A Resource-Based View on DevOps Teams

Key Capabilities of DevOps Teams and their Influence on Software Process Innovation: A Resource-Based View

Full Paper

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Abstract

The resource-based view (RBV) purpose is to explore which capabilities of information system development teams enable companies to gain a competitive advantage. The aim of this paper is to analyze the key capabilities for building DevOps teams to react fast in rapid changing environments. DevOps teams aim to close the gap between development and operation activities within an information system development environment and to accelerate software feature deployments. Therefore, we derived seven key capabilities from previous literature and conducted a case study with five companies from different industries to find out how they affect software process innovation. We ordered these key capabilities to the dimensions of intellectual capital. Subsequently, we explain through which of them DevOps teams, could achieve a software process innovation in form of the fast deployment of the feature of a software.

Keywords

Resource-based view, key capabilities, ISD teams, DevOps, software process innovation, case study

Introduction

Agile software development methodologies became very popular (Vial and Rivard 2015) as they provide an effective method to react to rapidly changing customer requirements in challenging environments (Hummel et al. 2013). Hence, more and more organizations decided to move from plan-driven software development to agile approaches (Dybå and Dingsøyr 2008; Tripp et al. 2016). Agile development methods try to react fast to unforeseen changes by using iterative approaches that enable adaptions during the software development process. As a result, companies are searching for a tighter collaboration between development and operation teams, which guarantees that errors are recognized and resolved as early and fast as possible (Lwakatare et al. 2016).

The “DevOps” movement, “Development” and “Operations” abbreviated, started gaining popularity in the last few years and now is widely discuss by IT professionals. The DevOps concept offers solutions that avoid interruptions between the several stages of the software development process (Fitzgerald and Stol 2014) and that complements agile software development (Mullaguru 2015). Thus DevOps-oriented teams combine all activities of software delivery in cross-functional teams (Mullaguru 2015). DevOps-oriented teams allow frequent (multiple times per month or per day) and automated deployments of new software features, which reduce risks and allows a fast availability of new software features for companies to gain a competitive advantage (Lwakatare et al. 2016).

The DevOps concept expands the agile ISD approach through the application of continuous integration. This improves the release process through a better collaboration between developers and operation employees, which delivers fast value for business (Mullaguru 2015). Prior research highlights that agile methodologies could lead to software process innovation (SPI) (Mangalaraj et al. 2009) it is mentioned that companies are able to gain competitive advantage through the application of the DevOps concept (Lwakatare et al. 2016). In the present paper we view the fast software feature delivery of DevOps-
oriented ISD teams as SPI. Highly innovative companies like Google prove that a high level of cross-functional teams improve their level of competitiveness, which can be seen as a key advantage (Finkle 2012; Kranz et al. 2016).

The resource-based view (RBV) of an organization suggests that the competitiveness of companies rely on the uniqueness of their resources. (Barney 1991; Bharadwaj 2000; Tarafdar and Gordon 2007). Several resources that work together create a capability (Lin et al. 2015). Intellectual capital could help companies to develop key capabilities. In this paper, we derived DevOps teams’ key capabilities from literature and conducted a case study research to find out if SPI is enhanced through these capabilities in case of rapid software feature deployment.

Research regarding the RBV is very limited in the area of process innovation (Tarafdar and Gordon 2007) as well as on a team level (Lin et al. 2015). Furthermore, we want to deliver new insights what teams need for an effective SPI from their IT departments. We analyzed literature to find out which capabilities can influence the success of SPI. Then we conducted a case study to find out how these capabilities influence companies and their SPI. Hence, the goal of this study is to gain deeper insights into the key capabilities of successful DevOps oriented ISD teams (henceforth DevOps teams). Accordingly, we put forth the following research questions:

Which key capabilities enable a DevOps team to foster competitive advantage through SPI?

We adopt RBV to examine and answer our research question. The next sections describe the theoretical background about the DevOps concept as well as the RBV. The methodology section explains the case study research. Then, we present and discuss the findings and show possibilities for further research.

