Understanding Internal Crowdsourcing

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Oliver Zuchowski

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Prof. Dr. Kai Fischbach

Prof. Dr. Tim Weitzel

Prof. Dr. Alexander Fliaster

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This dissertation is composed in a cumulative style.

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Summary

This doctoral thesis is a cumulative account that summarizes the latest research about an open, social IT enabled phenomenon called "internal crowdsourcing".

Organizations are increasingly leveraging open organizational forms to organize knowledge (Afuah and Tucci 2012; Puranam, et al. 2013; Majchrzak, et al., 2021). Social information technology (i.e., social IT) is seen an enabler and transformer of such new organizational structures (e.g., McAfee, 2009; Leonardi, et al., 2013; Schlagwein and Hu 2016; Baptista, et al., 2020). The internal use of social IT in organizations has increased substantially in recent years. In the annual McKinsey Social Media survey, over 85 percent of respondents said their companies use social IT for internal purposes (Bughin et al., 2017). To understand such new social-IT based phenomenons new theoretical considerations are required (e.g., Puranam, et al., 2014; Argote, 2012).

Inspired by the success of external crowdsourcing with customers, a number of organizations have recently adopted internal crowdsourcing with employees (e.g., BOSCH, Daimler, LEGO). Crowdsourcing refers to the practice of issuing open calls to large groups of people via social IT (Estellés-Arolas and González-Ladrón-de-Guevara, 2012). Crowdsourcing provides organizations with access to the knowledge and skills of a distributed and potentially very large "crowd" for solving a problem (Benbya and Van Alstyne, 2011; Simula and Vuori, 2012; Afuah and Tucci, 2012; Jeppesen and Lakhani, 2009; Malone et al., 2009). As an emerging phenomenon in professional praxis, it has been under-researched and many fundamental questions still remain unanswered. We know little about how internal crowdsourcing works and how it is impacting the organization (Leonardi, 2007, Majchrzak and Cherbakov, 2009; Malone, et al., 2009; Faraj, et al., 2011; 2014; Johnson, et al. 2014; Chen, 2013; Majchrzak, et al. 2000, 2021; Gilson, et al., 2014).

The purpose of this thesis is therefore to shed light on internal crowdsourcing to theorize this empirical phenomenon and to build theory about new social-IT based phenomenons in general. This cumulative thesis contains four papers that contribute to this central goal. The results of these papers have been iteratively developed, each with a distinct set of research questions. Paper I was conducted to provide a conceptual development, to synthesize the current state of literature and to provide a research agenda about internal crowdsourcing. Paper II was set up to understand the state-of-art of organizational learning theory vis-à-vis information systems in terms of drivers and barriers. The paper thus lays the foundation to apply the organizational learning lens to the empirical phenomenon internal crowdsourcing. Paper III was conducted in order to understand how organizations learn through internal crowdsourcing. The paper explains internal crowdsourcing's learning practices. Paper IV builds on the literature on new forms of organizing and develops an organizing model focusing on internal crowdsourcing's preconditions, nature and consequences, providing a theoretical account of internal crowdsourcing as form of organizing.

Thesis Overview

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Understanding Internal Crowdsourcing

Oliver Zuchowski

University of Bamberg
An der Weberei 5, 96047 Bamberg, Germany

Chair for Information Systems and Social Networks.

Oliver.Zuchowski@email.de

2021

1. Introduction

Enabled by information technology (IT), organizations are increasingly leveraging new open organizational forms to source and organize knowledge (e.g., Afuah and Tucci; 2012; Puranam, et al. 2013; Majchrzak, et al.; 2021). Social IT is seen as a key enabler and transformer of such new processes and organizational structures, such as crowdsourcing (e.g., Baptista, et al., 2020; McAfee, 2009; Leonardi, et al.; 2013; Schlagwein and Hu, 2016). Crowdsourcing describes "the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call" (Howe, 2006). It enables organizations to reach beyond their borders to find new knowledge and skills (Fréry et al., 2015). Supported by the progress of internet-based platforms that lay the technological foundation, and by the necessity for flexible know-how exchange, crowdsourcing has grown from the grassroots. (Nevo, and Kotlarsky, 2020).

The core idea of crowdsourcing is that a large group of people is invited to contribute work, money, or knowledge via social IT (Estellés-Arolas and González-Ladrón-de-Guevara, 2012). The phenomenon is observed in an increasing number of organizations including Dell (Di Gangi et al., 2010), LEGO (Schlagwein and Bjørn-Andersen, 2014), SAP (Leimeister et al., 2009; Durward et al., 2019; Pohlisch, 2020), Allianz (Benbya, and Leidner, 2018) and Starbucks (Gallaugher and Ransbotham, 2010). These organizations opened up their organizational boundaries to obtain customer feedback or to improve products and services.

Despite the growth in practice, crowdsourcing is theoretically not well understood. Being a newly created social-IT based phenomenon, it is not well defined and theoretically analyzed. We lack fundamental knowledge to understand how this phenomenon works and what its´ impact is (Nevo, and Kotlarsky, 2020; Puranam, et al., 2014). External crowdsourcing has been studied from different perspectives and levels (e.g. Chua, et al., 2015; Deng, et al., 2016; Alam, 2017), on organizational level there are fewer research efforts available (Schlagwein, and Bjørn-Andersen, 2014).

More recently, internal crowdsourcing has emerged as a distinct, recognized phenomenon. Internal crowdsourcing addresses a wide array of experts, who are known to the organization (Zuchowski, et al.,

2016; Smith et al. 2017; Knop, et al., 2019). While newer, and less documented, this form of crowdsourcing holds the largest promise for organizational impact (Nevo, and Kotlarsky, 2020; Benbya and Van Alstyne, 2011; Simula and Vuori, 2012; Malone et al., 2009). Though this phenomenon has been documented in a number of cases (Simula and Vuori, 2012; Malone et al., 2009; Ulbrich, et al., 2021; Wedel, et al., 2021; Zuchowski, et al.; 2016), we lack theories and knowledge to answer essential questions regarding this social-IT based phenomenon.

To understand such new social-IT based phenomenons new theoretical considerations are required (Nevo, and Kotlarsky, 2020; Puranam, et al., 2014; Argote, 2012; Gioia et al. 2013). As suggested in the most comprehensive organizational learning literature review by Argote (2012), new technologies such as crowdsourcing provide opportunities for organizations and should be further theorized by researchers. When developing new theory for a novel organizing phenomenon, then the natural starting point is to theorize antecedents, the nature and the consequences of this phenomenon (Gioia et al. 2013). To fully understand crowdsourcing as an organization practice, the general scope of organizational theory should be met. In particular, the theory should not focus on singular variables and hypotheses but cover the inherent scope of the phenomenon (Sutton and Staw 1995; Whetten et al. 2009). The theory should then articulate the causal and/or temporal relationships between these key aspects as well as theorize the underlying mechanisms (Sutton and Staw 1995; Whetten et al. 2009).

Thus, the purpose of this thesis is to address these gaps and increase our understanding of and knowledge about internal crowdsourcing to learn and theorize about social-IT based phenomenons in general. We ask four research questions:

- What are the preconditions for internal crowdsourcing?
- What is the nature of internal crowdsourcing?
- What are the long-term consequences of internal crowdsourcing?
- How do organizations learn through internal crowdsourcing?

For this purpose, four research papers were written in an iterative way. Paper I was conducted to provide a conceptual development, to synthesize the current state of literature and to provide a research agenda

about internal crowdsourcing. Paper II was set up to understand the state-of-art of organizational learning theory vis-à-vis information systems in terms of drivers and barriers. Paper III was conducted in order to understand how organizations learn through internal crowdsourcing. Paper IV builds on the literature on new forms of organizing and develops an organizing model focusing on internal crowdsourcing's preconditions, nature and consequences.

As this thesis is based on exploratory and interpretative research the contributions emerge from and are grounded in the data (Nag and Gioia 2012; Walsham 1993). However, this thesis follows a traditional structure and presents an overview on the theory first. In section 2, I provide an overview about related work to preview the understanding of internal crowdsourcing, organizational learning and organizing theory. In section 3, I outline the structure of this cumulative thesis and highlight how the four paper contribute towards the overall research target. Section 4 contains summaries of the four papers including the most recent findings. In section 5, the overall contribution of this thesis is synthesized. In section 6, I complete the thesis overview with a conclusion and a concise outline of future research. The full versions of the four papers can be found in the subsequent attachment of this thesis.

2. Related Work

Firms are opening up their boundaries to involve external expertise in their innovation process (Testa, et al., 2019; Pohlisch, 2019; 2021; Boudreau, 2010; Boudreau et al., 2011; Chesbrough, 2003). Instead of just collaborating with some known externals, organizations are increasingly applying a phenomenon called "crowdsourcing" (e.g., Majchrzak and Malhotra, 2013; 2021; Leimeister, et al., 2020; Pohlisch, 2021).

In the following paragraph, I summarize what we already know about "classic" crowdsourcing with externals, as well as about internal crowdsourcing with organization's own employees. Furthermore, I outline the theoretical foundations of this research: organizing theory and organizational learning.

2.1. Prior Work on External Crowdsourcing

The rising interest in crowdsourcing from both practitioners and scholars led to an increasing number of research efforts (Afuah and Tucci, 2012; Schweitzer et al., 2012; Stieger et al., 2012; Jiang, et al., 2018; Nevo, and Kotlarsky, 2020). Crowdsourcing is an emerging phenomenon that exemplifies the changing relationship between workers and firms (Taylor, 2018). The application of crowdsourcing is manifold and new applications are appearing. Hence the term crowdsourcing is undergoing a constant evolution. Estellés-Arolas and González- Ladrón-de-Guevara (2012) made a study of definitions of crowdsourcing. They found more than 40 definitions of crowdsourcing in the extant literature. In their integrated definition, crowdsourcing is a type of participative online activity in which solvers voluntarily undertake tasks through an open call. As the crowdsourcing phenomenon is emerging, several overlapping terms describing similar phenomenons exist: Distant Search (Rhyn, et al., 2017; Afuah and Tucci, 2012; Piezunka and Dahlander, 2015), Opensourcing (Ågerfalk and Fitzgerald, 2008), Crowdfunding (Gleasure, 2015), Open Collaborative Innovation Projects (Baldwin and Von Hippel 2011), Peer Production (Benkler 2002), Community Based Innovation System (Franke and Shah 2003), Wikinomics and Mass Collaboration (Tapscott and Williams 2006), Collaborative communities (Adler et al. 2008), Transaction-Free Zones (Baldwin 2008), Collaborative Consumption (Goodman 2010), Open Collaboration (Levine, 2013), Electronic Networks of Practice or Online Communities (Faraj et al. 2011; Kollock 1999; Wasko and Faraj 2005), User generated content (Lukyanenko et al., 2017) and Open Innovation (West and Gallagher 2006).

Even though the term crowdsourcing has been used only recently (Howe, 2006), this phenomenon goes back for several centuries. For example, as early as 1714, "The Longitude Prize" of £20,000 was offered by the British Government to anyone who can develop a reliable way to compute longitude (Royal Naval Museum, 2014). In 1884, the Oxford English Dictionary used 800 readers to catalogue words.

Many scholars hold that crowdsourcing is an important type of open innovation (Marjanovic et al., 2012; Wikhamn and Wikhamn, 2013). Consequently, crowdsourcing is one of the most frequently used keywords in open innovation literature (Ebner et al., 2009). "Open strategy" is a form of internal crowdsourcing in which strategy is developed in a transparent and inclusive mode (Hautz et al.,2017; Tavakoli et al., 2017).

External crowdsourcing has been studied from different perspectives and levels. The impact of cultural differences on crowdsourcing has been investigated in terms of how cultural tightness and cultural distance affect crowdsourcing for innovation (Chua, et al., 2015). On an individual level mostly solvers participating in crowdsourcing were in the focus of research. Especially questions such as how to motivate solvers (Alam, 2017; Franke, 2013; Yu, 2017; Boons, et al., 2015) or how to properly set up a crowdsourcing campaign (e.g. Laurence, et al., 2017; Papanastasiou, et al., 2017) to attract solvers have been examined. Lu, et al. (2017) showed how to set up crowdsourcing in a socially optimal way to overcome antisocial behavior of solvers, such as free-ride. Solvers usually share common values (i.e. access, autonomy, fairness, transparency, communication, security, accountability, making an impact, and dignity) and these value are implicated in four crowdsourcing structures: compensation, governance, technology, and microtask (Deng, et al., 2016). On an individual level also management was analyzed in literature. Several factors (i.e. fear of disclosure, fear of visible failure, and fear of projecting desperation) influence the resistance of managers to engage in crowdfunding (Gleasure, 2015). On group level it was analyzed how team structures, in terms of social and intellectual capital of the team members and the team leader, influence their success in crowdsourcing contests (Dissanayake, et al., 2015). Kietzmann (2017) believes that the task does not necessarily have to be done by human beings, but that a combination of humans and machines can also serve as a crowd.

On an organizational level there are less research efforts available (Schlagwein and Bjørn-Andersen, 2014). It was shown that although applying crowdsourcing, organizations often pay more attention to familiar

answers instead of dealing with distant knowledge (Piezunka and Dahlander, 2015). Ågerfalk and Fitzgerald (2008) analysed a similar open phenomenon, called open sourcing. The authors found that open sourcing worked better under conditions of openness, trust, tact, professionalism, transparency, and complementariness (Ågerfalk and Fitzgerald, 2008). To enable organizations to acquire knowledge from externals an intermediary (i.e. crowdsourcing platform) is necessary. One of the most popular ones is Amazon's Mechanical Turk, providing a platform for crowdsourcing micro-tasks (Bergvall-Kåreborn, 2014). The features of this intermediary influence the success of crowdsourcing campaigns (Feller, et al., 2012).

External crowdsourcing is being used by organisations for several purposes (Blohm, et al, 2016). Often it is applied to create or improve products (Bayus, 2013; Huang, et al., 2014) and services (Orlikowski and Scott, 2015), e.g. organizations such as Dell (Di Gangi et al., 2010), LEGO (Schlagwein and Bjørn-Andersen, 2014), SAP (Leimeister et al., 2009) and Starbucks (Gallaugher and Ransbotham, 2010) apply crowdsourcing to obtain customer feedback or to improve products and services. Additionally, crowdfunding has emerged as a new a way for organizations to fund their activities (Brabham, 2009; Kuppuswamy and Bayus, 2013). In addition, crowdsourcing has been applied in various fields such as health care (Ranand et al., 2014), public policy (Aitamurto, 2012) or journalism (Hermida, 2010).

2.2. Prior Work on Internal Crowdsourcing

Benbya and van Alstyne (2011) were among the first to emphasize the potential of "internal knowledge markets" to improve the information flow within organizations and to find solutions to problems internally. According to the first wave of research studies on the topic, internal crowdsourcing is a practice or method to activate or find knowledge or skills of employees within an organization who would not otherwise be involved with the problem in question (Zuchowski, et al., 2016). Through internal crowdsourcing, knowledge and information that may be scattered among distributed functions, departments, and geographic locations within the organization can be integrated (e.g., Benbya and Van Alstyne, 2011; Chen, et al., 2019). Examples of internal crowdsourcing include IBM mobilizing thousands of employees to share ideas in "Innovation Jams" (Bjelland and Wood, 2008) and Deutsche Telekom receiving predictions about future events and analysing big data from previous projects (Hoerbelt, 2013). Internal crowdsourcing

leverages employees as a source of ideas for improving existing products, services, or processes (Gadiraju, 2018; Simula and Vuori, 2012) or creating new ones (e.g., Simula and Ahola, 2014). Internal crowdsourcing provides the organization with a systematic process for deriving decisions and increases employee's identification with those decisions (Malone et al., 2009).

IT is playing a crucial role for internal crowdsourcing. As with crowdsourcing in general, internal crowdsourcing is a social IT-enabled phenomenon that employs both generic social media (e.g., wikis, blogs, forums) and specific software for internal crowdsourcing platforms. As a group activity, internal crowdsourcing can be run in a collaborative (e.g., Bjelland, and Wood, 2008) or competitive manner (e.g. Simula and Ahola, 2014).

While research on internal crowdsourcing was studied on individual level (Beretta, and Søndergaard, 2021; Durward, et al., 2019; Morschheuser, et al., 2017; 2019; Malhotra, et al., 2020; Durward, et al., 2019; Benbya and Van Alstyne, 2010; Feng et al., 2018), employee work agreements (Otte, and Schröter, 2019) or the role of IT (e.g., Bailey and Horvitz, 2010) and platforms (e.g., Beretta, et al., 2021; Blohm, 2018; Knop, et al., 2017; Niu, et al. 2019; Deichmann, et al., 2021), we do not yet fully understand how internal crowdsourcing is to be understood at an organizational level of analysis. We do not know what is necessary to implement internal crowdsourcing (i.e. preconditions), how internal crowdsourcing works (i.e. nature), nor what are the consequences (Simmert et al., 2020).

Zuchowski et al. (2016) provide a review of all internal crowdsourcing research currently available.

2.3. Prior Work on Organizing

For our analysis of internal crowdsourcing, we found it useful to draw from theories of organizing, including seminal works on organizing (esp. Karl Weick's work) and the emerging literature on new forms of organizing. We present here a brief overview of this literature, as this theoretical account provides the theoretical background for our analysis of the BOSCH case.

The complex and diverse nature of "organizing" has been a focus of, a raison d'être of the field of organization studies. Weick defines organizing as "the resolving of equivocality in an enacted environment

by means of interlocked behaviors embedded in conditionally related process" (Weick, 1969, p.11). That is, equivocality and uncertainty can be reduced through information processing. This is manifested in repetitive, reciprocal, contingent behaviors that develop and are maintained between two actors (Weick, 1969, p. 91). He calls this process "enacting" the organization (Weick 1969; 1974).

Historically, organizing was seen as a process for creating structures to divide, allocate tasks, motivate by rewards, and control information flows (Puranam, et al., 2014). This view of organizing can be too static and too naive. The new view of organizing replaces concepts such as structure, decisions, and control by a network concept of social theory. Even the simplest organization is dynamic and interdependent, rather than a static entity with well-defined boundaries. This new view of organizing is highly relevant to many traditional IS research topics. Rather than studying IS-enabled organizational forms as bounded phenomenons, IS researchers should consider examining them as a system within multiple systems (Majchrzak, et al., 2016).

Based on a comprehensive review of the literature of organizing and building on the work of Weick (1995), Puranam, et. al. (2014) consider four theoretical dimensions that a comprehensive theoretical account of a form of organizing needs to consider (Puranam, et al., 2014): Division of tasks, task allocation, reward distribution, information flow.

A theory of any organizing form has to account for the 4 dimensions of organizing. Puranam et al. (2014) consider that the novelty of a form of organizing must be assessed compared to the form of organizing it replaces, challenges, or complements along the universal dimensions of organizing. We found it useful to draw on universal dimensions of organizing (Weick 1969; 1974; Puranam et al. 2014). These four dimensions are the universal problems and dimensions of organizing. Any form of organizing provides specific solutions to these four problems. Hence, a theoretical account of the nature of a new form of organizing has to consider these dimensions.

"New forms of organizing" that are typically enabled by IT need new theoretical consideration (Puranam, et al., 2014; Argote, 2012). This led to the research stream of "open organizing" in terms of open, post-bureaucratic organizational forms. From literature we know open organizing forms such as business

ecosystems (Baldwin, 2012), meta organizations (Ahrne and Brunsson, 2005; Gulati et al., 2012), fluid or liquid organizations (Clegg and Baumeler, 2010), latent organizations (Starkey et al. 2000) or boundaryfree organizations (Ashkenas et al., 2002).

2.4. Prior Work on Organizational Learning

For our analysis of internal crowdsourcing, we found it useful to draw from organizational learning theories, especially the seminal work on organizational learning of Argyris and Schön (1978). In the next section, we summarize this literature briefly, as this theoretical account provides the eventual theoretical background for our analysis of the BOSCH case.

Organizational learning analyses organizations taking the behavioral approach. Put simply, organizational learning means the process of improving actions through better knowledge (Argote 2012), whereby knowledge is composed of both declarative (such as facts) and procedural knowledge (such as skills or routines). A very comprehensive definition of organizational learning is the following: "Organizational learning is different from the simple sum of the learning of its members. Although individuals may come and go, what they have learned as individuals or in groups does not necessarily leave with them. Some learning is embedded in the systems, structures, strategy, routines, prescribed practices of the organization, and investments in information systems and infrastructure" (Crossan, et al. 1999, p.529).

Organizational learning has been defined in several ways by researchers throughout the years. Nevertheless in almost every definition a certain core theme can be observed. Organizational learning always includes a change in the organization based on acquired experiences. Fiol and Lyles (1985) speak about a change in the organization's knowledge, explicit or tacit, that occurs as a function of experience (Fiol and Lyles 1985). Argyris (1978) defines organizational learning as the process of "detection and correction of errors." In his view organizations learn through individuals acting as agents for them: "The individuals' learning activities, in turn, are facilitated or inhibited by an ecological system of factors that may be called an organizational learning system" (Argyris and Schön 1978), p.177). Huber (1991) notes that "it might be reasonable to conclude that more learning has occurred when more and more varied interpretations have been developed,

because such development changes the range of the organization's potential behaviors (...)" (Huber 1991), p. 102).

Organizational learning has been identified long ago as relevant for IS research (Argyris and Schön 1978). The role of IS for organizational learning has been discussed in the most recent and most comprehensive literature review on organizational learning by Argote (2012). According to her summary organizational learning IT systems can be categorized into two groups. The traditional ones provide primarily a document repository for explicit knowledge. They can serve as pointers to experts and thereby enable "connections between members that facilitate the transfer of tacit knowledge" (Argote 2012). Yet, the connection between the involved parties happens outside of the IT system. Enabled by Web 2.0 technologies, new generations of IT systems arise, providing new opportunities for organizational learning that "facilitate connections and interactions among individuals within the system through blogs and forums" (Argote 2012). However, the realization of these new opportunities depends on how they are implemented and supported in organizations (Argote 2012).

Paper III specifically builds on Argyris and Schön's (1978) model of organizational learning. Their model consists of three organizational learning processes: single-loop, double-loop and deuteron learning. The definition of single-loop learning is based on Bateson (1973), who describes it as „the organization's ability to remain stable in a changing context denotes a kind of learning" (Argyris and Schön, 1978, p. 18). Single-loop learning occurs when errors are detected and corrected, while organizational policies and goals remain untouched. Double-loop learning occurs when, in addition to the error detection and correction process, organization's underlying norms, policies and objectives are adapted (Argyris and Schön, 1978, p. 2-3). Deuteron learning is learning how to learn. It occurs when the two processes, single and double loop learning, are integrated into the entire learning system of error detection and correction. Organizations reflect on past learning experiences to discover what facilitated or inhibited learning (Argyris and Schön, 1978, p.4).

Argyris and Schön's (1978) organizational learning framework is particularly useful because the provided learning types seem to be well-suited to reflect the learning and feedback loop observed in long-term-

oriented internal crowdsourcing processes (Zuchowski, et al. 2016). In addition, it has been successfully applied to study IS topics through the organizational learning lens (Stein and Zwass 1995).

2.5. Recent developments in internal crowdsourcing

Although the concept of internal crowdsourcing is known for 10 years now, researchers are still talking about the "first wave of research" (Pohlisch, 2021; Benbya and Leidner 2018; Smith et al. 2017; Zuchowski et al. 2016). In this section, recent developments are summarized and discussed referring to the individual paper´s research findings.

Paper I. introduces a definition of internal crowdsourcing, which has been broadly adopted and confirmed by several further studies (e.g., Ulbrich, et al., 2021; Pohlisch, 2021; Iskender, et al., 2021).

As also shown in Paper I. recent research confirms that internal crowdsourcing needs to be considered as individual phenomenon, especially in comparison with external crowdsourcing. This has been confirmed also in recent literature. Due to the characteristic differences between the two concepts, one cannot draw from existing knowledge about external crowdsourcing to internal crowdsourcing (Knop et al. 2017).

Comparing the framework elaborated in Paper I. with the studies conducted recently (see table 2.), the new focus topics were IT-system, renumeration, and corporate culture, while task definition, task (dis-) aggregation, and governance were not touched.

Author	**Topic**	**Data**
Stephens et al. (2016)	Bubbling Up the Good Ideas: A Two-Mode Network Analysis of an Intraorganizational Idea Challenge	Dataset from one idea challenge at the company Global IT
Arena et al. (2017)	How to Catalyse Innovation in Your Organization	Conducted 560 interviews among 20 organizations

Dimitrova and Scarso (2017)	The Impact of Crowdsourcing on the Evolution of Knowledge Management: Insights from a Case Study	3 semi-structures interview at the company Bombardier transportation
Knop et al. (2017)	How to Design an Internal Crowdsourcing System	Participant observation at a bank of Switzerland
Malhotra et al. (2017)	Developing Innovative Solutions Through Internal Crowdsourcing	Multi-method research project, interviews at three large organizations
Smith et al. (2017)	The Evolution of an Innovation Capability	Participant observation at the company EMC
Benbya and Leidner (2018)	How Allianz UK Used an Idea Management Platform to Harness Employee Innovation	35 semi-structured interviews at the company Allianz
Knop and Blohm (2018)	Leveraging the Internal Work Force through Crowdtesting Crowdsourcing in Banking	Participant observation at a bank of Switzerland
Pohlisch (2019)	Crowdsourcing at SAP	10 interviews at the company SAP
Zhu et al. (2019)	How Does Online Interaction Affect Idea Quality? The Effect of Feedback in Firm Internal Idea Competitions	Dataset of 351 active participants at a global chemicals company
Uhl, André, and Edgar Göll (2021)	The Use of Internal Crowdsourcing for Qualification and Competence Development in Organizations	Two interview series and two workshops

Table 2. Overview on recent Empirical Studies

Like in **Paper III.,** Uhl and Goell (2021) focused on organizational learning in their work about "Internal Crowdsourcing for Qualification and Competence Development in Organizations". The authors observe a new, open learning culture enabled by social-IT which make it possible for employees to exchange experience and solutions. Extending our findings in terms of prerequisites for internal crowdsourcing, the authors identified further internal challenges, such as long-standing routines, slow communication procedures and decision-making processes, that need be addressed when initiating crowdsourcing. Also, they highlighted the conflict between hierarchy and democratization, top-down and bottom-up culture and the necessity of employee representatives for crowdsourcing (i.e., work council).

As highlighted especially in **Paper IV.,** basic questions to understand internal crowdsourcing were not answered. Recent studies confirm that internal crowdsourcing requires much more theoretical consideration (Knop, et al., 2017; Pohlisch, 2021). No further research effort exists that addresses the fundamental topics prerequisites, process, and outcomes in a holistic way like presented in Paper IV.

Several topics gained further interest in internal crowdsourcing literature just recently. First, transparency in terms of clear conditions of participation and an understandable process, from the open call to the selection of an idea (Benbya and Leidner 2018; Pohlisch 2019). Second, the role of experts within the crowd. Instead of including experts inside the crowd, researcher argue to limit their influence, because other solvers might be discouraged from uploading their ideas by the fact that experts are part of the crowd. Experts should be involved rather as moderators and motivators (Malhotra et al., 2017). Third, the access to the internal crowdsourcing platform. Researchers argue that everyone inside the company needs to be able to join crowdsourcing campaigns. This includes a barrier-free access for disabled employees (Rohrbeck et al. 2015), and also access for employees who are not using computers during their daily work (Dimitrova and Scarso 2017). Fourth, in addition to access barriers, differences in IT competences among employees could exclude a certain group of solvers. The organization has to provide trainings to raise the IT know-how of all employees to ensure all potential solvers can join a crowdsourcing initiative (Knop and Blohm 2018).

3. Thesis Structure and Design

The studies in this cumulative thesis are organized around three focal themes. Firstly, the research domain is "internal crowdsourcing". Secondly, the adopted theoretical/philosophical grounding is organizing and organizational learning. Thirdly, the adopted method is qualitative research comprising conceptual and thematic literature reviews and grounded theory-like case study analysis. Figure 1 visualizes these focal themes.

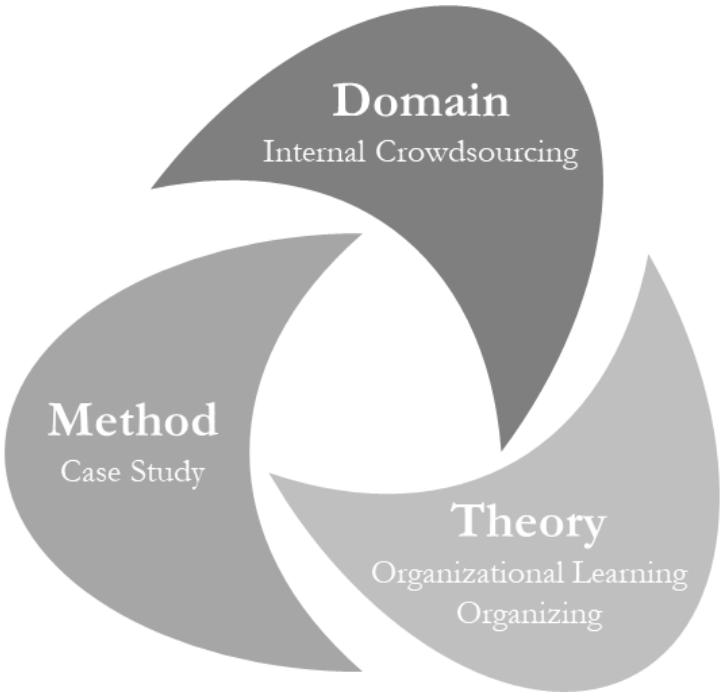

Figure 1. Three Focal Themes of This Thesis

This thesis' domain is "internal crowdsourcing". Internal crowdsourcing has been defined, as outlined above, as a practice of issuing open calls to large groups of people via social IT (Estellés-Arolas and González-Ladrón-de-Guevara, 2012). This thesis therefore is all about theorizing internal crowdsourcing as an organizational practice, including its' preconditions, nature, and outcomes.

Two theoretical lenses were selected through which internal crowdsourcing is viewed. Paper III applies organizational learning theory and paper IV organizing theory. Organizational learning theory in this thesis includes all theories concerned with how organizations learn (for an extensive review, see Argote, 2012). Organizational learning is defined as the process of improving actions through better knowledge, whereby

knowledge is composed of both declarative, i.e. facts, and procedural knowledge, i.e. skills or routines (Argote 2012). Organizing theory was historically about concepts, such as structures, decisions, and control. Today organizations are seen as a dynamic and interdependent network rather than a static entity with clear-cut boundaries. When IS met organizing theory a new research stream on "New forms of organizing" about open, post -bureaucratic organizational forms emerged. These new phenomena, that are typically enabled by IT, need new theoretical consideration (Puranam, et al., 2014; Argote, 2012).

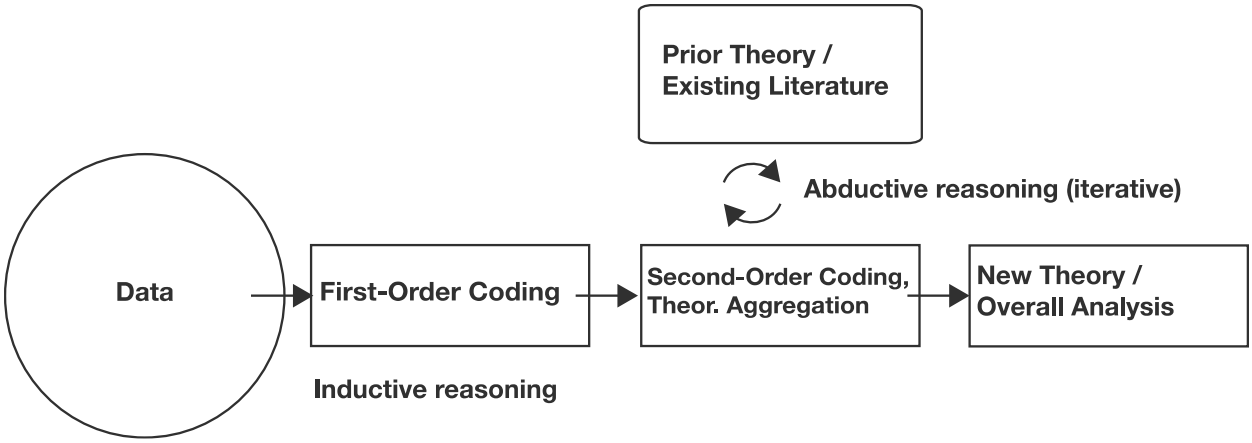

Figure 2: Methodological Approach

In this thesis I selected the method "review and interpretivist case study". As internal crowdsourcing is an emerging phenomenon at the complex intersection of IT, business and social behavior we adopted an interpretivist epistemic approach to IS research (Barrett and Walsham 2004; Klein and Myers 1999; Myers 1993, Walsham 1993). Interpretivist approaches make it possible to study an emerging phenomenon in its full richness and contextual complexity. They focus on the lived, differential experiences of the people involved in a given social setting and account for the fact that there is substantial sense-making on the part of both participants and researchers involved in interpreting the meaning of such settings (Gioia, et al. 2012). This intense research method combined the techniques of ethnography and longitudinal case study. An ethnographic, "actor-observer" approach was used (Gioia, et al., 1994) with me being actively involved in the BOSCH projects as a "crowd manager", constantly documenting and reflecting on the practices enacted, wearing two hats, that of the practicing expert and that of a reflective scholar at the same time. For data analysis Gioia, et al.'s (2012) approach was followed (see also Figure 1 below). The research strategy targeted to achieve an "inference to the best explanation". As opposed to "deductive"/upfront theorizing,

and a purely inductive/grounded approach of theory development theory was "brought in" after having a complete understanding of the case.

For the review of literature both structured thematic and conceptual methods were applied (e.g., Boell and Cecez-Kecmanovic 2015; Rowe 2014) to build the foundation from existing literature (see also Paper I and II).

