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Information technology self-leadership and its influence on team level product and process innovation

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Abstract

We define IT self-leadership as the initiatives of a team's members to use IT to improve their team performance. This exploratory multiple case study explores how IT self-leadership manifests in teams and how it contributes to the innovativeness of teams. IT self- leadership construct is developed by adapting the self-leadership construct to the information technology context. The study is conducted at six different product- or process-innovative teams, where the context of those teams was distributed between small organizations and large multinationals. Results show that IT self-leadership influences innovative behavior by enhancing communication, feedback, brainstorming, networking, sharing knowledge, visualization and adaptive behavior. Moreover, product innovations appear to be mostly influenced by IT self-leadership through technology driven idea generation. Process innovation on the other hand, is driven by the business and to a lesser degree by IT self-leadership. This paper concludes with practical suggestions to improve IT self-leadership and thereby team innovativeness.

Keywords: IT self-leadership, self-leadership, information technology, innovation, team innovativeness, product innovation, process innovation

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1. Introduction

For teams to effective in today's changing environment, innovation is critical (Lee 2008). Despite the rising interest in innovation, not all factors that contribute to innovation are fully addressed (Boso 2013; Conway 2009). This leads to a search for new factors that influence innovation. Self-leadership is proposed to have a positive influence on innovation (Phelan 2003), and technologies may play an important role regarding self-leadership (Manz 1992). The behavioral outcomes of innovation with information technologies constitute an important research agenda (Wang and Hsieh 2013). Indeed, information technologies (IT) are associated with a higher success rate of innovation (Carlo 2012). Yet, how individuals exhibit self-leadership with regard to information technologies in order to innovate is a relatively unexplored topic. This study explores

what constitutes self-leadership with information technologies (hereforth referred as "IT self-leaderhip") and the influence of IT self-leadership on team innovation.

Innovation is one of the most important factors in the national and international competitiveness of firms (Filipescu 2009). Innovation can be described as creating or improving something, which requires a substantial degree of learning and adds value (Bodewes 2003; Garcia and Calantone 2002; Jacobs 2007). Therefore, team innovativeness is defined as the ability to do something new or different within a team, which adds value to the organization (Garcia and Calantone 2002; Goh 2013; Jacobs 2007). Team innovativeness can be assessed by measuring the number of innovations or new ideas produced by a team, the team's implementation and performance on technique, and the ability to adapt to changes within teams (Liu and Zeng 2011). Team member autonomy and freedom in their work improves innovation (Amabile 1996). When autonomy lacks, teams tend to adopt the most straightforward options (Amabile 1998). Hence, in today's changing environment and changing nature of work (Devine et al. 1999), employees' freedom to provide self-leading behaviors is increasingly crucial (House 1995). Moreover, employees are encouraged to show proactive behavior and to have personal ownership, which is influenced through individual self-leadership (Manz 1986). Self-leadership definded as "leading oneself toward performance of naturally motivating tasks as well as managing oneself to do work that must be done but is not naturally motivating" (Manz 1986). Self-leadership term goes beyond the concept of self-management, by focusing on behavioral reinforcement, intrinsic motivation, and constructive thinking to enhance individuals' self-regulation and self-direction (Neck and Houghton 2006). The self-leadership theory assumes that individuals' perception of self-efficacy and intrinsic motivation can be improved by self-leadership strategies to improve their behaviors (Bandura 1991; Deci and Ryan 1985; Manz 1986). Self-leadership can be seen as a leadership technique; instead of relying on an external leader, individuals can make their own choices, set their own goals, monitor their own performance, and motivate and reward themselves (Hauschildt and Konradt 2012). Self-leadership positively influences team performance and motivation (Konradt 2009; Neck and Houghton 2006) and team innovation. Self-leading individuals are considered to be more creative (Phelan and Young 2003). Creative self-leaders reflect their internal process and construct their own thoughts and intentions towards changes, enhancements, and innovations. Self- leaders display high levels of innovative behavior in organizations (Cameli and Weisberg 2006). Furthermore, organizations can train individuals to improve their self-leading skills and thus improve innovation and performance (Cameli and Weisberg 2006).

While the importance of self-leadership is well addressed in the organizational leadership literature (Manz 1986; House 1995; Houghton and Neck 2002), its relation to information technologies is not. Information technologies are crucial for organizations to manage information and to remain competitive. IT has become crucial in the management of firms (Pearlson and Saunders 2009). A movement towards self-leading behavior is influenced by the work context, including employed technology (Manz 1992). Since individual IT use leads to higher performance (Sundaram et al. 2007), team members' IT self-leadership is also expected to enhance their team performance. Therefore, this paper examines the role of IT self-leadership. Where self-leadership is defined as individual choices to improve performance without directions from their task description (Manz 1986), we define IT self-leadership as the initiatives of a team's members to use information technoogies to improve their team performance, where there is no external requirement (through an external team manager, or as defined by the task requirements) to use information technologies. The team members can use IT do improve the team's communication, coordination or efficiency and performance. This exploratory study examines the relationship between IT self-leadership behaviors and team innovation by posing the following research question:

How do team members' IT self-leadership influence team-level product and process innovation?

2. Theoretical framework

2.1. Product and process innovation in teams

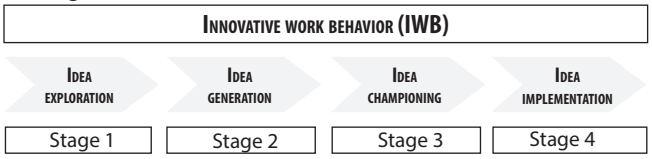
2.1.1. Team innovativeness

Organizations need to innovate to remain competitive in the changing and turbulent environment (Lee 2008). Innovation is the ability to create or improve something which adds value to the organization (Jacobs 2007), the development or implementation of products, which strives for commercial success (Garcia and Calantone 2002), or the improvement of production processes (Jacobs 2007), which requires a substantial degree of learning (Bodewes and de Jong 2003). To sum up, team innovativeness can be defined as the ability to do something new or different within a team that adds value to the organization (Jacobs 2007; Garcia and Calatone 2002; Liu 2013). There are two types of innovations; (a) changes in products (product innovation) and (b) changes in internal processes (process innovation) (Tidd 2001).