### Theoretical Background

#### The DevOps Concept

Cross-functional teams are created to enhance the speed of IT product delivery (Kranz et al. 2016). This new paradigm in software development aims to substitute the collaboration, automation, and use of new tools and technologies that can bridge activities of development and operation within information systems development (ISD) teams (Humble and Farley 2011; Lwakatare et al. 2016). Within DevOps teams, all activities are related to the enhancement, operation and delivery of IT-based products. Furthermore, the services are combined within cross-functional teams (Mullaguru 2015). DevOps teams are committed to innovation. They aim to deploy new products and software features that create unique value for customers and thus quickly create competitive advantages for the company (Lwakatare et al. 2016). Besides a major concern of the DevOps concept is to secure fast product and service release cycles, continuous delivery, and fast fixing of defects. DevOps teams possess end to end responsibility for the products or services they develop, enhance, and operate (Fitzgerald and Stol 2015; Mullaguru 2015). Hence, implementing DevOps teams may enable incumbent companies to successfully imitate the strengths of digital leaders like Google, Facebook, and Spotify.

DevOps is strongly related to agile ISD methods. For instance, both focus on exploiting the capabilities of individuals, while constantly exploring innovative ways to create customer benefits (Fruhling and Vreede 2006; Mangalaraj et al. 2009; Vidgen and Wang 2009). This requires effective collaboration within self-organized teams and strong connections to customers (Botzenhardt et al. 2011; Overhage and Schlauderer 2012; Sarker et al. 2009). Ultimately, the DevOps concept improves agile ISD through the aim to change traditional organizational structures and approaches that try to achieve economies of scale through a strict division of labor between organizational units (Davis and Daniels 2016). Table 1 summarizes the underlying principles of DevOps.

<table>
<thead>
<tr>
<th>Principles</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Culture</td>
<td>Is defined as the acceptance to share responsibility within team collaboration to provide high quality software to the customer.</td>
</tr>
<tr>
<td>Automation</td>
<td>Is defined as the full automated building, deployment, and testing of software to gain short lead times, rapid delivery, and feedback from customers.</td>
</tr>
</tbody>
</table>
Measurement | Is defined as the metrics taken to determine the capabilities of the current delivery with the aim of setting goals or improve them.
--- | ---
Sharing | Is defined as bringing development and operations closer together, and ranges within various levels and different characteristics, from sharing knowledge, tools, and infrastructure to success and feedback.

**Table 1. The Four Principles of the DevOps Concept (Fitzgerald and Stol 2015)**

**A Resource-Based View and Software Process Innovation**

The RBV was presented by Wernerfelt (1984), the research based on the work of Penrose (1959). The roots of the RBV are in the field of organizational structure and strategy (Tarafdar and Gordon 2007), but there exists also research that applies the RBV at lower levels, e.g. teams (Lin et al. 2015). Gardner et al. (2012) present a study in which they used RBV to investigate how IT teams can develop a knowledge-integration capability to attain a higher team performance. They argued that the RBV is an appropriate theory, because IT departments or teams are responsible for the execution of tasks and capabilities are necessary for their execution.

As mentioned before, RBV highlights that resources are unique, valuable, rare, not substitutable and not easy to imitate assets that could lead to improve effectiveness and efficiency (Barney 1991; Lin et al. 2015). In addition, RBV emphasizes that resources need to be heterogeneously distributed within the organization to gain sustainable competitive advantage (Amit and Schoemaker 1993; Barney 1991). Furthermore, if resources work together, they can be seen as antecedent of capabilities (Lin et al. 2015). Hence, a capability is defined as an ability of a company to apply combined resources to achieve a desired outcome (Tarafdar and Gordon 2007). Prior research specified capabilities through dividing resources in two dimensions, tangible and intangible assets. Tangible assets are current and fixed assets within the company, e.g., technologies or raw materials (Tarafdar and Gordon 2007; Wernerfelt 1984). On the other hand, intangible assets are e.g. values, brands, and knowledge (Grant 1991; Tarafdar and Gordon 2007). Intangible resources contain, e.g., knowledge assets, flexible IS culture, relationships to customer and management (Bharadwaj 2000; Ross et al. 1996; Tarafdar and Gordon 2007).

