ideation process.

Stabilizing Attention with CORK.IN

The organization's R & D Unit prepared an extensive training plan to ensure that all employees would become proficient in using the various features of CORK.IN. By learning the embedded best practices, the employees would be trained in the relevant concepts, values and beliefs about innovation, promoting an intersubjective space of communication and action that was considered key to changing from a culture of silos of collective experience to one of open collaboration.

The long history of innovation of the various business units was based on deep knowledge of the business and market expectations. With CORK.IN it was intended that this experience be shared, allowing cross-pollination of ideas. On the platform's Wiki users were able to post on a particular subject and, in a collaborative way, see their contributions complemented by other employees. The Wiki provided knowledge representations often used to support the description of innovative ideas or to support the selection of ideas.

These knowledge representations were shared in articles focusing on a particular subject and / or in reports and practical reflections. They were giving voice to the decision makers in the different organic units.

The use of the Wiki allowed for the detailed description of innovation challenges and the aggregation of multiple contributions focusing a new process, the logic underlying past decisions, or other issues considered relevant to innovation. Nevertheless, the sharing of information via Wiki was felt by some interviewees as an effort that took time away from them to perform their usual tasks.

CORK.IN integrated an internal social network – referred informally as *Facebook* – with the objective of promoting collaboration and the exchange of experience. This functionality not only facilitated interaction among the employees registered in the platform, it also supported the sharing of information, questions and suggestions, categorized in central themes of interest to the organization. The CORK.IN social network did not differ much from social networks such as Facebook and LinkedIn; this similarity capitalized on the experience of using those other networks.

Our study of the use of the CORK.IN platform allowed to identify some key categories describing the interconnection between stability of attention and the use of the CORK.IN. Table 2 presents these categories.

Table 2. Attention stability and the use of CORK.IN			
Codes	Category	Description	Attention Stability & CORK.IN
Investment on Innovation Time to use the platform HR allocated to Innovation	Resources allocated to innovation	Time, incentives, budget, human resources dedicated to innovation.	Time and effort put in using CORK.IN to innovate were rewarded. CORK.IN implemented the defined innovation incentives and best practices. Significant budget allocated to the innovation supported by CORK.IN
Innovation practice Innovation policy	Adherence to established practices	Institutional effort to stabilize the innovation practices across the various business units and to ensure compliance with those practices.	Training was provided to learn innovation practices and use CORK.IN. CORK.IN contributed to the institutionalizing innovation routines.
Knowledge sharing (wiki, forum, social network -SN)	Experience's repository	Use of tools to preserve and share knowledge.	The Wiki and the social network features of CORK.IN allowed for the codification of relevant for innovation. This knowledge base guided the assessment of shared ideas, therefore stabilizing the attention issues and action alternatives that past experience proved relevant.

Table 2. Attention stability and the use of CORK.IN

Attention to non-salient cues enabled by CORK.IN

The transversal communication facilitated by CORK.IN was seen as fundamental for greater collective attention to the impacts of decisions and a faster reaction to new problems / opportunities resulting from these decisions. The CORK.IN social network supported the fluid and transversal communication between business units. This meant that production and administrative challenges, very similar across the organization's business units, were quickly propagated internally, prompting strong engagement with sense making, problem solving and opportunities' seizing.

Some of the published information, often about technology and science advances relevant for the cork industry, immediately received extensive comments, suggestions and testimonies, whether positive or negative. This online dialogue fostered the collective understanding of the operational challenges faced by the various business units and encouraged the development of innovative solutions that would meet the various dimensions of problems.

CORK.IN implemented another feature to support the open discussion of issues relevant to innovation: the discussion forum. The Forum was a communication channel dedicated to the discussion of specific contents. Decision-makers in specific technical areas were able to transmit their messages to the wider audience. Thus, on the one hand, the organization was able to identify specialists from a particular area and, on the other hand, the relevant experience was being recorded to be used when it was needed, feeding the collective memory. This structure organized by discussion categories widened the attention of the forum's users.

By keeping participants informed about issues that might not be in their immediate range of interests, the Forum was feeding creativity and insight. Some interviewees mentioned the need to complement the discussions in the forum with face-to-face interactions in order to help structuring the reflections around an idea and develop actionable concepts.