Table 1 provides an overview of the six papers that comprise this thesis. The papers underwent different iterative development processes which involved the following two steps: (1) conference presentation to an interested academic audience; and (2) journal publication to a general (academic) audience, with this publication containing the most recent and most detailed content. A summary with more details on the content is provided in the remainder of this introductory paper.

		Publication per Study	
	Paper	(1) Conference	(2) Journal (part of this thesis)
I	Internal Crowdsourcing Literature Review	n/a	**Paper I.:** Journal of Information Technology (published)
II	Information Systems as Drivers and Barriers for Organizational Learning	n/a	**Paper II:** Working paper
III	Organizational Learning Through Internal Crowdsourcing	**Paper III.0.:** Research-in progress paper at the European Conference on Information Systems 2016 (published)	**Paper III.:** Organization Science (submission in preparation)
IV	Preconditions, Nature and Consequences of Internal Crowdsourcing	**Paper IV.0.:** Research-in progress paper at the International Conference on Information Systems 2016 (published)	**Paper IV.:** Organization Studies (first round review)

Table 1. Iterative Development of Studies across Outlets

Paper I is a literature review on the domain of this thesis, internal crowdsourcing. The paper went through several iterations, based on feedbacks from the editors of the *Journal of Information Technology (JIT)*. Finally, the paper was published in this journal in the year 2016. Paper II is a literature review on a theoretical lens of this thesis, organizational learning. This paper gives on overview on the impact of information systems as drivers and barriers for organizational learning. It is published as part of this thesis as "working paper", targeting the journal *MISQ Quarterly*. It lays the foundation for Paper III, which is an empirical case study of internal crowdsourcing at BOSCH, applying the organizational learning as theoretical lens. It was published as Research-in-Progress (Paper III.0) at the *European Conference on Information Systems* (ECIS) in 2016. A revised, extended, and updated version of this paper (Paper III) is ready for submission to the Organization Science Journal. Paper IV is a theory driven case study of internal crowdsourcing at BOSCH, applying organizing theory. It has been published as Research-in-Progress (Paper IV.0) at the *International Conference on Information Systems* (ICIS) in the year 2016. It has been submitted (Paper IV) as revised, extended, and updated paper to the Organization Studies Journal (2020) and is currently under review.

4. Paper Summaries

In this section, I provide summaries of the four major papers that together comprise this cumulative thesis. The papers represent the latest findings of the individual studies. The paper summaries aggregate the motivation, problem statement, major contributions, approach and limitations for each paper. For further details including an outline of the extant research on which these papers are built, the reader is referred to the full papers.

I have conducted the underlying research and have been the lead author of all papers in this thesis. My co-authors/advisors, in addition to assisting with writing, have contributed to research design, theory and argument development.

4.1. Paper I - Internal Crowdsourcing: Conceptual Framework, Structured Review and Research Agenda

Published in Journal of Information Technology

Zuchowski, O., Posegga, O., Schlagwein, D., and Fischbach, K. (2016). Internal crowdsourcing: conceptual framework, structured review, and research agenda. *Journal of Information Technology*, *31*(2), 166-184.

The first paper's target was to get an overview on internal crowdsourcing literature. Thus, we conducted an extensive study to understand, what exactly is internal crowdsourcing, what do we know about internal crowdsourcing, and where are we lacking in knowledge about internal crowdsourcing. These three questions framed our structured review of 74 research papers covering internal crowdsourcing. The presented conceptual framework of internal crowdsourcing reviews and synthesizes internal crowdsourcing literature and highlights the differences in comparison to external crowdsourcing. The conclusion of this paper presents gaps in our understanding of internal crowdsourcing. Based on that, a potential research agenda gives an outlook on future research in this domain.

In order to better describe the domain of internal crowdsourcing, we used a structured review, following best practices for literature reviews accepted in the Information Systems (IS) discipline (Webster and

Watson, 2002; Schryen, 2013). First, we performed a key word based search, using the academic databases Academic OneFile, EBSCO BusinessHost, Science Direct, and Scopus. We selected papers based on the qualitative assessment we made in our reading. We included 32 papers in this review which met all criteria after the systematic analysis of each article. In addition, we conducted a concept-based search. We checked 4976 papers in this step (762 papers from the backward search, and 4214 papers from the forward search). We identified additional 37 relevant papers to be included in the review. In a non-systematic approach we also considered papers, not identified through either the keyword- or concept-based searches. These other search forms included our working with internal crowdsourcing in research and practice, reading of reviews of tangential domains and receiving recommendations and suggestions through other channels. We identified an additional five papers not already covered by the previous two search forms. In total, we studied and analyzed 74 papers on internal crowdsourcing, which we referred to as 'set of papers'. It is worth mentioning that although this research paper is presented in a linear structure review, our review process was iterative not linear. That is, we did not begin with any preconceived endpoint but instead developed the definition, conceptualization, and inclusion and exclusion criteria through the review process.

After in depth study of our 'set of papers' we proposed our own definition of internal crowdsourcing, followed by a framework that allows us to structure the review of important components of the phenomenon. For each component of the framework, first we provided an overview of findings and insights in detail, summarized these findings in a table, and then compared internal crowdsourcing with external crowdsourcing and hierarchy-based work. According to the reviewed literature, three different problem types can be addressed with internal crowdsourcing: intelligence, design, and decision problems. We understand 'governance' as all actions and policies used to govern, manage, and steer the crowd and internal crowdsourcing. Largely corresponding to Pedersen et al. (2013) and Zogaj and Bretschneider (2014), we classify the main crowdsourcing governance tasks based on the review as: (a) management of corporate culture and change; (b) incentive design; (c) task definition and decomposition; (d) quality assurance; (e) community management; and (f) management of regulations and legal implications. People are categorized in internal crowdsourcing as: requestors (organisers, crowdsourcer) and solvers (workers, crowdsourcees) (e.g., Vukovic, 2009; Zogaj and Bretschneider, 2014). The process of internal crowdsourcing consists of four main steps: preparation, execution, evaluation and aggregation, and

resolution. We can group IT that enables internal crowdsourcing into two groups: generic social IT platforms (i.e., multi-purpose tools such as social networking sites or wikis), and specific crowdsourcing IT platforms (i.e., tools developed specifically for crowdsourcing). The outcomes of internal crowdsourcing will typically correspond to the original problem addressed. Based on the set of papers we reviewed, three outcome types can be expected of internal crowdsourcing: integration, innovation and choice.

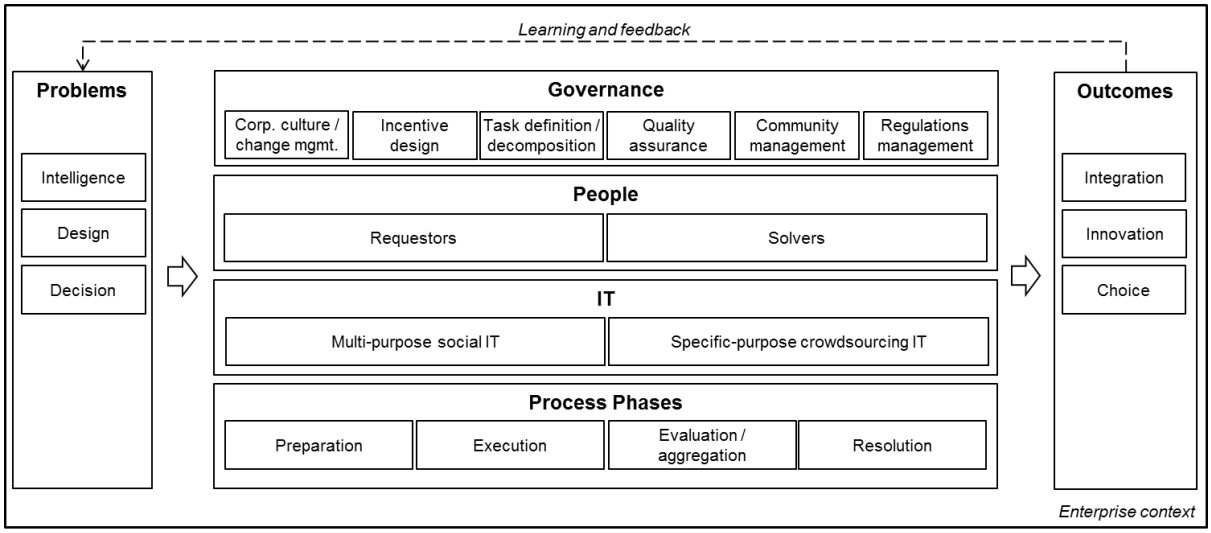

Figure 3: Conceptual Framework for Internal Crowdsourcing Review

We found that internal crowdsourcing can be used to solve several types of problems. To address such problems effectively, several major design and governance parameters (i.e., criteria, duration, rewards, etc.) have to be set. Research informing such design decisions will be useful as it helps organizers and requestors with a better design of internal crowdsourcing. We found in the review that many models inherently seemed to assume a context-free, 'single truth' phenomenon, which seems reductionist and unrealistic. For future research, rather than ignoring context, it would be useful to analize the relationships between the characteristics of internal crowdsourcing initiatives and their particular context. That is, which type and design of internal crowdsourcing and which parameter are the most suitable for particular situations? We agree with Pedersen et al. (2013) that the contextual features that enhance or inhibit the use of (internal) crowdsourcing are not well-understood.

To conclude the findings of the first paper, IT-enabled internal crowdsourcing has emerged as a phenomenon and has generated a first generation of research papers and studies. Internal crowdsourcing has unique characteristics that make it distinct from both from external crowdsourcing and hierarchy-based

work. The first paper contributes to support future research on internal crowdsourcing by strengthening the integration of insights and providing conceptual foundations.

4.2. Paper II - Information Systems as Drivers and Barriers for Organizational Learning: Review Framework and Research Agenda

Working Paper

Zuchowski, O., Schlagwein, D., and Fischbach, K. (2020) "Information Systems as Drivers and Barriers for Organizational Learning: Review Framework and Research Agenda", University of Bamberg, Chair for Information Systems and Social Networks. (Status: Published as part of this thesis)

The second paper's target was to get a detailed overview on the current state of organizational learning theory vis-à-vis information systems literature. Thus, we conducted an extensive study to understand, how information systems affect learning in organizations. We adopted a hermeneutic approach for conducting literature reviews and literature searches provided by Boell and Cecez-Kecmanovic (2014), as this approach provides the opportunity for researchers to gain a better understanding of the relevant literature during the research project. We searched for paper focusing on the role of information systems, or technology in general, for organizational learning within major journals in the domain of organizational studies. In addition, we applied a concept-based search, using backward and forward searches. Furthermore, we also considered papers not identified through either the hermeneutic- nor concept-based searches.

Organizational learning is the process of creating, retaining, transferring and applying knowledge in an organization. The ability of an organization to learn effectively and apply what has been leant is considered imperative for its survival. "Although individuals may come and go, what they have learned as individuals or in groups does not necessarily leave with them. Some learning is embedded in the systems, structures, strategy, routines, prescribed practices of the organization, and investments in information systems and infrastructure" (Crossan, Lane, and White, 1999, p. 529). In our paper we include early roots of organizational learning, which include Cyert and March's Behavioral Theory of the Firm (1963), Argyris

and Schön's Organizational Learning (1978), Weick's Conceptualization of Organizational Learning (1991), Crossan et al.'s 4I Framework, and further contemporary developments.

Information systems (IS) are increasingly critical as a support of conventional forms of organizational learning as well as enabler for new forms or organizational learning. This paper contributes an understanding of the role of information system for organizational learning in a process perspective and a multilevel perspective. In our study of the process perspective, our review framework consolidated four major organizational learning concepts into the three phases: scanning (i.e. sensing, intuiting), interpreting (i.e. transforming, specializing), and taking action (i.e. implementing, exploiting, institutionalizing). In our review framework for the multi-level perspective, four major organizational learning concepts were consolidated into three levels: individuals, groups, and organization.

Finally, the paper discusses contemporary issues around organizational learning that are particularly relevant for IS research, namely the ability of IS to enable learning with externals, such as online communities or other organizations in "ecosystems". This leads to specific suggestions how the role of IS for organizational learning needs to be further addressed in future research.

4.3. Paper III - Organizational Learning Through Internal Crowdsourcing: A Case Study of BOSCH

Published as Research-in-Progress Paper

Zuchowski, O. (2016). Learning with the Crowd: a Field Study of Internal Crowdsourcing as a Form of Organizational Learning. *24th European Conference on Information Systems, Istanbul, Turkey (2016), Research-in-Progress Papers*. 21.

Full Paper prepared for submission to Organization Science Journal

The third paper builds on organizational learning theory and analyses internal crowdsourcing at BOSCH through this lens. Organizational learning theory has been successfully applied to gain revelatory insights for external crowdsourcing with end-users. Hence, it is promising to analyze internal crowdsourcing as a form of organizational learning. Although organizations apply internal crowdsourcing to uncover and codify what those who work know (e.g., Stocker, et al., 2012), research on internal crowdsourcing as a form of organizational learning is still in its infancy. This research paper presents results of an interpretivist case study (Walsham 2006, Barrett and Walsham 2004, Klein and Myers 1999, Walsham 1995), built on organizational learning theory (Argyris and Schön 1978). Two internal crowdsourcing communities were analyzed at BOSCH to answer the question: How do organizations learn through internal crowdsourcing (in contrast to traditional, hierarchy-based learning in organizations)?

There is no theory available that provides an understanding of internal crowdsourcing as a form of organizational learning. The underlying theory for this research is organizational learning, including all theories concerned with how organizations learn (see Argote, 2012). Argyris and Schön's (1978) organizational learning framework is particularly useful because the provided learning types seem to be well-suited to reflect the learning and feedback loop observed in long-term-oriented internal crowdsourcing processes (Zuchowski, et al. 2016). In addition, it has been successfully applied to study IS topics through the organizational learning lens (Stein and Zwass 1995).

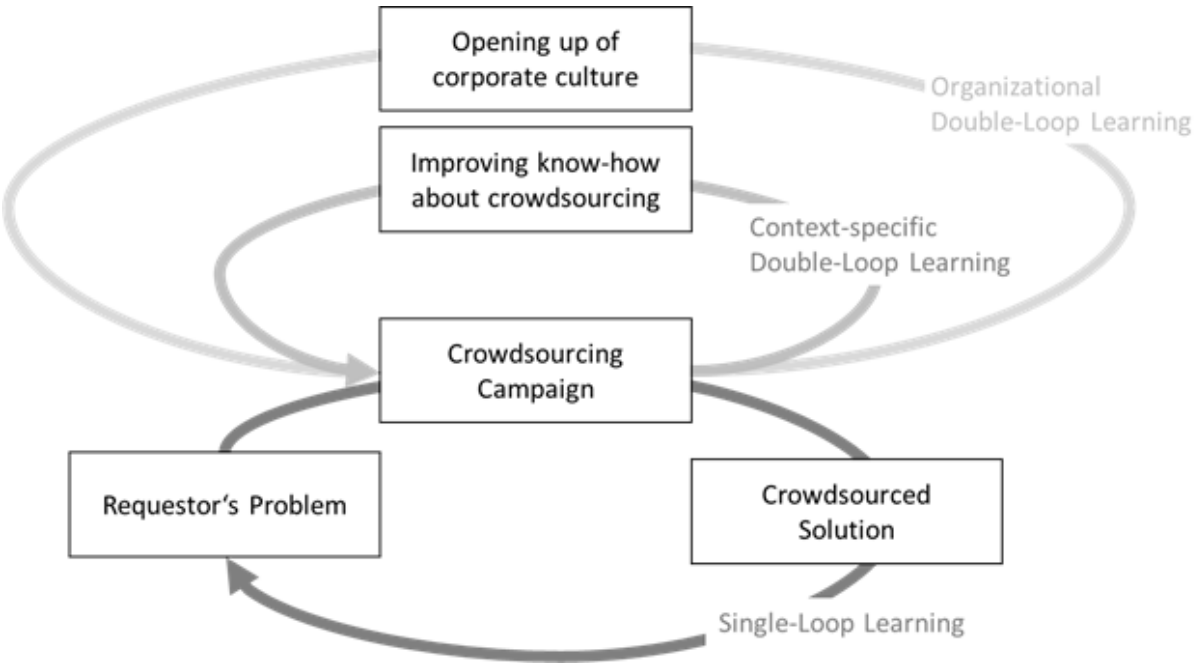

Figure 4. A Theoretical Model of Crowdsourcing as Organizational Learning

This paper contributes to our theoretical understanding of organizational learning through internal crowdsourcing. Hence, our study contributes to the organizational learning theory and our knowledge about crowdsourcing. Our study contributes to the organizational learning literature by explaining which kind of learning is observable when using crowdsourcing within an organization. Like in the work of Argyris and Schön (1974) we identified two learning loops. Single loop learning - get a solution for a problem - is also observable with internal crowdsourcing. Here crowdsourcing problems are identified by the crowdsourcing requestor, solutions or ideas are given by voluntary solvers. Double-loop learning is observable as well, but in a different way than as suggested by Argyris and Schön (1974) in their original model. Instead of adapting underlying norms and modifying objectives, internal crowdsourcing is improved as a method (i.e. context-specific double-loop learning) and opens up corporate culture (i.e. organizational double-loop learning). Results of this paper are majorly valid for all open call-based organizing forms. We believe that the learning model is sufficiently generic to cover a range of different types of organizing, but further work towards other organizations is needed to acknowledge the theoretical model. This would create an opportunity to advance our knowledge about crowdsourcing in terms of general verification of our findings.

4.4. Paper IV - Open Organizing at BOSCH: Preconditions, Nature and Consequences of Internal Crowdsourcing

Published as Research-in-Progress Paper

Zuchowski, O., Schlagwein, D., and Fischbach, K. (2016). "Open Calls" Rather than "Fixed Assignments": A Longitudinal Field Study of the Nature and Consequences of Internal Crowdsourcing. *Proceedings of the International Conference on Information Systems, Dublin, Ireland (2016), Research-in-Progress Papers*. 11.

Submitted as Full Paper

Zuchowski, O., Schlagwein, D., and Fischbach, K. (2020). Open Organizing at BOSCH: Preconditions, Nature and Consequences of Internal Crowdsourcing. *Organization Studies*.

The fourth paper contributes towards our theoretical understanding of internal crowdsourcing. The overall framework of this paper answers these three questions: What are the preconditions for internal crowdsourcing? What is the nature of internal crowdsourcing as a theoretical phenomenon? What are the long-term consequences of internal crowdsourcing? We develop answers to these questions based on a longitudinal case study and ethnographic account of the emergence and conduct of internal crowdsourcing at BOSCH, a multinational engineering and electronics company. We were able to attend the emergence of two internal crowdsourcing cases within the company's logistics department, involving employees worldwide across several department and functions.

External crowdsourcing and Internal crowd sourcing have been studied from different perspectives and levels. The rising interest in crowdsourcing from both practitioners and scholars led to an increasing number of research efforts spent (Afuah and Tucci 2012; Stieger, et al. 2012; Schweitzer, et al. 2012). Crowdsourcing is an emerging phenomenon that exemplifies the changing relationship between workers and firms (Taylor and Joshi 2019). The application of crowdsourcing is manifold and new applications are appearing. While research on internal crowdsourcing has studied different motivations on individual level (Benbya and Van Alstyne 2010) or the role of IT (Bailey and Horvitz 2010), we do not yet fully understand

how internal crowdsourcing is to be understood at an organizational level of analysis. This is the focus of this study.

For our analysis of internal crowdsourcing, we found it useful to draw from theories of organizing, including seminal works on organizing (esp. Karl Weick's work) and the emerging literature on new forms of organizing. Historically, organizing was seen as a process for creating structures to divide, allocate tasks, motivate by rewards, and control information flows (Puranam, et al. 2014). While organizing has been theorized in various ways, it is widely accepted that any form of organizing needs to be described and theorized in regards to for major dimensions (Puranam, et al. 2014): How is the division of tasks organized?, How is the task allocation organized?, How is the reward distribution organized?, How is the information flow organized?. We found it useful to draw on these universal dimensions of organizing to theorize internal crowdsorucing. "New forms of organizing" that are typically enabled by IT need new theoretical consideration (Puranam, et al. 2014; Argote 2012). Crowdsourcing is one such new IT-enabled "open organizing" form.

For this study, we adopted an interpretivist epistemic stance and approach to information systems (IS) research (Barrett and Walsham 2004, Klein and Myers 1999, Walsham 1995, Myers 1993). Our case study was conducted at BOSCH, a German multinational engineering and electronics company, providing technology and services. We were able to study the planning, emergence and conduct of two crowdsourcing communities and platforms at BOSCH. The data collection followed a purposeful sampling approach to achieve a full, comprehensive understanding of the case by selecting all key stakeholders and different participants involved in internal crowdsourcing. We interviewed employees of the organization who participated in internal crowdsourcing campaigns as solvers, who initiated campaigns as requestors.

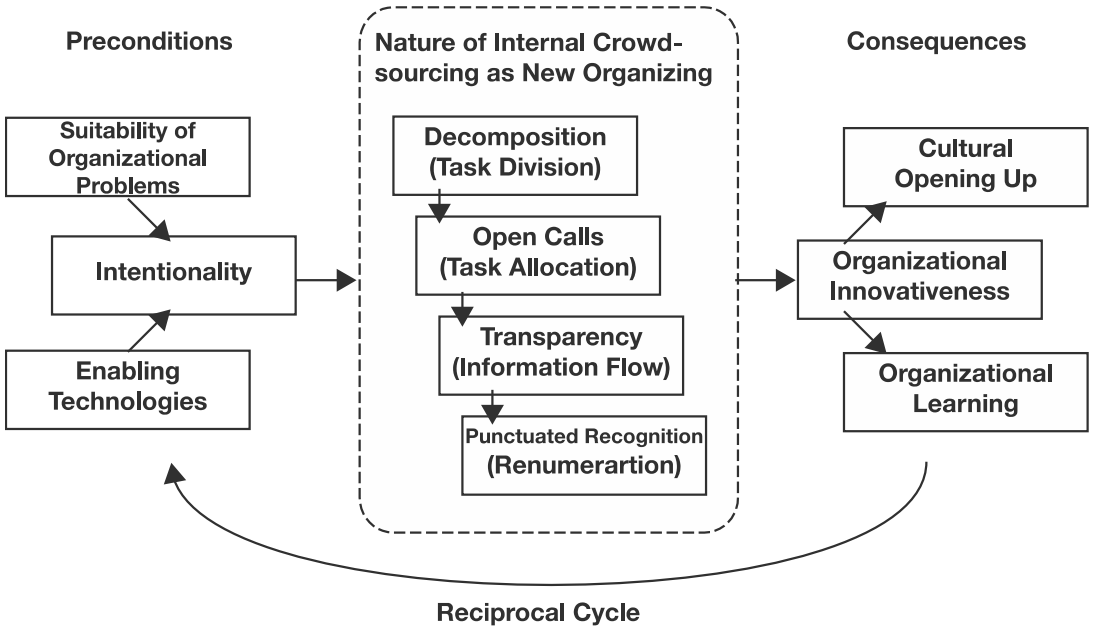

Figure 5: Preconditions, Nature and Consequences of Internal Crowdsourcing

Our in-depth analysis revealed three central preconditions for internal crowdsourcing: suitability of organization problems, availability of enabling technologies, and intentionality. the nature of internal crowdsourcing consists of four main dimensions: task division through decomposition (instead of delegation), task allocation through "open call" (instead of "fixed allocation"), information flow through transparency (instead of reporting), renumeration by punctuated recognition (instead of general rewards). We found three main consequences of internal crowdsourcing: organizational innovativeness, organizational learning, and cultural opening up. Every crowdsourcing campaign reinforces the development of resources, learning and cultural change. By establishing a designated crowdsourcing expert, organizations learn through each crowdsourcing experience and increase their knowledge about the proper use of the method and the IT platform. The same applies to cultural change. The more employees and managers understand what crowdsourcing is all about, the more likely they are willing to participate in and support it.

To conclude the findings of the third paper, we build on the literature on new forms of organizing to improve our theoretical understanding of internal crowdsourcing, and develop a theoretical model focusing of its preconditions, nature and consequences.

5. Contributions and Implications

In this section, I provide an overview about the contributions that this thesis makes to literature and which implications it has for practitioners. Beyond outlining the individual contributions of the papers (for details, see 4. Paper Summaries) this thesis contributes to our understanding of conducting theoretically-informed research on emerging phenomena.

For scholars, the papers included in this cumulative thesis each make an individual contribution to theory, all embedded in a practice-based understanding of the world. Paper I was conducted to provide a conceptual development, to synthesize the literature and to provide a research agenda about internal crowdsourcing. The paper contributes a conceptual foundation for future research on internal crowdsourcing. Paper II was set up to understand the state-of-art of organizational learning theory vis-à-vis information systems in terms of drivers and barriers. The paper thus lays the foundation to apply the organizational learning lens to the empirical phenomenon. Paper III was conducted in order to understand how organizations learn through internal crowdsourcing. Consequently, the paper contributes to a better understanding of empirical internal crowdsourcing learning practices. Paper IV builds on the literature on new forms of organizing and develops an organizing model focusing on internal crowdsourcing's preconditions, nature and consequences. Thus, contributing a theoretical account of internal crowdsourcing as a form of organizing.

Beyond these individual contributions, this thesis implicitly presents a research process that could support other students and researchers in their research efforts. Throughout the four papers, I employ an exploratory and interpretative research approach aiming for a better understanding of an empirical phenomenon. Grounded in the empirical data, an appropriate theoretical lens to analyze the empirical phenomenon is identified. The iterative process of understanding the theoretical lens and understanding the data, leads to new contributions to the phenomenon and the applied theory. This process is also applicable to other research efforts.

For practitioners, this thesis contributes an in-depth understanding of internal crowdsourcing practices on organizational level. The theoretical analysis in our paper explains how organizational learning through internal crowdsourcing works (Paper III) and how internal crowdsourcing as organizational practice works

(Paper IV). This thesis shows how large established organizations can benefit from internal crowdsourcing as it enables a new mode of learning, in addition to traditional organizational learning within hierarchy-based organizing. This thesis provides a) detailed insights into the preconditions, the nature, and the consequences of internal crowdsourcing and b) explanations for the relations between these dimensions.

There are two groups of practitioners who can particularly profit from our research findings. First, practitioners who are interested in implementing internal crowdsourcing within their organization. They can learn which preconditions are needed to use internal crowdsourcing, how to properly setup internal crowdsourcing by applying our learning model, how internal crowdsourcing works and which outcomes they can expect. Second, practitioners who are already applying internal crowdsourcing, can benchmark their approach with our research findings.

6. Conclusion

To put it in a nutshell, this cumulative thesis, split into four major papers, advances our understanding of internal crowdsourcing, organizing theory and organizational learning theory. Together with my co-authors, I synthesized the current state of knowledge about internal crowdsourcing, and answered fundamental questions about this social-IT based phenomenon. I showed that internal crowdsourcing is a distinct phenomenon with unique characteristics, making it different from both from external crowdsourcing and hierarchy-based work. From the theoretical perspective, this thesis represents the first, holistic and empirically based account of a theory of internal crowdsourcing. In addition to the individual contributions, this thesis presents a process for conducting exploratory, grounded-theory-like, "inference to the best explanation", research on emerging social-IT based phenomena.

However, this thesis faced several limitations. All findings are based on observations within one closed organization and defined crowd of internal employees. This setup gave us the unique opportunity to capture data inside the organization (see also method section) and understand one case in-depth, but we did not compare multiple cases. Future work would be to extent this study towards other organizations. Our findings are potentially valid for similar forms of open-call based organizing, such as crowdsourcing in general, or communities of practice. Further research is needed to verify if our findings are observable also for other forms of organizing. We cannot rule out that participants of our study were likely to frame crowdsourcing as a success, as all of them were involved in internal crowdsourcing campaigns. It would be interesting to analyses data from organizational members that did not participate.

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Paper I
Internal Crowdsourcing: Conceptual Framework, Structured Review and Research Agenda

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Paper II
Information Systems as Drivers and Barriers for Organizational Learning: Review Framework and Research Agenda

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Information Systems as Drivers and Barriers for Organizational Learning: Review Framework and Research Agenda

Oliver Zuchowski
University of Bamberg
An der Weberei 5
96047 Bamberg
oliver.zuchowski@uni-bamberg.de

Daniel Schlagwein
UNSW Australia Business School
UNSW Sydney
NSW 2052, Australia
schlagwein@unsw.edu.au

Kai Fischbach
University of Bamberg
An der Weberei 5
96047 Bamberg
kai.fischbach@uni-bamberg.de

Abstract: Organizational learning is the process of creating, retaining, transferring and applying knowledge in an organization. The ability of an organization to learn effectively and apply what has been learnt is considered imperative for its survival. Information systems (IS) are increasingly critical as a support of conventional forms of organizational learning, as well as an enabler for new forms or organizational learning. This paper contributes an evaluation of the conceptualization of the relation between organizational learning and IS in the literature. IS and organizational researchers have described this relation in diverse and sometimes conflicting ways. Confusion surrounds the conceptualization of organizational learning in the IS literature. This review, synthesis and discusses the literature on the relation of organizational learning and IS to reduce confusion, improve our understanding, and support future research. This paper provides the history and context of organizational theory. What follows, is an analysis of the relation. This analysis is based on the development of a common understanding of organizational learning that is used to synthesize existing insights on the relation of organizational learning and IS. The analysis used both a processual and a multi-level "cut" through the theoretical phenomenon organizational learning. Finally, the paper discusses contemporary issues around organizational learning that are particularly relevant for IS research, namely the ability of IS to enable learning with externals, such as online communities or other organizations in "ecosystems". This leads to specific suggestion how the role of IS for organizational learning needs to be further addressed in future research.

Keywords: Organizational learning information systems, process theory, multi-level theory, ambient organizational learning, literature review.

1. Introduction

It is commonly acknowledged that "if research consisted only of heaps of information, it would be no more than a chaotic bundle of statements, impossible to decipher or evaluate or apply to any meaningful purpose" (Harrington 2005). Sarker et al. (2013) emphasize that most editors of top journals see lack of theory as a key reason for rejecting a manuscript and mention Lee (1999) who underlined this issue with respect to qualitative research.

Orlikowski and Scott (2008) argue that the existing literature on technology in organizations can be distinguished into two research streams: discrete entities and mutually dependent ensembles. The discrete perspective sees the social and technical world as independent entities with inherent characteristics. The dependent view sees humans or organizations and technology as interdependent systems that shape each other through interaction. "Despite the substantial empirical evidence of technology's central role in organizational affairs, technologies remain largely understudied in organizational research. Whatever the reasons, we believe that such an absence of attention to technological issues in organizational research is a serious concern." (Orlikowski and Scott 2008, p. 34). "Our commentary has been motivated by a belief that the tendency to take IT artifacts for granted in IS studies has limited our ability as researchers to understand many of their critical implications-both intended and unintended-for individuals, groups, organizations, and society. We believe that to understand these implications, we must theorize about the meanings, capabilities, and uses of IT artifacts, their multiple, emergent, and dynamic properties, as well as the recursive transformations occurring in the various social worlds in which they are embedded." (Orlikowski and Iacono 2001, p. 13).

Organizational learning has always been considered to be a theory directly relevant for IS research (Argote 2012). The purpose of this paper is to shed lights into the relation between organizational learning theory and information systems. We ask two research questions: What do we know about organizational learning? What is the role of information systems for organizational learning from a process and a multi-level perspective? We develop answers to these questions based on a structured review of 35 research papers covering organizational learning theory and information systems.

The paper is organized as follows. Section 2 explains our literature search and review method. Section 3 gives an overview on the history of organizational learning and contemporary developments. Sections 4 presents the role of information systems for organizational learning from a process perspective. Section 5 shows this role from a multi-level perspective. Section 6 highlights gaps in our understanding of IS as driver and barrier for organizational learning and proposes a research agenda. The paper concludes with a brief summary.

2. Review Method

The basis for our review is the hermeneutic approach for conducting literature reviews and literature searches provided by Boell and Cecez-Kecmanovic (2014). According to this hermeneutic approach, researchers gain a better understanding of the relevant literature during the research project. Hence, the identification of relevant literature is not a straightforward procedure that can be carried out at the beginning of a research project depending on a fixed keyword search (Levy and Ellis 2006). While a research project and the review of literature develops, new aspects might be disclosed, making a further engagement with existing literature necessary.

First, we applied the hermeneutic approach by scanning AIS basket journals[1] for paper dealing with Information Systems as driver or barrier for Organizational Learning and derived 23 relevant paper.

Second, we searched within major journals in the domain of organizational studies[2] for paper focusing on the role of information systems, or technology in general, for organizational learning. Here we found additional 5 papers.

Third, conducted a concept-based search using backward and forward searches (Webster and Watson 2002)) of the above 28 papers. For the backward searches, we examined the 28 papers for citations of earlier sources and then obtained copies of the cited sources we considered potentially relevant. Our forward

[1] European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems, MIS Quarterly

[2] The major journals were derived based on the Academic Journal Quality Guide Version 4 (Harvey et al., 2010)

search looked for later sources that cited the 28 papers. This was done using the "cited by" functions of Google Scholar. Again, we obtained copies of the citing sources we considered potentially relevant. We then also checked all newly identified papers through the processes of forward and backward search until no further additional sources could be identified. 7 further paper were identified.

We also considered papers not identified through either the hermeneutic- nor concept-based searches. These other search forms included the authors' knowledge of technology and organizational learning in research and practice. In total, we identified an additional seven papers not already covered by the previous two three search forms.

3. A Short History of Thinking on Organizational Learning

3.1. Definition

Organizational learning has been defined in several ways by researchers throughout the years. Nevertheless, in almost every definition a certain core theme can be observed. Organizational learning always includes a change in the organization based on acquired experiences. Fiol and Lyles (1985) speak about a change in the organization's knowledge, explicit or tacit, that occurs as a function of experience.