Intangible assets are also known as intellectual capital (Bontis 1999; Tabares et al. 2015). The perhaps most-widely accepted framework divided intellectual capital of an organization in three dimensions: human capital, social capital, and organizational capital (Subramaniam and Youndt 2005; Turner et al. 2013). Human capital focuses on the knowledge, capabilities, and skills that belong to and are used by individuals within an organization (Subramaniam and Youndt 2005). Social capital reflects the knowledge that is available via relational networks. It is the pipeline for knowledge exchange and combination within the company. Firms gain advantages through sharing knowledge and insights and/or mental models within working groups and social relationships (Kang and Snell 2009; Karahanna and Preston 2013; Nahapiet and Ghoshal 1998). Lastly, organizational capital refers to the institutional knowledge that is embedded in processes, structures and systems (Grant 1996; Kang and Snell 2009).

Intangible capital could generate key capabilities for companies, which are difficult to imitate by other companies. Organizations that foster intellectual capital could generate capabilities and hence, achieve competitive advantage. This approach was applied by prior literature e.g. Tabares et al. (2015). According to previous literature, we conclude that a set of capabilities enables SPI with focus on intangible assets. We conducted a review on existing literature of agile, cross-functional ISD teams and process innovation to identify a set of capabilities that can effect SPI and ordered them to intellectual capital dimensions. Figure 1 depicts the model with seven capabilities we derived from literature.
Figure 1. Key Capabilities Derived from Literature

The aim of RBV is to identify which firm capabilities (independent variables) enable a company to achieve competitive advantage (dependent variable) (Barney 1991). Former investigations apply RBV to evaluate the relationship between ISD and achievement of process performance as competitive advantage. For example, the customer service process can be positively influenced by the capabilities of shared knowledge and IT infrastructure flexibility (Ray et al. 2005). Another study presents results that IT capabilities like capability building, entrepreneurial actions, and co-evolutionary adaptation influence company performance through their influence on strategic processes (Sambamurthy et al. 2003). Furthermore, prior literature highlighted that competitive advantage can be achieved through process innovation and research on RBV and process innovation is rare (Taraftar and Gordon 2007). Innovation is an essential driver in IS and mentioned in prior literature short cycle time systems development could be ordered as such an innovation (Baskerville and Pries-Heje 2004). In this paper, we examine which role cross-functional ISD teams play to enable SPI through providing of rapid software features. Hence, we built up the RBV approach with focus on intangible assets identified by literature to gain a range of capabilities that facilitates SPI.

Research Methodology

A case study approach is used to assess the relationship between superior capabilities of a DevOps team and their SPI. Investigations in this area are rare and researcher as well as practitioners searching for new insights through systematic frameworks (Cao et al. 2013; Eisenhardt 1989). That calls for the application of a qualitative method, since the phenomenon needs better understanding (Yin 2009). DevOps approaches have to be investigated in their daily business to gain insights about the approach and how the ISD teams are working with that issue. The advantage of case study research is that it can zoom in on real-life situations and test or develop theoretical perspectives in relation to phenomena as they unfold in practice (Flyvbjerg 2006). Furthermore, prior research depicts that intangible assets should be derived by qualitative methods (Barney 1991). Hence, to summarize case studies is an appropriate method to test the theory of RBV and improve our understanding on DevOps teams and to show which capabilities are related to them. The unit of analysis is the DevOps team.

