Social Software for Product Development - Explorative Study on Influencing Factors and related Challenges

Full Paper

Sebastian Rohmann
University of Goettingen, Germany
srohman@uni-goettingen.de

Sara Heuschneider
University of Goettingen, Germany
sara.heuschneider@uni-goettingen.de

Matthias Schumann
University of Goettingen, Germany
mschuma1@uni-goettingen.de

Abstract

Adopting social software in organizational knowledge sharing activities has been argued to improve communication and outreach to key stakeholders. However, when dealing with social technologies in product development settings, organizations and individuals face a variety of barriers that hamper the success of these tools. Therefore a contextualized understanding of these challenges as well as the factors that influence these challenges is needed. By means of a qualitative, exploratory study we identify and map existing influencing factors with related challenges. The most significant concerns raised during the study concerned organizational activities, especially change management. Thirty-nine challenges were identified, classified and discussed in order to provide the product development community with practical evidence, and also to inform future research directions in managing social software in product development settings.

Keywords
Social Software, Product Development, Qualitative Study, Influencing Factors, Challenges.

Introduction

Product development (PD) is vital for long term success of organizations. More than other contexts PD is an inherently interdependent activity, requiring extensive coordination across different areas of expertise (Bischof 2010). Furthermore, to reduce lead times, PD takes place across different time zones and organizational boundaries (Ebrahim et al. 2011). Therefore PD projects are often characterized by a high level of uncertainty and complexity (Chalupnik et al. 2009). To reduce uncertainty communication is essential to PD projects, since communication is viewed as a process in which individuals or functions share and create valuable new knowledge (Brode and Dittrich 2010). Because PD is a knowledge intensive task, companies need to manage product relevant knowledge and knowledge exchange efficient to gain and sustain competitive advantage. In the last decade knowledge management has undergone some development (Back and Koch 2011). From a focus on capturing (externalizing) information from people, and storing the information in databases without having a particular use in mind, to learning that knowledge is somehow bound to people, and that it therefore is essential to connect people (instead of filling databases). This changed through the introduction of social software (SoSo) and a new paradigm to how knowledge networks work (the Web 2.0) (Back and Koch 2011).
Social Software Challenges in Product Development

With those characteristics social software has the potential to change work routines and culture within product development settings and the organization as a whole. However, minimal research has examined the challenges this media may face within the enterprise and especially in product development settings. Industry is interested in the operational and strategic issues involved in its implementation. In this regard, we focus on this gap by conducting qualitative-exploratory research to identify challenges of SoSo within the organization. The goal of this research is to understand the challenges of social media adoption and utilization and the underlying factors that influence these tool adoptions. Thus, we ask:

**RQ1:** What are the factors that influence the adoption and use of social software in product development settings?

**RQ2:** What are the challenges that hamper the success of social software in product development settings?

The remainder of this paper comprises a review of related work in the area of social media based product development, followed by the methodology of our qualitative-exploratory study and a section illustrating the results of empirical data analysis and classification. Two further sections discuss the findings, focusing on the limitations of the study, and finally ending with a section presenting the conclusions.

**Social Software based Product Development**

Although, web 2.0 tools are not completely new in PD and potential benefits are highlighted under terms like “product development 2.0” or “social product development” (Hinchcliffe 2007; Piller et al. 2012; McKinsey 2012) the number of articles employing research on SoSo in PD however is scarce and can be depicted as follows: Conceptual frameworks and classifications (e.g., Begel et al. 2010; Gopsill et al. 2013) provide theoretical frameworks and suggest ways in which SoSo can be leveraged for PD. Empirical studies (e.g., Bertoni et al. 2012; Peltola and Mäkinen 2014b; Tucker et al. 2014) analyze the adoption and diffusion for several objective areas, e.g., customer co-creation or SoSo-based efforts in global, virtual and cross-functional settings. However, as stated in previous reviews (e.g., Kärkkäinen et al. 2011; Rohmann et al. 2014) research on SoSo for PD is currently fragmented into studies of individual applications (e.g., Baum et al. 2013; He and Yan 2013), tools and technologies (e.g., Roberts and Candi 2014) with little focus on the big picture, e.g. the whole PD process and its parts, and it is mainly based on individual cases (e.g., Klein and Spiegel 2013). Although some articles focus on the challenges of SoSo in organizations in general (e.g., Kuika and Äkkinen 2011), however, specific insights about the challenges and factors that influence SoSo within PD are missing (Bertoni et al. 2012; Begel et al. 2010). Thus, it can be concluded that the lack in present research on SoSo for PD is twofold: First, none of existing research studied influencing factors and related challenges of SoSo for PD in practice. Second, phase transcend research is missing, although, there has been a call for research on understanding the role of IT across distinct phases of the PD process (Tucker et al. 2014). To tackle these gaps and to answer our research questions we address both aspects and look into factors that influence the adoption and use of SoSo in PD settings and related challenges.

