

EMPOWERING LEADERSHIP AND TEAM EFFECTIVENESS – THE MEDIATING ROLE OF DIGITAL MATURITY

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Preface

Hereby I declare that the work presented in this study is original, and that only the references in the text were used for writing this thesis.

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Acknowledgments

This master thesis marks the end of two very intense, but informative and fun years of study at the Rotterdam School of Management. I made friends for life and developed myself into a more complete professional than before. This thesis is the final piece of work before the study is completed.

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Abstract

This study surveyed 88 employees spread over 25 small working teams at Royal Schiphol Group, Holland to explore the mediating role of digital team maturity in the relationship between empowering leadership and team effectiveness. Using the input-process-output (IPO) model to frame the construct, this study explores the role of digital team maturity as process variable. Employees empowered by their leader spend more time at growth and development of new skills. Teams with higher digital maturity show higher innovativeness and better performance compared to other teams. Results show that there is no mediating role of digital team maturity between empowering leadership and team effectiveness. Also, there is no positive relation found between empowering leadership and digital team maturity. This study did find a positive relation between digital team maturity and team effectiveness, which is in line with expectations and an addition to the understanding of what processes are beneficial for team effectiveness. Translated to daily practice this means that spending time and money in ways to improve digital maturity of teams, can be an enabler for improving team effectiveness.

1. Introduction

Small working teams have been described as a key advantage for organizational success in the current global, fast-paced digital economy (Sundstrom, 1999). Empowering leadership has been seen as a very useful and powerful antecedent for improving employee involvement and therewith enabling businesses to be much more flexible and adaptive compared to other players within their environment (Kirkman & Rosen, 1999). Also, empowered teams have greater decision power, more autonomy and have more responsibility (Kirkman & Rosen, 1999). These influences have been studied within the input-process-outcome (IPO) framework, linking empowering leadership to team effectiveness (Mathieu, Gilson, & Ruddy, 2006). However, this construct has never been examined within the context of digital transformations of businesses, nor using digital team maturity as the mediating factor between empowering leadership and team effectiveness.

The goal in this study is to use the IPO framework to investigate if digital team maturity is the mediating factor, linking empowering leadership (input) to team effectiveness (output). In doing so, this study argues that this relation will be mediated by digital team maturity. I will test the model by using survey data collected from 88 respondents, spread across 25 small working teams within the Royal Schiphol Group in the Netherlands. Lastly, this study will conclude by discussing the results and the implications of the findings, both for future research, as well as practice.

1.1 Digital context

Recently many studies have stressed the importance for companies to digitally transform their organization and their workers (Westerman et al., 2012; Aral & Weill, 2007). Sousa & Rocha (2019a), in addition to the World Economic Forum (The Future of Jobs, 2016), have contributed to this field of study by addressing digital maturity in the setting of digital

transformations of companies. Their research highlights the importance for companies to start changing and preparing their human capital agenda for the continuity of their business. According to their studies, the nature of work changes, due changes in technology, information driven work environments and data which will become a significant part of daily work routine. Their studies show that companies are digital mature when their human resources are prepared for a digital future.

In their recent investigation around the skills needed for companies to create and manage disruptive digital businesses, Sousa and Rocha (2019b) have not only looked at skills for companies or employees, but also skills for leaders to guide companies and followers through their digital transition. They propose three main focus areas for successful digital managers. 1) innovation, meaning the capacity to innovate, be creative or exploit new business opportunities. 2) leadership, which can relate to employees performance management, techniques to improve satisfaction, and skills to improve employee commitment. 3) management, defined as being knowledgeable across different types of technologies, and have the ability to manage analysis of information regarding employee productivity and workforce optimization of cost.

All these studies around digital skills of companies, employees or leaders have common agreement that peoples digital skills are an important factor for the success of digital transformation and for out-performance against peer companies. This is especially relevant within companies with rapid technology change, where mature digital skills have a greater impact (Van Laar, 2018). These skills are not only built upon by having excellent communication and collaboration skills, but also with the need for technical, information management, creativity, critical thinking and problem solving skills (Van Laar, 2018). This study will leverage the articles mentioned above as input for a configured IPO framework;

accomplished by using digital team maturity as an explaining process variable for successful team performance, measured by perceived team effectiveness.

2. Theoretical review and hypothesis

2.1 Antecedents of team effectiveness

A broad scope of research has focused on team effectiveness. Within that research a variety of models have been used to measure team effectiveness. Team effectiveness can be defined as “the capacity a team has to accomplish the goals or objectives administered by an authorized personnel or the organization” (Aubé & Rousseau, 2011). Many of the models are based around the input-process-output (IPO) framework, which links inputs with team processes, and team processes with output. Another take on this model is the input-mediator-output-input (IMOI) framework. This model has a more cognitive approach, linking team inputs with emerging states of a team and finally with output (Kozlowski & Ilgen, 2006). This study will focus on the basic IPO framework only. The theory offers a practical and empirically validated construct to link certain team inputs with the processes teams go through and ultimately with the output desired by the team and the company.

The input-process construct can be studied using several antecedents to measure team input. Antecedents for input can focus on individual level factors (e.g. personality traits, competencies, skills, strengths, weaknesses and preferences), or can be measured on team-level factors (e.g. size of the team, access to information, amount of time spend together, leadership styles and personal relationships amongst team members). Further, team input can also be measured using organizational and contextual factors like cooperation with other teams, changes in organizational environment and hierarchical structures of the organisation. This study will focus on empowering leadership as an important input variable, looking at different

antecedents of team empowerment and the effect on improvement of skills and team effectiveness (Mathieu et al., 2008).