Argyris (1977) defines organizational learning as the process of "detection and correction of errors." In his view organizations learn through individuals acting as agents for them: "The individuals' learning activities, in turn, are facilitated or inhibited by an ecological system of factors that may be called an organizational learning system" (p. 117)

Huber (1991) notes that "it might be reasonable to conclude that more learning has occurred when more and more varied interpretations have been developed, because such development changes the range of the organization's potential behaviors (...)" (p. 102).

A very comprehensive definition of organizational learning is the following: "Organizational learning is different from the simple sum of the learning of its members. Although individuals may come and go, what they have learned as individuals or in groups does not necessarily leave with them. Some learning is

embedded in the systems, structures, strategy, routines, prescribed practices of the organization, and investments in information systems and infrastructure" (Crossan et al. 1999, p. 529).

3.2. Early Roots

As Easterby-Smith and Araujo (1999) have commented the idea of organizational learning has been present in the management literature for decades, but it has only become widely recognized since around 1990.

Two developments have been highly significant in the growth of the field. First it has attracted the attention of scholars from disparate disciplines who had hitherto shown little interest in learning processes. A consequence of this is that the field has become conceptually fragmented, and representatives of different disciplines now vie over who has the correct model of organizational learning. The second development is that many consultants and companies have caught onto the commercial significance of organizational learning... Much of the effort of these theorists has been devoted to identifying templates, or ideal forms, which real organizations could attempt to emulate. (Easterby-Smith and Araujo 1999).

3.3. Cyert and March's Behavioral Theory of the Firm (1963)

Cyert and March (1963) behavioral theory takes the firm as basic unit of analysis and describe firms as political coalitions between individuals and groups with different goals and hence, possible conflicts. "Organizational goals are viewed as partly independent (potentially inconsistent) levels of aspiration. Decisions are functions of goals and of perceptions of alternatives, consequences, performance of the organization and other like organizations, and states of the world. Of the set of goals, only some are considered at one time, hence attention-focusing processes occupy an important place in the theory" (Gibbs and Browning 1966). Cyert and March claims that firms are operating more through routines than through evaluated decisions. Experience is represented in standard procedures and rules based on solutions to problems or conflicts from the past. "As time passes and experience changes, the firm's routines change through processes of organizational search, learning, and negotiation. As a result, the firm is seen as a system of rules that change over time in response to experience, as that experience is interpreted in terms of the relation between performance and aspirations and in terms of multiple, conflicting goals" (Augier and March 2008, p. 3). Hence, firm's organizational learning means to adapt aspiration levels to internal

and external experiences. As different parts of a firm experience different things and interpret things in a different way, they might learn different things from the same events.

3.4. Argyris and Schön's Organizational Learning (1978)

Argyris and Schön (1978) work describes three way of how organizations learn: single-loop, double-loop and deuteron learning. "Organizational learning involves the detection and correction of error. When the error is detected and corrected permits the organization to carry on its present policies or achieve its present objectives, then that error-detection-and-correction process is single-loop learning. Double-loop learning occurs when error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies and objectives." (Argyris and Schön 1978, p. 3). For deutero learning the two levels, single and double loop learning, are inquired into the entire learning system of error detection and correction. "When an organization engages in deuteron-learning, its members learn about previous context of learning. They reflect on and inquire into previous episodes of organizational learning, of failure to learn. They discover what they did that facilitated or inhibited learning, they invent new strategies for learning, they produce these strategies, and they evaluate and generalize what they have produced." (Argyris and Schön 1978, p. 4).

3.5. Weick's Conceptualization of Organizational Learning

Weick (1991) argues that the defining property of learning is the combination of same stimulus and different response. According to him, learning is "a shift in performance when the stimulus situation remains essentially the same" (Weick 1991, p. 116). However, such stimulus situations in organizations are rarely stable and predictable: "This instability makes it hard to establish sufficient stimulus similarity so that it becomes possible to make a different response. (…) When there is a flux, there is both no stimulus and a changing stimulus, but there is seldom the same stimulus." (Weick 1991, p. 117). Hence, he argues that this traditional behaviorist view of learning (same stimulus, different response) cannot be applied directly to organizations. He proposes to either keep the traditional view, or replace it "with a definition that is tied more closely to the properties of organizations" (Weick 1991, p. 121). In comparison to individuals, organizations also learn when the respond in a similar way to a constant stimulus over time. Organizations

establish stable routines that steer the sensemaking of environmental stimuli. Organizations can do that because they have a cognitive subsystem in place. Individuals learn, when they respond differently to the same stimulus. A constant interaction between individuals and groups allows organizations to develop characteristics that used to be associated only with individuals. Hence, organizational sense-making is a collective individual process, where individual sense-making is integrated on organizational level.

3.6. Crossan et al.'s 4I Framework

Crossan et al. (1999) 4I model of organizational learning is one of the most universally accepted and influential model of organizational learning. It is based on previous organizational learning frameworks (Daft and Weick 1984; March 1991; Nonaka 1991) and focuses on a detailed analysis of the learning process transitions from individual to group and organizational level. These levels are connected by bi-directional processes that involve intuiting, interpreting, integrating and institutionalizing.

The authors define intuiting as "the preconscious recognition of the pattern and/or possibilities inherent in a personal stream of experience" (Crossan et al. 1999, p. 525). Interpreting is "is the explaining, through words and/or actions, of an insight or idea to one's self and to others." (Crossan et al. 1999, p. 525). The first process on group level is integrating, which is "the process of developing shared understanding among individuals and of taking coordinated action through mutual adjustment." (Crossan et al. 1999, p. 525). Institutionalizing happens when learning is embodied into the organization "and it includes systems, structures, procedures, and strategy." (Crossan et al. 1999, p. 525).

3.7. Further and Contemporary Developments

Huber (1991) considers four constructs as integrally linked to organizational learning: knowledge acquisition, information distribution, information interpretation, and organizational memory. He clarifies that learning need not be conscious or intentional. Further, learning does not always increase the learner's effectiveness, or even potential effectiveness. Moreover, learning need not result in observable changes in behavior. Taking a behavioral perspective, Huber (1991) notes: An entity learns if, through its processing of information, the range of its potential behaviors is changed.

Senge (1990) defines the Learning Organization as the organization "in which you cannot not learn because learning is so insinuated into the fabric of life." Also, he defines Learning Organization as "a group of people continually enhancing their capacity to create what they want to create." I would define Learning Organization as an "Organization with an ingrained philosophy for anticipating, reacting and responding to change, complexity and uncertainty." The concept of Learning Organization is increasingly relevant given the increasing complexity and uncertainty of the organizational environment. As Senge (1990) remarks: "The rate at which organizations learn may become the only sustainable source of competitive advantage."

McGill et al. (1992) define the Learning Organization as "a company that can respond to new information by altering the very "programming" by which information is processed and evaluated."

Ang and Joseph (1996) contrast Organizational Learning and Learning Organization in terms of process versus structure.

McGill et al. (1992) do not distinguish between Learning Organization and Organizational Learning. They define Organizational Learning as the ability of an organization to gain insight and understanding from experience through experimentation, observation, analysis, and a willingness to examine both successes and failures.

The current view of organizations is based on adaptive learning, which is about coping. Senge (1990) notes that increasing adaptiveness is only the first stage; companies need to focus on generative learning or "double-loop learning" (Argyris 1977). Generative learning emphasizes continuous experimentation and feedback in an ongoing examination of the very way organizations go about defining and solving problems. In Senge (1990) view, generative learning is about creating - it requires "systemic thinking," "shared vision," "personal mastery," "team learning," and "creative tension" [between the vision and the current reality]. [Do Japanese companies accomplish the same thing with "strategic" and "interpretive" equivocality"?] Generative learning, unlike adaptive learning, requires new ways of looking at the world.

In contrast, Adaptive Learning or single-loop learning focuses on solving problems in the present without examining the appropriateness of current learning behaviors. Adaptive organizations focus on incremental improvements, often based upon the past track record of success. Essentially, they don't question the

fundamental assumptions underlying the existing ways of doing work. The essential difference is between being adaptive and having adaptability.

To maintain adaptability, organizations need to operate themselves as "experimenting" or "self-designing" organizations, i.e., should maintain themselves in a state of frequent, nearly-continuous change in structures, processes, domains, goals, etc., even in the face of apparently optimal adaption (Hedberg and jöhsson 1977; Hedberg et al. 1976; Starbuck 1983) argue that operating in this mode is efficacious, perhaps even required, for survival in fast changing and unpredictable environments. They reason that probable and desirable consequences of an ongoing state of experimentation are that organizations learn about a variety of design features and remain flexible.

Senge (1990) argues that the leader's role in the Learning Organization is that of a designer, teacher, and steward who can build shared vision and challenge prevailing mental models. He/she is responsible for building organizations where people are continually expanding their capabilities to shape their future -- that is, leaders are responsible for learning.

Or, as (Mintzberg 1987) says: the key is not getting the right strategy but fostering strategic thinking. Or as Shell has leveraged the concept of Learning Organization in its credo "planning as learning" (De Geus 1988). Faced with dramatic changes and unpredictability in the world oil markets, Shell's planners realized a shift of their basic task: "We no longer saw our task as producing a documented view of the future business environment five or ten years ahead. Our real target was the microcosm (the 'mental model') of our decision makers." They reconceptualized their basic task as fostering learning rather than devising plans and engaged the managers in ferreting out the implications of possible scenarios. This conditioned the managers to be mentally prepared for the uncertainties in the task environment. Thus, they institutionalized the learning process at Shell. In entrepreneurship theory and practice. Notably, Eric Ries elaborated on the idea that a “lean startup” needs to prepare to “learn how to drive” rather than “preparing a rocket launch” (i.e., learning over planning (Ries 2011)

The key ingredient of the Learning Organization is in how organizations process their managerial experiences. Learning Organizations/Managers learn from their experiences rather than being bound by

their past experiences. In Generative Learning Organizations, the ability of an organization/manager is not measured by what it knows (that is the product of learning), but rather by how it learns -- the process of learning. Management practices encourage, recognize, and reward: openness, systemic thinking, creativity, a sense of efficacy, and empathy. Learning Organizations, the ability of an organization/manager is not measured by what it knows (that is the product of learning), but rather by how it learns -- the process of learning. Management practices encourage, recognize, and reward: openness, systemic thinking, creativity, a sense of efficacy, and empathy.

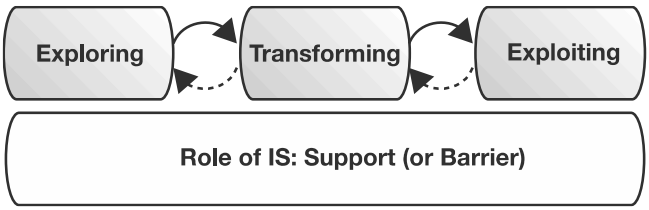
4. The Role of IS for Organizational Learning: Process Perspective

Some consider that organizational learning is primarily a concept describing processes. Ang and Joseph (1996). The manifest structure that contrast to that would then be the "learning organization" (Ang and Joseph 1996; Huber 1991) in which the organizational learning process takes place. While there is little doubt that organizational learning is a process theory, the precise theoretical concepts (e.g., phases of the process) differ between the major organizational learning conceptualization. For our review framework we consolidated the four major organizational learning concept into the three phases: scanning, interpreting, and taking action. Table 1 explains how the original process steps were matched with our proposed framework.

Organizational Learning Conceptualization	**Scanning (Sensing, Intuiting)**	**Interpreting (Transforming, Specializing)**	**Taking Action (Implementing, Exploiting, Institutionalizing)**
Cyert and March (1963)	Problems may be solved either by the application of organizational rules and procedures or by a process of search, if established rules seem inadequate. Search is often a double process - the solution looks for the problem as well as the problem looking for a solution.	Experience is interpreted in terms of the relation between performance and aspirations and in terms of multiple, conflicting goals.	Experience is embodied in standard operating procedures, rules reflecting solutions to problems that the firm has managed to solve in the past and negotiated resolutions of past conflicts.
Argyris and Schön (1978)	The initial step of organization learning is the detection of errors.	As the authors are taking the technical perspective of organizational learning, processing and interpretation of information have to be part of the process.	When a learning process leads to an alteration in the governing variables (modification of an organization's underlying norms, policies and objectives), the authors call it double-loop learning.
Weick (1991)	In the process step "enactment" information is produced or it is decided which information is relevant.	In the process step "selection" information is interpreted.	In the process step "retention" information is retained for future use.
Crossan et al. (1999)	The authors distinguish two forms of intuiting: "how to do things" and entrepreneurial intuiting "how to do things differently".	The authors define interpreting as explaining ideas or insights through words and/or action either to one's self or to others. Integrating is the development of a shared understanding.	During institutionalizing learning is embedded into the organization by systems, structures, procedures, and strategy.

Table 1: Matching of Organizational Learning Concepts to common Processes

Table 2 below shows how IS/IT can act as a driver or barrier and can enhance or impede organization learning according to published research in IS and other business fields.

Organizational Learning / Processual Perspective			
	Scanning (Sensing, Intuiting)	**Interpreting (Transforming, Specializing)**	**Taking Action (Implementing, Exploiting, Institutionalizing)**
IT as Driver	(IT) provides access to wide range of external knowledge and skills (e.g., Schlagwein and Bjørn-Andersen 2014) (IT) provides efficient access to internal knowledge and skills (Andreu and Ciborra 1996) (e.g., Alavi and Leidner (2001); (Goodman and Darr 1998; Gregor 2006; Griffith et al. 2003; Janson et al. 1997; Janson et al. 2007; Kane 2015; Kane and Alavi 2007; Lyytinen and Robey 1999; Mack et al. 2001; Mueller et al. 2011; Yap and Bjoern-Andersen 1998) (IT) allows for quick experimentation (e.g., rapid prototyping, minimal viable product) and hence fast learning (e.g., Andreu and Ciborra 1995) (IT) facilitates the distribution and finding of information within the firm (e.g., Alavi and Leidner 2001; Andreu and Ciborra 1995; Mack et al. 2001; Pentland 1995)	(IT) supports explication / codification of (expert) knowledge (e.g (Goodman and Darr 1998; Mueller et al. 2011; Stein and Zwass 1995; Yap and Bjoern-Andersen 1998) (IT) allows efficient communication within and among groups inside the organization (e.g., (Andreu and Ciborra 1995; Goodman and Darr 1998; Janson et al. 2007; Robey et al. 2000) and between organizations (Scott 2000) (IT) provides a memory for embedding routines, norms, directives and standards (e.g., Alavi and Leidner 2001; Janson et al. 2007; Stein and Zwass 1995) (Andreu and Ciborra 1995) (IT) enabled settings more likely create opportunities to move individual knowledge into organizational repositories (Griffith et al. 2003) (IT) supports the onboarding of new employees (e.g., Kane and Alavi 2007) (IT) helps prioritizing information in terms of relevance for the organization (e.g., (Bjelland and Wood 2008) (IT) enables learning	(IT) improves organizational performance (e.g (Ashworth et al. 2004; Pentland 1995) (IT) enables access to a broader range of markets (e.g (Yap and Bjoern-Andersen 1998). (IT) enabled learning processes help to cope with geographical dispersion and bringing new products to market quickly (e.g (Scott 2000)., (IT) increases the awareness of top management for organizational problems (Janson et al. 2007) (IT) help organization to innovate (Bjelland and Wood 2008)

		from external sources, crowdsourcing (e.g., Majchrzak and Malhotra 2013; Schlagwein and Bjørn-Andersen 2014)	
IT as Barrier	(IT) may lead to rigidity in the ways the organizations scans the environment (when more dynamic and flexible ways are needed) (e.g., (Robey et al. 2000; Stein and Zwass 1995) (IT) privileges (and find only) codified and explicit knowledge over tacit and implicit knowledge (Gill 1995; Robey et al. 2000) (IT) has the risk of replace offline interactions and as such hinders the creation of tacit knowledge (e.g., (Gill 1995; Griffith et al. 2003),	(IT) suggest context and time independent "truth" of (explicit) knowledge (does not sufficiently account for the problem of changing relevance of knowledge depending on context and progress of time) (e.g (Pentland 1995; Robey et al. 2000)	(IT) increased information processing capabilities, but at the same time and through that fact, restricts the possible range of experiences and actions by the organization and its members (e.g (Pentland 1995).,

Table 2: Process View on IS acting as Driver or Barrier for Organizational Learning

IT as driver for exploring (new learning/knowledge)

IS can act as a driver for the exploring phase of organization learning in various ways.

IS (e.g., Internet-based search systems and platforms) provides access to a wide range of external knowledge and skills. For example, Schlagwein and Bjørn-Andersen (2014) showed how organizations can access of knowledge from members that are outside of organization through IS.

Especially for internal knowledge and skills IS acts as an enabler (e.g., internal corporate portals, forums and wikis). Knowledge is no longer isolated through geographical dispersion, but is made available in central databases, equally accessible for everyone. These knowledge repositories are mentioned as foundation for organizational learning (e.g., Kane and Alavi 2007) and are labelled in several ways by IS scholars. Robey et al. (2000) call them organizational memory systems. Alavi and Leidner (2001) name this class of IS, knowledge management systems (KMS). The authors presented how IS facilitates access to best practices and finding internal experts. Also Goodman and Darr (1998) confirm the success of IS to facilitate exchange about best practices, i.e. solutions for problems across offices. Already 1997, Janson et al. (1997), described a case of a supermarket company, where all important documents, such as meetings minutes, were captured in a central database. Additionally in 2007, Janson et al. (2007) provided a longitudinal study of a Slovenian

company using a document management system opening access to annual reports, manuals and newspaper articles (Gregor 2006).

A rather new technology, virtual worlds (like Second-Life) were proved to successfully enhance the exploring process by enabling rich interaction among users (Mueller et al. 2011).

Through IS, learning through fast experimentation is possible (e.g., rapid prototyping, minimal viable product). Andreu and Ciborra (1995) state that IT applications foster the "experimentation with new resources, in particular with new sources of information and with IT itself (e.g. encouraging to use new technologies in pilot projects, etc." (Andreu and Ciborra 1995, p. 11).

IS facilitates the distribution and finding of information within the firm. Several search and retrieval solutions exist to explore organizational knowledge. Alavi and Leidner (2001) distinguish the traditional pull model, where knowledge is retrieved by specific user queries, and the push model, where information is automatically delivered to the user. (Mack et al. 2001) explains that search processes are supported explicitly, through search functions (e.g. in online knowledge repositories), and implicitly, through employee profiles that are tagged with current interests or expertise. An explicit search can be executed with a query, requesting similar documents or exploring taxonomies organizing documents into topics. (Mack et al. 2001). IS effectively supports the distribution and sharing of information by providing communication channels (e.g., groupware, email) reaching all involved members of the organization (Andreu and Ciborra 1995).

IT as driver for transforming

IS can act as a driver for the transforming phase of organization learning in various ways.

To achieve higher levels of organizational learning, organizational knowledge has to be explicit, communicable, and integrated (Duncan 1979). IS-enabled repositories fulfil these prerequisites, as the available knowledge is in this case is explicit, and can be updated and shared quickly (Stein and Zwass 1995). An important process in this context, which is supported by IS, is the explication and codification of knowledge. Implicit knowledge (such as technical issues, past decisions, projects, designs), stored at the employees of an organization, can be codified in e.g. knowledge platforms, making it available for future

use. Yap and Bjoern-Andersen (1998) show an example where IS supports the explication of engineering and architectural knowledge (through virtual reality and 3D imagery), needed for the design and marketing of products. By creating equal global access to rich forms of product knowledge, the company was able to "enrich knowledge representations, strengthen the nexus of corporate knowledge, and effectively convey complex technical knowledge throughout its global organization" (Yap and Bjoern-Andersen 1998, p. 274) "We believe that (…) more virtual teams, having made their knowledge more explicit and having used technological tools for communicating this knowledge (…), will have permanent (and searchable) access to this knowledge" (Griffith et al. 2003, p. 8).

To transform information, communication is inevitable. IS (e.g., groupware, emails, electronic discussion, electronic bulletin boards) facilitates efficient communication within the organization across time and space. Andreu and Ciborra (1995) show an example where IS facilitates the creation of more efficient work practices through communication within a group. Also between organizations the knowledge creation benefits from IS such as email and videoconferencing. A case study showed how engineers used email to share design data and troubleshoot technical problems with customers (Scott 2000).

IS (e.g., workflow automation systems) supports the process of transferring knowledge into organizational routines or standards. "Technology can support knowledge application by embedding knowledge into organizational routines. Procedures (…) can be embedded into IT so that the systems themselves become examples of organizational norms." (Alavi and Leidner 2001, p. 16). IS provides an explicit repository for existing norms and standards, which are subject to review and change (Stein and Zwass 1995).

It is in the nature of things that IS-enabled organizational settings more likely transfer knowledge from individual to organizational level. Especially virtual settings are associated with a greater focus on explicit knowledge, as they are per se documenting information in IS-enabled repositories (Griffith et al. 2003; Pelletier et al. 2003).

IS not only supports current employees, but also helps new employees by providing them relevant knowledge for their start in a new environment. (Kane and Alavi 2007, p. 16) summarizes that IS supports

"assimilating new employees quickly into the organization and imparting on them the relevant knowledge to address the environmental conditions"

To cope with information overflow, IS provides tools (e.g., text mining, online voting) to gain a better understanding of what is relevant for the organization by supporting structuring and prioritizing processes. Bjelland and Wood (2008) for example show how IBM makes use of text mining software to find the most valuable comments from an internal innovation jam.

For transforming knowledge from external sources (e.g., from customers) into organizational knowledge, IS has the role of an enabler. Crowdsourcing was successfully tested as method to incorporate such external sources for the innovation. (Schlagwein and Bjørn-Andersen 2014; p. 18) emphasize that "IT-enabled crowdsourcing allows the organization to learn from non-members and, in this way, the organization "broadens the base of minds" from which it can learn". Also Majchrzak and Malhotra (2013) agree, that crowdsourcing is a potentially effective and efficient way to open the organizational boundaries for innovation.

IT as driver for taking action

IS can act as a driver for the taking action phase of organization learning in various ways.

An improvement of organizational performance through IS-enabled organizational learning has been studied by IS scholar. Ashworth et al. (2004) found evidence that organizations are able to make us of gained knowledge (e.g., about production experiences) for improvement projects, resulting in productivity increases. Pentland (1995) showed how a new IS in a small engineering consulting company helped them to automate energy audits of commercial buildings. The author concludes that enhanced knowledge distribution processes (e.g., via email) can effectively improve organizational performance.

New knowledge (e.g., about products or customers) potentially unveils the access to new markets. Yap and Bjoern-Andersen (1998) investigated how a global sales department benefits from enhanced product knowledge and marketing competences. The authors found IS-enabled the global sales force to take action in terms of penetrating "a broader range of markets and sectors" (Yap and Bjoern-Andersen 1998, p. 12).

IS-enabled organizational learning supports product innovation. Scott (2000) summarize that through IS suppliers and customers can be involved in the product design by exchanging engineering knowledge, leading to faster processes: "The rapid communication and turnaround enables feedback, better coordination, (…), which improves the performance (…) in terms of faster time to market of new products, just-in-time IT deliveries, and reduced lead times. For example, e-mail removes physical barriers between organizations (…)"(Scott 2000, p. 17). Bjelland and Wood (2008) investigated so-called "Innovation Jams" at IBM, where all employees are invited to participate in the innovation process of new products and services. This IS-enabled "worldwide brainstorming" successfully helped IBM to find new business ideas.

IS increases top management awareness and understanding of organizational problems by offering communication and collaboration technologies across hierarchical boundaries. Janson et al. (2007) investigated IS-enabled organizational learning in longitudinal study of a Slovenian company. They found out that a new bottom-up learning emerged within the organization: "thanks to new learning structures, processes and IT systems, 'grass-root' members engaged in double-loop learning: they participated in intersubjective sense-making concerning the new environment and the new company vision (…)" (Janson et al. 2007, p. 29).

IT as barrier for exploring

IS can act as a barrier for the exploring phase of organization learning in various ways.

IS can create rigidity in exploring the environment, when the applied system for organizational learning is not evolving by "organizational experiments and the acquisition of experience from outside through the grafting of new members and assimilating the experience of other organizations" (Stein and Zwass 1995, p. 111). Robey et al. (2000) confirm that IS may act as a barrier for organizational learning by keeping rigid system, not adapting to changing environments.

IS-enabled organization learning environments tend to become overly dependent on formal representations of knowledge. Thus, less formal representations (e.g., found in the heads of experiences employees) are perceived as less important (Robey et al. 2000). Gill (1995) explained that IS replaced individuals (e.g., middle management) are no longer exploring the environment. While IS is processing formal

representations of knowledge, the system provides no solution for gathering and interpreting unstructured knowledge. As a consequence, the organizations is unaware of the need to change, resulting in e.g. lost market share.

The implementation of IS for exploring knowledge implies the risk of replacing offline (e.g., face-to-face) interactions. Thus IS acts as a barrier for the creation of new tacit knowledge. Gill (1995) elaborated that phenomenon in two case studies, confirming that IS may impede environmental scanning activities. (Griffith et al. 2003) conclude in their work about virtualness and knowledge in teams that "team virtualness may impede informal interaction among members. This suggests that there is less possibility that tacit knowledge from relevant communities of practice will transfer from team member to team member in more virtual teams." (Griffith et al. 2003, p. 276).

IT as barrier for transforming

IS can act as a barrier for the transforming phase of organization learning in a specific way.

Knowledge stored in IS suggests a context and time independent truth of knowledge. Thus, it does not sufficiently account for the problem of changing relevance of knowledge depending on context and progress of time. When the context of use changes the available information needs to be examined and, if necessary, updated. Thus, IS-enabled organizational learning requires maintenance (e.g., Pentland 1995). Robey et al. (2000) claim that systems supporting learning may be useful as long as the assumptions on which they are built do not become obsolete.

IT as barrier for taking action

IS can act as a barrier for the taking action phase of organization learning in a specific way.

IS increases information processing capabilities and understanding, but at the same time and through that fact, restricts the possible range of experiences and actions by the organization and its members (e.g., Pentland 1995).

5. The Role of IS for Organizational Learning: Multi-Level Perspective

Some argue that organizational learning takes place in a structure called the "learning organization" (Ang and Joseph 1996; Senge 1991). However, contemporary thinking on organizational learning has largely done away with this distinction and scholars seem to agree that all organizations learn, and that there can be a processual perspective (discussed in the previous section) and/or a structural perspective on this learning (McGill et al. 1992). Some have attempted to "merge" the processual and the structural perspective into a single framework (Crossan et al. 1999)

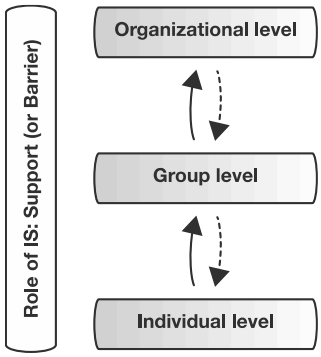
As organizational learning is a multi-level phenomenon, the structural perspective of organizational learning has typically considered several levels (Weick 1991). For our review framework we consolidated the four major organizational learning concepts into the three levels: Individuals, Groups, and Organization. Table 3 explains how the original process steps were matched with our proposed framework.

Conceptualization	**Individuals**	**Groups**	**Organization**
Cyert and March (1963)	The modem business firm is as a group of individuals who are engaged in the decision-making process.	Intra-organizational learning is done by groups, departments, or other units that constitute organizations.	The authors speak about organizational and inter-organization learning, focusing on learning at the level of the overall organization.
Argyris (1979); Schön and Argyris (1996)	The authors represent individual knowledge as "theories of action". Every individual of an organization constructs his or her own representation or image of the theory-in-use of the whole.	The authors emphasize the existence of group and organizational theories of action.	The authors state that the results of double-loop learning has always an impact on organizational level.
Weick (1991)	The author states that the process of enactment is	The author states distinguishes between	The author states sees the organization as a system

	driven by people acting and bringing structures and events into existence.	individual and group sense making.	taking in information from its environment, trying to make sense of that, and using what was learned in the future. Organizations evolve as they make sense out of themselves and their environment.
Crossan et al. (1999)	The authors locate intuiting and interpreting to the individual level.	The authors see that integrating occurs at group level.	The authors put integrating and institutionalizing to the the organizational level.

Table 3: Matching of Organizational Learning Concepts to common Levels

Table 4 below shows how IS/IT can act as a driver or barrier and can enhance or impede organization learning according to published research in IS and other business fields.

Organizational Learning / Multi-Level Perspective			
	Individuals	**Groups**	**Organization**
IT as Driver	(IT) enables individuals to represent / reflect their knowledge and to explicate their knowledge, enhancing sharing of knowledge among dispersed individuals (e.g., Alavi and Leidner 2001) (Boland Jr et al. 1994; Goodman and Darr 1998; Hamilton and Scandura 2003; Mack et al. 2001) (Andreu and Ciborra 1996; Kock and	(IT) enhances the distribution of knowledge between groups (e.g., Mack et al. 2001; Pentland 1995) (Dodgson et al. 2013; Stein and Zwass 1995)	(IT) enabled transfer of knowledge occurs at various levels (e.g., Alavi and Leidner 2001), and across organizational boundaries (Dodgson et al. 2013) Schlagwein and Bjørn-Andersen (2014) (IT) departments act as brokers of knowledge within

	McQueen 1998; Majchrzak and Malhotra 2013; Mueller et al. 2011; Scott 2000) (IT) supports individuals in their decision making process by making knowledge about past experiences available (e.g., Stein and Zwass 1995) (IT) increases the commitment of individuals to the organizational mission and targets (e.g., Andreu and Ciborra 1995) (IT) supports individuals with large volumes of information, compensating individuals with limited memory (Kane and Alavi 2007)		organizations (e.g., Pawlowski and Robey (2004)
IT as Barrier	(IT) enabled communication can decrease individual learning due to a higher conversational ambiguity (e.g., Kock and McQueen (1998)		(IT) substituted offline interactions bear the risk of ignoring important sources of information for organizational learning (e.g., Gill 1995)

Table 4: Multi-Level View on IS acting as Driver or Barrier for Organizational Learning

IT as driver for individuals

IS can act as a driver for individuals in organization learning in various ways.

IS facilitates individuals to explicate, represent and reflect their own knowledge. IS also supports the exchange and discussion of knowledge among geographically dispersed individuals. The role of IS can be summarized "by enabling individuals to make rich representations of their understanding, reflect upon those representations, engage in dialogue (…)" (Boland Jr et al. 1994, p. 3). Individuals who have discovered solutions for certain problems are able to share their experiences through IS enabled platforms (e.g., Goodman and Darr 1998; Hamilton and Scandura 2003; Majchrzak and Malhotra 2013; Scott 2000) explains further that IS (e.g. email and videoconferencing) facilitates collaboration among individuals bridging geographic or time barriers.

IS provides access to past experiences and thus helps individuals in their decision making process. Stein and Zwass (1995) state that IS provides access to different kinds of information and data (such as historical data, snapshots of current data, transaction data, and summarized data). The authors summarize this rich availability as "depth", offered by an organizational memory information system, which raises the confidences of individuals in their decision making.

IS make individuals aware of the organizational mission and targets. Thus, individuals are more committed to these organizational goals. Andreu and Ciborra (1995) explain this phenomenon as effectively forcing "individuals and groups in the organization to behave in a way consistent with the current business mission of the firm." (Andreu and Ciborra 1995, p. 13).

IS provides individuals with of information, which can help individuals with limited learning capabilities: "Faced with large volumes of information, individuals with limited memory may benefit significantly from knowledge repository technologies that enable them to compensate for this limitation" (Kane and Alavi 2007, p. 3).

IT as driver for groups

IS act as an enabler for knowledge sharing between groups within an organization. Different functional and organizational groups (i.e. departments or division) have very specific needs for information access. "Examples include sales and marketing, best practices, competitive intelligence, research and development, and general corporate resources" (Mack et al. 2001, p. 2). Specialized portals, so-called "vortals" address this requirement by providing in-depth capabilities focused on a certain organizational division. In this context, Dodgson et al. (2013) speak about "the sense of being there together" (p.14), fostered by IS. They investigated virtual worlds at IBM that created appropriate spaces for different forms of group interaction. Stein and Zwass (1995) call such systems, focusing on the enabling of business groups, "team memory" or "group memory". Such groups usually work on several projects, including virtual meetings with geographically dispersed participants. IS supports these groups in their explication and updating of common repositories.

IT as driver for the organization

IS enabled transfer of knowledge occurs at various levels: between individuals, from individuals to explicit sources, from individuals to groups, between groups, across groups, from the group to the organization (e.g., Alavi and Leidner 2001), and across organizational boundaries (Dodgson et al. 2013; Schlagwein and Bjørn-Andersen 2014).

IS departments within organizations play an important role for organizational knowledge. IS professionals are brokers of organizational knowledge and thus in strategic position to transfer knowledge among user communities that were historically isolated from each other (Pawlowski and Robey 2004).

IT as barrier for individuals

IS enabled communication come with the risk of higher conversational ambiguity. Thus, IS can decrease individual learning. (Kock and McQueen 1998) invested the impacts of email conferencing on individual learning. The authors showed that ambiguity is increased in communication when using IS. This is caused by the lack of immediate feedback during the conversation, especially when complex issues are discussed.

IT as barrier for the organization

IS can substitute offline interaction and therefore increasing the risk of ignoring important sources for knowledge, such as exchange with colleagues (see also IT as barrier for exploring).