**Methodology**

The exploratory study was conducted on the basis of qualitative data we collected on semi-structured interviews in large enterprises. In accordance with the guidelines proposed by Kvale (1996), an appropriate interview design was reached. We intended a heterogeneous study population that represents different product types (goods and services) and already uses social software for PD activities. Based on theoretical sampling we identified 41 enterprises and appropriate experts across industries that met our criteria. 15 of these companies agreed to participate in our study. Similar to the selection of companies we used defined criteria to select appropriate interviewees within those companies. We focused on two groups of elite individuals (Odendahl and Shaw 2002; Gillham 2000): experts in the product development domain (user group) and experts for internal SoSo applications (supplier group). At the outset 19 experts from fifteen international large firms were willing to participate in face-to-face or telephone interviews (response rate: 37 %) that lasted approximately one hour (Table 1). English and German was used. All interviews were tape recorded. Two of the authors individually listened to the recorded conversation and transcribed it in written text. At the end, the notes were compared to
consolidate any differences or missed conversation. In some cases written notes were sent to the interviewees for validation and to provide any further comments and feedback (Nidhra et al. 2013).

Table 1. Sample Characteristics

<table>
<thead>
<tr>
<th>Interview</th>
<th>Industry</th>
<th>No. of Employees</th>
<th>Expert</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int01</td>
<td>Financial insurance activities</td>
<td>50,001 - 100,000</td>
<td>Exp01</td>
<td>Idea Management</td>
</tr>
<tr>
<td>Int02</td>
<td>Financial insurance activities</td>
<td>25,001 - 50,000</td>
<td>Exp02</td>
<td>Enterprise 2.0</td>
</tr>
<tr>
<td>Int03</td>
<td>Manufacturing</td>
<td>10,001 - 25,000</td>
<td>Exp03</td>
<td>IT-Management</td>
</tr>
<tr>
<td>Int04</td>
<td>Manufacturing</td>
<td>50,001 - 100,000</td>
<td>Exp04</td>
<td>Knowledge Management</td>
</tr>
<tr>
<td>Int05</td>
<td>Manufacturing</td>
<td>100,001 - 200,000</td>
<td>Exp05</td>
<td>IT-R&amp;D</td>
</tr>
<tr>
<td>Int06</td>
<td>Manufacturing</td>
<td>100,001 - 200,000</td>
<td>Exp06</td>
<td>IT-Innovation-Mgt.</td>
</tr>
<tr>
<td>Int07</td>
<td>Information and communication</td>
<td>50,001 - 100,000</td>
<td>Exp07</td>
<td>Product Management</td>
</tr>
<tr>
<td>Int08</td>
<td>Manufacturing</td>
<td>50,001 - 100,000</td>
<td>Exp08</td>
<td>Social Media Mgt.</td>
</tr>
<tr>
<td>Int09</td>
<td>Information and communication</td>
<td>&gt; 200,000</td>
<td>Exp09</td>
<td>Enterprise 2.0</td>
</tr>
<tr>
<td>Int10</td>
<td>Manufacturing</td>
<td>&gt; 200,000</td>
<td>Exp10</td>
<td>IT-Management</td>
</tr>
<tr>
<td>Int11</td>
<td>Manufacturing</td>
<td>100,001 - 200,000</td>
<td>Exp11/12</td>
<td>IT-Product Process</td>
</tr>
<tr>
<td>Int12</td>
<td>Manufacturing</td>
<td>100,001 - 200,000</td>
<td>Exp13</td>
<td>Open Innovation Mgt.</td>
</tr>
<tr>
<td>Int13</td>
<td>Manufacturing</td>
<td>100,001 - 200,000</td>
<td>Exp14</td>
<td>Innovation and IT-Mgt.</td>
</tr>
<tr>
<td>Int14</td>
<td>Information and communication</td>
<td>&gt; 200,000</td>
<td>Exp15</td>
<td>IT-Management</td>
</tr>
<tr>
<td>Int15</td>
<td>Financial insurance activities</td>
<td>100,001 - 200,000</td>
<td>Exp16/17</td>
<td>Innovation Management</td>
</tr>
<tr>
<td>Int16</td>
<td>Information and communication</td>
<td>&gt; 200,000</td>
<td>Exp18</td>
<td>Product Management</td>
</tr>
<tr>
<td>Int17</td>
<td>Information and communication</td>
<td>500 - 1,000</td>
<td>Exp19</td>
<td>Business Development</td>
</tr>
</tbody>
</table>