The process part of the IPO framework describes how combining input antecedents can drive team processes, in a way that team members interactions will direct the team towards the accomplishment of tasks (Mathieu et al., 2008). These team processes should be the linking pin between team inputs and outcomes. Theoretically this means that team members will be influenced by certain inputs, which enables team members to action transition and execute processes as they see fit with team goals (Mathieu, Gilson, & Ruddy, 2006). Examples of team processes are relationship, task complexity, cooperation, cohesion, interpersonal team processes, team skills and team knowledge (Mathieu, Gilson, & Ruddy, 2006).

Looking at the process-output construct, a variety of antecedents can be used to measure team output. These can be divided into three main categories. First team performance can be measured, using antecedents like innovation, customer satisfaction, efficiency, productivity, response time and quality of work delivered. Second, attitude of the team and the team members can be studied, looking at things like employee satisfaction, trust in management, commitment to the team and perceived team effectiveness. Finally, team output can be measured using behaviour characteristics like absenteeism, turnover and safety.

As teams produce useful services and products for organizations and consumers, a lot of research can be found around team effectiveness. Several debates have pointed to the direction of team production (in relation to individual production) as being the most valuable variable of having teams in the first place (Argote & McGrath, 1993; Goodman, 1986). Much of the work that is being finished within organizations is completed through working in teams: this means individuals working together in groups to achieve something that goes beyond the capabilities of individuals working on their own. Success is never only a function of team members' talents and the resources that are available, but also the processes team members use

to interact with each other to accomplish the work. Understanding the processes that employees use to work together in teams will enable organizations to re-tool human resource systems and managers to select, train, develop, and reward personnel for effective teamwork.

2.2 Effect of empowering leadership on digital team maturity and team effectiveness

Empowerment can be explained in different ways and on different levels of analysis (Kirkman & Rosen, 1999; Pearce et al., 2003). There are two main ways to conceptualize empowerment: 1) structural empowerment, or empowering leadership, also called “social-structural” or “contextual” empowerment. 2) psychological empowerment. The latter is basically a consequence of the first (Spreitzer, 2008), which means that structural empowerment can contribute to the total cognitive state of empowerment of employees or teams (Maynard, Gilson, & Mathieu, 2012). For this research, empowering leadership will be defined as: “behaviours whereby power is shared with subordinates and that raise their level of intrinsic motivation” (Srivastava & Bartol, 2006, p. 1240). To explain in a bit more depth, I offer the following important dimensions of empowering leadership behaviour: leading by example, participative decision making, coaching, informing, and showing concern (Arnold et al., 2000).

Psychological empowerment refers to the broader cognitive state employees are in when they perceive a certain degree of competence, impact, autonomy and meaningfulness in their daily work (i.e. Chen & Tesluk, 2012; Koberg, Boss, Senjem, & Goodman, 1999). This study will only focus on the role of the leader when it comes to reaching a cognitive state of empowerment. Therefore, psychological empowerment as a subject will not be measured within the research constructs given in this study.

Besides looking at empowerment from either a leadership point of view, or a contextual point of view, or the relation between the two as done by Zhang and Bartol (2010), the level of

analysis can differ as well. Most researchers so far have focused on empowerment at an individual level, looking at the context and role of a leader on the individual situation of an employee (i.e. Perry, Pearce, & Sims, 1999; Wall, Cordery, & Clegg, 2002). However, there is also a group that has focused on empowerment applied to the concept of teams or work groups (i.e. Hyatt & Ruddy, 1997; Kirkman & Rosen, 1999; Liden & Tewksbury, 1995). Group empowerment takes into consideration processes that go beyond individuals, like sharing information or giving feedback (Kirkman & Rosen, 1999). This article will focus on empowering leadership within teams.

Within the construct of this research, empowering leadership is used as the input variable to partly explain perceived team effectiveness. This study has used the IPO framework to frame this construct. Looking into previous studies around the positive role of empowering leadership, similar effects will be expected within the context of this study. Empowering leadership, in this particular case, will enable members of a team to feel responsible and come into action. This will lead to interactions directed towards task completeness within a team and finally towards higher team effectiveness.

Empowering leadership and digital team maturity

In their study around team skills, Ellis et al. (2005), have shown that leader interferences can have very positive results on how teams develop skills and the improvement of efficiency that comes with it. This relates to the goal which is improvement of interactions to accomplish team task completeness. Therefore this study suggests there will be a positive relation between the way teams will be empowered by their leader, and the maturity of their digital skills build up over the period they work together.

The five dimensions of empowering leadership can be used to frame how empowering leadership enables digital maturity. First, to set an example for subordinates, an empowering leader can share his or her knowledge around digital practices, like informative decision

making, data driven way of working and using new technologies to enhance creativity and problem solving capabilities. By doing so, a leader can inspire team members to follow these practices and turn them into useful new applications (Srivastava and Bartol, 2006). Second, empowering leaders that show coaching behaviour know how to effectively help and coach team members to start using new technologies or using information products to make considered decisions (Arnold et al., 2000). Third, if a leader uses participative decision making, members of the team will have more influence on decisions and more opportunities to bring their suggestions to the table. In this setting, members of the team will see themselves as more important and will be more motivated to start using new applications that they have voted for (Locke et al., 1997). Fourth, an empowering leader is able to take away concerns from team members, by taking away barriers that block people from developing their skills. If employees feel free to grow and improve their skills, they will learn quicker and faster than before (Srivastava and Bartol, 2006). Finally, being informed by a leader motivates employees to be more collaborative within and outside the team. Getting information around strategy and mission on a regularly basis helps for employees to stay focused and aligned with company and team goals. More effort will be put in developing skills, exploring technologies and using information to base decisions on (Srivastava and Bartol, 2006). Overall, the framing of the previous five dimensions are suggesting that empowering leadership can have a strong influence on improving digital team maturity. This led to the following hypothesis (see figure 1.1 for the complete model):

Hypothesis 1: Empowering leadership is positively related to digital team maturity.