Most innovative activities are organized by teams (Eisen-

beiss and Boemer 2010). Innovation within teams is mostly influenced by innovative work behavior (de Jong and den Hartog 2010). It is the individual behavior that aims to achieve initiation and introduction of new ideas, processes, products, or procedures within groups or organizations (de Jong and Den Hartog 2007), meaning that individuals are the key drivers of innovation in teams. Innovative work behavior consists of four stages; (1) exploration, (2) generation, (3) championing, and (4) implementation (de Jong and Den Hartog 2010). The the idea exploration stage is the start of an innovation where a team member has an idea, sees a problem that needs to be solved, or discovers an opportunity (Kleysen and Street 2001). In the second stage (idea generation), the ideas become more concrete (Mumford 2000). This stage entails the activities of combining and reorganizing information and concepts to find solutions (de Jong and Den Hartog 2010). Once ideas are generated, the third stage of idea championing starts. New ideas will most likely face resistance; therefore idea championing stage is required to overcome resistance to change (Van de Ven, 1986). Idea championing is the search for support for innovation by propagating and selling its success and getting the right people involved (Howell et al. 2005). The last stage, i.e. idea implementation, refers to making the innovation part of the organization (process innovation) or the industry (product innovation) (Kleysen and Street 2001). Figure 1 summarizes these stages.

Figure 1. Stages of Innovative Work Behavior (De Jong and Den Hartog 2010)



2.1.2. IT and innovation

Creativity and innovation are strongly connected to the use of technologies by applying IT in new ways (Wang and Li 2011). Novel application of IT can support task performance and push the use to a higher level which surpasses routine ways of use. Two types of innovation exist; changes in products (product innovation) and changes in the internal process (process innovation) (Tidd 2001). Product innovation refers to what is produced while process innovation concerns how existing products/services are produced (Edquist et al. 2001). Information technologies can contribute to process innovation by affecting how transactions are processed, how the work is done, how customers and suppliers are dealt with and how new customers are approached (Fichman et al. 2014). Information systems help optimize internal processes and thereby are mostly considered to apply to process innovation (Pearlson and Saunders 2009). But information technologies can also be deployed to generate novel ideas for products or services. By using different systems, thoughts can be structured to find solutions to problems (Neck and Houghton 2006; Seligman 2011). Moreover, the development of new products or services can be enabled or be a part of IT (Fichman et al. 2014). With the help of IT, new products can be developed or existing products can be improved (Fichman et al. 2014). IT can be used to support the stages of the innovative work behavior model. In the first stage, idea exploration, IT can be used to find new ideas, to discover an opportunity or to indicate problems that need to be solved (Kleysen and Street 2001; Seligman 2011). Subsequently, in the second stage, the idea generation, IT can be put into practice to elaborate the novel idea and to receive feedback of others (Mumford 2000; Pearlson and Saunders 2009). In the idea championing stage, IT can be used to overcome resistance by involving the whole organization in the innnovation and to sell the idea internally (Howell et al. 2005). Lastly, in the idea implementation stage, inforamtion technlogies can help promote the idea to customers or to make the innovation part of the organization's processes (Kleysen and Street 2001; Fichman et al. 2014) through the use of information technologies. .

2.2. IT self-leadership

2.2.1. Self-leadership

The twenty-first century is characterized by flexible and dynamic organizational structures. Therefore, self-leading behavior of employees became more important (House 1995). Individuals are motivated to show proactive behavior, personal ownership, and personal initiative (Fay and Frese 2001). These behaviors are mostly influenced through individual self-leadership (Manz 1986). Self-leadership is the process in which people direct and motivate themselves to enhance their performance (Manz 1986; Houghton and Neck 2002). Self-leadership helps employees perform better for both motivating and unmotivating tasks by using cognitive and behavioral strategies (Cameli et al. 2006). Self-leadership consists of five strategies that help individuals and teams. These are; self-awareness, volition, motivation, cognition, and behavior strategies (Manz and Neck 1991). (1) **Self-awareness** is the observation of one's own behavior. It is important for high self-regulation, goal accomplishment and well-being (Manz and Sims 1980). People who have high self-awareness demonstrate higher creativity (Ryan and Deci 2000). (2) **Volitional strategies**, such as holding onto goals, help individuals attain the desired outcome (Gollwitzer 1990). Volitional strategies enable people to perform difficult tasks by eliminating short-term

distractions and increasing their long-term determination (Gollwitzer 1990). (3) **Motivational strategies** (also called natural reward strategies) include setting intermediate goals, using self-rewards, positive thinking, or seeing un-motivating tasks as a learning process (Deci, 1975). Individuals who utilize this strategy persist more than others to achieve goals, which leads to higher performance (Georgina 2007). (4) **Cognitive strategies**, such as self-analysis and improvement of beliefs (Manz 1986), increase job satisfaction, and expectations of success and performance (Manz and Neck 1991). Through cognitive strategies, individuals improve their previously unsuccessful processes. (5) **Behavior-focused strategies** are interwoven with the other aspects of self-leadership. Individuals can practice these strategies through self-observation, observation of others, and goal identification (Manz and Neck 1991) and achieve significant performance improvements (Bandura et al. 1969). Self-awareness, volitional and cognitive strategies can be grouped into 'constructive thought pattern strategies' (Neck and Houghton 2006). Constructive thought pattern strategies are those strategies that create a positive and focused mindset through eliminating distractions and learning from past actions (Neck and Houghton 2006; Seligman 2011).

Self-leadership is mostly described in the literature as a process at individual level. But Konradt (2009) also stresses the importance of self-leadership in teams. Team self-leadership leads to higher collective responsibility for decision making and behavioral control at the team level. Furthermore, Uhl-Bien and Graen (1998) found a positive effect of individual self-management on the effectiveness of teamwork. One other characteristic of team self-leadership is collective cognition (Stewart et al. 2011), which refers to collectively processing information within the team (Converse 1993).