The data analysis has been executed, using the approach of structured content analysis for semi-structured interviews by Mayring (2000) which is widely used in diverse literature streams. Specifically, we coded the interview transcripts using the three-steps of coding (open, axial, selective) (Strong et al. 2014). Two researchers were involved in the coding process, which helped to safeguard against the criticism of subjectivity, hermeneutics and value-load. This procedure safeguarded against the danger of a purely uniform coding scheme. At the same time, this safeguarded against biases and ensured equivalence of data handling (Sinkovics et al. 2005). This resulted in the generation of 125 relevant statements based on the participants’ responses. In addition, as suggested by Robson (2011) as a common approach for qualitative data analysis, the captured statements have undergone three hierarchical levels of classification (challenges, influencing factors, TOE-dimensions). The first level classified and grouped similar statements into challenges. The second level of classification entailed the construction of thematic networks whereas challenges have been assigned to factors that influence these challenges in the PD domain. Finally, we used the TOE-Framework proposed by Tornatzky and Fleischer (1990) and assigned the identified influencing factors to the associated TOE-dimensions. This way we developed the category system shown in Figure 1 and Table 3-6. Numerous studies have successfully applied the TOE framework to investigate the adoption of diverse information systems, e.g. open systems (Chau and Tam 1997) or enterprise systems (Ramdani et al. 2013). Furthermore the adoption of social networks has been investigated as well (Larosiliere et al. 2015). Therefore, the applicability of the TOE-framework for the present case and the characteristics of the TOE-Dimensions have been explained in prior literature (e.g., Kamal 2006; Oliveira and Martins 2011). In the next section, we discuss technological, organizational and environmental influencing factors and related challenges of our proposed research model.

Findings

This section describes the results based on the data classification of the 125 captured statements that have undergone three hierarchical levels of classification to obtain meaningful influencing factors and related challenges for this study.

Influencing Factors

Overall we identified 19 influencing factors and 39 challenges based on the participants’ responses that have been assigned to the TOE-Dimensions. Technological dimension represents the characteristics of current and new technological innovations (Venkatesh and Bala 2012). Organizational dimension is typically defined in terms of measures like organization size (Tornatzky and Fleischer 1990). Besides these aspects, elements that describe the situation and processes within an organization in more detail can be integrated (Tornatzky and Fleischer 1990; Kamal 2006). Therefore we divided the organizational dimension into three sub-dimensions (structural & procedural, strategic, cultural) for further
classification as these constitute important aspects in the organizational dimension of the related models of IT adoption (Kamal 2006; Oliveira and Martins 2011). Furthermore, the importance of strategy and cultural change for SoSo adoption is highlighted in the relevant literature (e.g., Bächle and Ritscher 2010). Finally, environmental dimension comprises the characteristics of the environment in which an organization conducts its business (Zhu and Kraemer 2005).

![Figure 1. Influencing Factors](image)

**Technological Dimension**

The technological dimension represents, with 9.6% of overall captured statements, the lowest rated challenge category. It comprises two influencing factors, which have the following contributions: system landscape 83% and system quality 17%, as shown in Table 2.

<table>
<thead>
<tr>
<th>ID</th>
<th>Influencing Factor</th>
<th>Challenges</th>
<th>Expert Insights (n=1*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT1</td>
<td>system landscape</td>
<td>FT1.1 SoSo is competing with other tools in the corporate system landscape</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FT1.2 SoSo is used as isolated applications</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FT1.3 Depending on System vendors (Release changes, Support, Updates)</td>
<td>1</td>
</tr>
<tr>
<td>FT2</td>
<td>system quality</td>
<td>FT2.1 SoSo functionality does not fit to product development tasks</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FT2.2 Lock-in Effect due to limited maintainability</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 2. Technological Challenges**

A high heterogeneity and complexity of the system landscape (FT1) may have an inhibitory influence on the successful introduction and use of social software (FT1.1). Due to heterogeneous domain-specific requirements SoSo is used as isolated application within single business units instead of a corporate wide uniform solution (FT1.2). Furthermore, companies use separate applications for internal use and for the integration of external actors. One participant summarizes:

"We counted 46 different platforms. There were some blogs in use since a few Wikis are gone, here was a social utility that [...] from an enterprise-wide perspective very problematic." (Exp9)

Furthermore, a separate system use in each development phase, without cross-integration mechanisms, complicates the use of SoSo to support a phase overarching transparency and networking in product development. In addition, significant beneficial effects remain untapped by distributed information silos.
System quality (FT2) of SoSo applications can be affected by the appropriateness of functionality (FT2.1). Specifically, the use of standard software causes the risk that unnecessary functionalities are implemented. This may lead to an excessive demand of users:

"We have a platform that we use parallel to tool K, because tool K is a social network [...] there are many things in there that I don’t need for my tasks." (Exp13)

Furthermore, appropriate applications should provide long-term maintenance and functionality for data migration, especially as standard solutions have not yet been established (FT2.2):

"Especially for wikis once it was extremely painful because we had Java wikis and then we switched to SharePoint and suddenly SharePoint became standard for wiki functionality [...] and then it was said: now we have to shut down the other, what are you doing? Do you transfer by hand? Standard tools for data migration don’t exist." (Exp6)

Because SoSo applications rely heavily on user-generated content to develop their added value, loss of this data can have negative impact on user motivation. It should also be designed for easy changeability to respond to changing requirements or user needs. In context of an evolutionary introduction of social software, it should thus be possible to flexibly adapt and extend functionalities (cf. FC2).

Organizational Dimension

Organizational challenges represent, with 64.8% of overall captured statements, the highest rated challenge category. Furthermore this category is divided into three subcategories: strategic 13.6%, structural and procedural 29.6% and cultural 21.6% factors.

Strategic Factors

Strategic factors refer to overall strategic conditions and management influence (Kamal 2006). We identified three factors (Table 3): business orientation 18%, strategic alignment 6%, and management support 76%.

<table>
<thead>
<tr>
<th>ID</th>
<th>Influencing Factor</th>
<th>Challenges</th>
<th>Expert Insights (n=10*)</th>
</tr>
</thead>
</table>
| FS1 | business orientation        | FS1.1 Market orientation inhibits integration of external actors into SoSo  
FS1.2 Restraint and cautious attitude with regard to new products inhibits SoSo use | 2  
1                                                  |
| FS2 | strategic alignment         | FS2.1 Strategy and aims of social media usage are not defined                                                        | 1                      |
| FS3 | management support          | FS3.1 Lack of sufficient resources (financial, human) for SoSo-initiatives  
FS3.2 SoSo is assessed as Nice-to-have or hype without significant added value  
FS3.3 Fear to get a loss of control (especially managers)  
FS3.4 Frustration due to high expectations regarding the use of SoSo  
FS3.5 Lack of SoSo- affinity on executive level | 6  
3  
2  
1  
1                                                  |

Table 3. Strategic Challenges

Business orientation (FS1) influences the relevance of SoSo utilization for PD. Segments, which don’t produce consumer-oriented products, face difficulties with integration of external actors (FS1.1):

"The closer it is to the consumer market, the easier is Open Innovation. We actually don't serve B2C but only B2B market and therefore that is similar challenging." (Exp14)

In addition, a restrained and cautious attitude with regard to new products, however, can inhibit the use of social software, particularly in the early stages of idea and concept generation (FS1.2).

Strategic Alignment (FS2) of social software in the enterprise exerts a stimulating effect on the successful establishment of the issue in the context of product development. In the companies surveyed, this is done e.g. based on explicitly formulated social media strategies or as part of company-wide excellence initiatives. As a result, the importance and priority of the issue is highlighted and it provides the necessary organizational and financial resources (cf. FO4):
"We have launched this Enterprise 2.0 strategy, it includes action plans, we make an annual roadmap, so the topic continues. But it always depends on the prioritization of business issues, including the prioritization of budgets." (Exp9)

A lack of acceptance and management support (FS3) has an inhibitory effect on SoSo use. Sometimes managers consider SoSo as a hype, which does not generate significant added value, and is therefore not actively supported by them (FS3.2). On the other hand, too high expectations regarding the use of SoSo may also have an inhibitory effect (FS3.4). In addition, sometimes there is an active resistance from management due to the fear of loss of control, since hierarchical structures are bypassed in favor of a decentralized, self-organized way of working through social software (FS3.3):

"There was big resistance from senior management, because when using social media it is no longer about hierarchy, it is about confidence. And initially they saw that as a threat, because in a way they lost control of what is going on." (Exp3)

In particular, the early stages of product development are often not the focus of management, which may negatively affect the provision of necessary resources (FS3.1). Finally, a lack of application affinity is mentioned as a cause, since at the management level often prevails an older generation (FS3.5).