Table 3. Attention vividness and the use of CORK.IN			
Codes	Category	Description	Attention Vividness & CORK.IN
Use of searching functionalities SN comments Participation in events Training	Resources to search for information	Tools, incentives, budget, facilitating processes that supported the sharing of experience and the gathering of external information	CORK.IN Social Network and Forum, together with the participation in international conferences and exhibitions, were the means used to capture and share internal and external changes with relevance for innovation.
Sharing of cues	Alertness to changes	Efforts to analyse available data to spot cues about new innovation demands, innovative approaches, changes in the environment.	CORK.IN Social Network and Forum allowed for the sharing of news and insights gained externally. They enacted attentional engagement with potential innovation issues and solutions.
Information flow Communication of innovation issues	Flexibility in solving problems	Shown ability to get better or faster results. Swift change of production processes to integrate an incremental innovation.	By supporting the communication between the business units, CORK.IN was highlighting common innovation challenges in production and administrative processes. Challenges were spotted faster and in a more sophisticated way than previously.

Table 1. Attention vividness and the use of CORK.IN

Tying the various focuses of attention with CORK.IN

Cork's business units stood out in the national and international markets for the quality of their products and their ability to integrate relevant scientific and technological developments. Over time these units had developed their own innovation strategies and practices. Our study found the organization making an effort to integrate these different foci of innovation.

The role of ambassador was created with the aim of facilitating the emergence of bottom-up leadership that could encourage participation and self-organization around cross-cutting innovation challenges. These ambassadors were responsible for engaging employees in daily participation and support an ever-evolving body of knowledge to guide innovation in the best interests of the organization's business. The diversity of information generated by the constant intervention of ambassadors ensured greater fluidity of communication and the consistency of practices throughout the organization.

CORK.IN was a core tool to connect the foci of attention, within and between the business units. Ambassadors in charge of disseminating the platform were gradually making of innovation a collaborative process, independent of the unit in which the participants were located.

Table 4. Attention coherence and the use of CORK.IN			
Codes	Category	Description	Attention Coherence & CORK.IN
Institutionalization of innovation Knowledge sharing	Enacting a transversal innovation culture	Ability to transfer knowledge about innovation and to implement the structural changes needed to create an innovation process across business units.	The history of innovation, the communication channels enabled by the platform and the innovation ambassadors were transforming the innovation culture in the organization.
Bottom-up collaboration Top-down collaboration HR allocated to Innovation	Collaboration in decision making	Ability to collaboratively analyse and select innovative ideas for development	Decision-making linked to innovation was becoming a collaborative effort between managers and those that in the day-to-day execution of their activities felt the problems and opportunities.
Knowledge sharing Idea sharing Incentives	Communication for innovation	Effectiveness of governance and operation channels in promoting the sharing and improving of innovative ideas.	CORK.IN had considerably improved the collective ability to share innovation ideas, select the best ones, and sophisticate them through the cross-pollination supported by the participation of experts in various fields.

Table 4. Attention coherence and the use of CORK.IN

Collective mindfulness to innovation

The previous sections describe an organization that was attentive to the challenges of innovation and implemented a well-defined innovation process; various monitoring mechanisms were used to detect internal and external changes, which allowed its employees to identify problems and opportunities on the periphery of their main innovation concerns. The organization's employees demonstrated strong commitment to solving innovation challenges even though the barriers linked to a tradition of independent innovation in the 5 business units did not allow a coherent interconnection of the various focal points of attention.

CORK.IN was a central instrument for the engagement of collective attention. Its daily and generalized use produced a certain level of collective mindfulness to innovation. CORK.IN was channelling collective attention, both integrating and expanding it; it was also reframing expectations and behaviours. In this sense, CORK.IN was a very important contributor to the organizational mindfulness towards innovation, sometimes seen as a disturbing factor as well.

On the factory floor employees were encouraged to share innovation challenges. However, and because of the intensive nature of the work performed there, these employees could not directly use the platform. The innovation ambassadors would enter, on the platform, the challenges and ideas identified by factory workers. Since the ambassadors' availability to this task was limited, this intermediation led to some ideas being lost or not always being recorded according to the original understanding.

Despite the effort to institutionalize innovation routines, some interviewees mentioned that in order to accelerate the selection of ideas to solve problems they circumvented CORK.IN. In a similar way Cork SA's top managers would sometimes define innovation projects based on external information instead of consulting the experienced employees. As a consequence, these ideas and solutions were not widely shared and, therefore, did not immediately benefit other business units. Moreover, internal experts felt disempowered by this disregard for established routines and communication channels.