6. Discussion and Research Agenda

The review above provides a common definition organizational learning and a comprehensive overview of research findings and insights about the relation of information systems (IS) and organizational learning to date. In this section, based on a discussion of particular aspects of our analysis, we briefly outline an agenda for future research on the role of information systems for organizational learning

IS offers several possibilities to support or develop new forms of organizational learning (such as online communities, open sourcing, crowdsourcing). As suggested in the most comprehensive organizational

learning literature review by (Argote 2012), IS potentially provide opportunities for organizational learning and should be further examined by researchers (Argote 2012). A few studies were conducted to fill this gap, focusing on e.g. crowdsourcing (Franke and Shah 2003; Majchrzak and Malhotra 2013; Schlagwein and Bjørn-Andersen 2014). Based on a longitudinal study of LEGO, Schlagwein and Bjørn-Andersen (2014) suggest that hierarchy-based learning is best for "expert intuiting" (solving problems that require expertise and experience) and learning through crowdsourcing is best for "entrepreneurial intuiting" (connecting different, previously unconnected contexts). Organizational learning theory should be applied to gain further insights about these new kind of organizational learning phenomenons.

Another unexplored domain in organizational learning and information literature is how organizations learn during the implementation of information systems. Organizational learning is essential during IS implementations (Phang et al. 2008), e.g. for team learning and cross-project transfer. However, only little attention is paid by IS workers on that topic (Newell and Edelman 2008) . For IS deployment projects the pace plays an important role, as it influences learning during a technical change. A gradual pace facilitates learning (Robey and Sahay 1996). Knowledge barriers and learning related endowments (human, technical, organizational) have a significant impact on the potential payoff of an IS project. "Firms that possess such endowments can innovate more economically and with greater probability of success, and this should increase the expected value of returns from investment" (Fichman 2004, p. 11). Organizations do not learn from their failures during the development of information systems for a variety of reasons. Lyytinen and Robey (1999) name limits of organizational intelligence, disincentives for learning, organizational designs, and educational barriers. We do not know much about how organizations learn, or should learn, when implementing information systems. Future research needs to examine how organizations go about, or could go about, documenting such learnings properly.

7. Conclusion

To conclude, information systems (IS) play an important role for organizational learning. IS and organizational researchers have described this role in diverse and sometimes conflicting ways. To sum up, the role of IS is increasingly important as a support of conventional forms of organizational learning, as

well as an enabler for new forms of organizational learning. In addition, IS have the ability to enable learning with externals, such as online communities or other organizations within ecosystems.

In our paper we developed a common understanding of organizational learning, based on historic and contemporary literature. We discussed the literature relevant for the relation between organizational learning and information systems (35 papers), both from a processual and a multi-level point of view, highlighting drivers and barriers of the theoretical phenomenon. Based on this, our paper supports future research on the role of information systems for organizational learning.

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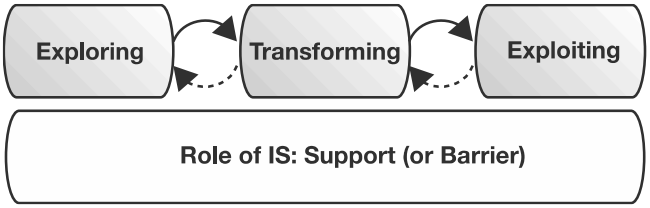
9. Appendix Table IT as driver/barrier (Process-perspective)

Organizational Learning / Processual Perspective			
	Scanning (Sensing, Intuiting)	**Interpreting (Transforming, Specializing)**	**Taking Action (Implementing, Exploiting, Institutionalizing)**
IT as Driver			
Pentland (1995)	"Within a particular knowledge system, the process of knowledge construction can draw upon a variety of sources, (…)" p.18	"Software is an excellent vehicle for storage and distribution (and thus for long-term memory) (…)" p.18	"But I would argue that information systems can also change the membership of an organization, the objects of its knowledge, and its criteria for truth." p.19 "It is reasonable to hypothesize that in situations where specialized knowledge is unevenly distributed, enhancing distribution processes (for example, via email) would be an effective means of improving organizational performance." p.17
Stein and Zwass (1995)	"Since an OMIS [organizational memory information system] is a memory-based system, the attendant processes of memory also need support. Memory may be parsed into the processes of acquisition, retention, maintenance, search, and retrieval of information" p.19	"Information-retrieval systems permit efficient search and retrieval through extensive indexing" p.22" An OMIS can support higher-level learning by (i) providing a partial record of existing norms and standards, which are thus made explicit and subject to review and modification, and (ii) providing a means to encode the outcomes of higher-level learning for future use." p.28	

Andreu and Ciborra (1996)	"One way is through IT applications that facilitate experimentation with new resources, in particular with new sources of information and with IT itself (e.g. encouraging to use new technologies in pilot projects, etc." p.11	"IT/IS can contribute to the routinization and capability learning loops in several ways, facilitating the learning that takes place and spreading it to all the individuals and groups involved" p.11 "Share work practices and facilitate communication within groups and among groups." p.11	"IT-based support is also feasible here: (…) Facilitate reflection, experimentation and training on routines and capabilities." p.12
Yap and Bjoern-Andersen (1998)	"(…)made equally accessible to all sales channels worldwide" p.10	"(…) technologies, through their ability to generate rich knowledge representations, are a vital innovation in capturing the complex essence of expert knowledge." p.13 "(…) rich knowledge representations and ubiquitous artificial memory, expert knowledge/know-how can be effectively shared in virtual work environments" p.14	"New technical product knowledge and marketing competence enabled the global sales force to penetrate a broader range of markets and sectors." p.12
Goodman and Darr (1998)	"The role of the computer-based system was to identify expertise and information from the firm's global operation and share that information across distributed work settings." p.4 "The ELS [electronic library system], (…), did meet the necessary criteria to be called a computer-aided organizational learning system. lt facilitated communication across time and space. lt created a memory independent of any individual, and it allowed for searching for solutions and for updating of the memory" p.21 "the CAS [computer aided systems] for learning may be		

	better suited for homogeneous environments The commonality of the problems, tasks, and languages within the distributed communities was key to facilitating knowledge sharing" p.22		
Janson et al. (1997)	"This system ensures access to information in unencumbered, effective, and efficient ways" p.13		
Lyytinen and Robey (1999)	"(…) information technologies enhance organizational learning by increasing members' communication and by supporting discourse among them." p.33	"The advantages include greater access to organizational memory, especially from remote locations, and greater opportunity to test and challenge prevailing assumptions and routines" p.33 "Systems that support learning by embedding routines into memory and storing historical information may be useful as long as the assumptions on which they are built do not become obsolete." p.34	
Scott (2000)	"At the lower level, electronic adaptive learning systems adjust to stimuli and provide fast feedback to promote greater efficiency using explicit knowledge" p.3 "In the first direct way, IT facilitates lower-level learning via a feedback mechanism using explicit knowledge encoded in information systems." p.27	"Interactive electronic feedback and electronic distribution of information and knowledge facilitate IOL [Inter organizational Learning]" p.23 "IT increases the range, amount, and velocity of information flow spanning boundaries within the organization, between organizations, and across time and space" p.23 "Finally, IT facilitates IOL indirectly by improving collaboration. Email and videoconferencing allow partners to discuss and explain issues despite organizational, geographic, or	"Facilitation of the IOL process with IT helps cope with geographical dispersion and the pressure to bring new products to market quickly" p.27

		time barriers. This exposes partners to a diversity of knowledge that may encourage change in organizational routines." p.28	
Alavi and Leidner (2001)	"Role of IT is to provide access to sources of knowledge rather than knowledge itself" p.5 "Role of IT involves gathering, storing, and transferring knowledge" p.5 "Role of IT is to provide effective search and retrieval mechanisms for locating relevant information" p.5	"Role of IT is to provide link among sources of knowledge to create wider breadth and depth of knowledge flows" p.5 "IT can also enhance the speed of knowledge integration and application by codifying and automating organizational routines." p.16 "IT can enhance knowledge integration and application by facilitating the capture, updating, and accessibility of organizational directives" p.16	"Role of IT is to enhance intellectual capital by supporting development of individual and organizational competencies" p.5
Mack et al. (2001)	"In order to make content accessible to the portal base technologies and ultimately to users, documents need to be automatically gathered by the system, registered, managed, and analyzed." p.7	"The raison d'être of portals is dissemination of knowledge captured in electronic form" p.20	"This emerging knowledge workplace will support targeted knowledge work tasks more directly and integrally, (…). This workplace will emerge even as the KW's [Knowledge worker] software environment expands and becomes more distributed and varied." p.24
Griffith et al. (2003)	"We believe that it is also possible that more virtual teams, having made their knowledge more explicit and having used technological tools for communicating this knowledge(e.g., e-mail),will have permanent (and searchable) access to this knowledge" p.8	"Thus, information technology is a jealous mistress to the extent that technologically enabled settings are more likely to create opportunities to intentionally, or even unintentionally move individual level knowledge into organizationally accessible repositories" p.17	
Ashworth et al. (2004)			"Evidence indicates that IT not only positively affects current period productivity but also magnifies an

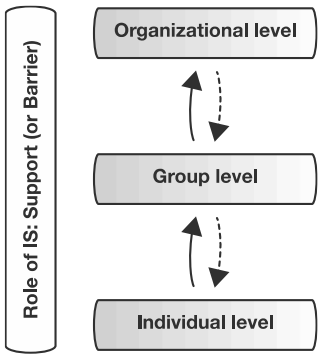
			organization's ability to translate knowledge gained over past accumulated production experience into incremental productivity increases." p.9
Gregor (2006)	"These results show that organizations believe they gain greatest value from improved informational flows with IT, with faster and easier access to information and improved information for managing the information" p.17	"Transformational benefits also were rated relatively highly, with firms perceiving benefits from more highly skilled employees (…)" p.17	"(…) new business plans and models and improved capabilities, structures, and processes." p.17
Janson et al. (2007)	"In single-loop learning, where learning processes are typically well structured, the role and tasks of IT systems can be defined in advance and often realized with off-the-shelf software products. (…) The use of such IT systems, however, becomes so embedded in work processes that they become an integral and indispensable part of the learning loop, so much so that the breakdown of the IT system interrupts both working and learning. Sava's experience also shows that the success of single-loop learning depends on workers' skills and their training in the IT systems' use." p.30	"But thanks to new learning structures, processes and IT systems, 'grass-root' members engaged in double-loop learning: they participated in intersubjective sense-making concerning the new environment and the new company vision" p.29 "IT systems may improve learning and make it more efficient and effective" p.30 "IT applications are envisaged as part of new channels and structures for organizational learning." p.31	"IT applications broadly support triple-loop learning: Sava's top management is generally informed by various IT systems that contribute to their awareness and understanding of organizational problems and increase their sensitivity to specific learning issues" p.31
Kane and Alavi (2007)	"Other tools (…) cultivate exploration by preserving knowledge heterogeneity, resulting in better long-term results, (…)" p.15	"These [IT-enabled] mechanisms function not only by preserving the valuable knowledge for later use by the organization, but also by assimilating new employees quickly into the organization and imparting on them the relevant knowledge to address the environmental conditions" p.16	"Certain tools (…) tend to promote exploitation by reducing knowledge heterogeneity, leading to improved results for the short term (…)" p.15

		"These tools better retain essential divergent knowledge in the organization that provides a knowledge base from which to effectively respond to inevitable changes in future knowledge requirements" p.16	
Bjelland and Wood (2008)	"The methodology that IBM utilized to find and make use of the most valuable comments started with sophisticated text mining software" p.7	"Human and machine together can effectively cluster many related postings, (…)" p.8	"The successes so far show that the IBM Jam process has helped IBM to innovate" p.5
Mueller et al. (2011)	"It is evident that virtual worlds bear potential for KM because they overcome several barriers of established technologies in order to facilitate interactive knowing and knowledge processes. The emergence of virtual worlds knits together knowledge workers in a way that was previously technically not feasible" p.17 "We could show that not only existing tacit and explicit knowledge can be accessed and shared (…)" p.17	"Virtual worlds can be applied for dynamic, practice-based and experience-rich knowledge generation far above the pure collection of knowledge in databases" p.13 "Virtual worlds can be applied for dynamic, practice-based and experience-rich knowledge generation far above the pure collection of knowledge in databases. Interactive and multimedia-rich environments allow to embed existing knowledge in relevant contexts, settings and timing, and further provide communication along many channels concurrently" p.14 "(…) also new knowledge is generated (…)" p.17 "(…) also new knowledge (…) is applied, thus supporting processes of knowing" p.17	
Majchrzak and Malhotra (2013)		"Firms are increasingly experimenting with new ways to make this external engagement for innovation more effective and efficient. Crowdsourcing for	

		innovation provides one such approach." p.10	
Schlagwein and Bjørn-Andersen (2014)	"because it enables an additional, complementary mode of intuiting (…)" p.18	"IT not only "supports" learning but also "enables" and shapes crowdsourced learning" p.16 "IT-enabled crowdsourcing allows the organization to learn from non-members and, in this way, the organization "broadens the base of minds" from which it can learn." p.18	
IT as Barrier			
Gill (1995)	"The role of middle managers in scanning (…) the environment (…) cannot be replaced with information technology." p.16	"The role of middle managers in interpreting (…) the environment (…) cannot be replaced with information technology." p.16	By implication not performed.
Pentland (1995)		"Software is an excellent vehicle for storage and distribution (…), but it tends to suffer from the problem of changing relevance for just that reason." p.18	"The very systems that are meant to increase our information processing capabilities, thereby increasing understanding, may have the opposite effect by restricting the range of our inquiry and experience, effectively putting us in a kind of epistemological box." p.20
Stein and Zwass (1995)	"However, higher-level learning requires enactment of organizational processes directed at exploratory learning. These processes include organizational experiments and the acquisition of experience from outside through the grafting of new members and assimilating the experience of other organizations. Reliance on an OMIS that does not evolve through such processes may be expected to atrophy higher-level organizational learning" p.28	By implication not performed	By implication not performed

Robey et al. (2000)	"Thus, as with the other theories considered, organizational learning operates in dialectic fashion where new learning replaces old knowledge at the same time that the stores of existing knowledge preclude new learning." p.13	By implication not performed	By implication not performed
Lyytinen and Robey (1999)	"organizations may become overly dependent on formal systems and thereby lose their appreciation for less formal representations of organizational memory" p.31	"When business conditions change, however, those technologies may constrain search for new information and mask the logic underlying "intelligent" routines" p.34	"In each of these case studies, information technology disabled organizational learning" p.32
Griffith et al. (2003)	"Simultaneously, the same systems significantly hamper the ability of team member to create new, tacit knowledge through team interaction. (…)When this happens, the particular individual is no longer so unique or valuable a contributor within the organization. Thus, the relationship between the individual and the organization may be changed by information technology." p.17	By implication not performed	By implication not performed

10. Appendix Table IT as driver/barrier (Level-perspective)

Organizational Learning / Multi-Level Perspective			
	Individuals	**Groups**	**Organization**
IT as Driver			
Boland Jr et al. (1994)	"(…) information technology can support distributed cognition by enabling individuals to make rich representations of their understanding, reflect upon those representations, engage in dialogue about them with others, and use them to inform action" p.3	"a distributed cognition system that improves a group's ability to represent their interpretations, (…),will provide the conditions for surfacing and challenging important assumptions " p.5 "(…) information technology to support the interweaving of individual and group decision making processes" p.7	"Implications from that theoretical position were used to develop a set of design principles for information systems that would support distributed cognition in an organizational setting." p.17
Pentland (1995)	"The information system described here was specifically designed to embody technical knowledge and automate key aspects of a job that was generally performed by engineers." p.17	"Socially enacted knowledge distribution processes allowed members of the organization to collectively solve a stream of problems that no individual could have solved alone" p.17	"information systems change the fabric of social epistemology and the backdrop against which organizations construct, organize, store, distribute, and apply knowledge." p.19
Stein and Zwass (1995)	"An OMIS [organizational memory information system] is expected to have an effect on the performance of individual decision makers. (…) the "depth" offered by an organizational memory information system will have a similar confidence-raising	"Systems that are called team or group memory are oriented toward the support of a business team working on a set of projects and involving a large number of meetings with participants who are possibly dispersed in space" p.10	"An OMIS [organizational memory information system] is expected to enhance lower-level learning in all types of organizations, although we expect these benefits to be more pronounced in organizations that favor loosely structured teams" p.27

	effect on the decision makers" p.28	"By extension, an OMIS [organizational memory information system] will have the same effect on lower-level learning in groups." p.28	
Andreu and Ciborra (1996)	"IT applications that disseminate the business mission (…) effectively 'force' individuals and groups in the organization to behave in a way consistent with the current business mission of the firm" p.13 "(…) straight-forward applications (…) may be very effective in facilitating work practices' sharing, and in putting different work practices, 'owned' by different individuals or groups even geographically dispersed, to work effectively together." p.11		"(...) enhance the learning processes taking place in the organization, (...) by better embedding IT the core capabilities of the organization." p. 15
Goodman and Darr (1998)	"To contribute means that individuals who have discovered solutions to problems are willing to share these with others in different locations" p. 5		"Rapid developments in information technology should contribute to enhancing organizational learning" p.23
Hine and Goul (1998)	"several users stated that the OLSS [Organizational Learning Support System] technology helped them consider severa1 different environmental factors that would otherwise have been overlooked." p.28	"This system allows groups of managers to create individual maps of their strategies in the form of goals, options, and concepts." p. 5 "This research has also extended the application of knowledge-based systems in strategic management to the group paradigm" p.29	"It is our belief that organizational tools such as the OLSS [Organizational Learning Support System] will become common in future knowledge-based organizations" p.30
Kock and McQueen (1998)	"reduction (…) of the disruption that group discussions are likely to cause for individual group members, particularly when these members are from different departments" p.21	"EC [email conferencing] support effects on PI [process improvement groups] groups can be summarized as: (a) A reduction of the influence of distance and other physical obstacles to the participation of members from different departments in PI groups" p.21 "A reduction of interdepartmental conflict obstacles to the formation of PI groups" p.21	"EC [email conferencing] support seems to have a positive impact on knowledge dissemination in organisations" p.21

Yap and Bjoern-Andersen (1998)			"VR [Virtual Reality]/3D representations also allow a higher level of interactivity and richer integrative perspective (…), these two attributes are key to addressing the learning process because they provide a better feedback loop for the user." p.12
Scott (2000)	"IT facilitates IOL indirectly by improving collaboration. Email and videoconferencing allow partners to discuss and explain issues despite organizational, geographic, or time barriers" p.28		"Facilitation of the IOL process with IT helps cope with geographical dispersion and the pressure to bring new products to market quickly" p. 27
Alavi and Leidner (2001)	"It may be argued that the greater the shared knowledge space, the less the context needed for individuals to share knowledge within the group and, hence, the higher the value of explicit knowledge and the greater the value of IT applied to knowledge management.." p.6	"Electronic mail and group support systems have been shown to increase the number of weak ties in organizations. This in turn can accelerate the growth of knowledge creation" p.11	"Transfer occurs at various levels: transfer of knowledge between individuals, from individuals to explicit sources, from individuals to groups, between groups, across groups, and from the group to the organization." p.13
Mack et al. (2001)	"Some of the customization burden can be alleviated by allowing individuals to personalize their own portal" p.23	"This is especially true for internal corporate portals, where different functional and organizational groups and lines of business may have substantially different needs for information access and organization." p.2	
Hamilton and Scandura (2003)	"E-mentoring takes advantage of technology to broaden the definition of mentoring relationships by relaxing the constrains of geographical location and time" p.13		
Ashworth et al. (2004)			"IT improves the rate at which organizations learn" p.8

Pawlowski and Robey (2004)			"IT professionals as brokers of organizational knowledge" p.22
Bhatt and Grover (2005) Bhatt and Grover (2005)			"(…) higher levels of the intensity of organizational learning had a strong significant positive effect on (a) the quality of the IT infrastructure, (b) the level of IT business experience." p.19
Cotteleer and Bendoly (2006) (Bhatt and Grover 2005)			"Overall we find support for our hypothesis regarding the dynamics of on-going learning-based ERP benefits" p.30
Gregor (2006)			"There are lessons for managers in the results that show how organizations have coupled investments in IT with organizational learning and change to achieve increased value from IT" p.19
Kane and Alavi (2007)	"Individuals who use these IT-enabled learning mechanisms may have different learning characteristics than others who use the same mechanisms, leading certain individuals to benefit more from one type of mechanism than another type" p.2 "In contrast, this effect might be compensatory-IT augmenting underdeveloped individual learning capabilities. Faced with large volumes of information, individuals with limited memory may benefit significantly from knowledge repository technologies that enable them to compensate for this limitation." p.3		"Our results suggest that organizations can use IT to compensate for the effects of turnover and turbulence" p.16
Mueller et al. (2011)	"Users can learn how new products function, recognise their benefit, build Virtual		"We also show that flow-like experiences occur during the SL [virtual technology]

	worlds as knowledge management platform judgements, come up with new ideas and provide additional requirements, all of which are valuable for innovation teams" p.14		sessions when users are engaged in knowledge activities and identify herewith an important antecedent of learning and creativity." p.17
Dodgson et al. (2013)	"Organizational learning is based on social interaction, and users of virtual worlds were motivated to work and collaborate in a graphically rich, high-fidelity, interactive media that offer presence and copresence, or shared experiences." p.14	"The sense of "being there together" is enhanced by the technology, providing the capacity to create appropriate spaces for various forms of social interaction. These use "locational clues" to construct spaces conducive to different objectives, from creativity to information sharing" p.14	"Because of their immersive nature, visualization capacities, and opportunities for serendipity, virtual worlds enriched communications, shared understanding, and enabled learning across organizational and other boundaries—disciplinary, geographical, professional—in ways other information and communications technologies could not achieve" p.13
Majchrzak and Malhotra (2013)	"The developmental nature of a more collaborative crowdsourcing process may lead to a higher level of learning for individual participants (…)" p.9		
Schlagwein and Bjørn-Andersen (2014)	"Organizational learning with crowdsourcing is hence likely to produce different ideas on the individual level" p.13 "That is, intuiting and interpreting were systematically performed by non-members of the organization via IT." p.13	"(…) and groups that performed the intuiting and interpreting were not organizational members (…). Furthermore, this type of external learning was enabled and shaped by IT." p.15	"(…) we argue that crowdsourcing as in the LEGO case constitutes a legitimate and effective form of organizational learning" p.14
IT as Barrier			
Gill (1995)			"(…) heavy reliance on information technology inhibited organizational learning." p.15
Kock and McQueen (1998)	"The main reason for the decrease in individual learning, according to the respondents, was the higher conversational ambiguity caused by the EC, (…)" p.20	By implication not performed	By implication not performed

Paper III
Organizational Learning Through Internal Crowdsourcing: A Case Study of BOSCH

Prepared as Full Paper

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Internal Crowdsourcing as Organizational Learning: A Participant-Observer Study at BOSCH

Oliver Zuchowski
University of Bamberg
An der Weberei 5
96047 Bamberg
oliver.zuchowski@uni-bamberg.de

Daniel Schlagwein
UNSW Australia Business School
UNSW Sydney
NSW 2052, Australia
schlagwein@unsw.edu.au

Kai Fischbach
University of Bamberg
An der Weberei 5
96047 Bamberg
kai.fischbach@uni-bamberg.de

Abstract: The use of IT-enabled internal crowdsourcing with employees in organizations has substantially increased in recent years. Practitioners invest much effort in implementing internal crowdsourcing, without being sure about the outcomes they can expect for their organization. Being a novel phenomenon, internal crowdsourcing is also poorly understood theoretically. Organizational learning theory has been successfully applied to gain revelatory insights for external crowdsourcing with end-users. Hence, it is promising to analyse internal crowdsourcing as a form of organizational learning. This research paper examines the question how organizations learn through internal crowdsourcing. Based on a longitudinal interpretivist participant-observer study from 2013 to 2019; this research builds on and extends organizational learning theory through analysing two internal crowdsourcing communities of BOSCH, a German automotive supplier. Findings show that internal crowdsourcing can be understood as a part of a new wave of IT-enabled learning in organizations. Organizations do not only learn by generating crowdsourced solutions to their problems (single-loop learning), but also improve their know-how about crowdsourcing (i.e. context-specific double-loop learning) and open up their corporate culture (i.e. organizational double-loop learning).

Keywords: internal crowdsourcing, enterprise crowdsourcing, organizational learning, knowledge management, knowledge management system, social media, social business, case study, ethnography, interpretivist

1. Introduction

Organizations in the digital age face increasing technological demands that require fast learning. Social IT fosters communication, problem solving, and learning to democratize knowledge among organizations (Arora et al. 2020; Modaresnezhad et al. 2020). "Crowdsourcing" tasks to a large group of people is a famous example for a novel organizational process, enabled by social IT, that supports organizational learning (Schlagwein and Bjørn-Andersen 2014). Crowdsourcing makes knowledge and skills of a distributed crowd of people accessible for organizations (Nevo and Kotlarsky 2020). A specific form of crowdsourcing is created by narrowing down the involved crowd to identifiable internal employees, rather than independent externals. This "internal crowdsourcing" has emerged as a phenomenon in practice and has created a first generation of research (Zuchowski et al. 2016).

While the impact of external crowdsourcing on organizational learning has been already shown in a few studies (Majchrzak and Malhotra 2013; Schlagwein and Bjørn-Andersen 2014), we have no insights about how organizations learn, using internal crowdsourcing. This is because internal crowdsourcing is newer and hardly visible outside the organization (Zuchowski et al. 2016). Hence it is promising to have a closer look on internal crowdsourcing through the organizational learning lens. As the impact of internal crowdsourcing is potentially even more relevant for the organization (Benbya and Van Alstyne 2010; Simula and Vuori 2012; Zuchowski et al. 2016) we focused on the internal version of crowdsourcing and uncovered its' yet unknown role for organizational learning.

The purpose of this research is to contribute specifically to our understanding of internal crowdsourcing vis-à-vis organizational learning theory. We answer the research question: *How do organizations learn through internal crowdsourcing?*

Answers to this question are given based on a longitudinal, actor-observer (auto-ethnographic), interpretivist case study (Barrett and Walsham 2004; Klein and Myers 1999; Walsham 1995; Walsham 2006), of internal crowdsourcing initiatives at BOSCH. BOSCH is a multinational engineering and technology company with over 400,000 employees, headquartered in Germany. We observed two internal crowdsourcing communities at BOSCH from 2013 to 2019 through a unique perspective. One member of

our research team was BOSCH's crowdsourcing manager, giving us the opportunity to follow up on the lifecycle of the two crowdsourcing communities from the beginning and to reflect on their role for organizational learning. [### mention two communities]

The analysis of BOSCH's two internal crowdsourcing communities reveal three different types of learning. First, organizations learn by receiving crowdsourced solutions to a stated problem from a crowd of solvers (i.e. employees), "activated" by an open call. This is "classic" single-loop learning (we use Argyris and Schön (1978)'s organizational learning theory) brought to the digital age by social IT. Internal crowdsourcing's learning goes beyond this digitalized question – answer loop. Second, organizations improve their know-how about crowdsourcing with every crowdsourcing campaign, what we call context-specific double-loop learning. Third, an opening up of the organization's corporate culture is observable, a phenomenon we describe as organizational double-loop learning. In the remainder of the paper, we present and discuss these findings of the BOSCH study in detail.

The paper is organized as follows. The second section lays the foundation of this research by summarizing the empirical context (crowdsourcing), followed by the third section, the theoretical background (organizational learning theory). The fourth section explains the research method (interpretivist ethnography and longitudinal case study). An overview on the empirical material (case synopsis and empirical findings) is given in section five. Section six (theoretical analysis) presents the theoretical interpretation of the empirical material. Finally, section seven gives a conclusion and an outlook on future work.

2. Prior Work on Crowdsourcing

In the following section we place this paper within the crowdsourcing literature and give an overview on what we already know about this emerging phenomenon.

Advancements in social IT enable new organizational sourcing models with crowdsourcing being a particular famous one. Crowdsourcing describes "the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the

form of an open call" (Howe 2006, p. 1). It makes it possible for organizations to access knowledge and skills resources beyond organizational borders (Fréry et al. 2015). Crowdsourcing is an emerging phenomenon that exemplifies the changing relationship between workers and firms (Taylor and Joshi 2019). Generally, crowdsourcing can be seen as an online, distributed problem-solving approach that provides solutions to problems and tasks by unfolding the potential of large groups of solvers via social IT, instead of applying traditional hierarchy-based working models (Brabham 2008; Estellés-Arolas and González-Ladrón-De-Guevara 2012; Howe 2006; Pedersen et al. 2013; Prpić et al. 2015; Zuchowski et al. 2016).

The popularity of crowdsourcing is increasing for both researchers and practitioners, especially after the term was coined in 2006. Although, the concept of crowdsourcing existed long before the term was used. Several examples of sourcing tasks to from a crowd can be found in history. In 1714 the British Government offered rewards for a simple and practical method for the precise determination of a ship's longitude at sea. In 1814 the first version of the Oxford English Dictionary received submissions from hundreds of outsiders in response to an open call. The Sydney Opera House design, famously, was based on global, open call for design submission won by an at the time little-known Danish architect (Dawson and Bynghall 2012; Morgan and Wang 2010; Schlagwein and Bjørn-Andersen 2014; Surowiecki 2004).

Even though crowdsourcing has received a lot of attention, literature on crowdsourcing just recently started to evolve (Afuah and Tucci 2012; Bayus 2013; Poetz and Schreier 2012; Schlagwein et al. 2019; Schweitzer et al. 2012; Stieger et al. 2012). Researcher focus on certain types of crowdsourcing, such as "micro-task crowdsourcing" (Deng et al. 2016), or use general terms like "crowdwork" (Gol et al. 2019) and refer to a form of social IT enabled organizational form. Others continue using the broad term "crowdsourcing", but define it more specific according to their research (Nevo and Kotlarsky 2020). Estellés-Arolas and González-Ladrón-De-Guevara (2012) made a study of definitions of crowdsourcing. They found more than 36 definitions of crowdsourcing in the extant literature. They extracted information about the crowd of solvers, the requester, and the process. In their integrated definition, crowdsourcing is a type of participative online activity in which solvers voluntary undertake tasks through an open call.

Crowdsourcing has many definitions, and thus it was often misunderstood (Hopkins 2011). There exist a large number of (overlapping) terms under the headline "crowdsourcing", including (and not limited to):

Distant Search (Afuah and Tucci 2012; Piezunka and Dahlander 2015), Opensourcing (Ågerfalk and Fitzgerald 2008), Crowdfunding (Gleasure 2015; Gleasure and Morgan 2018), Open Collaborative Innovation Projects (Baldwin and Von Hippel 2011), Peer Production (Benkler 2017), Community Based Innovation System (Franke and Shah 2003), Wikinomics and Mass Collaboration (Tapscott and Williams 2008), Collaborative communities (Adler et al. 2008), Transaction-Free Zones (Baldwin 2008), Open Collaboration (Levine and Prietula 2014), Electronic Networks of Practice or Online Communities (Faraj et al. 2011; Kollock 1999), User generated content (Lukyanenko et al. 2017), Open Strategy (Tavakoli et al. 2017; Whittington et al. 2011), Open Government (Janssen et al. 2012; Kornberger et al. 2017), Open Science (Nosek et al. 2015), Crowdsourcing for education (Prester et al. 2019), Crowdsourcing in IS research (Love and Hirschheim 2017), Open Innovation (Chesbrough 2003; Liu et al. 2020; West and Gallagher 2006), human cloud (Kaganer et al. 2013), online marketplace (Gefen and Carmel 2008), Wikipedia and specialized wikis (See et al. 2015), online reputation systems (Malone et al. 2010), spatial crowdsourcing (Miao et al. 2016), customer support (Lu et al. 2015), micro-task crowdsourcing (Deng and Joshi 2016), innovation contests (Bockstedt et al. 2015), crowdvoting (Garrigos-Simon et al. 2017), and innovation networks (Liu et al. 2020).

In order to decide what is crowdsourcing and what is not, several criteria were introduced. Crowdsourcing needs: a requestor, a crowd of solvers, a task with a clear goal and expected outcome, remuneration principles, a participative process, an open call, and social-IT as platform (Estellés-Arolas and González-Ladrón-De-Guevara 2012; Zuchowski et al. 2016). These criteria make it possible not only to clarify if an observed phenomenon is crowdsourcing or not, but also to distinguish between different types of crowdsourcing.

Typically, crowdsourcing refers to external crowdsourcing, i.e. the involvement of a crowd, outside of organizational boundaries (such as customers or anonymous workers). Organizations apply external crowdsourcing for several purposes (Blohm et al. 2013) . Often it is used to create or improve products (Bayus 2013) and services (Orlikowski and Scott 2014). Famous examples of organisations applying external crowdsourcing are Dell (Di Gangi et al. 2010), LEGO (Schlagwein and Bjørn-Andersen 2014), SAP (Leimeister et al. 2009) and Starbucks (Gallaugher and Ransbotham 2010). External crowdsourcing has

been also applied in various fields such as health care (Ghosh and Sen 2015), public policy (Aitamurto 2012) and journalism (Hermida 2010). Furthermore, crowdfunding makes it possible for organizations to fund their activities with external resources, i.e. crowdfunding (Kuppuswamy and Bayus 2013).

Another type of very popular though less researched type crowdsourcing is internal crowdsourcing inside the organizational boundaries. Internal crowdsourcing is a practice or method to activate or find knowledge or skills of employees within an organization who would not otherwise be involved (Zuchowski et al. 2016). If an organization is sufficiently broad and heterogeneous, its employees also can act as a crowd of solvers (Bjelland and Wood 2008). Large multinational organizations, such as IBM (Bjelland and Wood 2008) or Deutsche Telekom (Rohrbeck et al. 2015), frequently, and systematically, use crowdsourcing with internal employees to innovate idea or predict the future. Internal crowdsourcing leverages the expertise and heterogeneous knowledge of organization's employees (Howe 2006) and provides a platform to access solver's tacit information to enhance the organizations' competitive advantages (Simula and Ahola 2014).

Further research to explore the extant literature on crowdsourcing is called for (Leimeister et al. 2009; Nevo and Kotlarsky 2020).