Site Selection

For the investigation, the focus laid on ISD teams that have already implemented the DevOps approach. Therefore, we searched through the Internet and social networks for business contact (e.g. LinkedIn) for suitable companies. The focus laid on people, which already work as members of DevOps teams and have an executive position within a company. It was important to find companies that work with the DevOps approach to assess and identify their capabilities. For the case studies, over 40 companies form different industries were contacted via e-mail and telephone. A positive feedback from five companies from different industries was achieved. In each company, minimum one senior manager (e.g. team lead) and a person who has knowledge about the daily business were identified to gain different views. The aim was to depict the leadership view and on the other hand the operative, daily business view. A short summary of the study participants, the team and project characteristics are presented in Table 2. All companies have a different amount of employees and the size of the DevOps teams varies between four and 23 people. The companies have experience with DevOps between six month and five years.
Table 2. Characteristics of the DevOps Teams and Participants

<table>
<thead>
<tr>
<th>Industry</th>
<th>Project Information</th>
<th>Interviewee</th>
</tr>
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<tbody>
<tr>
<td>Case 1</td>
<td><strong>Consumer Portal</strong>&lt;br&gt;DevOps orientation since five years</td>
<td>Executive (1.1), Senior Engineer (1.2)</td>
</tr>
<tr>
<td></td>
<td>Employees: 500-1,000&lt;br&gt;Team size: 4 people&lt;br&gt;Agile method: Kanban&lt;br&gt;Product: Service for website delivery</td>
<td></td>
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<tr>
<td>Case 2</td>
<td><strong>Pet Market</strong>&lt;br&gt;DevOps orientation since one year</td>
<td>Senior Engineer (2.1)&lt;br&gt;(team lead), Senior Engineer (2.2)</td>
</tr>
<tr>
<td></td>
<td>Employees: 100-500&lt;br&gt;Team size: 6 people&lt;br&gt;Agile method: Scrum&lt;br&gt;Product: Online shop</td>
<td></td>
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<tr>
<td>Case 3</td>
<td><strong>Furniture</strong>&lt;br&gt;DevOps orientation since two years</td>
<td>CTO (3.1), Director Engineering (3.2)</td>
</tr>
<tr>
<td></td>
<td>Employees: 1,000-2,000&lt;br&gt;Team size: 5 people&lt;br&gt;Agile method: Kanban&lt;br&gt;Product: Online shop</td>
<td></td>
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<tr>
<td>Case 4</td>
<td><strong>Bank</strong>&lt;br&gt;DevOps orientation since six month</td>
<td>Executive (4.1), Senior Engineer (4.2)</td>
</tr>
<tr>
<td></td>
<td>Employees: 3,000-4,000&lt;br&gt;Team size: 23 people&lt;br&gt;Agile method: Scrum&lt;br&gt;Product: Online shop</td>
<td></td>
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<tr>
<td>Case 5</td>
<td><strong>Media</strong>&lt;br&gt;DevOps orientation since two to three years</td>
<td>CTO (5.1), Senior Engineer (5.2)</td>
</tr>
<tr>
<td></td>
<td>Employees: 1-50&lt;br&gt;Team size: 7 people&lt;br&gt;Agile method: Kanban&lt;br&gt;Product: Online platform service</td>
<td></td>
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</table>

Data Collection

The data collection phase took place within six months from October 2016 through March 2017. After identifying possible interviewees, we conducted semi-structured interviews with the participants. The questionnaire comprises questions regarding general background of the organization, the role of capabilities and SPI. Each interview had a duration about 45-60 minutes and was conducted primarily personally through face-to-face meetings. For an exploratory research setting, personal interviews are recommended because they allow comprehensive discussions (Eisenhardt 1989). The interviews were held in German or English language. German statements were translated into English. The questions were mainly open-ended, that the interviewee had the possibility to explore their experience and views (Yin 2009). Every interview was recorded and notes were taken during the interview. Afterwards, every interview was transcribed and analyzed with the help of the software NVivo 10. During the case analysis, the several necessary key capabilities of DevOps teams were analyzed corresponding to intellectual capital (Tarafdar and Gordon 2007). We followed the guidelines of Yin (2009) for data analysis. As we mentioned before we interviewed companies that already have implemented the DevOps approach to a certain degree and analyzed them under the lens of RBV. Furthermore, we asked our participant how often they deploy or are able to deploy new software feature, to analyze the SPI.