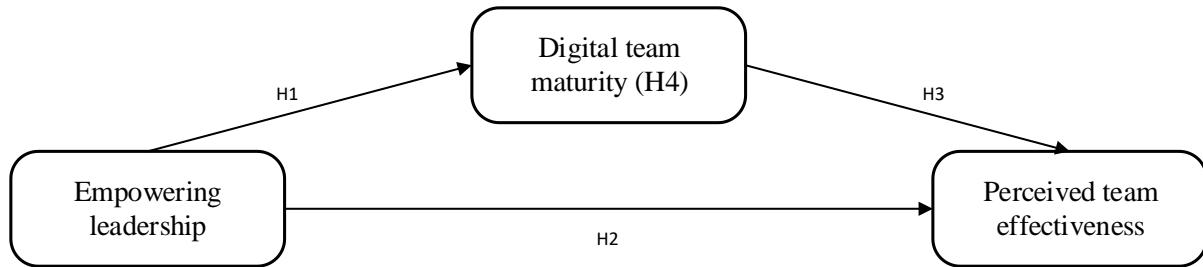


Figure 1.1 – Conceptual framework.

Empowering leadership and team effectiveness

Empowering leadership is examined in several ways within the IPO framework, looking at it from both an input and process perspective. For example Kirkman & Rosen (1999) have studied the relationship between empowering leadership and team effectiveness, concluding there is a direct link between the two. Also, Mathieu, Gilson, and Ruddy (2006) have examined the role of empowering leadership, by using empowering leadership as input variable within an advanced IPO framework. They concluded that empowering leadership indeed stimulates team processes and ultimately team performance output. In their research on empowerment and team effectiveness, they have looked at the effect of empowerment, building upon previous research which already showed that empowered teams enable companies to be more adaptive and responsive to their environment (Bowen & Lawler, 1992; Kirkman & Rosen, 1999; Wellins, Byham, & Wilson, 1991). Their findings show that teams structurally empowered by their leader, given greater responsibility and autonomy, will show greater effectiveness than traditionally managed teams (Hyatt & Ruddy, 1997). Previous studies have proven this is an important aspect of enabling employees to do their work better, faster and with more compassion.

The above mentioned studies around the positive role of empowering leadership are suggesting that similar effects can be expected within the context of this study. Looking at inputs that can be seen as the antecedent factors that will enable and constrain team members' interactions, empowering leadership, in this particular case, will enable members of a team to

feel responsible and come into action. This will lead to interactions directed towards task completeness within a team and finally towards greater team effectiveness (Mathieu et al., 2008). Building upon the earlier framing of the five dimensions of empowering leadership, I expect that every dimensions will directly have its impact on team effectiveness. Leading by example will stimulate employees to deliver higher output, participative decision making contributes to employees feeling important, coaching helps employees to be productive, informing keeps employees aware of end goals of both the team and the company, and showing concern eliminates stress and background noise from within the organization and helps with focus (Arnold et al., 2000). This in combination with earlier studies led to the following hypothesis:

Hypothesis 2: Empowering leadership is positively related to team effectiveness.

2.3 Digital team maturity and team effectiveness

Because of the demands of working in a team, the knowledge, skills, and competencies needed for effective performance can differ from those needed by individuals working on their own (Morgeson, Reider, & Campion, 2005). In their research, Mathieu and Schulze (2006) have tested that team outputs, looking at individual competencies of team members can have significant effects on the output that a team can deliver. However, these studies have not taken into account the rapid changing environment companies are in and the team skills that are actually needed to perform in this context. They mainly looked at general competencies of team members like communication and knowledge sharing. Specifically, teams working in companies with high adoption of new technologies, data and information driven strategies and high amount of management innovation are likely to benefit from team members with a high variety of mature digital skills (Westerman et al., 2012). These digital skills can be seen as a variety of skills looking at what ICT skills employees need to perform in daily changing

operations, but also to be ready for future changes in environment of the company they work for (Van Laar, 2017). The skills include technical skills (e.g., using mobile devices and application systems), information management skills (e.g., efficiently use ICT to search, filter and organize information), communication skills (e.g., transmitting digital information to others), collaboration skills (e.g., develop a social network and exchanging information in team context), creativity (i.e., generating new ideas, transform ideas into a MVP (minimal viable product) and service and process skills), critical thinking skills (e.g., making informed judgements and choices based on data and information, using reflective reasoning), and lastly problem solving skills (i.e., to cognitively process a problem and find an actual solution for a problem). These skills combined can be used to define digital maturity of individuals, as well as for teams when combined (Van Laar, 2018).

Information management helps to make better decisions towards task completeness, communication helps to align with other stakeholders working on the same products or services, collaboration stimulates the exchange of information needed to achieve goals, creativity stimulates the generation of new ideas in finishing tasks or being innovative, critical thinking makes products better and of higher quality and problem solving skills removes roadblocks along the way. Looking at it from an IPO framework perspective, this means that teams with a high level and variety of digital skills, are able to leverage these skills and transform this into higher effectiveness. This led to the following hypothesis:

Hypothesis 3: Digital team maturity is positively related to team effectiveness.

2.4 The mediating role of digital team maturity

This study argued that empowering leadership is positively related to both digital team maturity and team effectiveness. Also, I take the position that digital team maturity has a direct relationship with team effectiveness. Previous research has argued that team effectiveness will

benefit from an empowering style of leadership (Manz & Sims, 1987; Cohen, Chang, & Ledford, 1997). Also concluding from hypothesis 1 – 3, and based upon the IPO framework, I expect digital team maturity to play a mediating processing role in explaining how input (empowering leadership) can be transformed into output (team effectiveness). This led to the following hypothesis:

Hypothesis 4: Digital team maturity will mediate the relationship between empowering leadership and team effectiveness.