2.2.2. IT self-leadership

Information technologies facilitate the work of people and their behaviors (McAfee and Brynjolfsson 2008). Similar to self-leading strategies, information technologies help organizations enhance performance the team level. Where the movement towards self-leading behavior is influenced by technology (Manz 1992), the link between information technologies and self-leadership can be made. Use of IT for doing a task can be seen as aself-leading behavior when IT use changes the nature of the task, and when the use of an information system was not originally a part of the assigned task description. Therefore, IT self-leadership can be defined as the choice of the members of a team to use information technologies in order to enhance their team performance, where such technologies are not part of the original description of the task. IT self-leadership includes; (1) using different IT systems, (2) combining different IT systems in a new way, or (3) using an existing IT system on a higher level than it was used before. At the team level, the use of information technology will lead to higher collective responsibility for decision making and behav- ioral control at the workgroup (Konradt 2009). Moreover, higher levels of (IT) self-leadership lead to increased ef- forts towards the team (Hauschildt and Konradt 2012).

Previously, the five strategies that make up self-leadership were introduced. To explain IT self-leadership, we adapted these self-leading strategies to account for the information technology use. Therefore the following strategies make up the IT self-leadership: (1) **IT-enabled behavioral strategies** are strategies that use IT, in order to achive team goals by observing the performance of team members. An example of these strategy may be the use of IT to observe whether specific targets are achieved. (2) **IT-enabled reward strategies** include using IT to facilitate the team members to reward themselves when goals are achieved. (3) **IT-enabled constructive thoughts strategies** are those strategies in which information technologies are utilized to create a focused mindset, through which, on learns from the past, and in which data can be stored to facilitate team level learning. These IT self-leadership strategies, similar to the self-leading strategies (Carmeli et al. 2006; Neck and Manz 1996) are expected to improve team performance and innovativeness.

2.2.3. IT self-leadership strategies and innovation

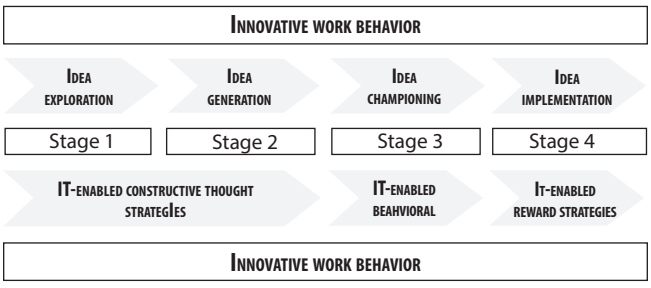
To find relevant literature for the concept of self-leadership in combination with IT and innovation, a systematic literature review was conducted. Doing systematic literature review helps to identify, evaluate and interpret all available studies in a field (Kitchenham 2010). While the Association for Information System's 'Basket of 8 Journals' did not result in any articles on self-leadership, further search in EBSCO database with the keyword "self-leadership" resulted in 98 articles. From these 98 articles, only those articles that indicate a possible relation with technology, information systems or innovation were identified. This elimination process resulted in a total of 18 reviewed articles. Out of 18, only one article (Manz 1992) suggested a relation between technology and self-leadership. Five articles were found about the relation of self-leadership with innovation (Manz 1992; Phelan and Young 2003; Cameli et al. 2006; DiLiello and Houghton 2006; Curral and Marques-Quinteiro 2009). These articles did not distinguish between product and process innovation. Manz (1992) clearly linked self-leadership with innovation by stating that there might be a relationship. Cameli et al. (2006) examined how self-leadership skills influence

innovative behavior at work. They found that there is a positive relationship between both concepts and suggest that income and intrinsic motivation is the main influencer for employees to act in a self-leading way to enhance their innovativeness. This is partly supported by the article of Curral and Marques-Quinteiro (2009); they stated that enhancing employees' self-leadership might influence innovative behavior through learning goal behavior and intrinsic motivation. Phelan and Young (2003) found that training has a positive impact on creative self- leadership.

Creativity and innovation can best be motivated by giving employees autonomy and intellectual freedom (Curral and Marques-Quinteriro 2009), behaviors which are strongly connected with self- leadership. Individuals with strong self-leadership are mostly considered to be more innovative and creative than individuals with low self-leadership (DiLiello and Houghton 2006). This view is partly supported by Carmeli et al. (2006) and Phelan and Young (2003); both of whom found that self-leadership influences creativity.

To extend this connection between self-leadership and IT, we connected the stages of innovative work behavior (de Jong and den Hartog 2010) to different self-leadership strategies (Figure 2) as described by Manz and Neck (1991). This has resulted in a combination of the three IT self-leadership strategies with the innovative work behavior model. IT-enabled constructive thought strategies are essential in the first and second stages of the innovative work behavior process. These strategies help individuals and teams recognize problems and generate new ideas or solutions through the use of IT. IT-enabled behavioral strategies can be used in the third stage, where team members' efforts to reach their goals effectively and efficiently through information technologies positively influence the championing of the innovation within the organization. IT-enabled reward strategies are important in the last stage of the innovative work behavior process. When people use information technologies to set goals, and to identify when goals are reached and to reward themselves, the adoption and innovative use of information technologies for innovation will happen much more smoothly.

Figure 2. Connecting innovative work behavior and IT self-leadership strategies



3. Method

As the concept of information technology self-leadership is a new one, we conducted an explorative study as described by Eisenhardt (1989). Based on the limited research found on information technology as it relates to self-leadership, we found that that the relationship between self-leadership and IT was both deemed important and yet not understood. Therefore, qualitative theory de-velopment is most appropriate (Myers 2009; Ozcan and Eisenhardt 2009). Moreover, case studies are more likely to generate new theories (Eisenhardt 1989), therefore we conducted a multiple case study. Since this study aims to understand the behaviors of individuals within teams and mechanisms of different constructs, in depth interviews were found appropriate (Cooper and Schindler 2006).

3.1. Data collection

In-depth semi-structured interviews were conducted with 7 teams from 6 companies. The cases were carefully selected to represent product and process innovation equally. While quantitative studies rely on random or representative sampling to find generalizable conclusions from the population, qualitative research relies on choosing participants on the criteria and phenomena of the study (Lincoln and Guba 1994). This theoretical sampling is more appropriate to understand the complexity of the research question, but decreases the generalizability of this study (Gersick 1988). Nevertheless, only interviewing participants who are experiencing the phenomena of the study were expected to result in findings with a higher relevance (Bailey 1992). Therefore, the participating teams in this study were selected on the following criteria: (1) The team is considered by the management as being product or process innovative and (2) the team is considered as being a leader on IT. To assure teams were innovative; the degree of innovation was also questioned once more as part of the interview protocol.