**Structural and procedural Factors**

Structural and procedural factors is the highest rated category, comprising six factors (Table 4): process integration 6%, benefit orientation 24%, process and task characteristics 19%, organizational alignment 8%, latitude 19%, and incentive systems 24%.

<table>
<thead>
<tr>
<th>ID</th>
<th>Influencing Factor</th>
<th>Challenges</th>
<th>Expert Insights (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FO1</td>
<td>process &amp; functional integration</td>
<td>FO1.1 Redundant activities due to a lack of integration into the business processes</td>
<td>2</td>
</tr>
<tr>
<td>FO2</td>
<td>benefit orientation</td>
<td>FO2.1 Social software benefits and/or use cases are unknown</td>
<td>9</td>
</tr>
</tbody>
</table>
| FO3| process and task characteristics | FO3.1 Ineffective social media usage due to a high degree of task specificity/complexity
FO3.2 Limited space for SoSo-usage due to the high degree of standardization and structuring of processes and tasks | 5                      |
| FO4| organizational alignment  | FO4.1 Lack of resource allocation for SoSo initiatives due to unclear responsibilities | 3                      |
| FO5| latitude                  | FO5.1 Employees refuse the use of SoSo due to time concerns               | 7                      |
| FO6| incentive systems         | FO6.1 User frustration due to filtered messages and people not listening
FO6.2 Frustration due to wrong expectations by SoSo discussions | 5                      |

*Table 4. Structural And Procedural Challenges*

**Process and functional integration (FO1)** may encourage the acceptance of SoSo applications because immediate reference to work processes and resulting added value is apparent for users. However, the study shows, that often SoSo is introduced without adequate process integration. Subsequently, redundant work processes and additional effort occur (FO1.2):

“When I implement social software then I have another function for things I do anyway, and then I have to think: Do I prefer the new system or am I doing it redundant? And often it’s just that: it then begins to build redundancies.” (Exp6).

**Benefit orientation (FO2):** 40 percent of the respondents mentioned that SoSo benefits are often unknown because concrete use cases in the enterprise remain unidentified (FO2.1). Lack of benefit orientation is reflected in undirected SoSo utilization and thus decreased acceptance of SoSo among users. Especially for ideation, a lack of focus leads to a flood of information, whereby a meaningful processing of the data is impossible or only with great effort:

“It is not manageable, [...]you did not know what to do with it, so everyone could add what he or she [did] and I think in the beginning we get 12,000 ideas.” (Exp16)
Processes and tasks (FO3) are characterized by specificity, complexity, division of tasks, and the degree of standardization. High task specificity has an inhibitory effect on the use of SoSo (FO3.1) because these activities are usually performed by dedicated experts. Therefore, the creation of a company-wide or cross-integration of a larger community through social software provides only limited benefit. Practice shows that to generate ideas within SNS, a high effort is sometimes required to design a problem description that can be understood by non-experts. Sometimes topics or ideas can be too specific for public discussion.

“Some ideas may be so complex that they are not understandable and won’t be discussed.” (Exp1)

Standardization affects the relevance of SoSo for PD. Highly standardized and structured development activities offer little clearance for SoSo utilization (FO3.2). In our sample, that emerged especially for the development and test phase. The predominant activities in those stages are highly formalized and already supported by specific application systems. Hence, SoSo is used here merely complementary (e.g., wiki to capture or exchange additional contextual information). In contrast, idea phase is often low structured and thus offers high potential for SoSo activities.

Organizational Alignment (FO4): Lack of clear organizational structures and responsibilities can hinder the establishment of SoSo within PD when heterogeneous interests meet. The internal and external corporate communications are named to represent different demands on use. For example, the integration of customers to generate ideas must be coordinated with the activities of the external corporate communications. This can lead to increased effort or complete rejection of SoSo activities.

Latitude (FO5) defined as space for creativity and individual initiatives is regarded as essential to innovate. This aspect is even more important since the use of these applications is influenced positively by providing open spaces for employees. However employees have little time to use these tools for not directly work-related activities, for example, to discuss ideas or product concepts (FO5.1). To a certain extent the lack of time is also perception-related, since employees do not see personal benefits and thus are not willing to invest time (see FC3).