3. Methods

3.1 Sample

The data for this study was collected at Royal Schiphol Airport in the Netherlands. The primary jobs of individuals differed from core operational management (e.g., guiding arrivals and departures of aircraft, baggage and passengers) to parking operations, terminal operations, business management activities, IT activities and more advanced data related jobs (e.g., data science, data engineering and working with artificial intelligence). The participants for this study were 88 employees spread over 25 multi-disciplinary agile teams, built up out of a minimum of three and a maximum of six employees per team. For every team, at least three colleagues were asked to fill out a survey. Respondents were approached and selected using the HR and Consumer Insights channels that were already in place. To reach out to all respondents a small communication campaign was set-up and guided by the Schiphol HR department. The communication contained several messages using channels like Slack, Yammer, Intranet and emailing. The communication covered a reach of approximately 90% of all of the 2.000 employees. The survey contains questions about: i) the digital skills of individual team members, ii) the perceived team performance output per individual, iii) their perception of being empowered by their leader. The study was conducted during the digital transformation program that Schiphol is going through. The survey template is built in Qualtrics, so that data can be easily extracted into R or SPSS for more advanced analytics.

I received a total of 166 questionnaires from employees across the whole Schiphol organization. However, only 88 surveys (53% of the surveys) were useful due to completion issues. The 88 useful questionnaires represented 25 working teams consisting of between 3 to 6 employees with a median of 4 employees per team. The average job tenure of the respondents is 5.4 years and the average team tenure is 1.5 years, with an average supervisor tenure of 1.5 years. In regards to gender, 80% of the respondents were male, 19% were female and 1%

classified as other. The average age of the respondents was 39 and 93% of the respondents had a full-time employment contract at Schiphol.

3.2 Measures

This paragraph describes the measures, including the measured Cronbach's alpha (α), per dimension.

Digital skills were measured using a 60-item scale developed by van Laar (2018). The scale measures the digital skills of individuals within a team on six dimensions: information management (three out of six items used, $\alpha = 0.75$), communication (17 items, $\alpha = 0.89$), collaboration (11 items, $\alpha = 0.94$), critical thinking (12 items, $\alpha = 0.89$), creativity (six items, $\alpha = 0.89$) and problem solving (eight items, $\alpha = 0.92$). All items are rated using a 5-point Likert scale from 1 = never to 5 = (almost) always. Example questions were: At work, how often do you save useful digital files directly to the right folder? At work, how often do you share important information with your team via the internet? For the communication dimension, there was decided to drop 3 items due to validity issues.

Team effectiveness was measured using a 20-item scale developed by Özralli (2003). This scale measures the perceived team effectiveness measured by input from team members only. Briefly, perceived team effectiveness can be described as the perception of: i) acceptable task output; ii) team members' willingness to work together again; and iii) members' needs more satisfied than frustrated by their team experience (Hackman, 1983). Instead of measuring the qualitative or quantitative performance of a team, this study operationalizes team effectiveness as the perception of the attitude a team has amongst their own performances (perceived team effectiveness). Historically this can be seen as a valid indication of the actual performance of a team, by comparing this with quantitative and qualitative performance measures (Lemieux-Charles et al, 2002). Other studies show that perceived effectiveness of a team is often strongly linked with the measured output by supervisors. In her study on the effect

of transformational leadership on team effectiveness, Özkaralli (2003) examined the relation between a transformational leadership style and the effectiveness of teams measured by the perception of the performance of individuals in those teams. Within her study, she has proven that perceived effectiveness of teams is a valid and reliable indication of the actual performance of a team, comparing the perception measures with actual performance data. In addition to this study, Costa (2003), has proven that perceived team effectiveness as an output measure, has proven to be a trustful measure compared to actual performance measures during a given time frame. The scale that was used measured team members perception on how effective their teams are on three dimensions: innovativeness (four items, $\alpha = 0.78$), in-group communication (five items, $\alpha = 0.74$) and performance (four items, $\alpha = 0.79$). All items were rated using a five-point Likert scale from 1 = not at all to 5 = always.

Empowering leadership was measured using a 38-item scale developed by Arnold et al. (2000). This scale measures team members perception of empowering leadership on five dimensions: coaching (eleven items, $\alpha = 0.88$), informing (six items, $\alpha = 0.85$), leading by example (five items, $\alpha = 0.82$), showing concern / interacting with the team (10 items, $\alpha = 0.91$) and participative decision-making (six items, $\alpha = 0.88$). All items are rated using a five-point Likert scale from 1 = not at all to 5 = always. Example items were: My supervisor sets high standards for performance by his/her own behaviour. My supervisor makes decisions that are based only on his/her own ideas.

4. Results

All means, standard deviations and correlations are presented in Table 1. The full correlation table with all lower level dimensions can be found in appendix II.

Table I. Means, standard deviations, correlations and Cronbach's alphas.

		Mean	St. dev	(1)	(2)	(3)	(4)	(5)	(6)
(1)	Empowering leadership	3.29	0.30	(-0,96)					
(2)	Digital team maturity	3.80	0.24	-0,05	(-0,95)				
(3)	Team effectiveness	3.82	0.26	0,38	,430*	(-0,81)			
(4)	Company tenure	5.50	4.94	0,20	-0,20	-0,02	-		
(5)	Team tenure	1.70	1.20	0,09	-0,27	-0,29	,814**	-	
(6)	Supervisor tenure	1.50	1.06	-0,23	0,03	-0,25	0,10	0,21	

Numbers in parentheses on the diagonal are the Cronbach's alphas.