This resulted in a total of seven teams that were interviewed, at six different companies. Two small companies (<50 employees), one medium company (~200 employees), one large company (~1400 employees) and two large multinationals (>90,000 employees). The choice of conducting the interviews at different companies was made for the distinction between product and process innovative teams. Moreover, different firm sizes were included to increase the generalizability of the study. A total of twenty participants were interviewed, ten of them being product innovative and ten process innovative (table 1). Because there appeared to be differences in IT self--leading behavior between members, the team members to be interviewed were chosen by their familiarity with IT and their drive to find new IT.

This study is conducted with semi-structured interviews. Although the questions were prepared up front to find consistent and reliable results, the loose and flexible setting left room for new insights (Galletta 2013). The relationship between innovation and IT self-leadership was examined by formulating questions using the critical incident technique. Interviewees were asked to describe a situation in which they were innovative and they were probed to understand what enabled their innovative behaviors. This way, we probed for all factors causing innovative behaviors including IT self-leadership, rather than biasing the answers. The critical incident technique is useful to gather specific behaviors (Flanagan 1954), which was useful in this study to capture innovative and IT self-leadership behavior.

3.2. Data analysis

After conducting the interviews, the recordings were transcribed verbatim. The data that derived from the interviews were analyzed as described by Eisenhardt (1989). Each case was first analyzed using both deductive and inductive coding (within-case analysis). Upfront, main deductive categories were set, based on the literature, to set boundaries for factors that influences the examined mechanisms. Within these categories, inductive codes were explored and explained within each different case. When new codes emerged, the previous interviews were reanalyzed using the new codes. When all interviews were completely coded, the codes were explored and explained across the cases to conduct a theory. The cross-case analysis was conducted following within-case analyses. Cross-case analyses can be conducted as independent research studies or as a predesigned part of the same study (Yin 2009). In this study, the latter was the case. Before the start of the coding, two main (deductive) categories were set; **Innovation trough IT self-leadership**, and **Innovation trough IT without self-leadership**. The second category was also part of the coding schema to make a clear distinction between factors that are part of IT self-leadership and factors that are not, to set clear research boundaries and to avoid coder bias.

4. Results

4. 1. Product innovation and IT self-leadership

4.1.1. Product idea generation and IT self--leadership

The category product idea generation consists of the exploration and generation of novel product ideas through IT self-leadership. The findings of this study suggest that the exploration and generation of new product ideas with IT self-leadership is mostly driven by technology, and not by business as described below. The main reason why product innovation was triggered by technology was that modern external technologies overtook the business. One of the interviewees, who is part of the news team, argued; "We were in a situation where the news we were supposed to provide were already caught by Twitter users". The news this new company generated was not fast enough to compete with Twitter, therefore a product innovation had to be initiated. Another way teams generated novel product ideas, which was reported by 3 out of the 4 product teams, was formulated by one of the participants: "Especially by following innovative websites and innovative people one finds new ideas". These results indicate that the exploration of new product ideas is driven by technology, which is strongly related to IT self-leadership because it is not something described within the task description, but a free choice to find new ideas with the help of IT.

The generation of new ideas appears to be largely influenced by IT self-leadership. The results from all product innovation cases indicate that the generation of novel product ideas is positively influenced; (1) by communication tools, (2) by gathering and sharing knowledge with IT, and (3) by social networking tools. Communication tools, chosen by recipients, are for example; WhatsApp, Telegram and other instant messaging tools. These tools contribute to the generation of novel ideas by supporting the brainstorming process within a team. One of the interviewees indicated; "The brainstorming of different ideas is enhanced through a chat tool". Communication tools also added towards the generation of novel ideas by providing a platform for feedback. Such tools make it easier to provide feedback for ideas, as one of the recipients stated: "This [communication tool] also helps for feedback, which made it easier because you don't have to give feedback face-to-face".

The interviewees suggested that product idea generation is also positively influenced by the gathering and sharing of knowledge with IT in a self-leading way. The gathering and sharing of information through various information technologies provided a place for team members to be able to see and work on all documents. Having a central location for all work-in-progress documents provided team members the opportunity to give feedback to and share ideas with other team members, without involvement of a manager. IT tools which are used for this purpose are for example Google Drive and forum tools. One of the interviewees argued; "We use Google Drive a lot. We can use IT to share documents with others and they can give feedback".

Last, the generation and exploration of novel product ideas was influenced by social networking tools. Social networking tools were chosen by team members to find new ideas by looking beyond the borders of the team.

Participants of this study indicated that this was done by following innovative websites, searching on social media and by communicating with people from other companies and countries. As one of the interviewees stated; "We use a chat box where people from different countries enter to discuss how to implement the product".

Table 2. Sample codes: product idea generation and IT self-leadership

Subcategory	Code	Example
Product idea generation by communication tools	Brainstorming via a communication tool	"The brainstorming of different ideas is enhanced through a chat tool."
	Feedback via a communication tool	"This [communication tool] also helps for feedback, which is made easier because you don't have to give feedback face-to-face."
	Communication with chat tool	"We don't have to use email anymore, with the chat tool we can do everything."
Product idea generation by gathering and sharing knowledge with IT	Data gathering by forum tool	"We have used Basecamp [forum tool] to gather data and to be able to see it other times."
	Feedback by sharing tool	"We use Google Drive a lot. We can share documents with others and they can give feedback."
	Sharing ideas with IT	"We have a Google Doc [sharing tool] to write down ideas and share them, so everyone could read these and give their opinions."
	Collaborative idea generation	"We can work on the same document to improve our ideas."
		"Mostly I work alone, but IT enables us to work together on documents."
Product idea generation and exploration by network tools	Following innovative websites for ideas	"Especially the following of innovative websites en innovative people helps to find new ideas."
	Searching on social media	"Via internet, for example on Twitter and LinkedIn, I find valuable ideas."
	Communication with other companies and countries	"We use a chat box where people from different countries enter to discuss how to implement the product."
Technology driven innovation	Technological threats driving innovation	"We were in a situation where the news we were supposed to provide were already caught by Twitter users."
	Following innovative ideas through IT	"Especially by following innovative websites and innovative people one finds new ideas."
		"We find ideas by following innovative ideas on websites of competitors."
	Technological opportunity	

4.1.2. Product idea implementation and IT self-leadership

The category product idea implementation consists of the championing and implementation of product ideas by IT self-leadership. The results indicate that IT self-leadership contributes to both championing and implementation of novel product ideas. The championing of ideas by IT self-leadership is done by choosing IT with the purpose of (1) visualization, (2) prototyping, and by (3) working around standard procedures. Visualization appears to be very important for the championing of novel product ideas; 7 out of the 10 participants with product innovation indicated this. One of the interviewees suggested; "Photoshop is holy for this [implementation] (...) to buy an idea, people need to visualize it". Visualizing the idea for the organization helps to sell the idea by providing an example or prototype. Similarly, other interviews show that visualization is a commonly used tool for the championing of a new idea. Prototypes can be used to visualize a concept, as one of the interviewees stated; "To sell the new idea we use a tool for prototyping (…) by which the customer can see how it works".