Internal crowdsourcing has unique characteristics. In contrast to external crowdsourcing, internal crowdsourcing is more long-term oriented, as solvers are permanent employees. Factors such as change management and long-term incentivisation become important. As employment contracts are in place, there is less legal framing required. Internal crowdsourcing is an effective model to integrate internal knowledge distributed across the organisation whereas external crowdsourcing has more potential to reveal 'outside-the-box' solutions resulting from distant knowledge (Afuah and Tucci 2012; Jeppesen and Lakhani 2010; Schlagwein and Bjørn-Andersen 2014). IT is an important driver for internal crowdsourcing. Internal crowdsourcing is - like crowdsourcing in general - a social IT-enabled phenomenon that takes place via social media (e.g., wikis, blogs, forums) or on specific crowdsourcing platforms (IBM Hype). Internal crowdsourcing can be executed in a collaborative (Bjelland and Wood 2008) or competitive manner (Simula and Ahola 2014).

Zuchowski et al. (2016) provide a review of all internal crowdsourcing research currently available.

Although being widely applied by practitioner, the internal version of crowdsourcing received much less attention in research. At individual level internal crowdsourcing research efforts focused on e.g. solver's motivations (Benbya and Van Alstyne 2010) or the role of IT (Bailey and Horvitz 2010). At organizational level only little research was conducted so far and we are still lacking knowledge about internal crowdsourcing, how it works and what makes it special. Thus, in this study we will have a look on internal crowdsourcing from the organizational perspective.

2.1 Theorising Crowdsourcing

Crowdsourcing research lacks theory, especially on organizational level of analysis (Geiger et al. 2011; Majchrzak and Malhotra 2013; Schlagwein and Bjørn-Andersen 2014). All research efforts on organizational level focused on "traditional", external crowdsourcing so far.

One set of research papers focuses on the questions, why organizations prefer to choose collaborative working over other sourcing options. Afuah and Tucci (2012) developed a model describing factors that influence the probability that an organization will choose crowdsourcing over other types of work. Their model embodies characteristics of the problem, knowledge required to solve the problem, the crowd, and the solution. Another research conducted by Ye and Kankanhalli (2017) reflect antecedents of the decision to crowdsource, like skills access, solution diverseness, costs and brand popularity.

Another major question, which has been stated on organizational level is, how crowdsourcing activities have been designed. Studies either targeted on the first phases of crowdsourcing design, including the problem statement, the contest mode (competitive vs. collaborative) and remunerations, or targeted the impact of such design decisions on the outcome of crowdsourcing. Terwiesch and Xu (2008) worked on first design phases of different crowdsourcing campaigns, and found out that performance-driven remunerations work better rather than fixed-price awards. Archak and Sundararajan (2009) analyzed different remuneration structures and their impact on the campaign's outcome. Martinez (2017) focused on how design decisions (such as the campaign's difficulty level and autonomy, task variety, and learning characteristics) affect the quality and number of solutions. Leimeister et al. (2009) analyzed crowdsourcing design in terms of how competition and motivation can be increased within a campaign. Ghezzi et al. (2018)

studied the effect on campaign's outcome of different interaction scenarios looking at characteristics of the problem, solvers, and the platform,

Further papers cover all phases of crowdsourcing campaigns from a broader perspective, serving as general organizational guidelines for crowdsourcing. These research efforts analyze how crowdsourcing works by providing a framework on how to crowdsource (Bonabeau 2009), summarize necessary capabilities for organizations before initiating crowdsourcing (e.g. Nevo and Kotlarsky 2020), as well as describe how the obtained knowledge from a campaign can be integrated (Malhotra et al. 2017).

The solvers' behavior has been investigated from the organizational perspective as well. Koh (2014) analyzed how provided information by organizations can influence solvers strategies. Chua et al. (2015) reflected on cultural alignment between requestors and the solvers. Gatzweiler et al. (2017) investigated on how unintended and unwanted content in crowdsourcing campaigns affects organizations innovation potential and Ebel et al. (2014) showed how an organization can apply a pyramid approach to find new solvers.

Another topic covered by crowdsourcing literature on organizational level is the evaluation, selection of crowdsourced inputs. In this crucial phase the organization needs to sort out, aggregate, and evaluate solver's submissions, which is a high effort for organizations (Nagar et al. 2016). This phase might become very challenging, especially if a crowdsourcing campaign received many ideas. This large pool of submissions is referred to as "crowding". When crowding occurs, organizations are only able to focus on a subset of this submission. In this case organizations often focus on ideas which are familiar to what organizations already know or do. The authors propose three measures (i.e. content distance, structural distance, and personal distance) to evaluate the extent to which a crowdsourced idea differs from the what is already known (Piezunka and Dahlander 2015). Several approaches exist to automate the crowdsourcing evaluation process. This can be done by analyzing different features of the submission, such as length, completeness, likes received, and further linguistic parameters (Nagar et al. 2016). Hoornaert et al. (2017) present approaches how to aggregate and assess ideas based on content, the solver, and the crowd.

The utilization of crowdsourced ideas has been also investigated from the organizational perspective. It has been documented that organizations successfully crowdsourced ideas for new or improved products (Bayus 2013; Huang et al. 2014) and services (Orlikowski and Scott 2014). Organizations crowdsourced functional design solutions, referred to as "design crowdsourcing (Allen et al. 2018)". If organizations present crowdsourcing as the source of their design ideas to customers, it has a positive impact on product sales (Nishikawa et al. 2017). Further research presents the value of crowdsourced data (Steelman et al. 2015), and the ability of solvers to compete with experts from the RandD department in terms of novelty, and feasibility of submitted ideas (Poetz and Schreier 2012). A novel framework for improving the outcomes of crowdsourcing learning tasks has been introduced by (Hu et al. 2016).

Finally, literature on the organization level see crowdsourcing as ongoing phenomenon, rather than focusing on isolated crowdsourcing campaigns. (Fayard et al. 2016) showed how organizational culture influences the emergence and success of crowdsourcing. Based on the organization's attitude towards novel insights, organizations reject, adopt or even adapt crowdsourcing. Fréry et al. (2015) had a look on organizational strategy and crowdsourcing. They found out that the outcome from crowdsourcing business models can outweigh the value of a few unique strategic assets (i.e. "crowd jewels"). Morgan and Wang (2010) worked on a decision tree to guide organizations when repeated crowdsourcing campaigns are advantageous.

Organizational learning is another evident area in studying crowdsourcing long-term. Only limited scholarly attempts for crowdsourcing vis-à-vis organizational learning theory exist (Schlagwein and Bjørn-Andersen 2014). Only three papers discuss on how organization learn with crowdsourcing, one at the individual level (Huang et al. 2014), and two at the organizational level (Majchrzak and Malhotra 2013; Schlagwein and Bjørn-Andersen 2014). Crowdsourcing fosters organizational learning through externals and infuses traditional learning over the long term. Four main learning processes are observable in the nature of crowdsourcing. The external crowd is intuiting and interpreting information, the integration and institutionalization of information is still done by internal employees. This phenomenon is referred to as "ambient organizational learning". Crowdsourcing enables a broader base of minds that can be used for organizational learning (Schlagwein and Bjørn-Andersen 2014). Majchrzak and Malhotra (2013) analyzed

crowdsourcing as a method for innovation. The authors found out that crowdsourcing enables organizations to learn from external sources which results in internal idea generation and innovation. The research paper is written based on open innovation literature. In contrast to previous literature the authors state that information systems are not just an enabler for open innovation, but rather a shaper to optimize open innovation and especially crowdsourcing.

In the most recent literature review about crowdsourcing, Nevo and Kotlarsky (2020) see a specific opportunity in developing a multi-level learning model for crowdsourcing as long-term and ongoing phenomenon. The authors suggest to take a holistic approach for studying crowdsourcing by including both learning during crowdsourcing campaigns as well as continuous learning between individual campaigns. Schlagwein and Bjørn-Andersen (2014)'s "ambient learning" framework, including both externals and internal members of the organization, is already a first step towards such as holistic model. Nevo and Kotlarsky (2020) suggest to extend this work by analyzing how learning can be transferred from individuals to organizations, especially for internal crowdsourcing, where solvers are internal members of the organization. Overall, the authors see organizational learning is an interesting and underexplored outcome of crowdsourcing projects for future research focus.

To sum it up, learning through crowdsourcing has been only theorized scarcely so far. Only external crowdsourcing has been analysed through the organizational learning lens. There is no theory available that provides a holistic understanding of internal crowdsourcing as a form of organizational learning.

3. Organizational Learning Theories

As we have seen above, crowdsourcing as an organizational practice seem to generate short- and long-term effects for the organization through generating new insights. Theories of "organizational learning"[3] focus on how organizations generate, transform and store new insights.

[3] This lens was chosen after on having achieved a substantial understanding of the case; it is presented here before the case for structural reasons. In inductive and interpretive research, theory is often discussed as after presenting findings (Glaser and Strauss, 1967; Strauss and Corbin, 199; Daft, 1985). However, we use the more conventional paper structure here as most

What is “organizational learning”? It is a family of theories dealing with the process of creating, retaining, transferring and applying knowledge within an organization. The ability of an organization to learn effectively and apply what has been learnt is considered imperative for its survival. Social IT is increasingly critical as a support of conventional forms of organizational learning, as well as an enabler for new forms or organizational learning. Put simply, organizational learning means the process of improving actions through better knowledge, whereby knowledge is composed of both declarative (such as facts) and procedural knowledge (such as skills or routines) (Argote 2012).

Organizational learning has been defined in several ways by researchers throughout the years Nevertheless, in almost every definition a certain core theme can be observed. Organizational learning always includes a change in the organization based on acquired experiences. Fiol and Lyles (1985) speak about a change in the organization’s knowledge, explicit or tacit, that occurs as a function of experience (Fiol and Lyles 1985). Argyris (1977) defines organizational learning as the process of "detection and correction of errors." In his view organizations learn through individuals acting as agents for them: "The individuals' learning activities, in turn, are facilitated or inhibited by an ecological system of factors that may be called an organizational learning system" (Argyris and Schön 1978, p. 177). (Huber 1991) notes that "it might be reasonable to conclude that more learning has occurred when more and more varied interpretations have been developed, because such development changes the range of the organization's potential behaviours (...)" (Huber 1991, p. 102). Cyert and March (1963) claim that firms are operating more through routines than through evaluated decisions. Experience is represented in standard procedures and rules based on solutions to problems or conflicts from the past. These routines change over time through experiences made, i.e. organizational learning. (Augier and March 2008; Cyert and March 1963). McGill et al. (1992) define the Learning Organization as "a company that can respond to new information by altering the very "programming" by which information is processed and evaluated.". A very comprehensive definition of organizational learning is the following: “Organizational learning is different from the simple sum of the learning of its members. Although individuals may come and go, what they have learned as individuals or

reader Expect theory positioning upfront and the theoretical background did in fact impact on our later stage analysis (we use inference to the best explanation here, not purely grounded theory, see method section).

in groups does not necessarily leave with them. Some learning is embedded in the systems, structures, strategy, routines, prescribed practices of the organization, and investments in information systems and infrastructure" (Crossan et al. 1999, p. 527).

Organizational learning has been identified long ago as relevant for IS research (Argyris and Schön 1978). The role of IS for organizational learning has been discussed in the most recent and most comprehensive literature review on organizational learning by Argote (2012). According to her summary organizational learning IT systems can be categorized into two groups. The traditional ones provide primarily a document repository for explicit knowledge. They can serve as pointers to experts and thereby enable "connections between members that facilitate the transfer of tacit knowledge" (Argote 2012; p. 46) .Yet, the connection between the involved parties happens outside of the IT system. New generations of IT systems arise, providing new opportunities for organizational learning that "facilitate connections and interactions among individuals within the system through blogs and forums" (Argote 2012; p. 46). However, the realization of these new opportunities depends on how they are implemented and supported in organizations (Argote 2012)

Argyris and Schön (1978) developed a well-known model of organizational learning. Their model consists of three organizational learning processes: single-loop, double-loop and deuteron learning. The definition of single-loop learning is based on Bateson (1973), who describes it as „the organization's ability to remain stable in a changing context denotes a kind of learning" (Argyris and Schön 1978, p. 18). Single-loop learning occurs when errors are detected and corrected, while organizational policies and goals remain untouched. Double-loop learning occurs when, in addition to the error detection and correction process, organization's underlying norms, policies and objectives are adapted. "Organizational learning involves the detection and correction of error. When the error is detected and corrected permits the organization to carry on its present policies or achieve its present objectives, then that error-detection-and-correction process is single-loop learning. Double-loop learning occurs when error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies and objectives." (Argyris and Schön 1978, p. 3). Argyris and Schön (1978)organizational learning framework is particularly useful because

the provided learning types seem to be well-suited to reflect the learning and feedback loop observed in long-term-oriented internal crowdsourcing processes (Nevo and Kotlarsky 2020; Zuchowski et al. 2016).

4. Research Method

To identify what kind of learning results from internal crowdsourcing we adopted an interpretive research approach (Barrett and Walsham 2004; Klein and Myers 1999; Walsham 1995; Walsham 2006). Interpretive methodologies allow us to study a phenomenon in the richness and complexity of its context, which is especially relevant for internal crowdsourcing, being an emerging phenomenon. Instead of assuming a rigid external meaning and building theory disconnected from the lived experience, the interpretive way gives voice to the actors involved, and the researcher's interpretation thereof (Gioia et al. 2013).

We studied an early case of internal crowdsourcing at BOSCH, a German, multinational automotive supplier in the functional area of logistics. The Bosch Group currently employs over 400,000 associates worldwide and generated 78.5 billion euros sales revenue in 2018. With its 460 subsidiaries, regional companies and sales and service partners the Bosch Group covers almost every country in the world. BOSCH operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology (Robert Bosch GmbH 2019). The automotive industry is currently undergoing a period of upheaval on an unprecedented scale. Environmental factors like the driving bans triggered by the diesel crisis, the shift towards alternative drives, such as electric motors, and the rising recession of the economy may result in job losses in the mobility sector. In the area of logistics, the supply chain management must react to the immense challenges that are linked to those transformations of the market (Fletcher 2020). Two internal crowdsourcing communities were of the LOGipedia community is to integrate logistics knowledge, scattered among logistics departments all over the world (such as common definitions or good practices). The purpose of the myLogistics community is to solve logistics design and decision problems (such as ideas for process optimizations or common requirement specifications). For the data collection we applied combined the techniques of ethnography and longitudinal case study. An ethnographic, "actor-observer" approach was used (Gioia et al. 1994) with one of the authors being directly and actively involved in the projects as a "crowd manager", and constantly

documenting and reflecting on the practices enacted (wearing two hats, that of the practicing expert and that of a reflective scholar at the same time).

In addition to the ethnographic data, a "conventional" case study research approach was used for which 41 interviews were conducted and all kinds of natural data was collected. All key stakeholders were taken into account until no further insights emerged. The interviews were carried out with employees of the organization that participated in internal crowdsourcing campaigns. The interviews involved 12 requestors, 28 solvers and the general initiator of internal crowdsourcing within the functional area of logistics. A semi-structured interview protocol was used, starting with general questions about the interviewees' experience with internal crowdsourcing, followed by questions focusing on learning aspects of internal crowdsourcing. Also, questions concerning the interviewees' role in the internal crowdsourcing activity, the perceived differences through the introduction of IT, and obstacles and benefits from internal crowdsourcing, were asked. The time-period of examining the case started in January 2014 and ended of December 2019.

Example Data	**First-Order Codes**	**Second-Order Categories**	**Aggregated Dimension**
"We got fast good feedback about how to optimize the process," myLogistics Requestor 5.	Process innovation: New ideas how to optimize processes	Crowdsourced solution: (Aggregated) answers from solvers	Single-loop learning
"As we seen, we got so many ideas for new products, (…)" myLogistics Requestor 4.	Product innovation: New ideas for (virtual and actual) products and services		
"We learned a lot from the first campaign about crowdsourcing" myLogistics Requestor 2.	Improving know-how of requestor: Tacit knowledge about crowdsourcing	Improving know-how about crowdsourcing: The crowdsourcing method and the used IT platform are improved, based on experiences made and lessons learned	Context-specific Double-Loop Learning
"I learn something with every crowdsourcing experience I make. " Crowd Manager 1.	Improving know-how of crowd manager:		

	Tacit knowledge about crowdsourcing		
"After that campaign I would change several things to improve the usability of BOSCH Connect." myLogistics Requestor 1.	Improving the IT platform: Learning about the social-IT environment hosting the crowdsourcing campaign		
"Now working in this crowd-mode has become part of my daily life" Logipedia Solver 9.	Part of daily work: Crowdsourcing becomes a routine	Opening-up of corporate culture: The organizational culture is developed towards knowledge sharing and transparency by default	Organizational Double-Loop Learning
"Speaking about culture, many things changed with BOSCH Connect. The open sharing of knowledge is one example" Logipedia Solver 6.	Change process: Visible changes in the way employees work together		

Table 3: Representative Data and Codes Underlying Categories and Dimensions

For the analysis of the data we followed Gioia et al. (2013) approach for qualitative research. The initial step of analysing the emergent data was done by open coding, using in vivo language whenever suitable (Charmaz 2006). To reduce the codes to a manageable number similarities and differences among the first-order codes were found (comparable to axial coding; Charmaz, 2006, p.75). To derive second-order concepts emerging themes were identified, helping to describe and explain the examined phenomenon. Simultaneously to scanning for emerging themes, the literature was conducted to start a process of cycling between emergent data, codes, concepts, dimensions and the relevant literature. This tandem approach of reporting both voices – interviewee and researcher – makes is possible to transparently document how the relations between data and the interpreted concepts and dimensions were built (Gioia et al. 2013). A soon as a conclusion is in sight and no further relevant concepts emerge, a state called "theoretical saturation" was reached (Charmaz 2006).

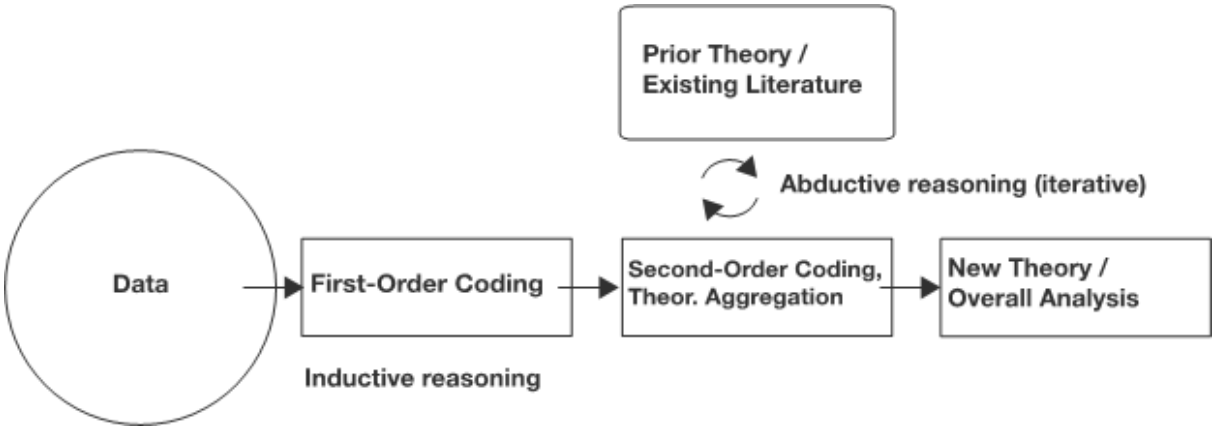

Figure 1: Data Analysis Approach

We structure our theoretical analysis according to the theoretical learning loops identified. To analyse how organizational learning is performed at the case organization Argyris, and Schön's (1978) organizational learning types were used.

We brought in theory at later point in the analysis process, as described in Figure 1. This methodology is based on abductive reasoning, which is referred to as "inference to the best explanation" by what Philosophy of Science (Lipton 2004). This theory development methodology is opposed to both "deductive" (i.e. upfront theorizing), and entirely inductive (i.e. grounded) theorizing. This "best of both worlds" approach allowed us finding new concepts which could be labeled already according to what is known in current literature.

5. Case Synopsis and Empirical Findings

In this chapter, the empirical findings of the field study are presented in a purely reporting and narrative manner (Gioia et al. 2013). Two internal crowdsourcing communities were implemented at BOSCH for this research. These two communities were the first examples of internal crowdsourcing within the organization. We follow up and observed the emerging communities over six years, providing a unique possibility to capture the social-IT based phenomenon of internal crowdsourcing.

5.1 Crowdsourced Knowledge Management with BOSCH LOGipedia

Before crowdsourcing, BOSCH employed a team of fixed-allocated experts to take care of logistics terminology worldwide. This central logistics team was responsible for defining, explaining and summarizing logistics terms. Logistics terms were defined top-down and written down in several PDF-files. This "logistics dictionary" was updated quarterly and made available through a hierarchy-based email cascade. All kinds of logistics topics in the areas of sourcing, supplier management, transportation, material handling, inventory, replenishment, dispatch, distribution, warehouse management, and customer demand planning, were covered. Typical entries were "cross-dock", "customs regulations", "goods receipt", "packaging", "incoterms", and so on.

Based on our interviews with a number of logistics employees, this Logistics Dictionary was not very helpful for daily tasks. As per one interview the flaws in the logistics dictionary were, *"Many important logistics terms weren't explained at all. Many explanations were very short and unclear or only available in German language."* (LOGipedia solver #2). Another interviewee complained, *"The biggest problem was that often the definitions were completely different than our understanding on-site and it was very cumbersome to give feedback. We, as experts on-site were disconnected from the definition process."* (LOGipedia solver #5).

The old centralised way of defining logistics terminology was found as being inefficient. Thus, in 2014; senior management decided to implement a crowd-based approach. Within the BOSCH intranet the social-IT based solution "IBM Connections" had just been made available, making it possible to create own communities including general social applications such as wikis, blogs, and forums. "LOGipedia", one of the very first communities at BOSCH, was founded. The naming was explained by one interviewee*, "Finally, we have an own Wikipedia for logistics topics"* (LOGipedia solver #1). The target of LOGipedia was to *"crowdsource the old PDF-version of the logistics dictionary, (…) using state-of-the art technology"* (LOGipedia requestor #1). At the time of writing, 482 articles had been created by 164 authors, on average 1,100 employees visit LOGipedia per month.

With this approach very different insights were found in comparison to the hierarchy-based old way: "That was a milestone for online collaboration within BOSCH" (LOGipedia requestor #1). A good example of

how internal crowdsourcing has helped the organization to formulate such different definitions by providing freedom to propose contrasting views are articles about logistics "SAP parameters". Before LOGipedia was introduced, the central logistics department provided a manual with a set of parameters including an explanation on how they can be used for logistics planning. This manual was updated on an annual base and distributed via email. With the introduction of LOGipedia, an article was initially created, by coping the content of this PDF manual. The open-call was published to encourage users to edit and comment LOGipedia's content. Solvers from different geographic locations (in this case in particularly India, USA, and Vietnam) and from different departments (e.g. purchasing, manufacturing) joined the discussion. It turned out that beside the already known standard parameters, the logistics employees in the production plants were using many more parameters and customized even own ones. Instead of one article, a set of articles was created and interlinked with each other: *"At the beginning it was one short article about SAP parameters, now it developed towards a whole parameter encyclopedia, which is continuously updated by colleagues worldwide"* (LOGipedia solver #1). Instead of processing such information through individual emails, all discussions and adaptations of the article were transparently documented on the internal crowdsourcing platform, visible for everyone within the organization. A LOGipedia is based on generic wiki software, users were also able adapt the platform according to their needs, like one LOGpedia solver summarized: *"Here LOGipedia's strength was that we could adapt the community according to our needs and easily create a new category, new tags and even an overview page for a better navigation." (LOGipedia solver #1).*

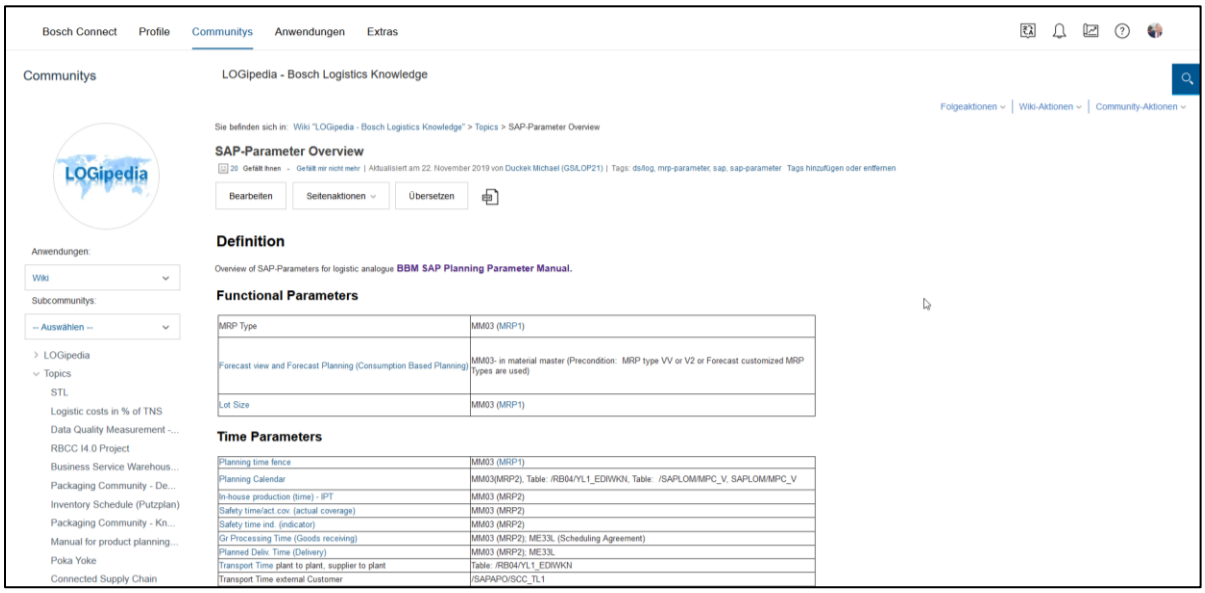

Figure 2: Screenshot of the "SAP-Parameter Overview" article in BOSCH LOGipedia (Knowledge-Sharing Wiki)

Together with the logistics definitions several additional aspects were documented, such as manuals for IT-tools, best practices for certain processes, and explanations of customer related requirements. This led to interesting new insights from the logistics organization, like a logistics requestor summarized: "Suddenly we had a good overview on which IT tools is used where. We even found that there are IT-tools in use, which we were not aware of. With our traditional methods it would take years to get all of this data."

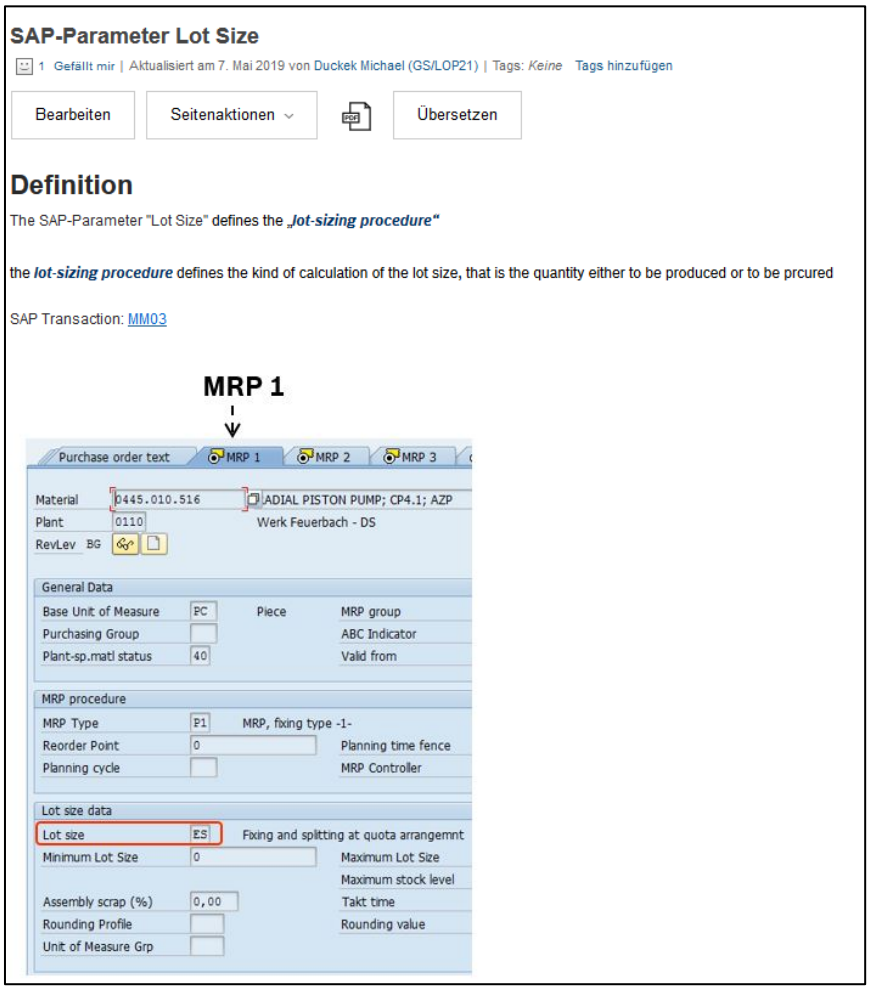

Figure 3: Screenshot of the article "SAP-Parameter Lot Size "in BOSCH LOGipedia (Knowledge-Sharing Wiki)

In the meantime, LOGipedia has been established as the central exchange platform for logistics at BOSCH. Central departments as well as logistics teams from locations worldwide use it to develop content together. Especially employees are benefitting by this platform, as all logistics topics can be found on a single

platform. Static content from several other databases, link lists, MS office documents were transferred into interactive LOGipedia articles. With the establishment of LOGipedia a trend towards knowledge sharing can be observed. Several LOGipedia solvers emphasize how easy it is to contribute to the platform. LOGipedia give rise to the attitude towards knowledge sharing: *"LOGipedia demonstrates how good it is to share your knowledge, so everyone can be benefited"* (LOGipedia solver #2). Several logistics departments integrated *"transparency by default" or "Instead of writing an email, write an LOGipedia article*" to their "true-north of collaboration" (LOGipedia solver #5), a guideline with self-chosen team rules.

Figure 4: Screenshot of the main page, including a button for the newly founded "Newcomer Club" in BOSCH LOGipedia (Knowledge-Sharing Wiki)

BOSCH logistics base their onboarding process for new logistics staff and their learning about logistics topics on LOGipedia. Although this type of usage was not foreseen at the beginning, a group of volunteering experienced employees and newcomers worked on an onboarding section in LOGipedia. As all pages of the wiki can be changed by everyone, they could adapt LOGipedia's main page on their own. *"I think it's great that through the initiative by a group of worldwide volunteers the new Newcomer Club in LOGipedia was founded. They even added a new button to the starting page of LOGipedia, something like this was not possible before"* (LOGipedia solver #5).

5.2 Crowdsourced Idea Generation via BOSCH myLogistics

Before BOSCH decided to implement internal crowdsourcing, logistical standards, such as processes and IT solutions, were developed by small teams of experts within the hierarchically organized central logistics department. Based on their work, logistics standards were specified and introduced worldwide. In 2014;

senior management encouraged to broaden the base of minds for designing logistics standards. Instead of working inside a team of experts the development process should involve voluntary employees worldwide. As a requester of myLogistics told in our interview, *"Instead of always asking the same people, we now have the chance to get feedback from a huge and diverse group of people worldwide. Most important is, that everyone can join, doesn't matter from which department or function"* (myLogistics requestor #1).

In comparison to the LOGipedia community, which was growing and evolving over time through continuous crowdsourcing, the myLogistics community was a platform for in vidual problem-solving or innovation campaigns. Each campaign had a specific setup in terms of aim, requestor, solvers and form of invitation. The duration of a campaign's contribution phase was usually open for two weeks. At the end of every campaign solver's contributions were aggregated and summarized by the crowd manager. Participation was done on a voluntary basis. Every campaign was open for all employees worldwide, although employees working in logistics and related functions were in focus. The open invitation was sent out via email to all logistics employees in the organization by the requestor himself. Additionally, invitations were posted on several other internal online platforms and intranet pages. At the time of writing, 1,987 BOSCH employees had participated in the myLogistics community. After successful completion of six campaigns it was observed that on average 158 employees had participated actively in each campaign. This resulted in generation of 421 ideas and submission of 1,952 votes.