“When I go into R&D to someone who has not even included in his target agreement: Help Person M to make open innovation. [...] If he wants to do me a favor, he gives me an idea[...]. But for that "one might try it" is far not become a finished product [...] And these steps in between, this is where many ideas are lost because someone has to invest time.” (Exp13)

Incentive scheme (FO6): Extrinsic incentives can inhibit successful use of social software in product development, when the effect of incentives is not carefully evaluated. In one case the submission of ideas within a SNS was anchored in the target agreements which led to an unmanageable flood of partly useless ideas. By an exaggerated expectation extrinsic incentives can also lead to dissatisfaction and demotivation of employees (FO6.2). Our interviewees mentioned that intrinsic motivation (e.g. appreciativeness) is to evaluate higher. Due to the high number of participants timely feedback to posts is challenging (FO6.1).

Cultural Factors

We identified four cultural factors (Table 5): social software affinity 26%, change management 30%, trust and personal responsibility 18%, and openness 26%.

<table>
<thead>
<tr>
<th>ID</th>
<th>Influencing Factor</th>
<th>Challenges</th>
<th>Expert Insights (n=17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC1</td>
<td>social media affinity</td>
<td>FC1.1 Low social software affinity hampers the tool use</td>
<td>7</td>
</tr>
<tr>
<td>FC2</td>
<td>change management</td>
<td>FC2.1 Lack of change measure alignment on target group</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FC2.2 Lack of long-term change measures</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FC2.3 Lack of early involvement of all relevant stakeholder</td>
<td>2</td>
</tr>
<tr>
<td>FC3</td>
<td>trust and personal responsibility</td>
<td>FC3.1 Work cultures aligned on control and hierarchy inhibit SoSo use</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FC3.2 Lack of transparency about who is allowed to read what contributions</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FC3.3 Lack of trust on involved project partners</td>
<td>1</td>
</tr>
<tr>
<td>FC4</td>
<td>openness</td>
<td>FC4.1 Restrictions regarding the content that may be shared</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FC4.2 Not-Invented-here-Syndrome</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 5. Cultural Challenges
Social software affinity (FC1) depends on existing experience with external SoSo applications, which is especially pronounced in the younger generation employees. In addition, affinity is influenced by the general attitude of users to open, distributed work which is largely determined by the expression of the corporate culture. In the manufacturing sector, product development, however, is a highly engineering discipline typically dominated by an older generation of employees which is less affine (FC1.1):

“Product development is very much an engineering business actually [...] Engineers and especially older Engineers generally may be not so savvy to these media.”(Exp11)

Change Management (FC2) refers to cultural change measures that encourage the successful introduction and establishment of social software in the product development process:

“You need to know these work culture, and accordingly necessary you need to adjust your communication around the topic as a whole, and for the roll-out in concrete terms. Also, training would be completely different.”(Exp2)

A fundamental aspect of this is an initial and continuous communication to the users to generate attention and to emphasize the individual added value. The main challenge is to convey the personal benefits of these tools continuously (FC2.2) and to align the measures to the target group (FC2.1) to reduce early reservations towards SoSo use. This is particularly problematic because often individual benefits are unknown (cf. FO2). In addition relevant stakeholders (e.g., R&D, IT, legal) should be early involved (FC2.3; cf. FE1, FE3).

Trust and personal responsibility (FC3) affects both the formation of an innovation-driven corporate culture and the use of SoSo within this context. Thus, the empirical data suggest that a strong culture of trust with a high level of employee responsibility is conducive to successful SoSo adoption. It takes personal responsibility of each employee instead of checks and balances to promote creativity and motivation for innovative activities (FC3.3). In contrast, work cultures aligned on control and hierarchy inhibit SoSo use (FC3.1). The fear of losing control is particularly evident on executive level, since traditional, hierarchical structures are disrupted by SoSo (cf. FS3):

"There are a lot of difficult things about control. We are a big and traditional company, there have been certain ways of working and with social networking you totally break with all that.“(Exp3)

This way, SoSo enables a shift towards more self-organization, which impacts leadership and communication structures in the company. In contrast, a control-oriented culture leads to reservations about sharing of content, because the information provider cannot control use of published information (FC3.2):

"The feeling: I want to know who can see my information, is indeed, simply existing. So I decide, this is something I've created and someone else can change it, only happens in an environment where trust can prevail.“(Exp4)