* $p < 0,05$ ** $p < 0,01$

The effects of processing the variables are shown in table II. As can be seen, empowering leadership did not have a significant relationship with digital team maturity. Therefore, according to Kenny et al. (1998), it will not be possible to prove a significant mediating role of digital team maturity in the construct between empowering leadership and team effectiveness. Testing the indirect mediating role of digital team maturity requires a significant effect from empowering leadership on digital team maturity and a significant effect from empowering leadership on team effectiveness (Kenny et al., 1998).

Table II. Effects of empowering leadership and digital team maturity on team effectiveness.

	Team effectiveness					
	β	s.e.	t-value	p	R	R sq.
<i>Main effects</i>						
Empowering leadership (ES)	0,34	0,17	1,95	0,06	0,14	0,10
Digital maturity (DM)	0,47	0,21	2,28	0,03*	0,18	0,14

* $p < 0,05$ ** $p < 0,01$

Mediation analyses are used to verify the hypothesis and test the indirect effect of empowering leadership on team effectiveness. Figure 2 shows the standardized path

coefficients. The model only shows positive significant results for hypothesis 3 ($p < 0.05$), linking digital team maturity to perceived team effectiveness. For hypothesis 2, an almost significant result was found ($p < 0.1$). For hypothesis 1 no significant relations have been found. This means that empowering leadership did not have a significant effect on digital team maturity. Also, not in line with earlier studies on empowerment, there was no significant effect found between empowering leadership and perceived team effectiveness. Also no significant relationships were found amongst the sub-dimensions, except for two constructs that relate to innovativeness. For both information management skills and collaboration skills, a significant relation has been found with innovativeness. The full regression table of the sub-dimensions can be found in Appendix III.

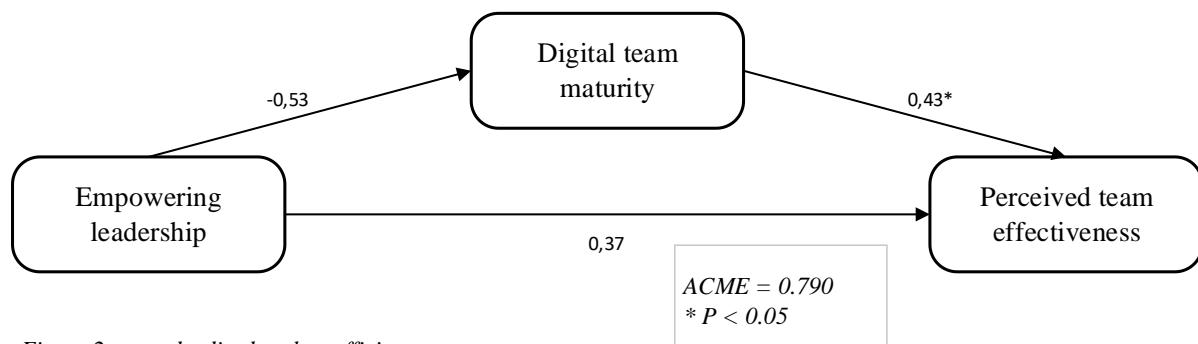


Figure 2 – standardized path coefficients

5. Discussion

The aim of this research was to test if digital maturity plays a mediating role in the relationship between empowering leadership and team effectiveness. Additionally, this study addressed there are direct relationships between empowering leadership, digital team maturity and team effectiveness. Results show that digital team maturity as the mediator in the model was not supported. Also, there was no significant relationship between empowering leadership and digital team maturity. However, results show that there is a significant relationship between digital team maturity and team effectiveness. In addition, an almost significant relation was found between digital team maturity and team effectiveness. Results on a sub-dimensional level show a positive relation between information skills, collaboration skills (digital team maturity) and innovativeness (team effectiveness).

5.1 Theoretical implications

The findings within this study extend previous research in three important ways. First, this study found no significant results to prove that digital team maturity plays a mediating role between empowering leadership and team effectiveness. Although many recent studies stress the importance of making teams ready for the digital future (Sousa and Rocha, 2019b), empowering leadership does not seem to play a role in the stimulation of growth of digital teams. However, the results did show an almost significant relation between empowering leadership and team effectiveness. This is in addition to and in line with many previous studies, which did show very strong significant relationships between the two concepts (e.g. Manz & Sims, 1987; Cohen, Chang, & Ledford, 1997).

Against earlier expectations (within the context of digitalization), empowering employees does not seem to have an effect on the growth of digital skills of team members. This means that even if teams get involved in decision making processes, or being informed

about latest developments by their leader, this does not directly mean that skills will improve. This is against earlier studies where empowering leadership has proven to be positive as input variable against other process variables (Mathieu et al., 2008).

Second, this study found that digital team maturity is positively related to team effectiveness. This is consistent with earlier research of Mathieu and Schulze (2006). The extension to this earlier study is that this has now been tested in an digital environment, specifically focussing on digital skills of teams. This is important because when teams use more data, information, and technologies to communicate, collaborate, and create products or services, this results in more innovation and better team effectiveness.

Third, this study used a relatively new questionnaire to measure digital team maturity. The questionnaire was not used very frequent as of yet. Given the earlier outcomes on reliability and validity of the measures within this questionnaire and the significant results found by using these measures, this is important step in measuring digital team maturity. Digitalization is a frequently studied topic nowadays, now supported by a validated questionnaire that fuels future research.

Finally, this study contributes to existing research by showing significant results between information skills and collaboration skills (digital team maturity) and innovativeness (team effectiveness). This means that team members with excellent information and collaboration skills potentially might see themselves as innovative.

5.2 Managerial implications

This study shows the direct importance of enabling digital team maturity. Meaning that digital team maturity is positively related to team effectiveness. In practice, leaders, as well as teams, should stimulate development of digital skills like communication and collaboration, but also innovativeness, and creativity by using more information, data, and technologies to

improve products and services. Specifically, focus on digital team maturity development will greatly benefit companies in the middle of a digital transformation. As relevant to the Schiphol organisation, which could also benefit from an increased focus on digital skill development across teams.