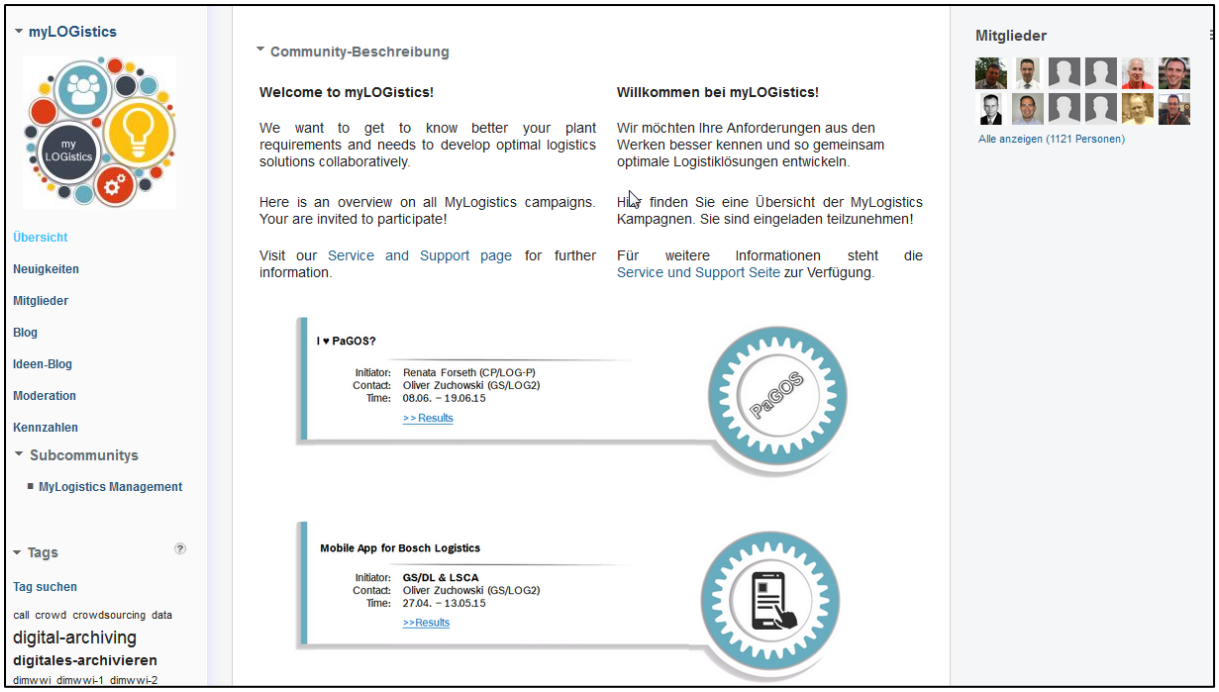

Figure 3: Screenshot of the page of BOSCH myLogistics (Ideation Community)

The implementation of a logistics mobile application is an illustrative example from our case that highlights the main features of internal crowdsourcing at BOSCH. Earlier, the task of developing new IT solutions was delegated by management in a hierarchical way to a defined group of experts, who gathered the requirements and process specifications on their own. This top-down approach led to correct applications, in terms of a development according to the requirements and functional specification, but receiving poor feedback from end-users. As one interviewee told us, "The software met the requirements according to the spec[ification], but the wrong things has been specified. We got correct software, but nothing which really helped us in daily business" (myLogistics solver #6). Another interviewee summarized such top-down software developments, "We achieved the target to build a software in time and with planned costs, but the target was wrong and we missed user's needs" (myLogistics solver #5). Several months later, a second attempt was made to improve the application. This time an internal crowdsourcing campaign was initiated in the myLogistics community. Instead of defining requirements top-down, ideas from the crowd should be the basis for a bottom-up requirement gathering. This crowdsourcing approach led to very different results. The crowd posted their thoughts, based on their lived experiences on-site in the production plants, which resulted in a variety of "hands-on" ideas. An interviewee explained the solvers' background *"(…) they know what's really going on and where the pain points are.* (myLogistics solver #6). Another solver stated that the

efficiency in daily work is most important for users, *"We don't think about, if something is according to the overall strategy, but we know what makes our daily life easier"* (myLogistics solver #5). To prioritize the list of potentially useful features, a subsequent campaign was initiated. The myLogistics community was adapted and an online voting and commenting function was added. This list of prioritized features needed to by aggregated by the crowd manager to consolidate the ideas into a "management-ready" format. Finally, the mobile application was designed and implemented based on the crowdsourced inputs.

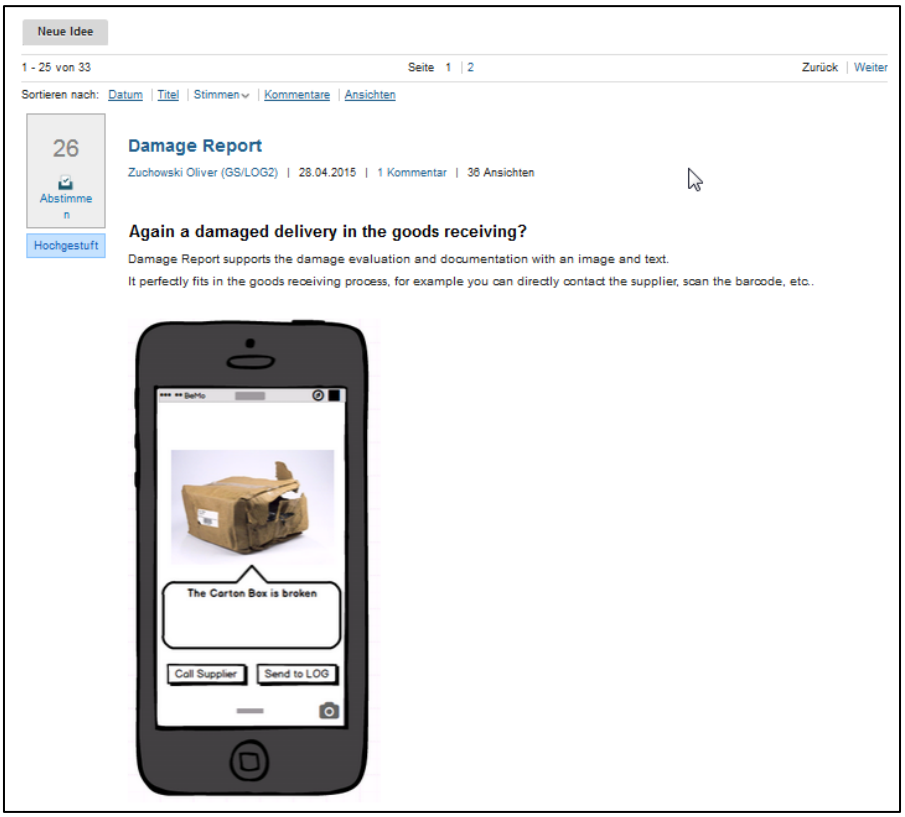

Figure 4: Screenshot of an idea in BOSCH myLogistics (Ideation Community)

BOSCH documented and published the campaign's outcomes in internal paper newsletters and digital magazines. The myLogistics community and the crowdsourcing approach became well known within the organization. With every campaign the number of viewers and active solvers increased *"At the beginning I just observed what is going on in the campaigns, then they invited to give feedback on a software I use daily, of course took the chance to share my thoughts"* (myLogistics solver #8). BOSCH, as a traditional German manufacturing firm, and its employees were not used to such open online collaboration working models. The continuous promotion of crowdsourcing campaigns and their outcomes helped to engage hesitating employees after

some time. As one solver explained his experience, *"At the beginning I was very skeptical about this community type of work. After reading about the success of previous campaigns, I started commenting ideas and finally contributing own ones"* (myLogistics solver #7).

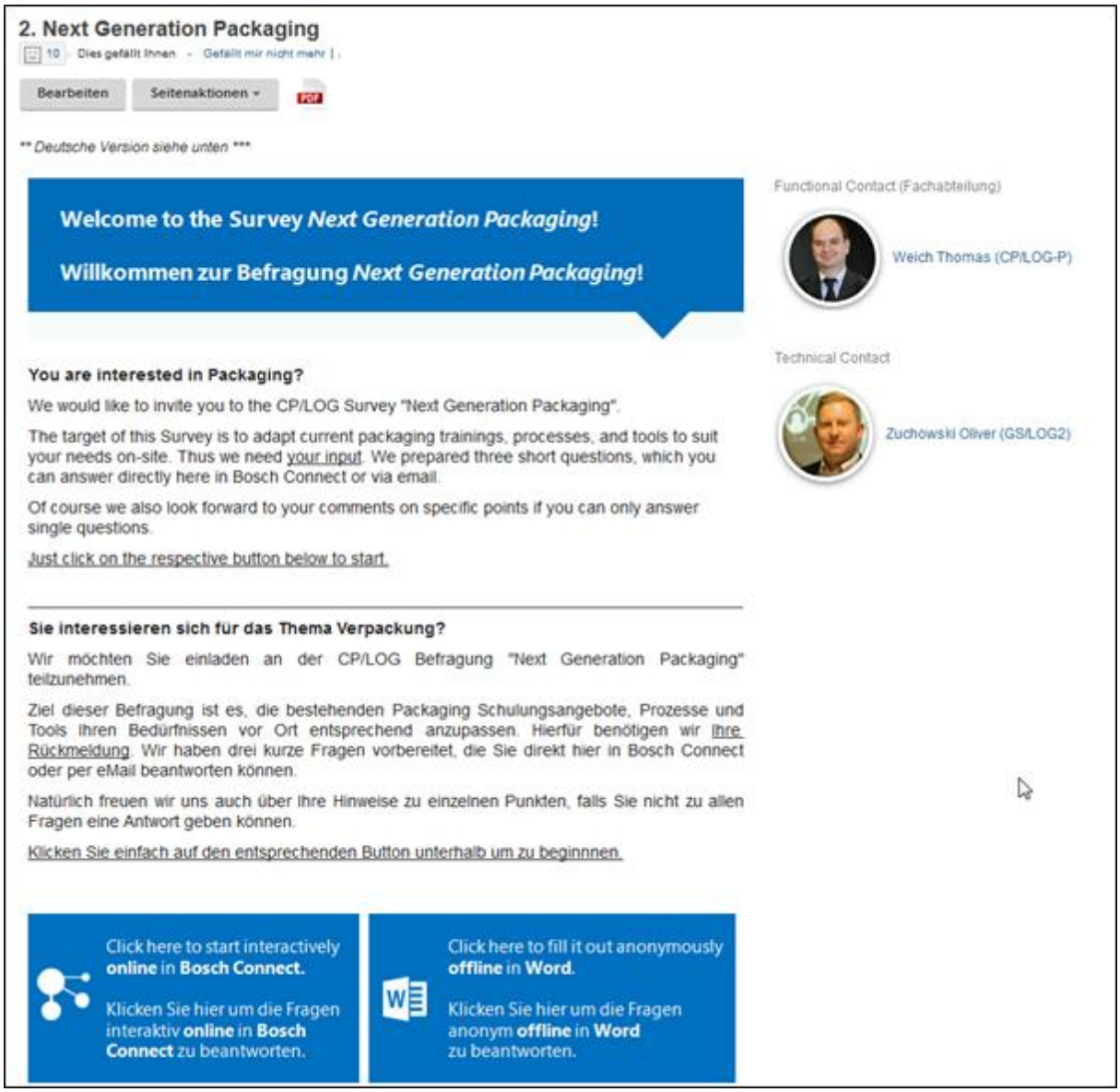

Figure 5: Screenshot of a campaign's overview page in BOSCH myLogistics (Ideation Community)

Both LOGipedia and the myLogistics community were part of the very first wave of online communities at BOSCH, being the first using crowdsourcing as working model. Together with requestors and the crowd manager, the communities were adapted based on the experiences made over time to improve the crowdsourcing's outcomes. For LOGipedia the structure of articles (e.g. new section with links to external

sources) evolved over time and new sections (e.g. the newcomer club") were added. The campaign's overview page within the myLogistics community was changed, in terms of shortening the campaign's introduction text and adding the requestor's and crowd manager's name and picture. One requestor summarized the adaptions, *"This crowdsourcing thing was completely new to all of us, by carefully observing the campaigns, and listening to the employees' feedback, we improved the approach and the platform a lot."* (myLogistics requestor #1).

6. Theoretical Analysis

This section presents the theoretical interpretation of the empirical material. Table 2 gives an overview on BOSCH's organizational learning types. Figure 4 combines the analytical insights of organizational learning through internal crowdsourcing in a theoretical model.

6.1 Single-Loop Learning Through Crowdsourcing

Single-loop learning is observed in different ways at the case organization, BOSCH. For every internal crowdsourcing campaign performed, a problem is identified by the crowdsourcing requestor, usually coming from top management. Internal crowdsourcing supports the correction of those problems by inviting basically everyone within the organization to contribute. This open invitation, known as 'open call', is performed in this case either actively (e.g., email) or passively (e.g., blog post). Afterwards solvers can self-select themselves to join the crowdsourcing campaign and to contribute with ideas or other forms of input to solve the stated problem. These contributions are provided by solvers in the form of collaborative answers (LOGipedia articles co-authored by solvers), creative ideas for new products and services, or new process solutions (e.g., by solvers' feedback in myLogistics). Contributions are made through an internal IT platform featuring social application (e.g., wikis, blogs, and forums), making it possible to discuss potential ideas globally. A requestor emphasized that only thanks to IT, internal crowdsourcing is possible: *"such platforms are the best opportunity to reach them [solvers]"* (myLogistics requestor #1).

The outcome of such a campaign may also lead to the creation of new problems, consistent with Argyris, and Schön's claim that "the achievement of stable solutions is not an appropriate criterion for organizational

learning" (Argyris and Schön 1978, p. 42). For hierarchy-based organizational learning problems are identified by management and formulated as tasks to be executed by employees to correct the problem.

<table>
<tr><th>Organizational learning types (based on Argyris and Schön (1974)</th><th>Internal crowdsourcing based organizational learning (at BOSCH)</th></tr>
<tr><td>Single-loop learning: how are problems identified and corrected?</td><td>Problems are identified by the crowdsourcing requestor, solutions or ideas for solutions are given by voluntary solvers</td></tr>
<tr><td rowspan="2">Double-loop learning: how are underlying norms and objectives modified?</td><td>Context-specific Double-Loop Learning: Internal crowdsourcing is improved as method</td></tr>
<tr><td>Organizational Double-Loop Learning: Corporate culture is opened-up</td></tr>
</table>

Table 2. Organizational learning types at BOSCH

6.2 Context-Specific Double-Loop Learning

Based on the analyzed data a new learning type could be observed, which is a particular case of double-loop learning. This new type of learning occurs when the organization gathers know-how about the context where the learning takes place. At the case organization context-specific double-loop learning happens when know-how about internal crowdsourcing as method is gathered. The organization experiences how different campaign setups lead to different outcomes. With every internal crowdsourcing campaign this know-how is extended and can already be used to adapt and optimize further campaigns.

Every internal crowdsourcing campaign is one single learning loop, initiated with an identified problem as input and completed with potential corrections as outcome. With internal crowdsourcing, being a new method at the case organization, every performed internal crowdsourcing campaign comes with new lessons learned about the method. The collection and analysis of these lessons learned yields in context-specific double-loop learning. Double-loop learning occurs when internal crowdsourcing (as a method) is improved,

based on experiences made in the organization. Requestors reported that improvements were made in terms of how problems are formulated into tasks processable for solvers (e.g., *"A well performed transformation of a problem into 'crowdsourceable' tasks is the crucial part",* (myLogistics requestor #2), or how the user interface is designed (e.g., "(…) after rearranging several items, it was much easier to navigate" (myLogistics requestor #3). (Schön and Argyris 1996, p. 79) emphasises that double-loop learning only occurs when changes in actions are made. In the observed case the improvements were not only recognized, but also directly implemented at following campaigns.

6.3 Organizational Double-Loop Learning

Organizational double-loop learning can be observed at the case organization in the way how corporate culture is being transformed since the introduction of internal crowdsourcing. As stated by Argyris, and Schön (1978, p.27) organizations realize what inhibited and supported their learning. Based on that organizations develop new learning strategies, in this case a new corporate culture. Both LOGipedia and myLogistics are based on voluntary work (see case synopsis). Hence contributions are only possible when solvers are open towards knowledge sharing and solutions from other departments or functions. These cultural differences are often theorized as "organizational culture" (e.g. Argote 2012; Simula and Ahola 2014), or "corporate culture" (e.g. McAfee 2006). Several solvers experienced a change of the corporate culture through the introduction of internal crowdsourcing. For example, a solver of LOGipedia reported: *"I see that many colleagues actually discovered that they like to share their knowledge (…) and this is not only happening in our department"* (myLogistics requestor #4).

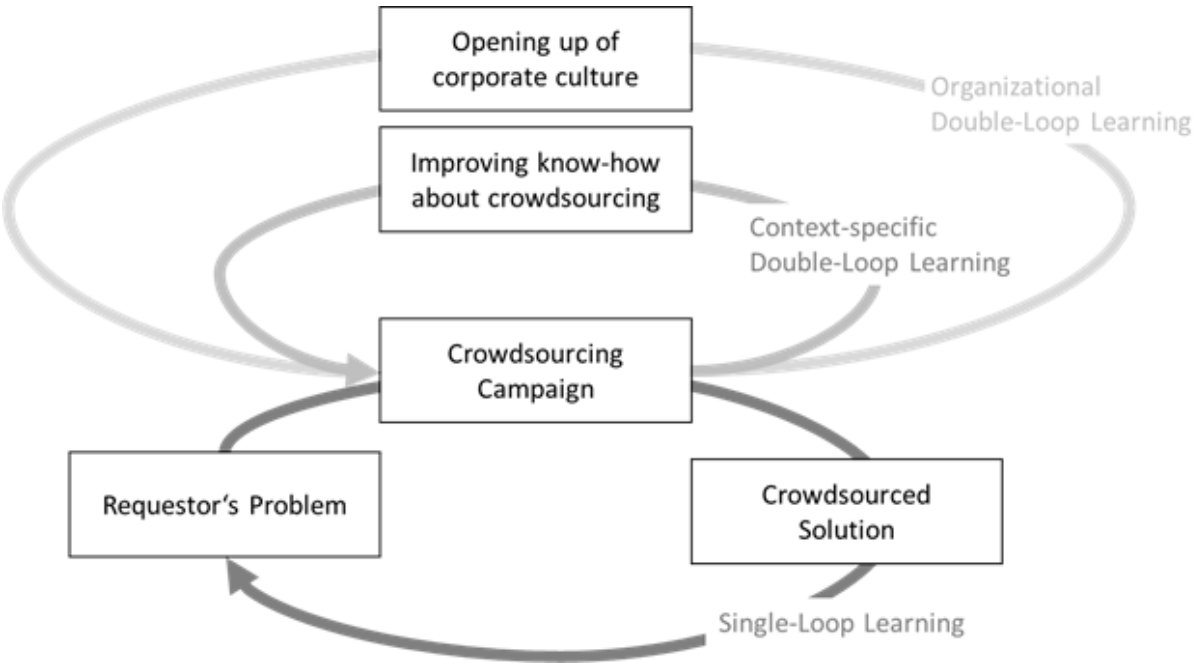

Figure 6. A Theoretical Model of Crowdsourcing as Organizational Learning

6.4 Implications of Crowdsourcing as Organizational Learning

As suggested in the most comprehensive organizational learning literature review by Argote (2012), new developments in technologies potentially provide opportunities for organizational learning and should be further examined by researchers (Argote 2012). A few studies were conducted to fill this gap, focusing on external crowdsourcing (Majchrzak and Malhotra 2013; Schlagwein and Bjørn-Andersen 2014; Ye and Kankanhalli 2017). No one examined organizational learning with internal crowdsourcing and only one study presented the differences of hierarchy-based learning vis-à-vis crowdsourcing's learning (Schlagwein and Bjørn-Andersen 2014). Our study contributes to the organizational learning literature by explaining which kind of learning is observable when using crowdsourcing within an organization. Crowdsourcing is one of those "IT-enabled" forms of organizational learning. With every pioneer work several questions can be answered and many further questions arise.

The organizational learning lens was applied for the first time on internal crowdsourcing in our study. Thus, we could find interesting insights about the social-IT based phenomenon and contribute to the organizational learning research and to our knowledge about crowdsourcing. Our paper provides a theoretical model to think about the short-term, but also about the long-term outcomes of internal

crowdsourcing. Internal crowdsourcing's learning is not only about getting solutions for a specific problem, but also leads to an opening-up of employees towards other new types of work practices. Crowdsourcing supports organizational learning (Feller et al. 2012; Majchrzak and Malhotra 2013), but the learning perspective of crowdsourcing has only been in focus in one research paper so far (Schlagwein and Bjørn-Andersen 2014)- The theoretical analysis in our paper explains how organizational learning with internal crowdsourcing works. Although Erickson et al. (2012) stated that intangible long-term organizational outcomes of internal crowdsourcing are difficult to assess, our paper shows how large established organizations can benefit from internal crowdsourcing as it enables a new mode of learning, supplemental to traditional organizational learning within hierarchy-based organizing. Based on organizational learning we found three outcomes of internal crowdsourcing (i.e. crowdsourced solution, know-how about crowdsourcing, opened corporate culture). The results of this study uncover further potential reasons why organizations could choose crowdsourcing over other sourcing options, in addition to those we already know (Afuah and Tucci 2012; Ye and Kankanhalli 2017). With the help of other organizational theories, further outcomes of (internal) crowdsourcing could be found or further insights could be gained about the outcomes we presented.

Single loop learning is also observable with internal crowdsourcing as a specific form of Argyris and Schön (1974)'s "getting a solution for a problem" learning. Crowdsourcing problems are identified by the crowdsourcing requestor, solutions or ideas are given by voluntary solvers. Research about the involved actors (i.e. requestor, solvers), applied IT (i.e. crowdsourcing platform), and results (i.e. solver's solutions) is scarce. Further research is needed to better understand which problems are suitable for an open call-based solution. We still do not really understand how an organization can create "good" crowdsourcing tasks for an underlying problem. Future research should answer the question how organizations can break down problems into crowdsourceable tasks. IT is the enabling technology for internal crowdsourcing. The interactions between the crowdsourcing actors and IT have not been in focus so far. We need to clarify the question how a proper crowdsourcing platform should look like to support requestor's and solver's interactions in the best way.

Schlagwein and Bjørn-Andersen (2014) described that crowdsourcing "broadens the base of minds" as it involved non-members in the organizational learning process. Although solvers are employees within the organization, we argue that the "base of minds" is still broadened. In comparison to traditional learning in hierarchies, the open call in internal crowdsourcing enables involving voluntary solvers from all over the organization. External crowdsourcing overcomes the organization's border, internal crowdsourcing overcomes internal boundaries, such as hierarchy, location, and function. Research about this "post-crowdsourcing" phase is scarce. We lack theories and knowledge to about essential topics regarding what happens after a crowdsourcing campaign. Our findings and relevant literature (e.g. Malhotra et al. 2017) are a good starting point to shed light into questions such as, what happens with the gained knowledge, and how are new crowdsourced ideas integrated.

In our study we showed how an organization can use subsequent single learning loops for the evaluation and selection of crowdsourced inputs, a process so far presented as highly manual effort in responsibility of crowdsourcing management (Hoornaert et al. 2017; Nagar et al. 2016; Piezunka and Dahlander 2015). The engagement of the crowd itself for grouping, selecting and prioritizing their own ideas requires further research, especially on the question how to integrate this process methodically to achieve right results and to relieve management with this task.

Instead of adapting underlying norms and modifying objectives Argyris and Schön (1974) internal crowdsourcing is improved as method within context-specific double-loop learning. With this contextualised approach we found that an organization improves its crowdsourcing skills with every crowdsourcing campaign. Although the design of crowdsourcing campaigns is in the focus of research since a long time (Archak and Sundararajan 2009; Ghezzi et al. 2018; Leimeister et al. 2009; Martinez 2017; Terwiesch and Xu 2008), the aspect of iterative learning from each crowdsourcing campaign (i.e. adapting the design based on lessons learned from previous campaigns) has never shown been before. Immediate next research steps would be to find out how this extraction of lessons learned can be fostered by the organization or supported by the crowdsourcing platform itself.

In addition to Argyris and Schön (1974) generic double loop learning, internal crowdsourcing fosters organizational double-loop learning, resulting in an opening up of corporate culture. This outcome of

internal crowdsourcing is in favor for other open forms of work organizations (such as communities of practice or open strategy). The relation between different open organizing forms has never been examined. Even the relation between internal and external crowdsourcing has not been in focus of research. Fundamental questions to be answered would be, how can organizations apply internal and external crowdsourcing as work practice and how can such open forms of organizing be integrated into the existing, often hierarchy-based organizing. Organizations need to act on the ideas generated in crowdsourcing, and they need to find a credible and systematic way how to integrate crowdsourcing results into the organization (Schlagwein and Bjørn-Andersen 2014).

From literature we know that organizational culture has an impact to the emergence and success of crowdsourcing (Fayard et al. 2016), though the cultural opening up through crowdsourcing is a new concept in crowdsourcing research. Through the open nature of crowdsourcing ("open call") other open practices could emerge easier in reference to successful internal crowdsourcing campaigns. This has never been described in crowdsourcing research so far, although the changing of organization culture and work practice is well known in the organizational culture literature (Schein 2010). While external crowdsourcing's learning is rather limited to single loop learning (Majchrzak and Malhotra 2013), learning through internal crowdsourcing is much richer and takes place on both learning loops. With internal crowdsourcing the organization does not only get an idea for a new product or service but establishes and improves a new form of organizing and opens up its corporate culture towards knowledge sharing and collaboration across hierarchical and geographical borders.

Our research explains practitioners about why and how they should implement internal crowdsourcing in large, established, hierarchy-based organizations. The paper provides examples of how organizations can benefit from social-IT enabled internal crowdsourcing. Particularly, crowdsourcing supports organizational learning in terms of solutions or ideas to organization-specific problems. Additionally, the organization becomes better in applying internal crowdsourcing with every campaign and opens up its corporate culture. Two groups of practitioners can particularly benefit from these research findings. First, practitioners who are interested in using internal crowdsourcing for knowledge management or innovation, can apply our learning model to properly setup internal crowdsourcing within their organization. Second, practitioners

who are already applying internal crowdsourcing on an online knowledge management or ideating platform, can benchmark their solution with our research findings.

As with any study, there are several limitations to be acknowledged. Results of this paper are majorly valid for open call-based organizing, based on internal crowdsourcing at BOSCH. Further study is required to analyze whether these results can also be observed for other new forms of organizing. We applied purposeful sampling in our study to get insides about the internal crowdsourcing phenomenon within the organizations. It would be also interesting to analyse data from members who did not participated in "open calls" either by ignoring the invitation or rejecting the term "open calls". Participants of this study are likely to conclude that crowdsourcing is a success as all of them were involved in internal crowdsourcing campaigns in either way as a requestors or solvers. Results of this paper are based on observations within one closed organization and a defined crowd of internal solvers. This setup gave us the unique possibility to capture organization' data (see also: method section) and understand the case in-depth. We believe that the learning model is sufficiently generic to cover a range of different types of organizing, but further work towards other organizations is needed to acknowledge the theoretical model. This would create an opportunity to advance our knowledge about crowdsourcing in terms of general verification of our findings.

7. Conclusion

This research shows that internal crowdsourcing is a specific form of - often mentioned but little researched - IT-enabled organizational learning. Internal crowdsourcing-based learning is very different to hierarchy-based learning. Argyris and Schön (1974)'s learning types provide a valid and valuable lens on the phenomenon. This in-depth field study contributes to organizational learning theory and the theoretical understanding of internal crowdsourcing. We have a clearer picture of crowdsourcing's organizational benefits, we highlight cultural implications, and place crowdsourcing within organizational theory. Internal crowdsourcing can be used for additional problems and trigger organizational change. Additionally, the results provide insight into how organizational learning is supported by social IT. For practitioners, the analysis of the case reveals learning experiences that the organization achieved through internal

crowdsourcing. This paper provides a reference for practitioners interested in using internal crowdsourcing in their organization.

8. Acknowledgements

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Paper IV - Open Organizing at BOSCH: Preconditions, Nature and Consequences of Internal Crowdsourcing

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Open Organizing at BOSCH: Preconditions, Nature and Consequences of Internal Crowdsourcing

Oliver Zuchowski
University of Bamberg
An der Weberei 5
96047 Bamberg
oliver.zuchowski@uni-bamberg.de

Daniel Schlagwein
UNSW Australia Business School
UNSW Sydney
NSW 2052, Australia
schlagwein@unsw.edu.au

Kai Fischbach
University of Bamberg
An der Weberei 5
96047 Bamberg
kai.fischbach@uni-bamberg.de

Abstract: Following the success of external crowdsourcing with customers, a number of organizations have recently adopted internal crowdsourcing with employees (e.g., BOSCH, Daimler, LEGO). This open form of organizing is substantially different from how the similar work tasks were organized previously. In internal crowdsourcing, work is allocated based on responses to "open calls" (i.e., employees voluntarily responding to calls) instead of being "fixed assignments" (i.e., employees working in hierarchically defined role). The analysis presented here to was conducted to understand how internal crowdsourcing transforms organizing. The analysis is based on longitudinal, actor-observer case study at German manufacturing firm BOSCH. We studied the emergence of internal crowdsourcing, its reconfiguration of organizing and its lasting impact. The findings are presented in the form of a theoretical model of internal crowdsourcing, which considers its preconditions (e.g., the availability of enabling technologies), its nature as a form of organizing (along four fundamental dimensions of organizing) and its wider consequences (e.g., an "opening up" of organizational culture). The paper discusses the wider implications of these findings for organizational practice and theory.

Keywords: Openness, open innovation, open organizing, crowdsourcing, internal crowdsourcing, co-creation, organizing, dimensions of organizing, organizational learning, cultural change, case study.

1. Introduction

Digital transformation and the re-organizing of organizational processes by "the digital" is an important topic across industries. "Open" and "social" information technology (IT) solutions enable communication and cocreation across organizational boundaries (Schlagwein and Hu 2017). In a McKinsey and Company survey on digital transformations, more 80% of respondents said that their organizations have undertaken digital transformation efforts involving social IT in the past five years (De la Boutetière et al. 2018). Social IT increasingly enables new processes and transforms organizational structures (Leonardi et al. 2013) and produces forms of work that is different from how "labour" is conventionally conceptualized (Beverungen et al. 2015). Organizations are increasingly such IT-enabled new, open forms of organizing to reveal value creation opportunities and find innovative solutions to their problems (Afuah and Tucci 2012; Chen et al. 2019; Felin et al. 2014; Puranam et al. 2014; West and Bogers 2014).

While their importance has been acknowledged in the recent literature, we still know little how "open" and "social" processes come about, and what lasting transformational impact on the larger organization they have (Chen 2013; Faraj et al. 2011; Johnson et al. 2014; Leonardi et al. 2013; Majchrzak-Celinska et al. 2009; Malone et al. 2009; Maynard and Gilson 2014). That is, while some immediate aspects of open organizing such as motivation of participants" have been studied extensively (Spindeldreher and Schlagwein 2016), we lack understanding about how such processes can be placed in the context of larger transformation and cultural change in organizations. Existing research on open organizing forms (Ahrne and Brunsson 2005; Ashkenas et al. 2015; Baldwin 2012; Clegg and Baumeler 2010; Gulati et al. 2012) has indicated that there are unique challenges (Berkowitz and Bor 2018), new dilemmas (Raviola 2017) and conflicts between open ways of organizing co-existing with traditional hierarchies (Oberg and Walgenbach 2009).

Crowdsourcing has emerged as one particularly successful, social IT-enabled open organizing form (Dobusch et al. 2019; Felin et al. 2014; Geiger et al. 2011). Crowdsourcing refers to the practice of issuing "open calls" to large groups of people via social IT (Estellés-Arolas and González-Ladrón-De-Guevara 2012)´s. Crowdsourcing provides organizations with access to the knowledge and skills of a distributed and potentially very large "crowd" for solving a problem (Afuah and Tucci 2012; Benbya and Van Alstyne 2010; Jeppesen and Lakhani 2010; Malone et al. 2009; Simula and Vuori 2012). External crowdsourcing –

organizations involving external parties such as customers or the general public – has been documented at number of prominent cases including LEGO (Schlagwein and Bjørn-Andersen 2014), NASA (Lakhani et al. 2012) and the City of Vienna (Kornberger et al. 2017). More recently, internal crowdsourcing has emerged as a related yet distinct phenomenon to external crowdsourcing. Here, organizations involving internal parties (i.e., employees and sometimes partners and contractors) in crowdsourcing processes to find solutions across organizational locations and departments (Zuchowski et al. 2016). As participants are part of the organization, internal crowdsourcing is more long-term oriented and may produce lasting organizational impacts (Zuchowski et al. 2016). While internal is crowdsourcing is newer, less visible to outsiders, and less studied, it has been argued to be more impactful for organizations (Benbya and Van Alstyne 2010; Simula and Vuori 2012; Zuchowski et al. 2016). In this study, we focused on internal crowdsourcing as new, open form of organizing.

Crowdsourcing and its organizational impact are not well understood empirically and theoretically (Geiger et al. 2011; Majchrzak and Malhotra 2013; Pedersen et al. 2013). While the phenomenon has been documented in a number of studies (Simula and Vuori 2012; Zuchowski et al. 2016) (Malone et al. 2009), there are no theoretical models and accounts in regard to its emergence and consequences over time. We lack theories and knowledge to answer essential questions regarding this form of work organization, such why it has emerged at the organization or what are its long-term consequences are for the organization.

The purpose of this research is to contribute specifically to our understanding of (internal) crowdsourcing. We ask three research questions: *What are the preconditions for internal crowdsourcing? What is the nature of internal crowdsourcing? What are the long-term consequences of internal crowdsourcing?*

We develop answers to these questions based on a longitudinal, actor-observer (auto-ethnographic) case study of the emergence, conduct and consequences of internal crowdsourcing at BOSCH. BOSCH is a multinational engineering and electronics company with over 400,000 employees. BOSCH's Crowdsourcing Manager was part of our research team in addition to the professorial researchers. We were hence in a unique insider/outsider position to trace and reflect on the emergence, the unfolding and the impact of two internal crowdsourcing initiatives at BOSCH, both of which involved employees worldwide across its department and functions, from 2013-19.

Based on the analysis of the BOSCH case study data, we are able to develop answers to the research questions. The two crowdsourcing initiatives within the larger BOSCH case reveal several preconditions have to be fulfilled for crowdsourcing to emerge (e.g., organizational problems have to be inherently suitable for this kind of organizing; enabling technologies have to be available; management needs to visibly commit to crowdsourcing). Internal crowdsourcing reconfigures the fundamental dimensions of organizing (we are using Puranam et al. (2014)'s framework, which in turn is based on Weick) with it "open calls", self-selection, approach to task allocation being central. The BOSCH case also shows that crowdsourcing benefits not only to the immediate problem at hand (i.e., increases organizational innovativeness) but also long-term consequences such as increased organizational learning and an "opening up" of organizational culture (an effect has not been previously documented, to our knowledge). In the remainder of the paper, we present and discuss these findings of the BOSCH study in detail.

The paper is organized as follows. Section 2 summarizes prior research on crowdsourcing, in particular in relation to organizing. Section 3 discusses the theoretical background of our analysis. Section 4 outlines our research method. Section 5 presents our key empirical findings. Section 6 further discusses those findings and implication for research and practice. The paper concludes with a brief summary and outlook.