In large companies, IT self-leadership was generally lower. This was mainly because centralized decision making hindered individuals' own IT choices. Sometimes IT self-leadership was used to work around these standard operating procedures. One of the interviewees, who is working at a large multinational, argued; "We have decided not to make the new product a part of the current business (...) if we had followed the official path, the innovation would not have been possible". In this team, the new (IT) product was built outside of the business. Once its success was proven, the company accepted the new innovative product.

Table 3. Sample codes: category product idea implementation and IT self-leadership

Subcategory	Code	Example
Championing by IT self- leadership	Visualization by IT	"Photoshop is holy for this [implementation] (...) to buy an idea, people need to visualize it"
	Working around standard procedures by IT	"We have decided not to make the new product as a part of the current business (..) if we had followed the official path, the innovation would not have been possible."
	Prototyping	"[To sell the new idea] we use a tool for prototyping (…) by which the customer can see how it works."
Product idea implementation by sharing knowledge	Feedback through IT	"We use a forum to discuss projects with the customer (…) they can give feedback, which helps for the implementation"
	Sharing ideas through IT	"We have a Google Doc [sharing tool] to write down ideas and share it, so everyone could read it and give their ideas"

The final implementation of the product innovations were mainly influenced by sharing knowledge through IT self-leadership. The results from this study show that 70% of the respondents indicated that sharing knowledge is influencing the implementation of the product. Sharing knowledge consists of: (1) giving feedback and (2) sharing ideas. The opportunity for customers and co-workers to give feedback on the new product appeared to help the implementation of the product innovation. As one of the interviewees explained; "We use a forum to discuss projects

with the customer (...) they can give feedback, which helps for the implementation". Furthermore, the interviewees also indicated that the sharing of ideas within the company using information technologies contributed to product implementation success, because IT helped improve the transparency of the team.

4.2. Process innovation and IT self-leadership

4.2.1. Process idea generation and IT self--leadership

The results from the interviews show that process idea generation is less connected to IT self- leadership in comparison to product idea generation. Among the process-innovative team members, 40% of the interviewees rated themselves high on IT self-leadership. In comparison, among the product-innovative team members 70% of the interviewees rated themselves high on IT self- leadership. This could be because innovation was mainly driven by a gap in the business, rather than by the initiatives of the team members. One of the interviewees argued; "There was a need for improvement, so the team leader asked me to do research in how this could be improved". 80% of the interviewees within process-innovative teams stated that the process innovation was triggered by the business. The starting point of a process improvement included business analysis or the need for a process optimization, which is supported by one of the interviewees; "We have gone through the whole process and looked how we could improve it with IT, so that we could work more efficiently". Within the category process idea generation, there was not a clear distinction between the exploration and generation of ideas. Because a process innovation appears to be initiated by the business need, the exploration of ideas were mostly skipped until the gap in the business was already clear.

The main IT self-leadership drivers of process idea generation, appeared to be; (1) communication tools and (2) the gathering and sharing of documents with IT. The enablement provided by the communication tools caused people to take initiative and use IT. Communication tools were mainly used by the participating teams as facilitator to improve fast and efficient communication. A benefit of communication tools was a decreasing need for physical meetings. Other benefits identified by the interviewees included faster communication and the possibility to brainstorm through the communication tool as a facilitator. A participant, part of the management team of an ICT company argued; "It is possible [with the communication tool] to put different people in a group to let them brainstorm about the problem".

Gathering and sharing knowledge also facilitates the generation of process improvement ideas. As one of the interviewees pointed out: "It was not needed anymore to sit in the same room, with the new system it was possible to work in the same document from different places". The possibility to choose to work in the same document was seen to be a huge benefit for team members, because the work becomes faster and more efficient which can lead to more and better improvement ideas.

Table 4. Sample codes: process idea generation and IT self-leadership

Subcategory	Code	Example
Business driven innovation	Process optimization initiative from the business	"We have gone through the whole process and looked how we could improve it with IT, so that we could work more efficiently." "There was a need for improvement, so the team leader asked me to do research how this could be improved."
Process idea generation via a communication tools	Brainstorming / exchanging innovative ideas	"This communication tool helps exchange innovative ideas." "It is possible [with the communication tool] to get different people together."
	Geographical boundary spanning	"It was not needed anymore to sit in the same room, with the new system it was possible to work on the same document from different places."
Gathering and sharing documents with IT	Simultaneous working in distance	"I worked together with somebody with Google Docs, in this way we could work on the same document and see each other work."
	Gathering and sharing ideas	"We use IT to chat and share documents (...) different people can be placed within a group to share their ideas and to brainstorm."

4.2.2. Process idea implementation and IT self-leadership

4.3. Other outcomes IT self-leadership

4.3.1. Degree of IT self-leadership

Table 5. Sample codes: process idea generation and IT self-leadership

The category process idea	Code	Example
Championing by IT self- leadership	Visualization by prototypes with IT	"We use a tool for prototyping, the customer really sees the benefit of this [...] this spares a lot of time."
Process idea implementation by sharing knowledge	Sharing ideas with IT	"For this [implementation] we used Google Drive to share a document with the new way of working so everyone could read it."
	Feedback with IT	"It [forum tool] is a program in which people can give feedback on projects. It really motivates people, because it makes them aware of their progress." "[IT] also enables me to give more feedback, because it is not face to face but in a system."
	Planning with IT	"[For the implementation] we use a chat tool to discuss the progress with each other." "We use an IT system to create tickets for the tasks that must be done, as a planning tool."