Openness (FC4) refers to openness of communication and openness of use. Data indicates that there should be no content restrictions within SoSo applications. Instead, open communication should be established whereby critical issues must be addressed and fears of employees must be removed prior to exposure (FC4.1):

"So an idea and discussion will be instantly visible on the platform without a filter. If you install a filter on what may be discussed, then the tool would already die.”(Exp1)

Openness of use, however, can be inhibited by resistance from employees when reservations concerning the opening of the development activities exist (FC4.2). This as "Not-Invented-Here" designated attitude sometimes leads to reservations towards the integration of internal and external knowledge sources into the product development process:

"Some people don't want to slip up so badly on in there, it shows then on, it's a little bit: that's my turf. So here I am ... I have idea about.”(Exp14).
Environmental Dimension

Environmental factors represent 25.6% in this study. It resulted in four factors (Table 6): protection of product relevant data 41%, intellectual property 16%, works council regulations 31%, privacy of personal data 12%.

<table>
<thead>
<tr>
<th>ID</th>
<th>Influencing Factor</th>
<th>Challenges</th>
<th>Expert Insights (n=17)</th>
</tr>
</thead>
</table>
| FE1 | protection of product relevant data | FE1.1 Risk of data misuse by employees or competitors  
FE1.2 Fear that SoSo-content will be used for lawsuits  
FE1.3 Limited use of SoSo due to IT security regulations | 9  
3  
1 |
| FE2 | intellectual Property | FE2.1 Difficulties in assigning copyright claims due to the amount of users  
FE2.2 Uncertainties due to copyright regulations inhibit information sharing | 3  
2 |
| FE3 | works council regulations | FE3.1 Limited use of SoSo due to regulations by the works council  
FE3.2 Extra costs due to monetary participations of employees on ideas/improvements | 7  
3 |
| FE4 | privacy of personal data | FE4.1 Contents and uses of personal data are limited  
FE4.2 Functionality to filter and analyze user generated content and profile data is limited due to data privacy restrictions | 2  
2 |

Table 6. Environmental Challenges

The **protection of product relevant data (FE1)** influences social software use. For example, sensitive data are information about new products and their attributes or new applications for established technologies. Confidentiality and the risk of abuse of sensitive data can lead to restrictions of openness of SoSo to prevent that confidential information is made public or passed on to competitors (FE1.1). In addition, enterprises try to avoid that information on products or product features will be used against the company, e.g., in product liability claims or customer complaints (FE1.2):

“This has legal relevance, we are a bit careful. Everything concerns product liability when an employee posts on Facebook: that will never work with component X - that can be used in a lawsuit against us.” (Exp11)

Also in internal social networks the communities for PD activities are limited to a narrow circle of users due to sensitivity data (FE1.1):

„Because of sensitive nature of the ideas, these are closed communities. The environment can be accessed by 130,000 people, you don’t want to discuss details of a product that might potentially become a blogbuster. So you do that in a much more closed community.” (Exp3)

By excluding a large user community, however, significant effects of SoSo remain unused. Finally, IT security regulations (e.g., restrictions to mobile availability) can prohibit SoSo use(FE1.3).

SoSo involves a larger number of stakeholders in the PD process, which can lay claim to participation (FE2.1). Therefore the clarification of **intellectual property (FE2)** on ideas or concepts influences SoSo use:

"If you interact with more parties, then the question is when you reach something new: who has IP rights? And that makes sometimes open collaboration quite difficult, because the moment people sense: Hey, there is something here that could make money, they go back closing down and not sharing." (Exp3).

Clarification of copyright is particularly problematic when external actors (e.g., customers or development partners) are involved. In addition, users won’t share information when no regulations exist on how to handle intellectual properties (FE2.2):

“The fact that someone commented something publicly is relatively rare. [...] This has something to do with it when someone takes a technology that works in one context and transfers it to a new context, it may be protectable. Of course he wants to have copyright. Even if it is within the company, he will not publish this information too soon.” (Exp13)

**Works council (FE3)** specifications restrict application areas or cause increased effort in implementation. Restrictions arise, for example, in relation to a restricted user group or prohibition of a
mobile availability to ensure work-live-balance of employees (FE3.1). The ability to access SoSo outside the usual working environment, however, has been found useful in particular with regard to the promotion of creativity and innovation. Other provisions relate to monetary participation of employees on ideas, resulting in higher costs for the establishment of such solutions (FE3.2).