Results

The aim of this study was to understand and identify what key capabilities of DevOps teams foster SPI in case of fast software feature delivery. Therefore, we analyzed the cases with focus on the three dimensions of intellectual capital to uncover with help of RBV lens which key capabilities they use. Furthermore, we asked the interviewees how often they are able to conduct a deployment. In sum, our findings show the reference to prior literature and explain their extension to DevOps.

Human Capital

Regarding the human capital of DevOps teams, the findings present two key capabilities. The first one is the change readiness capability that encompasses technical as well as business oriented skills. Change readiness is defined as the ability to rapidly deploy and develop critical IT systems and, hence is depended on skilled IS team members (Clark et al. 1997). Change readiness contains the possibility to work
autonomous and to foster collaboration and work sharing practices within an ISD team (Bharadwaj 2000). Our experts have argued that every team member should be able to do every task of the team and is responsible for the service. The CTO from case 3 said “everyone on the team takes care of everything. Of course, there are strengths and weaknesses of the individual team members, but in principle everyone can jump in for the other (3.1).” Within a DevOps team several activities are integrated, e.g., development, quality assurance, testing, and operation (Mullaguru 2015) to name just a few examples. One expert of case 5 mentioned that they lay their focus on T-shaped employees. That means that human capital of teams reflects a mix of specialized knowledge and skills (“team members with profound knowledge in one area”, CTO team 8) and cross-disciplinary knowledge. The depicted statements show that for DevOps teams it is necessary that they are able to take over new tasks and take over responsibility for the complete service delivery. Hence, change readiness capability seem to be a necessary construct in the team. The second capability, which we identified, is decision making. Decision making is defined as the capability to maximize the potential for making a complex decision in rapid changing environments (Coyle et al. 2015). For the decisions making process the team members have to share their knowledge and learn from each other. The introduction of lessons learned or feedback sessions were characterized as helpful for the success of the DevOps approach. The executive 1.1 mentioned that “this makes small teams agile, that they can make decisions for themselves. [...] In these teams, DevOps is definitely more distinct.” Overall, these findings indicate that the decision making capability plays an essential role within the self-organized DevOps teams. Through decision making authority the teams could be able to make essential decisions for service relevant activities.

**Social Capital**

We also asked our experts which social capital aspects influence the SPI of DevOps teams. Cultural openness in the collaboration and the capability for achieving intrapreneurship properties seem to be important factors for SPI. The cultural collaboration capability means that within DevOps teams, Individual team members have to work well together (Bharadwaj 2000). We found evidences that individual team members need the attitude and openness to identify themselves with the DevOps concept. The teams that we investigated mentioned different approaches how they implemented the DevOps concept. The investigated team in case 3 mentioned that they had problems during the introduction of the DevOps concept, since they had only less time for the implementation. However, after the introduction they invest great efforts to make the employees familiar with this new concept and achieve a high state of employer satisfaction. Whereas in the team of case 1, DevOps is a concern since several years and they had “a very gentle development to the current state (1.1).” The culture collaboration capability shows that it seems to be necessary that the team members become familiar with the DevOps approach. In addition, we identified intrapreneurship skills as a capability of DevOps teams for fostering SPI. Through intrapreneurship skills traditional firms can leverage faster innovations cycles and better dynamics to catch up with competitors. Intrapreneurship is a characteristic of groups of individuals that behave like entrepreneurs and strive to produce pioneering products and services within existing companies (Henfridsson and Yoo 2014). The findings of our case study highlighted that companies want to enhance their SPI through the DevOps concept with “maximum speed and innovation rate (3.1)”.