Also, empowering leadership seems somewhat beneficial for effectiveness of small working teams. Translated to practice this means that empowering employees by coaching them by doing their job, informing them on time, letting them participate in decision making processes, showing them concern regarding uncertainties, and showing the right example might be positive for team effectiveness.

5.3 Study limitations and future research

There are five important limitations for this research. First, the theoretical framework that was used to frame the construct of this study was build around team work. However, the input for this study was only gathered on the level of an individual, to then leverage towards team level output. Future studies might want to look at measuring team outputs on quantitative or qualitative levels (e.g. actual output, customer satisfaction or turnover). By doing so, actual team results can be measured in stead of only using individual inputs.

Second, more respondents should be questioned to improve the generalizability of this research. As such, the results of this study should be verified within other businesses/operations. By doing so, companies that are in other phases of digital transformation can be measured using the same constructs. Companies that are further in their digital transformation, might show better results. Also, companies that haven't really started transforming their business yet, might show poorer results.

Third, many other studies that have examined team effectiveness did measure effectiveness measured by using historical KPI's or by supervisor input to validate the team

outputs (Mathieu et al., 2008). For example supervisors could have been questioned to improve the data around team effectiveness. Adding to this, database data (e.g., KPI output, or budget) could have been used to measure team effectiveness. However, due the short time frame in which this study needed to be completed, there was not enough time to also question all individual team supervisors for input, nor collecting database data to validate team outputs in a quantitative manner (Mathieu, Gilson, & Ruddy, 2006). Following studies can look into wider audiences by comparing different companies in different phases of digital transformation.

Fourth, in addition to the previous limitations, team members have classified their own view on how digital mature they are and how they perform. This brings a certain degree of subjectiveness to the outcomes of the research. By validating against other sources of data, future research can improve validity of data. For example, when teams score very high on a dimension, like perceived performance, but supervisor input and historical quantitative data show otherwise, data can be removed or additional data can be gathered.

Finally, data for this study has only been gathered once. None of the respondents have been questioned several times. Also performance has not been measured over time. This means that process improvements won't be visible in the effectiveness over time. Some other studies have done multiple validation of team performance over time to make sure improvements are measured. Future research on this topic might benefit from measuring all input several times in a period of for example a year. Any improvements in processes, skills (i.e. by having training), or team changes can than be taken into account.

Regarding potential future research, it might be very interesting to look into the digital team maturity / team effectiveness construct on a deeper level. For example looking into the antecedents of communication or collaboration in relation to innovativeness. Future investigations could also focus on other levels of analyses, like measuring the team outputs in

different ways than by only using individual input. In line with earlier research on improvement of skills and effects on individual output, the questionnaire being used in this study can be used to measure digital skills on different levels within the organization. Finally, future studies can focus on other leadership styles than empowering leadership; perhaps a more directive or transformational approach will show other results. For example, Pearce & Sims (2002) have already looked into different leadership styles and their effects on team processes and outputs. In addition to this construct, future research can focus on any of the other leadership styles and their relation to development of digital team maturity.

5.4 Conclusion

The results of this study are partly in line with expectations based on earlier studies by Westerman et al. (2012) and Mathieu and Schulze (2006) around impact of skills on team effectiveness. Also the IPO framework has proven to be of value in investigating this construct, showing somewhat positive outcomes by linking process variables with output variables. In addition, this study highlights the importance for companies to invest in digital maturity of teams to improve team outcomes. In the context of digital transformation, it is important to focus on the development of a team's digital maturity.

References

Aral, S., & Weill, P. (2007). IT assets, organizational capabilities, and firm performance: How resource allocations and organizational differences explain performance variation. *Organization Science*, 18(5), 763-780.

Argote, L., & McGrath, J. E. (1993). Group processes in organizations: Continuity and change. *International review of industrial and organizational psychology*, 8(1993), 333-389.

Arnold, J. A., Arad, S., Rhoades, J. A., & Drasgow, F. (2000). The empowering leadership questionnaire: The construction and validation of a new scale for measuring leader behaviors. *Journal of Organizational Behavior*, 21(3), 249-269.

Aubé, C., & Rousseau, V. (2011). Interpersonal aggression and team effectiveness: The mediating role of team goal commitment. *Journal of Occupational and Organizational Psychology*, 84(3), 565-580.

Bowen, D. E., & Lawler III, E. E. (1992). The empowerment of service workers: What, why, how, and when. *MIT Sloan Management Review*, 33(3), 31.

Chen, G., & Tesluk, P. (2012). Team participation and empowerment: A multilevel perspective. In *The Oxford Handbook of Organizational Psychology, Volume 2*.

Chen, G., Kirkman, B. L., Kanfer, R., Allen, D., & Rosen, B. (2007). A multilevel study of leadership, empowerment, and performance in teams. *Journal of applied psychology*, 92(2), 331.

Cohen, S. G., Chang, L., & Ledford Jr, G. E. (1997). A hierarchical construct of self-management leadership and its relationship to quality of work life and perceived work group effectiveness. *Personnel psychology*, 50(2), 275-308.

Costa, A. C. (2003). Work team trust and effectiveness. *Personnel review*, 32(5), 605-622.

Ellis, A. P., Bell, B. S., Ployhart, R. E., Hollenbeck, J. R., & Ilgen, D. R. (2005). An evaluation of generic teamwork skills training with action teams: Effects on cognitive and skill-based outcomes. *Personnel psychology*, 58(3), 641-672.

Gao, L., Janssen, O., & Shi, K. (2011). Leader trust and employee voice: The moderating role of empowering leader behaviors. *The Leadership Quarterly*, 22(4), 787-798.