**Privacy of personal data (FE4):** Through statutory and company data protection directives, the introduction and use of SoSo may be adversely affected. Especially the disclosure and unauthorized use of user data (e.g., analysis of profile data for skills balance or tracking of user activities) is seen as problematic (FE4.1):

"An employee in tool N leaves a digital trace. We have strong privacy policies, [...] I cannot follow an employee in the internal network, like I can follow on Facebook." (Exp14).

Hence, advanced search and filtering mechanisms are impaired (FE4.2).

**Discussion and Implications**

This paper presented cross-industry research to identify and capture the challenges of SoSo adoption and use in product development from the perspective of IT and business. In contrast to previous work in the literature that highlighted isolated aspects of some of the captured challenges (e.g., Peltola and Mäkinen 2014a; Begel et al. 2010), this study presented a structured and comprehensive approach to capturing and categorizing social software challenges in product development. The classification of challenges via thematic coding in combination with the frequency count provides a detailed overview of challenges as well as highlights the relation to underlying influencing factors.

Whilst all captured challenges are important and have impact on SoSo performance, the analysis shows that there are certain critical challenges. Less than 10% of all challenges refer to the technological dimension whereas more than 60% are located in the organizational dimension. Furthermore the top 5 rated challenges (unknown benefit 9, risk of data misuse 9, time concerns 7, works council regulations 7, affinity 7) refer to the organizational and the environmental dimension. Subsequently, the main focus should not be on the implemented tools, but on the altered working practices. The results show that it must be the main task of management to actively and continuously promote SoSo utilization in day-to-day practices to break down barriers. Therefore, management must focus on two aspects. The first is to provide sufficient latitude as the support and engagement in using SoSo is especially needed in case of the challenge “time concerns” (cf. FO5). As stated above, lack of time is also perception-related, since employees don’t perceive individual benefits of SoSo utilization and thus are not willing to invest time (cf. FC3 and FO5). In the IS-literature that problem has been attributed to users’ resistance in information systems change (cf., van Offenbeek et al. 2013; Jiang et al. 2000; Modol et al. 2012). Moreover existing strategies to overcome user resistance in other IS cases may be adapted to the PD domain. Besides encouraging SoSo use, the second aspect will be providing concrete recommendations on handling sensitive data in order to reduce the risk of data misuse. Therefore, management needs to find a balance between intensive SoSo promotion and awareness of the risk of data misuse. However, how to deal with that balance to increase SoSo adoption needs to be studied in further research. We suggest the development of e. g. social software guidelines and best practices for the specific context of PD, which can provide guidance to PD actors on how to use SoSo tools efficiently for exemplary PD tasks. These guidelines may also assist managers to develop promotion strategies to encourage SoSo utilization.

There are some potential limitations of this study. According to Prechelt and Oezbek (2011), the study cannot claim generalization to any specific domain because the data selection is driven by the needs of the analysis (theoretical sampling) rather than by representativeness (random sampling). Because of the sample size it is not possible to compare the results between our two groups (SoSo user and SoSo supplier) or between branches. However, the diverse backgrounds of our interviewees (Table 1) add some value to our sample. Further, different researchers may have interpreted the qualitative data and the codes in a different way. However, we conducted the analysis and its description with great care employing data triangulation, involving two researchers that reviewed the data coding and analysis and engaging in consensus-building discussions.

**Future work** that will address some of the limitations will focus on two main aspects: the first is to extend the overall sample, as the small number of companies included might challenge the generalizability of the results. At the same time it would be interesting to explore challenges in small and
medium sized enterprises. The second aspect will be to focus capturing, categorizing and evaluating appropriate mitigation strategies and to overcome the challenges identified in this study. In addition, some challenges may not have been thoroughly addressed in the current state-of-the-art literature and may require special attention in the future.

Conclusions

In this paper, we employed a qualitative interview study to identify influencing factors that hamper the success of SoSo in product development (RQ1). Furthermore, we investigated in detail the negative impact of the identified influencing factors by studying the challenges that are related to them (RQ2). As a result we developed a model that takes account on the influencing factors and challenges of SoSo utilization in the product development domain. Hence, our results can be used in both, research and practice: Our contribution will significantly contribute to the theoretical and practical understanding of enterprise social software in the PD domain and its impact on individuals and organizations. Subsequently the results of our study can pave the way for future research in the field and provide guidance for social software usage in practice. This helps to better predict, explain, and increase the adoption of SoSo in PD contexts. Furthermore the identified challenges can serve as a starting point to understand success factors of SoSo utilization in the investigated domain.

References

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