While CORK.IN's Social Network, Wiki and Forum generated great interest and participation, these platform's features where also a source of attention overload. Several respondents reported great difficulty

in participating actively in discussions and information sharing due to the intensity of their daily work. While ideas related to the tasks they performed were easy to comment on and complement, disruptive ideas, or from other business units, could require a lot of effort to analyse and collect complementary information. In these cases, CORK.IN was seen as a distraction factor, incompatible with the employee's other responsibilities. The result was a tendency to the incremental innovation of processes instead of product innovation. The product innovation continued to be carried out mainly without going through the ideation supported by CORK.IN and, often, would stay only within the business unit responsible for the commercialization of the product.

Table 5 describes the most salient dimensions of the innovation mindfulness displayed by Cork SA, as impacted by CORK.IN.

Table 5. Impact of CORK.IN on organizational mindfulness to innovation	
Organizational Mindfulness	CORK.IN impact
Preoccupation with failure	The platform was aligned with the innovation strategy of the organization and implemented the best practices considered fundamental to maximize the innovation success. Over time, certain occurrences started to have a negative impact on collective alertness to innovation challenges and solutions, namely (1) participants felt difficulties in reconciling day-to-day tasks with the effort required to describe an innovative idea, (2) top managers fed ideas obtained from external contacts into the innovation process without entering them on CORK.IN, (3) some innovative ideas were passed on to the R & D unit without being shared at CORK.IN, and (4) many employees had no time to share knowledge. These occurrences were challenging the success of innovation supported by CORK.IN.
Reluctance to simplify	Ideas were often improved with the contributions of other participants independently of their location in the organization or areas of expertise, therefore allowing for cross-pollination of ideas and multidisciplinary inputs.
Sensitivity to operations	The difficulty in reconciling participation with daily activities, as well as the impossibility of workers on the shop floor to participate directly in the process of ideation supported by the platform, limited the knowledge about the operational challenges of the 5 business units.
Commitment to resilience	The knowledge codification encouraged by the CORK.IN's Wiki, Forum and Social Network allowed to create a collective memory. This knowledge base was used to inspire future innovation and ensure the continuous flow of ideas on the platform.
Deference to Expertise	The various features of the platform supported horizontal communication, knowledge sharing and identification of specialists in the various areas of knowledge relevant to the innovation efforts. The trend of top management to bring ideas and solutions from external sources, without listening to internal experts and ideas already shared on CORK.IN, discouraged these experts from participating in the platform.

Table 5. Impact of CORK.IN on organizational mindfulness to innovation

Our study showed that CORK.IN was triangulating attention towards the incremental innovation of production and administrative processes and, therefore, deviating the attention from what was defined as a strategic goal of innovation – product innovation (incremental and disruptive).

> *"I have some ease in getting my ideas to arrive without being via CORK.IN and therefore I confess that [...] if I think there is something that can work or that can come to work better and that can solve a certain problem, I propose it as something to do, not via CORK.IN"* [E3]

Discussion of the research results: the emergence of a theory

In order to understand the organization's attention to innovation and, in particular, to the process of ideation, we identified the categories that had more consensus from interviews and observations; then we grouped them by the attention dimension to which they refer. The result of this process of characterization of collective attention is described on the left side of Table 6 (Case Study). On the right side of the Table 6 (Literature) we identify equivalent constructs defined or supported by the literature.

	Table 6. Abstracting the study's categories		
	Case Study	Literature	
	Category	Constructs	References
S T A B I L I T Y	Resources allocated to innovation	Effort investigating issues & action alternatives	Durand (2003); Rerup (2005)
	Adherence to established practices	Adherence to routines	Levinthal and Rerup (2006)
	Experience repository	Knowledge Codification	Rerup (2015); Roberts et al. (2012)
V I V I D N E S S	Resources to search for information	Searching Intensity	Lansing (2007); Li et al. (2013)
	Alertness to changes	Ability to identify non-salient cues	Maslach et al. (2018); Nigam and Ocasio (2010); Rerup (2009); Thatcher et al. (2018)
	Flexibility in solving problems	Ability to improvise	Fritz et al. (2009); Rerup (2001); Salvato (2009); Vendelo and Rerup (2009)
C O H E R E N C E	Enacting of a transversal innovation culture	Ability to reconfigure competences	Barreto (2010); Nadkarni and Barr (2008)
	Collaboration in decision making	Adherence to collaborative decision-making	Joseph and Ocasio (2012); Joseph and Wilson (2017); Sutcliffe et al. (2016)
	Communication for innovation	Effectiveness of communication channels	Cornelissen et al. (2015); Curtis et al. (2017); Joseph and Ocasio (2012); Schoeneborn (2011)