2. Prior Work on Crowdsourcing

Prior research has documented and analysed how organizations opening up their boundaries to involve external expertise and large groups of Internet users in their innovation, product development and problem-solving processes (Boudreau 2010; Boudreau et al. 2011; Chesbrough 2003). This new, open form of organizing is generally called "crowdsourcing" (Howe 2006; Majchrzak and Malhotra 2013).

The term "crowdsourcing" was originally introduced to refer to sourcing ideas from non-employee, external crowds (Howe 2006). This form of crowdsourcing has been examined in substantial number of research studies (Afuah and Tucci 2012; Schweitzer et al. 2012; Stieger et al. 2012). It has been argued that crowdsourcing is indicative how "the digital" fundamentally changes the relationship between workers and organizations (Taylor and Joshi 2019). The application areas of crowdsourcing are manifold. Hence, crowdsourcing has appeared in many different forms. This also leads to some confusion as to the boundaries and scope of concept. Forms of crowdsourcing have alternatively been labelled "distant search"

(Afuah and Tucci 2012; Piezunka and Dahlander 2015), "open sourcing" (Ågerfalk and Fitzgerald 2008), "crowdfunding" (Gleasure 2015), "open collaborative innovation" (Baldwin and Von Hippel 2011), "peer production" (Benkler 2017), "community-based innovation" (Franke and Shah 2003), "mass collaboration" (Tapscott and Williams 2008), "community collaboration" (Adler et al. 2008), "open collaboration" (Levine and Prietula 2013), "user content generation" (Lukyanenko et al. 2017); which are supporting value creation in "online communities" (Faraj et al. 2011), "open strategy" (Tavakoli et al. 2017; Whittington et al. 2011), "open government" (Janssen et al. 2012; Kornberger et al. 2017), "open science" (Love and Hirschheim 2017; Nosek et al. 2015) and "open education" (Prester et al. 2019). Most scholars consider that crowdsourcing is a sub-type of open innovation (Ebner et al. 2009; Hemetsberger and Reinhardt 2009; Marjanovic et al. 2012; Remneland Wikhamn and Wikhamn 2013), which denotes a wider range of "open" approaches to innovation (e.g. corporate-university research collaborations are "open innovation" but not "crowdsourcing") (Chesbrough 2003; West and Gallagher 2006).

How can we delineate which organizational practices "count" as crowdsourcing, and which do not? For the purposes of our analysis, the endorse Estellés-Arolas and González-Ladrón-De-Guevara (2012)'s conceptualization, which is based on a systematic analysis of definition and descriptions of "crowdsourcing" in the academic literature. They conclude that "crowdsourcing" is a "participative online activity in which solvers voluntary undertake tasks through an open call" (p. 5). This is the definition we use in this paper.

By this definition, firstly, crowdsourcing has been done before the term was invited or even the Internet existed. For example, as early as 1714, "The Longitude Prize" was offered by the British Government as an open call (to anyone who could develop a reliable way to establish longitude). The first 1814 edition of the Oxford English Dictionary received submissions from hundreds of outsiders in response to an open call. The Sydney Opera House design, famously, was based on global, open call for design submission won by an at the time little-known Danish architect (Dawson and Bynghall 2012; Schlagwein and Bjørn-Andersen 2014)

Secondly, the definition applies to both crowdsourcing with non-employees/non-organizational members as well as to crowdsourcing with employees/organizational members. We refer to these two forms of crowdsourcing as external crowdsourcing and internal crowdsourcing, respectively. Most research, by far,

has focused on external crowdsourcing in particular – despite that is has been argued that it is actually internal crowdsourcing that has the much larger impact(Benbya and Van Alstyne 2010; Simula and Vuori 2012; Zuchowski et al. 2016).

2.1 External Crowdsourcing

External crowdsourcing has been studied from different perspectives and analysed this organizational practice at multiple levels of analysis.

On individual level, a frequent focus of research has been what motivate participants ("solvers") (Alam and Campbell 2017; Boons et al. 2015; Franke et al. 2014; Khern-am-nuai et al. 2018; Zhang et al. 2019). An impact of cultural differences on crowdsourcing has been investigated, showing cultural tightness and cultural distance affect crowdsourcing (Chua et al. 2015). Such insights can then be used by organization to setup crowdsourcing initiatives to optimally attract solvers (Koh 2019; Papanastasiou et al. 2017), prevent solvers' aversion (Zheng et al. 2018) and focus on how to crowdsource in ways to overcome undesired behaviour of solvers (e.g., free-riding) (Lu et al. 2017) . Midlevel managers may also hold reservations and fear towards crowdsourcing (e.g., fear of disclosure or fear of visible failure) (Gleasure 2015), which leaders need to manage. Some research has focused on the interest of the solver workers rather than that of the requester organizations and questioned the ethics and fairness of crowdsourcing. For example, workers might feel unfairly compensated for their work (often free, speculative or underpaid work) with union protection and workplace legislation being circumvented by crowdsourcing (Deng et al. 2016; Schlagwein et al. 2019)

On group level, research has investigated how crowdsourcing team structures, in terms of social and intellectual capital of the team members and the team leader, influence their success in crowdsourcing contests (Dissanayake et al. 2015). Organizational learning in external crowdsourcing is improved by "increasing the base of minds" that learn for the organization (e.g., groups of non-employees discussing, refining, voting on etc. promising ideas (Schlagwein and Bjørn-Andersen 2014).

On organizational level, a range of benefits have been documented (Blohm et al. 2013). Crowdsourcing often results in the creation or improvement of products (Bayus 2013) and services (Orlikowski and Scott

2014) provided by the organizations – such as in the cases of Dell (Di Gangi et al. 2010), LEGO (Schlagwein and Bjørn-Andersen 2014), SAP (Leimeister et al. 2009) and Starbucks (Gallaugher and Ransbotham 2010). Crowdsourcing has been used in fields such as different as health care (Ghosh and Sen 2015), public policy (Aitamurto 2012) and journalism (Hermida 2010). Crowdsourcing, in the form of crowdfunding, also provides a way for organizations to fund their activities(Kuppuswamy and Bayus 2013) . Crowdsourcing works best under conditions of openness, trust, tact, professionalism, transparency and complementariness (Ågerfalk and Fitzgerald 2008). While crowdsourcing conceptually promises making "distant knowledge" accessible to the organization (Afuah and Tucci 2012), in practice, organizations often pay more attention to "familiar answers" (Piezunka and Dahlander 2015). Many organizations hence use intermediaries – using third-party platforms or their knowledge – to get the most out of their crowdsourcing initiatives (Bergvall-Kåreborn and Howcroft 2014; Feller et al. 2012; Schlagwein and Bjørn-Andersen 2014).

2.2 Internal Crowdsourcing

Internal crowdsourcing activates or find knowledge within the employees of organization, particularly those who would not otherwise be involved with the problem in question (Zuchowski et al. 2016). Through internal crowdsourcing, knowledge and information can be combined that may be among distributed functions, departments and geographic locations within the organization (Benbya and Van Alstyne 2010).

Research has documented a number of benefits and exemplary cases of internal crowdsourcing, yet our knowledge remains patchy compared to external crowdsourcing. Documented cases of internal crowdsourcing include IBM mobilizing thousands of employees to share ideas in "Innovation Jams" (Bjelland and Wood 2008) and Deutsche Telekom focused on crowd predictions based on analysing data from previous projects (Rohrbeck et al. 2015). Internal crowdsourcing leverages employees as a source of ideas to improving existing (Simula and Vuori 2012) or creating new products, services or processes (Simula and Ahola 2014). Similar to external crowdsourcing, internal crowdsourcing has been studied in regard to participant motivations (Benbya and Van Alstyne 2010). It has been noted that internal crowdsourcing is an organizational practice that has only recently become feasible with advancement in social IT (Bailey and Horvitz 2010). Internal crowdsourcing platforms use either generic social media (e.g., wikis, blogs, forums), third-party hosted crowdsourcing Internet platforms as "white box" crowdsourcing products for internal

deployment (run by on the organizations own IT infrastructure). Internal crowdsourcing can be run in a collaborative (Bjelland and Wood 2008) or competitive manner (Simula and Ahola 2014).

Interestingly, internal crowdsourcing increases employee's identification with resulting outcomes (Malone et al. 2009). Hence, some have argued that "open strategy", using internal crowdsourcing to develop the strategy of the organization is in a transparent and inclusive way that generates "buy-in" is a particularly promising area for crowdsourcing (Hautz et al. 2017; Tavakoli et al. 2017; Whittington et al. 2011). Crowdsourcing has also been related to increased organizational learning (Schlagwein and Bjørn-Andersen 2014).

These findings, while incomplete, are indicative of long-term implications for the organization when crowdsourcing is done with employees and long-term organizational members, instead of ad-hoc recruited, independent externals (the latter may lack an inside perspective or long-term interest in the organizations). To understand and theorize such implications of internal crowdsourcing for organization is the key purpose of our study.

2.3 Theorising Crowdsourcing

For understanding crowdsourcing's implications for organizations, we need to theorise it as organizational phenomenon. Crowdsourcing research lacks such theoretical approaches on organizational level of analysis (Geiger et al. 2011; Majchrzak and Malhotra 2013; Schlagwein and Bjørn-Andersen 2014) (in contrast to the individual level of analysis via psychological theories). Only limited scholarly attempts for crowdsourcing vis-à-vis organizational theory exist (Schlagwein and Bjørn-Andersen 2014). Reviewing the crowdsourcing literature, we identified three theoretical approaches to crowdsourcing as from of organizing: Jeppesen and Lakhani's (2006; 2009) "broadcast search", Afuah and Tucci (2012)'s "distant search", Schlagwein and Bjørn-Andersen (2014)'s "ambient organizational learning". We analyse these theoretical approaches below.

To fully appreciate crowdsourcing as an organization practice, the general scope of organizational theory should be met. In particular, the theory should not focus on singular variables and hypotheses but cover the inherent scope of the phenomenon (Sutton and Staw 1995; Whetten et al. 2009)(i.e., it should disregard

or "factor out" aspect that are inherently central to the nature of the phenomenon of interest). The theory should then articulate the causal and/or temporal relationships between these key aspects as well as theorize the underlying mechanisms (Sutton and Staw 1995; Whetten et al. 2009) (i.e., how and why aspects are related).

If developing new theory for a novel organizing phenomenon, then the natural starting point is to theorize antecedents or conditions of emergence, the nature (the "core" of what is going on) and the consequences (intended or unintended) of this phenomenon (Gioia et al. 2013). Given the small number of research efforts, these fundamental questions have not been answered in existing framings of crowdsourcing. The efforts spent focused on certain aspects of crowdsourcing as organizational phenomenon in an isolated way. Hence, here we are lacking a holistic theoretical explanation of the phenomenon.

Abstract theoretical requirements: (Charmaz 2006; Gioia et al. 2013; Sutton and Staw 1995; Whetten et al. 2009)	Theoretical account should detail the **preconditions** how and why phenomenon has emerged. (Why now? Why here? What antecedents caused it?	Theoretical account should reveal the **nature** of the phenomenon. (What is its essence? What are the core principles?)	Theoretical account should explore the **implications** of the phenomenon regardless of their type. (What are the key consequences and, outcomes, intended or otherwise?)
Jeppesen and Lakhani 2010; Lakhani 2006 "broadcast search"	/ (Not in scope)	Crowdsourcing is a broadcast search based on open call and self-selection.	Solutions to operational (RandD) problems.
Afuah and Tucci 2012: "distant search"	Characteristics of the problem need to be suitable. (Knowledge of the crowd needs to be assumed to be applicable.)	Crowdsourcing is about distant search for superior external ideas.	/ Not in scope; model stops at "likelihood of crowdsourcing" as dependent variable – model has been criticized for this aspect (Afuah and Tucci 2012; Bloodgood 2013)
Schlagwein and Bjørn-Andersen 2014: Organizational Learning with Crowdsourcing	/ (Not in scope, narrative account but no theorisation.)	Crowdsourcing is a form of "ambient organizational learning :in which intuiting and interpreting is performed by the crowd; integrating and institutionalizing is performed by employees.	Finds new product ideas (immediately), increase organizational learning of the organization (overall).

Table 1. Theoretical Accounts of Crowdsourcing

As in Table 1, Jeppesen and Lakhani 2010 theorize crowdsourcing as "broadcast search". This involves and organization-side open call for participation and participant-side self-selection based on expertise and interest. The authors summarized that the main outcome from crowdsourcing is the provision of solutions to problems that were not solved within the organization. The boundary conditions of the model are not entirely clear (to which cases of crowdsourcing it applies or does not apply; the model appears to be based on the particular design of the case studied).

Afuah and Tucci (2012) focused on the preconditions in their research about crowdsourcing as "distant search". The authors found four major characteristics (i.e. problem, the knowledge required for the solution, the crowd, and the solutions to be evaluated) of circumstances when an organization should prefer to crowdsource instead of using traditional problem solving. The model suggests that crowdsourcing's nature is able to transform distant search (i.e., problem solving apart from traditional, known processes: exploration) at the cost of local search (i.e. exploitation of known resources). Their scope is "crowdsourcing" in its entirety (claims are universal, not restricted to particular crowdsourcing types or cases).

Schlagwein and Bjørn-Andersen (2014) focus on the impact of crowdsourcing on organizational learning. The authors suggest that are reconfiguration of the four main organizational learning processes is the essence of crowdsourcing. Intuiting and interpreting are done by the external crowd. Integrating and institutionalizing is done by employees. The authors call that the overall process "ambient organizational learning". Their model suggest that organizations improve their organization learning, through, "broadening the base of minds that" it can use on individual level to achieve learning at the organizational level. While based on the LEGO case, the authors propose a general theory of crowdsourcing.

Taken together, these studies have contributed important insights into particular aspects the preconditions, nature and consequences of crowdsourcing. Yet, they have not yet provided a holistic theory of crowdsourcing as a novel form of open organizing. That is, there is a sense that important "parts of the story" are missing. Hence, we decided to take a fundamentally inductive approach to theorizing (to identify aspects not previously theorised), drawing on prior crowdsourcing theory (this section) and general theories of organizing (next section) in our analysis of the data.

3. Theories of Organizing

For our analysis of internal crowdsourcing, we found it useful to draw from theories of organizing, including seminal works on organizing (esp. Karl Weick's work) and the recent literature on new forms of organizing. We present here a brief overview of this literature, as this theoretical accounts provides the eventual theoretical background for our analysis of the BOSCH case.[4]

The complex and diverse nature of "organizing" has been a focus of, and in fact *raison d'être* for the field of organization studies. Weick (1969) defines organizing as "the resolving of equivocality in an enacted environment by means of interlocked behaviours embedded in conditionally related process" (p. 7). That is, equivocality and uncertainty can be reduced through information processing, manifested in repetitive, reciprocal, contingent behaviours that develop and are maintained between actors (Weick 1969).

Historically, organizing has been seen as work execution and information processing with static entity, "the organization", with well-defined boundaries (Puranam et al. 2014). This view of organizing can be limiting as many forms of organizations and organizing are socially constructed, open to interpretation, have no central planner and are "open systems".

Contemporary views of organizing replaces concepts such as structure, decisions and control with a more performative, networked theoretical views that sees organizations as dynamic and interdependent. Agents are considered to "enact" the organization rather than the organization being a standalone "entity" (Weick 1969; Weick 1974). Such views are particularly appropriate for novel, dynamic forms of organizing such as crowdsourcing, which are inherently difficult to place in fixed boxes.

"New forms of organizing" need new theoretical consideration (Argote 2012; Puranam et al. 2014). New forms of organizing refers to novel, typically IT-enabled, ways of organizing, including "open", "social" or "crowd" based approaches taking place in post-bureaucratic organizations (Faraj et al. 2011; Leonardi et al.

[4] This lens was chosen after on having achieved a substantial understanding of the case; it is presented here before the case for structural reasons. In inductive and interpretive research, theory is often discussed as after presenting findings (Glaser and Strauss, 1967; Strauss and Corbin, 199; Daft, 1985). However, we use the more conventional paper structure here as most reader expect theory positioning upfront and the theoretical background did in fact impact on our later stage analysis (see Method section).

2013; Levine and Prietula 2014; Malhotra et al. 2017; McAfee 2009). Further, "open organizing" is fundamental to organizational forms such as "business ecosystems" (Baldwin 2012), "meta organizations" (Ahrne and Brunsson 2005; Gulati et al. 2012), "liquid organizations" (Clegg and Baumeler 2010), "latent organizations" (Starkey et al. 2000) or "boundaryless organizations" (Ashkenas et al. 2002) (which all share that they extend their organizing beyond conventional organizational boundaries).

Based on the above, we can say that crowdsourcing is an IT-enabled new, open form of organizing (Malhotra et al. 2017). While organizing has been theorized in various ways, it is widely accepted that any (new, or otherwise) form of organizing needs to be described and theorized in regard to at least four major dimensions (Puranam et al. 2014; Weick 1995) . These four dimensions are:

Task division (how is the division of tasks organized?). Organizations and organizers have to break down their overall goals into feasible tasks for their organizational units. This dimension concerns the division of tasks and includes the definition of interrelated subtasks and necessary information flows between the parties involved (Newell and Simon 1972). Examples for artefacts that capture the division of tasks in organizations are workflow diagrams, business process mapping, value chains and engineering drawings. The knowledge that is necessary to divide the tasks may be thought of as "architectural knowledge" (Puranam et al. 2014), knowledge about the components of a complex system and how they are related (Baldwin 2008). This knowledge is gathered from experience and is more likely to exist for well-understood goals (Von Hippel 1990). This dimension is influenced by the initial intended design (MacCormack et al. 2006), by the participation of solvers (Puranam et al. 2014) and the baseline level of transparency (Baldwin and Clark 2006).

Task allocation (how is the task allocation organized?). The second dimension concerns the mapping of tasks resulting from the division of tasks among individuals and groups. It covers matching subtasks to the skills of available parties and, if applicable, joining similar repeatable tasks. This may involve assigning similar repeatable tasks to specific individuals instead of the entire work unit (i.e., Weber's "functional specialization"). Alternatives approaches to task allocation are to minimize interdependence across individuals, to increase diversity of tasks or to assign responsibility for tangible outputs rather than intermediate steps (Oldham et al. 1976) .Examples for task allocation include the specifications of the role

and the matching of individuals to roles. Typically, the task allocation is conducted through a superior in hierarchy. It is usually a key feature of an employment contract(Simon 1951). This requires both the determination of cooperation and coordination issues (Gulati et al. 2005; Lawrence and Lorsch 1967). Cooperation is achieved through motivation; coordination is achieved through information. Both issues have to be solved to successfully integrate organizing and work efforts (Camerer and Knez 1996; Camerer and Knez 1997; Heath and Staudenmayer 2000).

Reward distribution (How is the reward distribution organized?). The third dimension describes the allocation of financial and non-financial rewards to organizational members involved. These rewards are based on implicit or explicit mechanisms for motivating agents to contribute (Simon 1951). In the conventional organization in businesses, monetary rewards are usually specified in the employment contract. Non-monetary rewards are given in various forms and ways, such as work conditions, the choice of colleagues and career advancement opportunities (Prendergast 1999) (Gibbons 1998).

Information flow (how is the information distribution organized?). The fourth and final dimension describes how information is provided to the individuals and groups involved. The organization's parties need specific information for the execution and coordination of tasks (Schelling 1980). Either the information flow is addressed during the division of tasks with a target of reducing the need for information (e.g., through the use of directives, schedules, plans, and standards) or the channels needed to generate such information are provided (e.g., face-to-face meetings or electronic communication) (March and Simon 1993).

Theories of new forms of organizing needs to account for the above universal problems and dimensions of organizing (Puranam et al. 2014; Weick 1969; Weick 1974). Any form of organizing provides specific solutions to these four problems. Hence, a theoretical account of the nature of a new form of organizing should consider these dimensions (Puranam et al. 2014). We found it useful to draw on universal dimensions of organizing in our analysis and theorising.

An analysis along these dimension allows to answer the question: when does a form of organizing qualify, on theoretical grounds, as "new"? If a form of organizing is claimed to be "new and innovative" but does

not fundamentally change the actual organizing dimensions, then we are simply facing "old wine in new bottles" and should expect prior organizational theory to hold. However, if it can be shown that the new from organizing substantially reconfigures the organizing dimensions (relative to how similar work was organized previously), then we need separate study, possibly producing new and more appropriate theories for such a new organizing form (crowdsourcing, in our case).

Crowdsourcing can be held to be a new form of organizing and hence needs to be carefully, theoretically and empirically examined along these fundamental dimensions. Puranam et al. (2014) compare Wikipedia, an example of external crowdsourcing (Doan et al. 2011) with traditional organizing around the *Encyclopædia Britannica* and the German *Brockhaus Enzyklopädie*. They come to conclude that the Wikipedia case meets their criteria for being a novel form of organizing. Similarly, crowdsourcing in online communities (e.g., open source software communities) have also been identified as a new form of organizing (Adler 2001; Adler and Heckscher 2006; Adler et al. 2008; Chen 2013). However, empirical accounts and organizational-level theoretical analysis are lacking (Puranam et al. 2014).

Hence, we consider it useful and necessary to perform a careful, comprehensive theoretical analysis of the organizing dimensions of crowdsourcing, as well as its relations to the its wider organizational context and long-term implications (beyond the immediate "doing of crowdsourcing").

4. Research Method

For this study, we adopted a qualitative, interpretivist epistemic stance and approach (Barrett and Walsham 2004; Klein and Myers 1999; Walsham 1995). Interpretivist approaches make it possible to study a phenomenon in its full richness and interpret it in its contextual complexity. They focus on the lived, differential experiences of the people involved in a given social setting and account for the fact that there is substantial sense-making on the part of both participants and researchers involved in interpreting the meaning of such settings (Gioia et al. 2013). This stance is appropriate considering that internal crowdsourcing is an emerging phenomenon at the complex intersection of IT, business and social behaviour. It is also suitable for our intention of contributing a comprehensive theoretical account.

Our longitudinal case study was conducted at BOSCH. BOSCH a multinational engineering and electronics company providing technology and services. It employs over 400,000 employees worldwide. Headquartered in Stuttgart, Germany, BOSCH comprises roughly 450 subsidiaries in 60 countries. BOSCH operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology.

This research is based at BOSCH's cross-departmental Logistics function. It was there that BOSCH first instituted two internal crowdsourcing communities and platforms. No comparable internal crowdsourcing communities existed at BOSCH previously. We were able to study the planning, emergence, conduct and long-term impact of internal crowdsourcing. We had unique access due to the Crowdsourcing Manager being the "insider" part of the research team, with professorial researchers probing and challenging findings as "outsiders" (i.e., allowing us to combine "lived experience" insider and "neutral perspective" outsider views).

The data collection followed a purposeful sampling approach to achieve a full, comprehensive understanding of the case by selecting all key stakeholders and different participants involved in internal crowdsourcing. We interviewed employees of the organization who participated in internal crowdsourcing campaigns as solvers, who initiated campaigns as individual or departments requesters. The interviews involved 12 requesters, 28 solvers and additionally the daily ethnographic notes of the crowdsourcing manager.

For the interviews, we followed a semi-structured interview protocol, beginning with questions about the interviewees' experience with internal crowdsourcing and moving on to questions focused on organizational aspects of internal crowdsourcing. We also asked questions about the interviewees' roles in internal crowdsourcing activity, the perceived differences through the introduction of IT, and obstacles to and benefits of internal crowdsourcing.

We followed Gioia et al. (2013) and Charmaz (2006) approach for data analysis (see also Figure 1 below): developing insights inductively on the data yet consulting literature for their second-order interpretation. That is, as an initial step to analyse the emerging data, we used open coding, using *in vivo* language whenever

suitable (Charmaz 2006, p. 70) generate first-order codes. To reduce the codes to a manageable number, we searched for similarities and differences among them (comparable to axial coding; see Charmaz (2006, p. 75). Based on the condensed list of first-order codes, we looked for themes that would help describe and explain the phenomenon, resulting in second-order concepts. Simultaneous to scanning for these empirical themes, we consulted the literature to begin a process of cycling between emerging data, codes, concepts, dimensions, and the relevant literature. This approach of reporting both voices—interviewee and researcher—makes it possible to document transparently how the relations between data and the interpreted concepts and dimensions were built (Gioia et al. 2013). When further data collection and analysis produced no further relevant concepts and our theoretical understanding stabilized, we reached "theoretical saturation" (Charmaz 2006, p. 129).

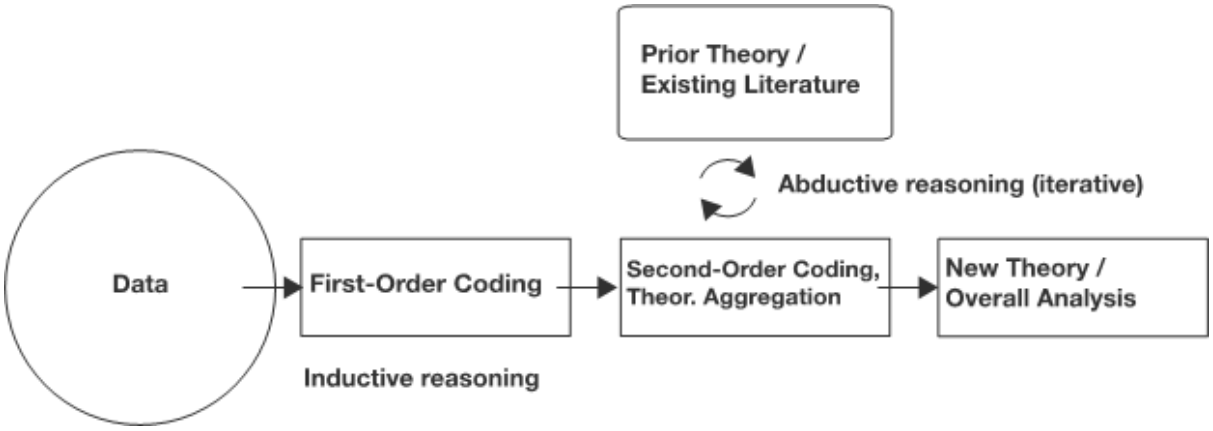

Figure 1: Methodological Approach

The approach to "bringing in" theory at a later stage of analysis as in Figure 1 is based on abductive reasoning and what Philosophy of Science now calls "inference to the best explanation" (Lipton 2004) (based on Peircean abduction). This research strategy is opposed to both "deductive", upfront theorizing approach, and a purely inductive, grounded approach of theory development; it can be considered to be a "best of both worlds". That is, allowing discovery of new concepts through initial inductive analysis yet avoiding unnecessary relabelling of already known concepts in academic discourse.

5. BOSCH Case Synopsis and Empirical Findings

5.1 Crowdsourced Knowledge Management via BOSCH LOGipedia

BOSCH's Logistics department was responsible for defining and explaining logistics terminology, which varied widely worldwide and led to miscommunication. A team of experts, allocated and supervised by management, answered questions such as: What is a "cross-dock" for? Which "incoterms" are available? Before the crowdsourcing-based reorganization, these experts where assigned by management to do this job. They typically defined terms top-down, based on their understanding. The "logistics dictionary" was updated regularly and distributed to relevant stakeholders via email. According to logistics employees, this dictionary was not always very helpful for their practical work needs, however. As one interviewee told us, *"Either terms are not explained properly, terms are missing completely, or the explanation does not fit to the local understanding. … This has often led to misconceptions, especially when we have to rely on a precise definition*". (LOGipedia solver #3)

In 2014; BOSCH senior management introduced a new, crowdsourcing-based approach to defining and explaining logistics terminology. The definitions were to be based on the collective views of all employees. The LOGipedia community was implemented and internal crowdsourcing was for the first used as an organizing method at BOSCH. An email invitation was sent to everyone in the Logistics department. As of the time of this writing, 394 definitions had been co-created and LOGipedia had almost 4,000 users (1,200 on average active per months). Certain topics were heavily discussed on the platform. As a LOGipedia requester (manager) stated, *"LOGipedia made it possible to develop logistics definitions together with many employees worldwide. With LOGipedia, we have the possibility to see what is bothering our employees. … It's amazing to see how the crowd organizes itself and how new topics come up, are prioritized, and developed until a consensus is found—at least until someone else has a different view and joins the discussion."* (LOGipedia requestor #1)

One example for how internal crowdsourcing helped BOSCH to unveil and resolved different definitions and viewpoints on a certain topic is the article about "cross-docks". From the central logistics perspective cross-docks were used to change the type of conveyance, to sort material or to combine material. The LOGipedia article was initially created by the central department with a definition reflecting this

understanding. Then, however, an open call was published to encourage users to edit and comment. Solvers (contributors) from different geographic locations (e.g., India, USA, Vietnam) and from different functions (e.g., Purchasing, Manufacturing) joined the discussion. Several different features were added to the definition of a cross-dock after discussion, notably the possibility to repack goods or to execute value-adding processes (e.g., "flashing" software) at cross-docks. Ultimately, the definition not only changed to reflect a broader consensus but become a full documentation of the knowledge associated with each term. All discussions and adaptions of the articles were transparently documented on the internal crowdsourcing platform, visible and able to challenge for everyone in the organizational. This eventually leading to a common understanding and articulated, shared knowledge of what a "cross-dock" is (or is not) and what can be done there (or not).

Figure 3: Screenshot of BOSCH LOGipedia (Knowledge-Sharing Wiki)

LOGipedia became the central exchange platform for logistics knowledge at BOSCH. Static content from several other databases, link lists, Microsoft office documents were ultimately transferred into crowdsourced LOGipedia articles. The central departments and the logistics teams from locations worldwide used (and at time of writing, still use) LOGipedia to develop content together. This has substantially reduced misunderstandings and miscommunications, esp. between employees that are not co-located. Generally, the establishment of LOGipedia lead towards a trend of knowledge sharing. Several LOGipedia solvers emphasize how easy it is to contribute to the platform. LOGipedia contributed to an attitude change towards knowledge sharing: "LOGipedia demonstrates how good it is to share your knowledge, so everyone can profit" (LOGipedia solver #2), was a common comment. Several logistics departments consequentially instituted "transparency by default", a shared rule of "instead of writing an

email, write an LOGipedia article" (LOGipedia solver #5). BOSCH based on their onboarding of new logistics staff and their learning about logistics topics on the LOGipedia, a type of use that was not originally foreseen.

5.2 Crowdsourced Idea Generation via BOSCH myLogistics

Before internal crowdsourcing was introduced at BOSCH, small teams of logistics experts were in charge of developing logistical processes and IT solutions. Their work allocated and supervised by management, part of their assigned job description. Logistics standards were specified and introduced worldwide.

In 2014; senior management encouraged voluntary internal crowdsourcing among logistics employees targeted at deriving such standard in a crowdsourced ways. As a requester (sponsors) of myLogistics wrote to staff, *"I would like to involve as many people as possible to get diverse opinions … under the motto 'you can join'"* (myLogistics requestor #1).

The crowdsourcing in the BOSCH myLogistics community was organized via individual campaigns, each with a specific setup in terms of target, requester, participating solvers and form of invitation. A campaign's contribution phase was typically open for two weeks, at the end of which contributions were aggregated and summarized by the crowdsourcing manager. Generally, all employees worldwide could be solvers, although the focus was to involve employees working in logistics and related functions. Solvers participated on a voluntary basis. The open invitation was issued by email to all logistics employees of the organization. In addition, an invitation was posted on several internal online blogs. At the time of this writing, 1,847 BOSCH employees had participated in the myLogistics community. In total, 421 ideas were generated.

For an example, one myLogistics campaign resulted a new Logistics mobile application. Previously, the task to develop such applications was delegated by management to a defined group of experts who addressed the requirements specifications on their own, following top-down approaches. Many interviewees said this approach led to "correct" (developed up to specifications) applications if seen from a top-down policy perspective, but there was that the applications needed further enhancements to be actually useful in practical use. Several months later, an internal crowdsourcing campaign was initiated seeking ideas from the crowd. That is, the application requirements gathering was crowdsourced. Interviewees said that the

results of the bottom-up crowdsourced process were completely different. The crowd offered a variety of "hands-on" ideas focused on how such an application could help in daily work. Through online discussions and the voting feature, the crowd came up with a prioritized list of potentially useful functions, which were then integrated into a coherent design and implemented.

Other campaign results were used for various proposes. *Inter alia,* they lead to new IT requirements specifications for an "RFID printer", a new expense reimbursement process, a new training approach, an updated logistics process, an improved user interfaces for the packaging software and new app to track internal deliveries.

Figure 4: Screenshot of BOSCH myLogistics (Ideation Community)

The outcomes of the internal crowdsourcing campaigns were well documented and published through internal magazines and e-papers at BOSCH. The myLogistics community became known to many employees. While entirely voluntary, the number of solvers per campaign increased: *"I heard that the results of the campaign will be used to optimize a software I work with every day, so I decided to join"* (myLogistics solver #8). The constant promotion of the campaign help top engage hesitating employees–not used to such open approaches at a traditional German manufacturing firm–to eventual participate. One participant explained that she joined after some successful campaigns: *"Honestly, I was not sure what myLogistics is exactly all about and*

what will happen with the posted content. Now I understood the concept and even contributed to the last campaign" (myLogistics solver #4). While initially only a few tech-savvy millennial employees may have participated, in later initiatives, a wide range of employees participated.

6. Theoretical Analysis

We structure our theoretical analysis along the theoretical concepts identified, following the structure: preconditions – nature – consequences. (See also the summarizing Figure 5 further below, and the underlying coding tables in Appendix A.)

6.1 Preconditions of Internal Crowdsourcing

The data analysis revealed three central preconditions for internal crowdsourcing: suitability of problems, (availability of) enabling technologies and managerial intention.