**Organizational Capital**

With respect to the organizational dimension, the interviewed experts explained that they have integrated different forms of the continuous capability within their team. The experts mentioned that they have integrated continuous development (case 1), continuous delivery (case 3), and continuous integration (Case 2, 4, and 5). One well-known continuous activity is continuous integration. Continuous integration provokes the process steps of the deployment pipeline that includes automatically and systematically execution of development as well as deployment activities. Furthermore, continuous integration is used, so that developers gain fast work feedback (Ameller et al. 2017; Fitzgerald and Stol 2015; Kim et al. 2008). The CTO of case 2 mentioned that they have already implemented continuous integration and now want to enhance the process “with the possibility to deploy things through push a button (2.1).” The findings show, that every DevOps team has implemented continuous capabilities to solve the gap between development and operation activities. Hence, we summarize that the implementation of continuous activities is a key capability of DevOps teams. The second key capability that we identified is the IT technical skills. IT technical skills comprises all IT assets including software, technical platforms and
We analyzed the importance of IT technical skills: “We are completely using cloud services for the area [...] so we have an infrastructure [...] with rather small-scaled services, which are independent, and we have as small packages as possible, which we can release quickly (3.2).” From the interviews, we can conclude that the IT technical skills are important points for DevOps activities. The cases show that for working as a DevOps team, they need adequate IT tools and infrastructure support and the employees need the knowledge to work with those assets. A team member of case 1 mentioned that “it is not so easy, to have someone who knows, controls and runs (1.2)” the systems. Furthermore, we identified a third capability, namely agile project management. As we mentioned before DevOps broaden the agile software development approach through closing the gap between development and operations tasks. Nevertheless, our findings provide insights that an agile project management like Scrum or Kanban method is important to manage DevOps teams. All interviewees mentioned that they use an agile method, the teams of case 1, 3 and 5 use Kanban, and teams of cases 2 and 4 use the Scrum approach. In sum, our findings show that every team of our case study built up on an agile method to enhance the DevOps approach within their team. Hence, we suggest that agile project management is a key capability of DevOps teams.

Software Process Innovation

We mentioned before that with the help of the DevOps concept, companies are able to achieve competitive advantage through the frequently deployment of new software features and their availability for customers (Lwakatare et al. 2016). To find out which key capabilities of DevOps teams affect SPI in companies we asked our participants how often they are able to deploy new software features. Table 3 presents our findings:

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
<th>Case 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployments</td>
<td>Daily</td>
<td>Two weeks</td>
<td>Daily</td>
<td>Two weeks</td>
</tr>
</tbody>
</table>

Table 3. Number of Deployments Possibilities per Case

Discussion

With the help of the literature, we suggested seven capabilities of DevOps teams that influence the success of SPI. Afterwards, we verified them with help of a case study approach. Hence, we determine key capabilities, which could be necessary to enhance SPI as competitive advantage in DevOps teams’ environments. During our data analysis, we recognized that every company adapted the DevOps concept to make it suitable for their organization. Subsequently, they achieve a competitive advantage through using the key capabilities of DevOps in different manifestations and created a valuable strategy. This is in line with prior research of Bharadwaj (2000), which highlighted that a competitive advantage is achieved if resources work together and create organizational capabilities. There exists a lot of research regarding RBV and IS capabilities using quantitative approaches e.g. Wang et al. (2012) and (Bharadwaj 2000). We extend existing research and provide a qualitative research under the lens of RBV. We only found few investigations with qualitative methods e.g. Tarafdar and Gordon (2007). Qualitative research in that area of RBV is emphasized by Barney et al. (2001) for investigations of intangible assets. In the present research we applied this approach. Furthermore, to the best of our knowledge, there is no study that theoretically and empirically presents the RBV in case of DevOps teams to find out how they leverage SPI.