Table 2. Abstracting the study's categories

In Figure 1 we propose that organizational attention moderates the impact of the IT use on the organizational mindfulness about innovation (context of our study). In our framework, the IT Use construct was adopted from DeLone and McLean (2016). The Organizational Mindfulness construct was adopted from Weick et al. (2008).
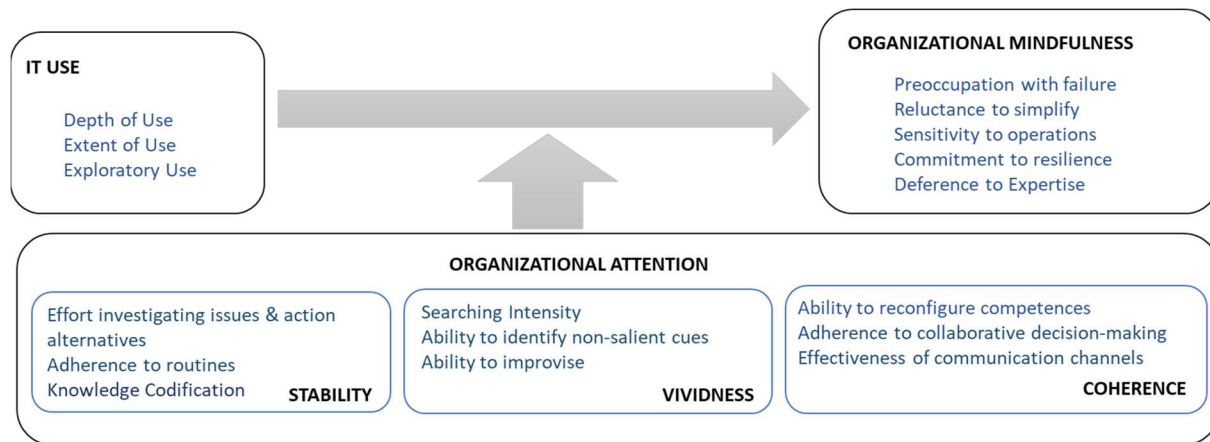
Figure 1. Impact of IT Use on organizational mindfulness: a first explanation

We propose that IT artifacts are used within certain levels of attentional stability, vividness and coherence towards the issues and action alternatives relevant to the supported activities (in our study, the ideation process). The use of the artifact channels collective attention by structuring the cognitions and interactions of its direct and indirect users. In this way, the artifact triangulates the stability, vividness and coherence of collective attention and, thus, contributes to the degree of mindfulness the group, or organization, displays about the issues and action alternatives, delimiting what is to be seen and what can be ignored. Therefore, the collective of its users displays an enhanced (or impaired) preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience and deference to expertise, i.e., a certain degree of collective mindfulness to the problems, opportunities, events and sudden changes that are relevant to the activities performed with the support of the artifact.

Conclusion

Our study helped to clarify why CORK.IN, a platform developed to provide comprehensive support to innovation and to promote the emergence of ground-breaking ideas, was instead engaging its users in the incremental innovation of production and administrative processes. From the analysis of the gathered data resulted a first explanation for the impact of using IT artifacts on organizational. We see our framework as the basis for an IS mindful theory.

The studied carried out has an essentially exploratory nature. The validation of the framework requires further research to stabilize the constructs and create a theoretical model. This theoretical model will then be validated through a survey.

Our study presents some limitations, namely in the number of people interviewed. This limitation should be unavailable for the interview by users of the platform. This limitation was due to unavailability for the interview by some of the users. It was circumvented by a longer time dedicated to the observation of meetings and use of the platform as well as the inclusion of users that played a key role in the dissemination of the platform and the innovation strategy.

Complementing the efforts of research in the Information Systems field with theoretical insights from the Management field we intend to contribute to the development of an IS mindfulness theory. We also expect that this knowledge allows managers to assess the quality of IT-mediated organizational attention as well as to define socio-technical arrangements that expand organizational mindfulness. Furthermore, with a better understanding of the impact of information systems on collective attention, it will be possible to define effective strategies to bind human and artificial cognition to better achieve organizational goals.

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