Goodman, P. S. (1986). *Designing effective work groups*. Jossey-Bass Inc Pub.

Hackman, J. R. (1983). *A normative model of work team effectiveness* (No. TR-2). OFFICE OF NAVAL RESEARCH ARLINGTON VA.

Hyatt, D. E., & Ruddy, T. M. (1997). An examination of the relationship between work group characteristics and performance: Once more into the breech. *Personnel Psychology*, 50(3), 553-585.

Kirkman, B. L., & Rosen, B. (1999). Beyond self-management: Antecedents and consequences of team empowerment. *Academy of Management journal*, 42(1), 58-74.

Kirkman, B. L., Rosen, B., Tesluk, P. E., & Gibson, C. B. (2004). The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction. *Academy of Management Journal*, 47(2), 175-192.

Koberg, C. S., Boss, R. W., Senjem, J. C., & Goodman, E. A. (1999). Antecedents and outcomes of empowerment: Empirical evidence from the health care industry. *Group & organization management*, 24(1), 71-91.

Kozlowski, S. W., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological science in the public interest*, 7(3), 77-124.

Leach, D. J., Wall, T. D., & Jackson, P. R. (2003). The effect of empowerment on job knowledge: An empirical test involving operators of complex technology. *Journal of Occupational and Organizational Psychology*, 76(1), 27-52.

Lemieux-Charles, L., Murray, M., Ross Baker, G., Barnsley, J., Tasa, K., & Ibrahim, S. A. (2002). The effects of quality improvement practices on team effectiveness: a mediational model. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 23(5), 533-553.

Liden, R. C., & Tewksbury, T. W. (1995). Empowerment and work teams. *Handbook of human resources management*, 386, 403.

Locke, E. A., Alavi, M., & Wagner, J. A. III. (1997). Participation in decision making: An information exchange perspective. *Research in personnel and human resources management*, 15, 293-331.

Manz, C. C., & Sims Jr, H. P. (1987). Leading workers to lead themselves: The external leadership of self-managing work teams. *Administrative science quarterly*, 106-129.

Mathieu, J. E., & Schulze, W. (2006). The influence of team knowledge and formal plans on episodic team process-performance relationships. *Academy of Management Journal*, 49(3), 605-619.

Mathieu, J. E., Gilson, L. L., & Ruddy, T. M. (2006). Empowerment and team effectiveness: an empirical test of an integrated model. *Journal of applied psychology*, 91(1), 97.

Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team effectiveness 1997-2007: A review of recent advancements and a glimpse into the future. *Journal of management*, 34(3), 410-476.

Maynard, M. T., Gilson, L. L., & Mathieu, J. E. (2012). Empowerment—fad or fab? A multilevel review of the past two decades of research. *Journal of Management*, 38(4), 1231-1281.

Morgeson, F. P., Reider, M. H., & Campion, M. A. (2005). Selecting individuals in team settings: The importance of social skills, personality characteristics, and teamwork knowledge. *Personnel psychology*, 58(3), 583-611.

Özaralli, N. (2003). Effects of transformational leadership on empowerment and team effectiveness. *Leadership & Organization Development Journal*, 24(6), 335-344.

Pearce, C. L., & Sims Jr, H. P. (2002). Vertical versus shared leadership as predictors of the effectiveness of change management teams: An examination of aversive, directive, transactional, transformational, and empowering leader behaviors. *Group dynamics: Theory, research, and practice*, 6(2), 172.

Pearce, C. L., Sims Jr, H. P., Cox, J. F., Ball, G., Schnell, E., Smith, K. A., & Trevino, L. (2003). Transactors, transformers and beyond: A multi-method development of a theoretical typology of leadership. *Journal of Management development*, 22(4), 273-307.

Perry, M. L., Pearce, C. L., & Sims Jr, H. P. (1999). Empowered selling teams: How shared leadership can contribute to selling team outcomes. *Journal of Personal Selling & Sales Management*, 19(3), 35-51.

Sousa, M. J., & Rocha, Á. (2019a). Digital learning: Developing skills for digital transformation of organizations. *Future Generation Computer Systems*, 91, 327-334.

Sousa, M. J., & Rocha, Á. (2019b). Skills for disruptive digital business. *Journal of Business Research*, 94, 257-263.

Spreitzer, G. M. (2008). Taking stock: A review of more than twenty years of research on empowerment at work. *Handbook of organizational behavior*, 2, 54-72.

Srivastava, A., Bartol, K. M., & Locke, E. A. (2006). Empowering leadership in management teams: Effects on knowledge sharing, efficacy, and performance. *Academy of management journal*, 49(6), 1239-1251.

Sundstrom, E., De Meuse, K. P., & Futrell, D. (1990). Work teams: Applications and effectiveness. *American psychologist*, 45(2), 120.

Van Laar, E., van Deursen, A. J., van Dijk, J. A., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in human behavior*, 72, 577-588.

van Laar, E., van Deursen, A. J., van Dijk, J. A., & de Haan, J. (2018). 21st-century digital skills instrument aimed at working professionals: Conceptual development and empirical validation. *Telematics and informatics*, 35(8), 2184-2200.

Wall, T. D., Cordery, J. L., & Clegg, C. W. (2002). Empowerment, performance, and operational uncertainty: A theoretical integration. *Applied Psychology*, 51(1), 146-169.

Wellins, R. S., Byham, W. C., & Wilson, J. M. (1991). Empowered teams: Creating self-managing working groups and the improvement of productivity and participation.

Westerman, G., Tannou, M., Bonnet, D., Ferraris, P., & McAfee, A. (2012). The Digital Advantage: How digital leaders outperform their peers in every industry. *MIT Sloan Management and Capgemini Consulting*, MA, 2, 2-23.