Overall, we present key capabilities classified into the several dimension of intellectual capital, namely human, social and organizational. We found out that the dimensions of intellectual capital and the corresponding key capabilities are used in different manifestations within the several teams. For example, the teams use the continuous capabilities in different forms. Our interviewees pointed out, that the team members should be able to overtake all service relevant activities. Through the building of cross-functional ISD teams, the cases were able to foster the continuous capability. Due to the close cooperation and the integration of the various software delivery tasks within the DevOps teams, our cases delete discontinuities to a certain degree and hence, foster continuous integration. This is also confirmed by
Fitzgerald and Stol (2015) stating that DevOps closed the gap between development and operational deployment to make it continuous. Further research could investigate how or if the implementation of different continuous activities influences the success of DevOps.

As we mentioned before, the DevOps concept is complementary to agile ISD methodology. Furthermore, investigated teams use an agile ISD method and its advantages to organize their team within the scope of the DevOps concept. Comparing DevOps with agile methods like Scrum, some differences are recognized. Agile methods like Scrum are mainly used by developers and adapt their working habits (Overhage and Schlauderer 2012). Whereas DevOps has a great focus on cultural aspects of organization and is not handled as software development method. DevOps want to close the gap between development and deployment tasks, while a software feature goes into production (Fitzgerald and Stol 2015). The success of Scrum is depended on the motivation of developers (Overhage and Schlauderer 2012), but DevOps highlighted that software code should no longer “thrown over the wall” (Fitzgerald and Stol 2015, p. 3) by developers to operations employees. Within DevOps teams, the members should be able to take over all activities of the software delivery cycle. The CTO of case 5 mentioned that there is a need for T-shaped employees (Hansen and Von Oetinger 2001). Our findings indicate that DevOps are mainly used in the context of web services. All interviewees mentioned that they implemented new technology knowledge. Our investigated teams use DevOps for providing services through the internet to their customers or are involved in a process for web services. Hence, prior research should investigate the platforms on which the services run, because customers of online shops will also use mobile devices such as smartphones or tablets and different operating systems.

As theoretical implication, the results of our exploratory study broaden our understanding of the key capabilities that could lead to the achievement of SPI in the case of DevOps teams. We help to explain through which capabilities DevOps teams could achieve SPI in form of rapid software feature deployment. Furthermore, as prior literature highlighted, we applied in-depth interviews with experts to assess key capabilities (Armstrong and Shimizu 2007). For practice, we give implications which key capabilities a company should implement on a team level that they are able to provide fast deployments to customers. Especially, we give insights into the design of DevOps teams, how they foster collaboration, enhance their software delivery time cycle and provide insights how DevOps differentiate to agile methods. We provide evidence that DevOps is an approach for firms to leverage their innovation rates.

Nevertheless, our research has some limitations that should be considered. The generalizability of the findings is limited, because we chose an explorative, qualitative research approach with a restricted sample (i.e. five companies). That means that only one DevOps team was examined in each company. Future research might identify more key capabilities, if the study could be broaden to more cases. Furthermore, the presented capabilities need further validation. Hence, further research should conduct a quantitative study to achieve validity for our findings. In addition, the interviews only took place in German companies and the case study is limited to two participants per team. As a result, further research could repeat the study in different countries or examine more teams per company.

**Conclusion**

In this paper, we used the RBV to explore the derivation of a subset of key capabilities that could enable DevOps teams to achieve competitive advantage. This research contributes to the research stream of agile ISD and the new phenomenon of DevOps. Furthermore, we applied the RBV on a team level and hence, contribute a new research study in this neglected research field. Our findings present seven key capabilities of DevOps teams, which can be assigned to the dimensions of human, social, and organizational capital of intellectual capital. We explained which key capabilities influence and enhance SPI. Currently, a lot of research exists about agile methodologies that focus on software development, e.g., Mangalaraj et al. (2009). Our research expands these research through introducing the new DevOps concept. Furthermore, we provide insights for companies to gain competitive advantage through SPI. In addition, implications for research and practice as well as possibilities for further research are given.
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