During the interviews, IT self-leadership was assessed with the following question:

How often do you, or your team members, try to improve your performance by using IT, even though you were not specifically asked to use this IT?

The results showed that high IT self-leadership was strongly connected with a decentralized management. Within the teams part of the smaller companies, where the management was decentralized, most interviewees indicated that improving performance by choosing IT was a natural part of doing business. One of the interviewees said: "Because nothing is centralized through the management, we come up with our own [IT] solutions". Team members within decentralized companies, which were also technology companies, had more freedom to make their own choices. Within these companies, the employees were mostly younger and were looking for new ways IT could improve business operations. This is well reflected by one participant, who said: "I am always looking for new ways to improve my performance, mostly with IT;" as well as another one that stated: "This [finding new IT solutions] is something that we always strive for in this company".

Table 6. Sample codes: degree of IT self-leadership

Subcategory	Code	Example
High IT self--leadership	Decentralized management	"Because nothing is centralized through the management, we come up with our own [IT] solutions."
	IT self-leadership part of the business	"This [finding new IT solutions] is something where we always strive for in this company."
	Self-motivation for IT use	"I am always looking for new ways to improve my performance, mostly with ICT."
	Young employees	"Maybe it is because we have a lot of young employees, they are looking more for new IT tools."
Low IT self--leadership	Centralized management	"We have very complex ICT management, because the decisions are made in Korea [headquarters."
		"The head office is blocking new IT systems for security reasons."
		"Something as common and simple as Dropbox is not allowed here, it is not safe enough. That is why it is blocked by the headquarters."
	Nature of Business	"I think it is very useful to sit together and talk about it."
		"Our company is a news company, so finding new IT is not part of the business."
		"I'm not doing that [searching for new IT] a lot, because I need to finish projects for the customer."
	Standard toolsets	"The work we do, does not require new tool sets. The standard tool sets are sufficient."
		"I think it is important to use [the IT] what the company I work for uses."

Data analysis indicates that low IT self-leadership was strongly connected with centralized management. The majority of the team members, who were part of a company that is managed centrally, mentioned having less freedom to make their own choices. Therefore, management permission was needed to make choices regarding IT use, which impeded IT self-leadership. One of the interviewees stated: "Something as common and simple as Dropbox is not allowed here, it is not safe enough. That is why it is blocked by the headquarters". Companies with a centralized management in this study, appear to be the larger companies. Within these companies, employees needed to adapt to the current IT. Mostly these companies determined standard toolsets and there was not much room for change.

Other reasons that hindered IT self-leadership within teams included: (1) the fact that physical meetings were important for the business and (2) that the projects were smaller in scale and required a quick turnover. An interviewee said: "I'm not doing that [searching for new IT] a lot, because I need to finish projects for the customer".

4.3.2. Influence of IT self-leadership on the individual and the team performance

The results showed that IT self-leadership has several influences on the work of individuals and teams. On individual level, IT enabled flexible working, self-monitoring and increased efficiency. On team level, IT self-leadership enabled flexible collaboration, improved communication, and overall collaboration efficiency and effectiveness as shown on table 7.

Table 7. Individual and team level outcomes of IT self-leadership

Flexible working	Working from different geographical locations; enabling visibility of work; access to needed resources.	Flexible collaboration	No physical meetings; access across geographical settings;
Self-monitoring	Checks for mistakes; feedback; data loss protection; ability to structure work through IT	Improved communication	Improved team communication; less time/ effort spent on communication; increased feedback; improved cross- boundary communication within the company.
Efficiency	Paperless work environment; visualization; time saving; automation	Improved team collaboration efficiency and effectiveness	Syncronous collaboration; increased sharing of knowledge; task management; improved time management; automation; paperless office

4.3.4. IT choice

IT self-leadership manifested most commonly in two ways: (1) an existing system was used in a different way than intended; (2) different existing systems were combined. 60% of the

participants stated that their performance was enhanced by using systems in a different way. 60% participants also stated that their performance was enhanced by combining different systems. While several others stated using information technologies that were not used before within the company, this was less commonly observed. As stated by one of the interviewees: "The technology I chose to use was new for the company, but it is not new for others outside of the company". Similarly, few others used spin-offs from existing systems.

4.4. IT based innovation without IT self--leadership

It is possible that team members innovate using information technologies, without providing IT self-leadership. These situations were specifically coded in order to avoid potential researcher bias. This coding category incorporated IT factors that influence innovation, but without IT self-leadership. Because the differences between product and process innovation for these categories are negligible the results from these two categories were combined. Results indicated that IT innovation without IT self-leadership were mostly business driven. Team members were asked by their leaders to research or analyze problems in the company. As one of the interviewees stated: "Change was needed, the team leader asked me to do a research for information technology solutions". This clearly indicated a business driven change; but because the task was assigned by the team leader, IT-self-leadership of the team member was not present. Solutions for these problems were found through IT by searching for ideas, for example, on the internet. The implementation of the ideas were enabled by IT through sharing and gathering knowledge. This enabled team members to work simultaneously and to share information, which helped implement new ideas.

Table 8. Innovation and IT without self-leadership

Category	Subcategory	Code
Idea generation by IT	Business driven innovation	Research for ideas by IT Problem analysis with IT Business problem
	Exploring existing ideas by IT	Searching on internet for ideas
Idea implementation by IT	Championing by IT	Giving presentations by IT Visualization by IT
	Work Monitoring by IT	Controlling the processes by IT
	Sharing and gathering knowledge with IT	Syncronous Collaborative working with IT Sharing information with IT

5. Discussion

The purpose of this study was to investigate how IT self-leadership influenced product and process innovation of teams. Based on the findings of this study, in this section, we first discuss the emergent findings on the benefits of IT self-leadership. Then we link the IT self-leadership to team innovativeness. While we had hypothesized IT self-leadership to influence product and process innovation differently, findings did not support this hypothesis. Thus, the findings for process and product innovation were combined as "team innovativeness".