6.1.1 Problem Suitability

For internal crowdsourcing to emerge, the organization must have suitable problems (it is hence not useful for all organizations). In the BOSCH case, the problems for the myLogistics ideation community were selected by the crowdsourcing requester, typically a senior manager. Before release to the crowd, they were broken down in collaboration with the crowdsourcing manager into crowd-solvable tasks. That is, the tasks selected and scoped at a level that can be expected to be solvable given the crowd's level of understanding and knowledge. For example, a requester found that *"question is suitable for crowdsourcing [if] it is important to get opinions from many people worldwide (to find the best solution)"* (myLogistics requestor #2). This applies to problems that a) stand to benefit from diverse feedback, which b) can be broken down into easily understandable units (or a are small in scale) suitable for crowds. In contrast to external crowdsourcing, the problem of a question or not being suitable for crowdsourcing because it would reveal business secrets is not typically an issue for internal crowdsourcing with employees. In more general terms, for this form of organizing to emerge, the organization needs to have problems that can be broken down into "crowdsourceable" tasks. A crowdsourceable problem has to be modularizable, that is, it must be possible to decompose the problem into reasonable (sub)tasks with solutions that can be aggregated or used in wider context later on. This has

been discussed in prior literature, with Puranam et al. (2014) with call this a "modular task architecture", while (Afuah and Tucci 2012) call refer to "delineation, transmission and modularizability".

6.1.2 Enabling Technologies

Another precondition for internal crowdsourcing, a number of technology resources need to exist. In the BOSCH case, this referred to existence of internal online platforms with social functionalities, specific crowdsourcing "whitebox" software solutions (developed by a third party) and a dedicated management team for these technology resources. These technologies are necessary to enable issuing the "open call" and for collecting solvers' responses. Requesters emphasized that internal crowdsourcing is possible only through IT as *"such platforms are the only opportunity to reach [the crowd]"* (myLogistics requestor #3). More generally, "crowdsourcing systems" (Doan et al. 2011; Geiger et al. 2011) (need to exist and be deployed in the organization (i.e., crowdsourcing was not possible in many organizations because the underlying technology, now taken for granted and part of the landscape, did not exist). In addition, relevant IT application knowledge is necessary for internal crowdsourcing. A crowdsourcing expert (such as the crowdsourcing manager) or similar intermediary is needed to deploy these technologies. These technology knowledge can be obtained via intermediary platforms that also offer corresponding consulting services (as in the LEGO case of Schlagwein and Bjørn-Andersen (2014) or by employing professionals with the relevant expertise (as in the BOSCH case).

6.1.3 Managerial Intent

For crowdsourcing to be enacted, influential organizational members (e.g., senior management, CEO) must endorse open organizing. For the emergence of internal crowdsourcing at BOSCH specifically, it was critical that the senior management showed clear intention to sponsor and endorse the initiative. In the BOSCH case, interviewees considered staff may not participate because their names and departments would be disclosed and their respective managers had not posted on the crowdsourcing platform (so they would feel out of line if they posted). Employees said there were looking at management for leading by example in these new socio-technical space. Generally, only with such top-level management intend will the organization overcome inertia to engage in open organizing in the form of internal crowdsourcing.

Contributions emerge, if and only if, solvers feel they are encouraged and empowered to share their ideas and solutions openly. This means senior members of the organization need to act as role models and clearly signal managerial support.

6.2 Nature (Organizing Dimensions) of Internal Crowdsourcing

We discuss the above four organizing dimension in relation to internal crowdsourcing, roughly tracing the international crowdsourcing process phases. We contrast this to how similar work (i.e., defining business terminology via LOGipedia and business development in myLogistics) were previously organised at BOSCH. That is, we contrast the open organizing in internal crowdsourcing to the processes it replaced to understand is nature as a form of organizing.

6.2.1 Task Division Through Decomposition (instead of Delegation)

In the first step and first organizing dimensions of internal crowdsourcing concerns the division of tasks. The requesters' problems are made "crowdsourceable" by decomposition. The division of the problem into tasks is done by the requester working alongside crowdsourcing method experts (as above, the crowd manager in the BOSCH case, external consultants in other cases). In the BOSCH case, the crowdsourcing manager noted as a learning from early campaigns that the *"task division process has to be transparent; only then will potential solvers understand the overall goal"*. This transparency allows solvers to self-select tasks in which to participate based on their personal skills and motivations, and at the same time understanding the overall purpose of crowdsourcing campaign. Task division is done with "task re-integration" in mind: the task is split up in a way that enables the *ex-post* aggregation of the results (i.e., how not only ideas are generated but can be integrated to an executable design or coherent plan). Decomposition replaces delegation as the key aspect of task division, forcing managers to "think through" how their needs can be met by defining the components of work in detail. Generally, the requesters identify and specify the problem to solve and map this problem to crowdsourceable tasks. The tasks need to be easily understandable for the target crowd– which typically does not know the full context (Bailey and Horvitz 2010). This is made challenging by the fact that the crowd composition, at least upfront, are unknown to the requesters.

6.2.2 Task Allocation Through Open Calls (instead of "Fixed Assignments")

In the second step (also the second organizing dimension) of internal crowdsourcing, the task allocation, tasks are assigned in a distributed manner through workers' reaction (or non-reaction) to "open calls". The open calls in the BOSCH case, were issued both via push (e.g., email) or pull (e.g., blog post). A requester emphasized the importance of the centrality of open calls: *"The main challenge is to reach the right people inside the organization and motivate them to contribute. This can be done only with the open call"* (myLogistics Requester #3). Hence, the open calls, even if only short blurbs, are seen crucial for the success of crowdsourcing. In the BOSCH case, they were designed with substantial attention to text and media. BOSCH engaged an agency specifically to develop a wording and advertising concept for the open call. Once the open call is issued, solvers can join the crowdsourcing campaign on voluntary basis and contribute ideas or other forms of input. BOSCH, as a multinational company, could draw on a very broad range of solvers, thus providing the necessary diversity for internal crowdsourcing (see also (Stieger et al. 2012). In general, the task "allocation" is done through the voluntary self-selection (not fixed assignments and job responsibilities). The "open call" makes the key difference in organizing.

6.2.3 Information Flow Through Transparency (instead of Reporting)

For the third step and organizing dimension in internal crowdsourcing the information and knowledge flows are focal. In the BOSCH case, all campaigns were performed in a collaborative mode. Solvers' names, departments, and contributions were visible to all, and online discussions were allowed and encouraged. As a solver put it, the transparency *"made it possible to combine ideas, develop ideas together or evaluate ideas. As everything happens on the platform, it is visible and transparent to all participants"* (myLogistics Solver# 12). Generally, in internal crowdsourcing, all relevant information is provided openly through the crowdsourcing platform. The initiation of the "open call", the explanation of the tasks to be performed and overall goal as well as the contributions from solvers take place online through the internal crowdsourcing platform. While internal crowdsourcing was collaborative at BOSCH, internal crowdsourcing can also be designed in competitive modes (see also (Boudreau and Lakhani 2013).

6.2.4 Renumeration Through Punctuated Recognition (instead of Salary)

The fourth dimension and final step is reward distribution. For internal crowdsourcing, rewards are typically given in non-monetary form. As employees, solves receives a monthly salary independent of any contribution made to the crowdsourcing initiative. The non-monetary recognition-based rewards were effective at BOSCH. Additionally, solvers perceived participation as enjoyable; as one myLogistics solver said, *"answering the questions was actually a lot of fun"* (myLogistics solver #7). This might be explained through the focus on the ease of use of every campaign, *"We try to provide the solver a positive experience when joining the campaign"* (myLogistics requestor #1). Solvers also reported a perceived "power to change something from the bottom up", for example, through decisions based on direct democratic voting, Crowdsourcing campaigns were seen as a welcome diversion from daily routine tasks. Generally, through their contributions to the online platform, solvers have an opportunity to "be visible" and to be recognized company-wide, across hierarchies and boundaries.

6.3 Consequences of International Crowdsourcing

Finally, the data analysis also revealed three central organizational consequences of using internal crowdsourcing: innovativeness through the immediate solutions developed, increased organizational learning and a general opening of organizational culture.

6.3.1 Organizational Innovativeness

Open organizing in the form of internal crowdsourcing leads to crowdsourced solutions or ideas for solutions to a requester's problem. This is, of course, the "intended consequence" of internal crowdsourcing. At BOSCH, these answers are provided by solvers in the form of collaborative contributions (e.g., LOGipedia articles co-authored by solvers) or creative ideas for new products, services or processes (e.g., through solvers' feedback in myLogistics forums). As a requester commented, "I am surprised how many different solutions already existed [within BOSCH]" (MyLogistics requester #3). Generally, new und unexpected solvers may react to the "open call", resulting in more diverse and creative solutions through internal crowdsourcing. This is what prior literature has dubbed "broadcast search" (Jeppesen and Lakhani 2010) or "distant search" (Afuah and Tucci 2012). Open call enable to find solutions

from individuals, who typically would not know about or be involved with the problem, providing the organization with alternative knowledge and new solution approaches.

6.3.2 Organizational Learning

Less obvious when studying one-off cases or campaign: internal crowdsourcing increases organizational learning. This manifests in two forms: single-loop learning (developing solutions for problems, as above) and double-loop learning (learning about this organizational learn method itself). At BOSCH, the introduction of the two communities LOGipedia and myLogistics has to be seen (and was intended) as early step to "learn" crowdsourcing. Hence, an important outcome is learning how internal crowdsourcing works and how it can be improved in terms of crowdsourcing of task design, organizational detail, tone and communication, applied IT solution etc. For example, a requester, unsatisfied with the responses received, suggested *"next time, I will use a completely different formulation of the questions"* (myLogistics requestor #1), referring in this case to an even simpler, better-developed wording of the task description. In that sense, the organization that crowdsources *"learns through and about crowdsourcing"* (Schlagwein and Bjørn-Andersen 2014; p. 115) by enacting it. Organization single-loop and double-loop learn with internal crowdsourcing.

6.3.3 Cultural Openness

Cultural change is the final, long-term consequence open organizing with internal crowdsourcing. In the BOSCH case, through the promotion of internal crowdsourcing, more and more "open calls" reached employees. This led to an increased number of solvers experiencing open organizing. As one solver commented, *"I like the idea of 'everyone can join' … this is sort of a revolution for our company!"* (myLogistics solver #5). A changed mindset and seeing new ways of doing things resulted from open organizing. At BOSCH, cultural change initiated or enhanced by the use of crowdsourcing can be summarized in three main categories: firstly, it reduced cultural barriers for collaboration across departments, hierarchies and geographic locations. Secondly, correspondingly, crowdsourcing increased the acceptance of solutions from "outside" parties (e.g., employees in other departments or locations) as valid. The transparent approach in crowdsourcing and the ability to intervene at any stage reduced the "not-invented-here" syndrome (the

rejection of outside ideas). Thirdly, the confidence of employees increased as internal crowdsourcing could generate respect by providing ideas and opinions which were evaluated largely independent of seniority in the organization. Typically, sentiment of participants was that crowdsourcing and other forms of open organizing presented a chance breaking way from *"[not just being] a small cog in a big wheel"* and have to influence on the organization and supported the chutzpah to speak up and contribute. Crowdsourcing's main impact at BOSCH, according to our analysis and observation, was an opening up of the organizational culture, mutually re-enforcing other open approaches (such as social media communication or internal startup approaches).

6.4 Theoretical Model of Internal Crowdsourcing as a New, Open Form of Organizing

Figure 3 combines the analytical insights in regard to the preconditions, the nature, and the consequences of internal crowdsourcing a theoretical model.

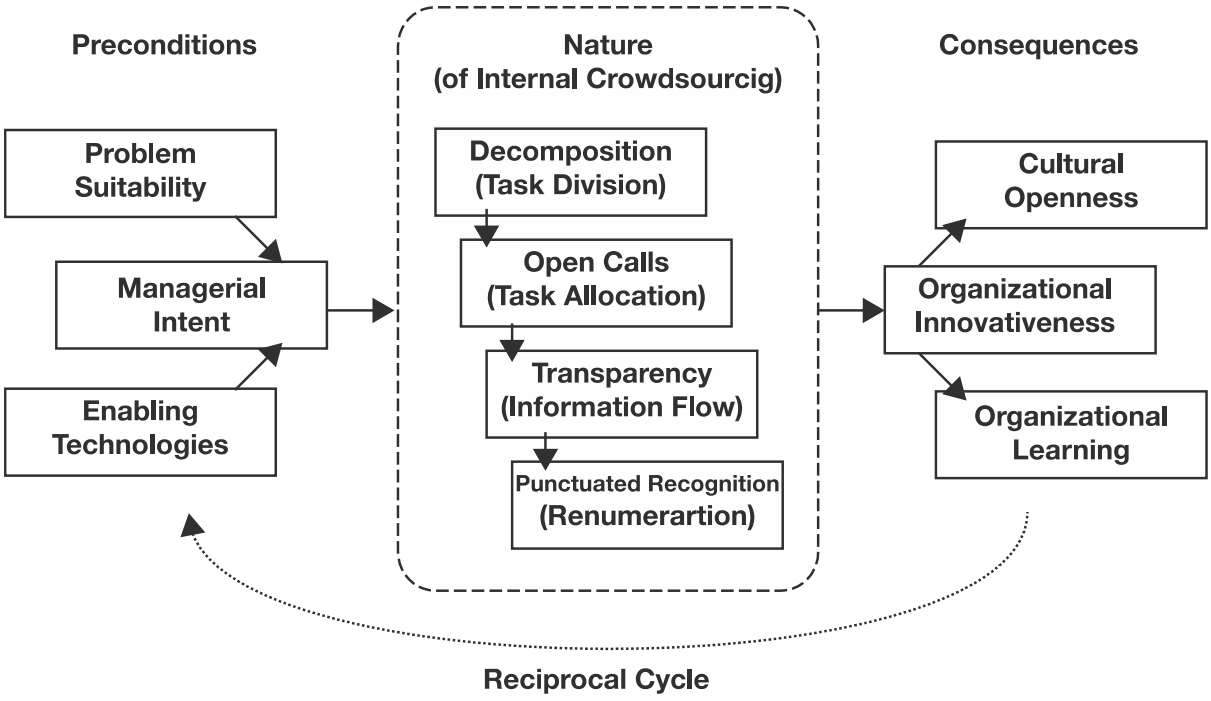

Figure 3: Theoretical Model of the Preconditions, Nature and Consequences of Internal Crowdsourcing as a New, Open Form of Organizing

In Figure 3, the boxes stand for the aggregated dimensions (theoretical concepts) that we found during the analysis of the data. Temporal and logical relations between these concepts, as narrated above, are indicated as arrows in Figure 3. Boxes and arrows correspond to our explained in the previous analysis sections and are grounded in the coding of the BOSCH case data as provided in Appendix A.

The model in Figure 3 also show a reciprocal relation between the consequences and the antecedents of internal crowdsourcing. Every crowdsourcing campaign reinforced organizational learning and cultural change, making is easier for future campaigns to be held and increasing participation. By enacting crowdsourcing, BOSCH learnt through each crowdsourcing experience and increase it knowledge about the proper use of the crowdsourcing method and underlying IT. The same applies to cultural change: The more employees and managers understand over time how crowdsourcing works, the more likely they are willing to participate in and support it. As a requester told us, *"After initiating and observing several campaigns, I am now much more confident about when and how to use internal crowdsourcing … I would like to do more campaigns to learn even more about this method."* (LOGipedia solver #5) This indicates that the immediate outcomes (solutions found) and intermediate consequences (organizational learning, cultural opening) of one crowdsourcing campaign influence the likelihood of this form of organizing being used again going forward. That is, the "backwards" line is the double-loop of organizational learning, indicate a reciprocal relation between the consequences and the preconditions of internal crowdsourcing.

Summarising the theory presented in Figure 3: For internal crowdsourcing to emerge as an IT-enabled new mode of organizing, a number of conditions need to be met. The problems the organization faces needs to inherently be suitable for crowdsourcing (solutions are the ends crowdsourcing). The necessarily technology needs to be available and rolled out (social IT are the means of crowdsourcing). If both conditions are given, it is then critical that managerial intention exists to successfully implement internal crowdsourcing. Once internal crowdsourcing is enacted, is constituted a new, open form of organizing that is distinct from how similar task were previously organized in the organization. Firstly, requester's problems are made "crowdsourceable" by breaking them down (task division by decomposition). Secondly, the tasks are allocated through "open calls" on the internal crowdsourcing platform (task allocation through open calls). Thirdly, all information about the tasks and all solvers' inputs are gathered publicly and openly discussed

(information flow through transparency). For these three steps the resources availability is crucial. Finally, the solvers need to reward such as through public, punctuated praise (reward through recognition). In terms of long-term use are three salient consequences of crowdsourcing. The crowdsourced solutions are obtained for the requester as the immediate outcome (increased organizational innovativeness). Second, the organization does not only "single-loop" learns about how to tackle its problems but also "double-loop" learns how to use crowdsourcing for future learning better (increased organizational learning). Finally, cultural change, an "opening up" of the organizational culture is triggered or supported by crowdsourcing (increased cultural openness). The last point in particular has not been documented in short-term studies of crowdsourcing but stood out in our long-term study at BOSCH: internal crowdsourcing contributed to an opening of the corporate culture towards endorsement of other open and transparent approaches more widely (e.g., social media use for business).

7. Discussion

This paper contributes to our theoretical understanding of the nature, preconditions and the consequences of (internal) crowdsourcing. While prior studies (Afuah and Tucci 2012; Jeppesen and Lakhani 2010; Schlagwein and Bjørn-Andersen 2014)focused on particular aspects of crowdsourcing, we can present here a comprehensive (covering all its salient aspects) theoretical model of internal crowdsourcing as new form of organizing. Based on rich longitudinal (2013-19) case data, this paper provides detailed insights into the preconditions, the nature, and the consequences of internal crowdsourcing by developing aggregated theoretical dimensions and presents the relations between these theoretical concepts. We summarized our findings in the form of a theoretical model, contributing to both the theoretical understanding of internal crowdsourcing and the wider contemporary organizing literature. The theory proposed in this paper goes beyond prior theories of crowdsourcing that largely black-box what is actually done in organizing practice – by explicitly analysing the nature of crowdsourcing in the fundamental four dimensions of organizing (based on (Puranam et al. 2014; Weick et al. 2005) as well as examining the long-term consequences for the organization (possible due to our longitudinal design). We briefly elaborate how the theoretical model developed in this study constitutes a "delta" (knowledge contribution) against prior studies.

Our study contributes to our understanding of preconditions of internal crowdsourcing by identifying three salient aspects that need to be fulfilled in order to crowdsource: suitability of the problem, availability of enabling technologies and managerial intentionality. This goes beyond prior theorizing (e.g.Afuah and Tucci 2012) by explicitly considering managerial intentionality. We found in the BOSCH case that it is crucial that managers are willing to foster change within their organization. Hence, especially inside hierarchal organizations, internal crowdsourcing cannot emerge without managerial intent. The prominence and hierarchy-level of the requester influences the number of solvers joining the crowdsourcing campaign. While there has been some reference to management involvement in crowdsourcing activities (Leung et al. 2014), it not been explicitly considered to be a constitutive element.

The nature of internal crowdsourcing needs to be understood along the four dimensions of organizing, and how those a reconfigured compared to how the same kind of work was accomplished previously. The task division is done by decomposition. This decomposition has to be done by the requester of the work (e.g.Olsen and Carmel 2013) and might be supported by crowdsourcing experts (i.e., a crowdsourcing manager as in the case of BOSCH; or external staff as in Schlagwein and Bjørn-Andersen (2014) .The task allocation is done via open calls. Open calls should contain the task to be done, the timeframe and the reward (Lopez et al. 2010). This is dimension, in particular, set crowdsourcing apart from conventional ways of organizing. Hence, as our study shows, organization such as BOSCH find it useful to refine their open calls with great care. The information flow is based on transparency. Same as in other cases (Benbya and Van Alstyne 2010; Bjelland and Wood 2008; Erickson et al. 2012), at BOSCH a social IT platform ensured transparency in crowdsourcing and lowered barriers to participation (see also (Rohrbeck et al. 2015). The renumeration is done via punctuated recognition and non-monetary rewards. This worked well in the BOSCH case, but it remains disputed in the literature if monetary incentives (Bailey and Horvitz 2010; Benbya and Van Alstyne 2010) or non-monetary incentives (Abu El-Ella et al. 2013; Soukhoroukova et al. 2012) are more effective. Key insight is that – in contrast to normal employment-based organizing – the monetary reward is not the trigger and key motivator for engaging in crowdsourcing, and its awarded in a punctuated manner (independent of continuous wage payment).

In regard to the consequences of crowdsourcing, this study contributes an analysis of long-term impacts beyond the immediate innovation outcomes that have been focal to prior studies (e.g.Bjelland and Wood 2008; Muller et al. 2013; Simula and Vuori 2012; Soukhoroukova et al. 2012; Standing and Kiniti 2011). In particular, the BOSCH case shows how organizations increase the learning with and about crowdsourcing. That is, organizations learn with crowdsourcing, such as new knowledge and new (organizational) skills (Schlagwein and Bjørn-Andersen 2014). At the same time, as the BOSCH case illustrates, organizations also learn about crowdsourcing by adapting and improving this (learning) process over time. This can be conceptualized as single- and double-loop organizational learning. The cultural opening up through the use of internal crowdsourcing, as found and modelled here, is a new insights. Through crowdsourcing's open nature (open call as central element of task allocation) other open organizing practices (social media use for business, intrapreneurship, online communities of practice, open strategizing, crowdfunding, social media communication etc.) could be anchored in and justified in reference to the successful crowdsourcing implementation. While this aspect has not been explicitly considered in the openness literature, it can be placed in the wider context of organizational culture, which suggest that work practices shape organization culture and vice versa (Schein 2010).

The model and insights presented above have practical implications. Practitioners interested in implementing internal crowdsourcing are provided with a framework which preconditions needed and what kind of consequences they can expect. That is, our paper provides a mental model to think through not only the promised immediate results but also the necessary preconditions (managerial intention) the long-term consequences of crowdsourcing (cultural openness). Most notably, crowdsourcing may not only produce high quality results for the problem at hand, but also leads to acceptance of other "cutting-edge" work practices which may improve the organizations in other aspects including making it more contemporary and attractive to a millennial workforce.

As with any study, there are several idiosyncrasies and delimitations to be acknowledged. All findings are based on observations in one organization, BOSCH. This setup gave us the unique opportunity to capture data inside the organization and understand one case in-depth, but we did not compare multiple cases. While we believe that the model is sufficiently generic to cover a range of different internal crowdsourcing

situations, we did not study scenarios. Future work would be to extent this study towards other organizations. While our participant-observer approach had the (strong) benefit of obtaining a daily, lived, first-hand account, and while we framed all interviews as anonymous and researcher-led, we cannot entirely rule out an impact on what participants told (or did not tell) as a consequence of an "insider" (crowd manager) being part of the study.

8. Conclusion

In this research, we build a longitudinal (2013-19) case study at BOSCH and on the literature on new forms of organizing to develop a comprehensive understanding and theoretical model of internal crowdsourcing as an emerging form of open organizing. For this purpose, we analysed its preconditions, nature and consequences in brought these key theoretical dimension in relation with one another and juxtaposed them with insights in prior literature. We found that a key characteristic of internal crowdsourcing and hence the key consideration regarding the nature of internal crowdsourcing is in the "open calls" form of task allocation. Also, previously largely undocumented, a notable consequence is the effect on cultural openness within the organization. We have discussed findings about the nature and consequences of open calls organizing to contribute to the literature on organizing and new forms of organizing.

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11. Appendix A: Coding Tables (Excerpts)

Example Data	First-Order Codes	Second-Order Categories	Aggregated Dimensions
"In my opinion, a kind of crowd manager should give advice, hints, and have a look on contributions." myLogistics Solver 15.	Crowd Manager: The person taking care of the crowdsourcing campaign	Needed human resources	Enabling Technologies: Human and technological capacities needed for crowdsourcing
"I think the most important requirement is that you have an active network of people and active crowd that is available to participate in such a campaigns" myLogistics Requester 2.	Solvers: Workforce actively participating in crowdsourcing campaign		
"Without this IT solution crowdsourcing campaigns like this would not have been possible in the past, (…)" LOGipedia Requester 3.	IT solution: The social-IT platform hosting the crowdsourcing campaign	Needed IT resources	
"I think that it is very important to have an well-known initiator for a crowdsourcing campaign, so that employees are encouraged to participate." myLogistics Requester 2.	Requester: The employee having a problem to be solved	Features of the requester	Suitability of Organizational Problems: Questions where the involvement of a huge number of people is beneficial
"A crowd problem needs a clear question statement, so that the crowd knows what is expected." myLogistics Requester 3.	Problem: Clear statement of the problem to be addressed	Features of the problem	
" (…) A good crowdsourcing problem needs the input of many people." myLogistics Requester 3.	Problem: Benefits from input of many solvers		

"I think the line manager has to bring the employees closer to Bosch Connect and the communities" myLogistics Requester 3.	Committed line manager: The solver's hierarchical manager	Management involvement and support	Intentionality: Degree to which management fosters internal crowdsourcing at the organization
"our top leaders need to show us that crowdsourcing is welcome at our company." myLogistics Requester 2.	Committed top management: Overall management of the organization		
" (…) It must be clearly stated that crowdsourcing is seen as part of the organization." myLogistics Requester 3.	Explicit statement towards crowdsourcing: showing will to use crowdsourcing as a method	Aim to use crowdsourcing	

Table A1: Coding Table Preconditions

Example Data	**First-Order Codes**	**Second-Order Categories**	**Aggregated Dimensions**
"It was quite a challenge to formulate the question in a way which is understandable by everyone" myLogistics Requester 3	Clear problem statement	Features of the problem	Decomposition (Task Division)
"Without an crowd experts it would have been very difficult to start such an initiative" myLogistics Requester 3	Support of crowd manager	Expert staff needed	
"I can decide if I join a campaign or not at the end" myLogistics Requester 4	Voluntary "pick-up"	Open nature	Open Calls (Task Allocation)
"The key of success of the platform was the open invitation" myLogistics Requester 5	"Open invitation"		

"All information regarding the problem are available on the crowdsourcing platform" myLogistics Requester 5	Explicating the question	Information exchange through internal online platform	Transparency (Information Flow)
"Solvers provide their input through the platform" myLogistics Requester 1	Gathering solver's input		
"I think it's good that all the ideas were presented to the board in an unfiltered way" myLogistics Solver 1	Being heard by management as reward	Several reward types exist	Punctuated Recognition (Renumeration)
"After a difficult meeting I participated in the campaign to find some diversion from my daily job" myLogistics Solver 2	Diversion as reward		
"Everyone is curious if his or her ideas gets liked" LOGipedia Solver 4	Visibility as reward		

Table A2: Coding Table Organizing Dimensions

Example Data	**First-Order Codes**	**Second-Order Categories**	**Aggregated Dimensions**
"We learned a lot from the first campaign about crowdsourcing" myLogistics Requester 2.	Improving know-how of requester: Tacit knowledge about crowdsourcing	Improving human resources knowledge about crowdsourcing method	Organizational Learning: Improvement of the usage of involved resources
"I learn something with every crowdsourcing experience I make. " Crowd Manager 1.	Improving know-how of crowd manager: Tacit knowledge about crowdsourcing		
"After that campaign I would change several things to improve the usability of Bosch Connect." myLogistics Requester 1.	Improving the IT platform: Learning about the social-IT environment hosting the crowdsourcing campaign	Improving IT resources for crowdsourcing	

"We got fast good feedback about how to optimize the process." myLogistics Requester 5.	Process innovation: New ideas how to optimize processes	Innovation as outcome of crowdsourcing	Organizational Innovativeness: Solver's contribution to the stated problem
"As we seen, we got so many ideas for new products, (…)" myLogistics Requester 4.	Product innovation: New ideas for (virtual and actual) products and services		
"I am really happy that more and more employees are visiting the platform and start reading and contributing." myLogistics Requester 3.	Increased awareness: Degree to which employees know about crowdsourcing	Employees perceiving crowdsourcing as part of the organization	Cultural Opening Up: Degree to which the organization's culture adopts crowdsourcing
"Now working in this crowd-mode has become part of my daily life." myLogistics Requester 2.	Part of daily work: Employees perception of crowdsourcing is a usual work practice		
"The change is there, now we can act worldwide and interactive, (…)" myLogistics Solver 12.	Change process: Ongoing process of cultural change	Organizational transformation	
"I like that my input can be read by everyone worldwide, including management" myLogistics Solver 12	Overcoming organizational boundaries		

Table A3: Coding Table Consequence

Example Data	**First-Order Codes**	**Second-Order Categories**	**Aggregated Dimensions**
"In my opinion, a kind of crowd manager should give advice, hints, and have a look on contributions." myLogistics Solver 15.	Crowd Manager: The person taking care of the crowdsourcing campaign	Needed human resources	Enabling Technologies: Human and technological capacities needed for crowdsourcing
"I think the most important requirement is that you have an active network of people and active crowd that is available to	Solvers: Workforce actively participating in crowdsourcing campaign		

participate in such a campaigns" myLogistics Requester 2.			
"Without this IT solution crowdsourcing campaigns like this would not have been possible in the past, (…)" LOGipedia Requester 3.	IT solution: The social-IT platform hosting the crowdsourcing campaign	Needed IT resources	
"I think that it is very important to have an well-known initiator for a crowdsourcing campaign, so that employees are encouraged to participate." myLogistics Requester 2.	Requester: The employee having a problem to be solved	Features of the requester	Suitability of Organizational Problems: Questions where the involvement of a huge number of people is beneficial
"A crowd problem needs a clear question statement, so that the crowd knows what is expected." myLogistics Requester 3.	Problem: Clear statement of the problem to be addressed	Features of the problem	
" (…) A good crowdsourcing problem needs the input of many people." myLogistics Requester 3.	Problem: Benefits from input of many solvers		
"I think the line manager has to bring the employees closer to Bosch Connect and the communities" myLogistics Requester 3.	Committed line manager: The solver's hierarchical manager	Management involvement and support	Intentionality: Degree to which management fosters internal crowdsourcing at the organization
"our top leaders need to show us that crowdsourcing is welcome at our company." myLogistics Requester 2.	Committed top management: Overall management of the organization		
" (…) It must be clearly stated that crowdsourcing is seen as part of the organization."	Explicit statement towards crowdsourcing: showing will to use crowdsourcing as a method	Aim to use crowdsourcing	

myLogistics Requester 3.			

Table A1: Coding Table Preconditions

Example Data	First-Order Codes	Second-Order Categories	Aggregated Dimensions
"It was quite a challenge to formulate the question in a way which is understandable by everyone" myLogistics Requester 3	Clear problem statement	Features of the problem	Decomposition (Task Division)
"Without an crowd experts it would have been very difficult to start such an initiative" myLogistics Requester 3	Support of crowd manager	Expert staff needed	
"I can decide if I join a campaign or not at the end" myLogistics Requester 4	Voluntary "pick-up"	Open nature	Open Calls (Task Allocation)
"The key of success of the platform was the open invitation" myLogistics Requester 5	"Open invitation"		
"All information regarding the problem are available on the crowdsourcing platform" myLogistics Requester 5	Explicating the question	Information exchange through internal online platform	Transparency (Information Flow)
"Solvers provide their input through the platform" myLogistics Requester 1	Gathering solver's input		
"I think it's good that all the ideas were presented to the board in an unfiltered way" myLogistics Solver 1	Being heard by management as reward	Several reward types exist	Punctuated Recognition (Renumeration)
"After a difficult meeting I participated in the campaign to find some diversion from my daily job" myLogistics Solver 2	Diversion as reward		

"Everyone is curious if his or her ideas gets liked" LOGipedia Solver 4	Visibility as reward		

Table A2: Coding Table Organizing Dimensions

Example Data	First-Order Codes	Second-Order Categories	Aggregated Dimensions
"We learned a lot from the first campaign about crowdsourcing" myLogistics Requester 2.	Improving know-how of requester: Tacit knowledge about crowdsourcing	Improving human resources knowledge about crowdsourcing method	Organizational Learning: Improvement of the usage of involved resources
"I learn something with every crowdsourcing experience I make. " Crowd Manager 1.	Improving know-how of crowd manager: Tacit knowledge about crowdsourcing		
"After that campaign I would change several things to improve the usability of Bosch Connect." myLogistics Requester 1.	Improving the IT platform: Learning about the social-IT environment hosting the crowdsourcing campaign	Improving IT resources for crowdsourcing	
"We got fast good feedback about how to optimize the process." myLogistics Requester 5.	Process innovation: New ideas how to optimize processes	Innovation as outcome of crowdsourcing	Organizational Innovativeness: Solver's contribution to the stated problem
"As we seen, we got so many ideas for new products, (…)" myLogistics Requester 4.	Product innovation: New ideas for (virtual and actual) products and services		
"I am really happy that more and more employees are visiting the platform and start reading and contributing." myLogistics Requester 3.	Increased awareness: Degree to which employees know about crowdsourcing	Employees perceiving crowdsourcing as part of the organization	Cultural Opening Up: Degree to which the organization's culture adopts crowdsourcing
"Now working in this crowd-mode has become part of my daily life." myLogistics Requester 2.	Part of daily work: Employees perception of crowdsourcing is a usual work practice		

"The change is there, now we can act worldwide and interactive, (…)" myLogistics Solver 12.	Change process: Ongoing process of cultural change	Organizational transformation	
"I like that my input can be read by everyone worldwide, including management" myLogistics Solver 12	Overcoming organizational boundaries		

Table A3: Coding Table Consequences

Publications

Published

Zuchowski, O., Posegga, O., Schlagwein, D., and Fischbach, K. (2016). Internal crowdsourcing: conceptual framework, structured review, and research agenda. Journal of Information Technology, 31(2), 166-184.

Zuchowski, O. (2016). Learning with the Crowd: a Field Study of Internal Crowdsourcing as a Form of Organizational Learning. *24th European Conference on Information Systems, Istanbul, Turkey (2016), Research-in-Progress Papers*. 21.

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