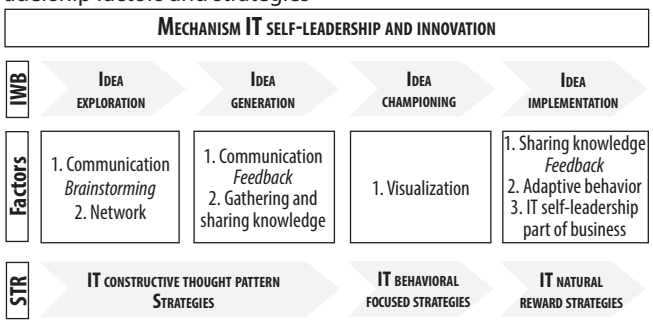
IT self-leadership was defined in this study as the choice of an individual or team to use information technologies in order to enhance own performance, where such technologies were not part of the original task description. Several IT self-leadership strategies arose from the literature, (1) which are IT behavioral focused strategies, (2) IT natural reward strategies and (3) IT constructive thoughts pattern strategies. In this study, we connected these strategies to the stages of the innovative work behavior model (figure 3). The results from this study explored the mechanism between innovation, which was assessed by means of the innovative work behavior model, and IT self-leadership, which is linked with the IT self-leadership strategies. The first two stages of the model are idea exploration and idea generation, which can be connected to IT constructive thought pattern strategies. IT constructive thoughts pattern strategies work through a more controlled work setting, which is enabled by IT self-leadership. This study has shown that this mechanism works (1) through self-chosen information technologies by enabling people to check work; (2) through feedback with communication tools; (3) through the storage and sharing of data; and (4) by setting reminders. This contributes to the recognition of problems and generation of novel ideas or solutions (Manz and Neck 1991).

The third stage, idea championing, is connected to IT behavioral focused strategies. IT behavioral focused strategies work through goal behavior by positively influencing the championing of the innovation. Results from this study show that information technologies make it possible to visualize the innovation by providing prototypes and visual images. These factors enable individuals to improve their goal behavior by providing a clear future goal (Manz and Neck, 1991). The factor 'working around standards', which was found in one of the cases, is not part of this mechanism because it does not influence the idea championing through IT behavioral focused strategies. Nevertheless, it does positively influence innovation. IT can be used to work around standard procedures to make new IT part of the organization.

The fourth and last stage of the innovative work behavior model is idea implementation. This stage is connected in this study with IT natural reward strategies. IT natural reward strategies are considered to ease the implementation process by leading people to set goals, self-rewards

and seeing the new innovation as a positive change (Deci, 1975). Only a part of this mechanism could be observed in this study. People, who tended to be adaptive towards innovation because of their IT self-leadership, appeared to be positively influencing the implementation of novel ideas. Most interviewees who indicated to be high on IT self-leadership, indicated this to be a result of a decentralized company where IT self-leadership was part of the business. A decentralized management is considered to give more freedom to employees (Kline and Martin, 1958) for setting goals and rewards, but this was not found in this study. However, most interviewees stated that they considered IT self-leadership as being part of the business. This influences individuals' attitude towards change and triggers adaptive behavior. When change and innovation is a day-to-day event within an organization, members of such organization are considered to be more open towards new innovations. The factor 'sharing knowledge', which was found in the cases, is important for the implementation process, because implementers of a new innovation can see positive feedback as a reward for their work. This has led to a final model of IT self-leadership and innovation, answering the research question of this study (figure 3).

Figure 3. Innovative work behavior stages connected to IT self-leadership factors and strategies



The results from the exploration of the mechanism between IT self-leadership and team innovativeness show evidence for the existence of certain relationships. This has resulted in several propositions:

P_1: *The idea exploration and generation process of innovation is positively influenced IT-enabled constructive thought strategies through communication, networking and sharing knowledge.*

P_2: *The idea championing process of innovation is positively influenced by IT-enabled behavioral strategies through visualization.*

P_3: *The idea implementation process of innovation is positively influenced by IT-enabled reward strategies through the sharing of knowledge and adaptive behavior.*

As mentioned earlier, the factors that influence the mechanism between innovation and IT self-leadership did not appear to differ much between product and process innovation. Although, the reason to innovate in an IT self-leading way does. Product innovation refers to what is produced while process innovation concerns how existing products or services are produced (Edquist et al. 2001). Information technology is mostly considered to optimize internal processes and therefore it is mostly considered to apply to process innovation (Pearlson and Saunders 2009). But this study found that IT self-leadership also influenced product innovations, either because the introduction of new products was triggered by new technologies or because a company was being caught up by other technologies. This technology driven product innovation within a company was mostly started by individuals or teams who were behaving in an IT self-leading way. By using IT in a new way, novel product ideas could be found. For example, by structuring thoughts or by networking new insights can be generated. Process innovation, however, is mostly driven by a gap in the business. This business-driven innovation could still be considered as IT self-leading in some cases because the gap or opportunity was discovered and exploited by an individual or team and IT was used to fulfill this. This has led to the following two propositions:

P_4: *Product innovation by IT self-leadership is technology driven.*

P_5: *Process innovation by IT self-leadership is business driven.*

IT self-leadership is higher in companies with a decentralized management. Proactive behavior, personal ownership and personal initiative are factors that influence self-leadership (Fay and Frese 2001; Manz 1986). Decentralization within a company enables team members to behave in such way (Kline and Martin 1958). A centralized management hinders the freedom of employees; team members need permission to use new IT and need to adapt to the currently-used IT. The teams of the small companies within this study showed a higher degree of IT self-leadership. Those companies were less centralized than bigger companies and allowed more freedom of choice. This is confirmed by Kline and Martin (1958) who state that decentralized companies give individuals freedom to act instead of authority to act. This has led to the final proposition of this study.

P_6: *Firm size has a negative influence on IT self-leadership.*

5.1. Theoretical implications

This section elaborates on the findings of this study compared with prior studies. In part, the findings of this study confirm and extended extant literature; however, some of the results of this study contradict prior research. First, extant literature point out to three IT self-leadership strategies (i.e., Manz and Neck 1991; Neck and Houghton 2006;

Seligman 2011). The results of this study only found two of the strategies to be clearly present at organizations. IT-enabled behavioral strategies and IT-enabled constructive thought strategies appeared to influence innovation within a company, however, IT-enabled reward strategies, did not appear as often. IT-enabled reward strategies are considered to ease the implementation process by leading people to set goals, self-rewards and by seeing the new innovation as a positive change (Deci 1975). The analyses of the cases did not support a relation for goal setting, self-rewards and innovation. It appeared that goal setting and rewards were mostly determined by team leaders, which impeded IT self-leadership.

Second, literature suggest that IT can enhance innovation, which is examined by combining the innovative work behavior stages with the benefits of information technologies (Mumford 2000; Kleysen and Street 2001; Pearlson and Saunders 2009). The results of this study confirmed a great part of this connection. In the first and second stage (idea exploration and generation), IT was used to find new ideas, to discover opportunities, and to indicate problems that need to be solved. Literature suggests that IT can be put into practice for idea exploration and generation by enabling the elaboration of a novel idea and giving the possibility for feedback (Kleysen and Street 2001; Mumford 2000). The results of this study also confirm this, by suggesting that information technologies mostly give team members the possibility to give feedback on novel ideas. Within the third stage (idea championing), literature suggests that IT can be used to overcome resistance by involving the whole organization and to sell the idea (Howell et al. 2005). The first relation was not extensively found in this study, the latter however appears to be present in most organizations. This study extends this prior work of Howell et al. (2005) by exploring how the championing of novel ideas is executed by visualizing the idea to others in the organization. In the last stage of the innovative work behavior model (idea implementation), IT is mostly put into practice to share knowledge with others in order to implement the idea. This confirms existing literature of the innovative work behavior model (Kleysen and Street 2001; Fichman et al. 2014), which states that IT can be used to make innovation part of the organization.

Third, literature suggests that it's possible to train the employees to show self-leadership in order to enhance performance and innovativeness (Carmeli et al. 2006). In the case of IT self-leadership, our findings indicated that this was only possible when the structure and culture of the organization allowed employees to make their own choices. Therefore, this study extends the prior work of Cameli and Weisberg (2006) and Neck and Manz (1996) on self-leadership to the context of technology by suggesting that IT self-leadership can be trained and enhanced within an organization, but only when this organization adapts an open culture and a decentralized structure. This is also supported by Curral and Marques-Quinteiro's (2009) findings that employees need autonomy and intellectual freedom to enhance creativity and innovation.

Fourth, prior literature suggest that (IT) self-leadership can occur on both individual and team level (Manz 1986). At individual level, Manz (1986) suggested that self-leadership lead to more direction and motivation. At team level, it was expected to lead to higher collective responsibility for decision-making and behavioral control at the workgroup (Konradt 2009). The findings of this study partly supported this; individuals used new IT for direction and motivation. Moreover, it extends previous research by finding that individual IT self-leadership creates more flexible and controlled working environment. At the team level, evidence from this study suggested that the team IT self-leadership led to improved communication and team work, which is partly in line with the findings of the study by Konradt (2009). Using IT in a new way for communication and teamwork led in many cases towards higher collective responsibility and behavioral control through improved feedback and the sharing of knowledge.

Finally, Carmeli et al. (2006) and Curral and Marques-Quinteiro (2009) stated that intrinsic motivation and compensations enhance individual self-leadership. For IT self-leadership, this relation was only partly supported. Prior research (Carmeli et al. 2006; Curral and Marques-Quinteiro 2009) explained intrinsic motivation as recognition and non-cash rewards for employees, where this study found that employees were mostly motivated by improved work conditions. Team members appeared to be motivated to find new IT when this makes their own work easier, faster and more pleasant.

5.2. Limitations and further research

As with all studies, this study is not without any limitations. First of all, the findings are narrowed by the boundaries of the study, which leads to a lower generalizability. This is considered to be a general shortcoming of theory building from cases (Eisenhardt 1989). This study partly tried to deal with this shortcoming by incorporating different cases with different company sizes; however, the results are still bounded to specific cases. Second, during the in-depth interviews, respondents might have given socially desirable answers even though their anonymity was guaranteed. This may be seen as limitation, as it can decrease the reliability of the study.

In the future, other factors that influence the mechanism between innovation and IT self-leadership should be explored. For example, this research focused on innovation at team level, while self-leadership is mostly researched on individual level (Manz 1986; Manz and Neck 1991; Houghton and Neck 2002). Although higher levels of IT self-leadership lead to increased efforts towards the team (Hauschildt and Konradt 2012), focusing on individual innovative behavior might result in different conclusions. Another example is the focus on software within this research. Although the research was not designed to focus only at software, the results indicate that hardware might not have been taken into consideration by the interviewees. Focusing on hardware, for example the use of tablets, may lead to interesting results in the field on IT self-leadership.

Second, this study suggests six hypotheses, which can be tested in the future. Testing the first three hypotheses will provide a deeper insight into the relation between innovation and the IT self-leadership strategies, while the latter three will broaden the field by exploring the drivers for IT self-leadership and innovation and the influence of company size.

The third suggestion is more general: more research is needed on IT self-leadership. It is still a novel term in the literature and needs to be extended. Suggestions for further research topics in relation with IT self-leadership include the influence of centralization of IT rules, the influence of leadership and the influence of IT self-leadership in multinationals. While this study focused more on team-level IT self-leadership, future studies should also investigate individual IT self-leadership and how it relates to innovativeness.

5.3. Practical implications

The findings of this study show that by encouraging IT self-leadership teams can become more innovative. IT self-leadership behavior removes the ambivalence for change because individuals are naturally motivated to look for new ways to improve performance by IT. This competency can be trained, thus performance and innovativeness can be improved (Carmeli et al. 2006; Neck and Manz 1996).

This implies that organizations should encourage IT self-leadership to enhance innovation within teams. IT can facilitate the entire process of innovation, from the exploration to implementation. But solely training the team members for IT self-leadership skills is not enough. Several factors should be considered by organizations in order to enable IT self-leadership and enhance innovation. The first is the freedom to choose IT for any task. Employees should be encouraged to make their own choices in which IT they use. Most large companies have rules regarding the use of IT, where only a few systems are allowed to be used. The setting of these rules kills IT self-leadership and therefore hinders innovation. When employees have the freedom to choose the IT they would like to use, this may lead to creation of new ideas. Secondly the organizations should explicitly make time available for their employees to search for new information technologies. This would provide the space for individuals and teams to provide IT self-leadership. Otherwise, reliance on short-term projects will hinder self-leadership and thereby impede innovation.

In this study we find IT self-leadership to be an important new factor influencing innovation within teams. Organizations should treat IT self-leadership as a competency that should be trained and stimulated to enhance the generation and implementation of novel ideas with the ultimate goal of improving innovativeness of teams.

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