World Economic Forum. (2016, January). The future of jobs: Employment, skills and workforce strategy for the fourth industrial revolution. In *World Economic Forum*.

Zhang, X., & Bartol, K. M. (2010). Linking empowering leadership and employee creativity: The influence of psychological empowerment, intrinsic motivation, and creative process engagement. *Academy of management journal*, 53(1), 107-128.

Appendix I: Questionnaire

Digital maturity

Information - At work, how often... - Do you save useful digital files directly to the right folder
Information - At work, how often... - Are you consistent in the naming of digital files
Information - At work, how often... - Do you organize digital files via a hierarchical folder structure
Information - At work, how often... - Do you check the reliability of a website
Information - At work, how often... - Do you check the information found on a different website
Information - At work, how often... - Do you check if the information found is up to date
Communication - At work, how often... - Do you get what you want from interactions on the internet
Communication - At work, how often... - Are you via the internet effective in accomplishing what you want
Communication - At work, how often... - Do you know how to use the internet to express ideas clearly
Communication - At work, how often... - Do you post new messages on the internet
Communication - At work, how often... - Do you post a blog/article on the internet
Communication - At work, how often... - Do you share information on the internet to start a discussion
Communication - At work, how often... - Do new collaborations emerge by approaching online contacts
Communication - At work, how often... - Do you establish online contacts to collaborate with
Communication - At work, how often... - Do you find experts on the internet to start a project with
Communication - At work, how often... - Do you spend time and effort in online networking with people from your field
Communication - At work, how often... - Do you use your online network to benefit from it
Communication - At work, how often... - Do you use your online network to generate business
Communication - At work, how often... - Do you build online relationships with people from your field
Communication - At work, how often... - Does the internet help you approach new professional contacts
Communication - At work, how often... - Do you use your online network to increase brand awareness
Communication - At work, how often... - Do you start a conversation with other professionals via the internet
Communication - At work, how often... - Do you use your online network to achieve policy goals
Collaboration - At work, how often... - Do you share important information with your team via the internet
Collaboration - At work, how often... - Do you use the internet to share information that supports the work of others
Collaboration - At work, how often... - Do you use the internet to share resources that help the team perform tasks
Collaboration - At work, how often... - Do you use the internet to provide each other with information that progresses work
Collaboration - At work, how often... - Does the internet help you get support from co-workers
Collaboration - At work, how often... - Do you communicate via the internet with co-workers from other disciplines
Collaboration - At work, how often... - Do you share work-related knowledge with each other via the internet
Collaboration - At work, how often... - Do you use the internet to give feedback to co-workers
Collaboration - At work, how often... - Does the internet help you carry out tasks according to the planning

Collaboration - At work, how often... - Do you use the internet to discuss your role and contributions with team members

Collaboration - At work, how often... - Does the internet help you use other professionals' expertise

Critical thinking - At work, how often... - Do you give substantiated arguments or reasoning

Critical thinking - At work, how often... - Do you give proof or examples of arguments you give

Critical thinking - At work, how often... - Do you give a justification for your point of view

Critical thinking - At work, how often... - Are you able to put the discussion into a new perspective

Critical thinking - At work, how often... - Do you ask questions to understand other people's viewpoint

Critical thinking - At work, how often... - Do you consider various arguments to formulate your own point of view

Critical thinking - At work, how often... - Do you connect viewpoints to give a new turn to the discussion

Critical thinking - At work, how often... - Do you suggest new related points

Critical thinking - At work, how often... - Do you filter the most important points from discussions

Critical thinking - At work, how often... - Do you generate new input from a discussion

Critical thinking - At work, how often... - Are you open for ideas that challenge some of your held beliefs

Critical thinking - At work, how often... - Do you use the internet to justify your choices

Creativity - At work, how often... - Do you give a creative turn to existing processes using the internet

Creativity - At work, how often... - Do you use the internet to generate innovative ideas for your field

Creativity - At work, how often... - Do you show originality in your work using the internet

Creativity - At work, how often... - Do you use the internet to execute your tasks creatively

Creativity - At work, how often... - Do you follow trends on the internet to generate original ideas

Creativity - At work, how often... - Do you use the internet to evaluate the usability of your ideas

Problem solving - At work, how often... - Does the internet help you find the best way to solve the problem

Problem solving - At work, how often... - Do you solve the problem using the internet

Problem solving - At work, how often... - Do you come up with solutions to the problem via the internet

Problem solving - At work, how often... - Does the internet help you find ways to solve problems

Problem solving - At work, how often... - Are you confronted with a problem that you are sure you can solve using the internet

Problem solving - At work, how often... - Do you make a decision using the internet that makes you feel happy afterwards

Problem solving - At work, how often... - Do you find the solution via the internet even though initially no solution is immediately apparent

Problem solving - At work, how often... - Does the actual outcome you achieved via the internet match what you expected

Team effectiveness

Innovativeness - Innovativeness - The innovativeness of our team's product is

Innovativeness - Innovativeness - The number of innovations or new ideas introduced by the team is

Innovativeness - Innovativeness - The team's overall technical performance is

Innovativeness - Innovativeness - The team's adaptability to changes is

In-group communication - In-group communication - I will share my work reports and official documents with members of my team more frequently in the future

In-group communication - In-group communication - I will always provide my manuals, methodologies and models for members of my organization

In-group communication - In-group communication - I intend to share my experience or know-how from work with other organizational members more frequently in the future

In-group communication - In-group communication - I will always provide my know-where or know-whom at the request of other organizational members

In-group communication - In-group communication - I will try to share my expertise from my education or training with other organizational members in a more effective way

Performance - Performance - I believe that our team's overall performance meets expectations

Performance - Performance - I am satisfied with my experience being part of my current team

Performance - Performance - I feel positive about my experience with this team

Performance - Performance - I would be willing to work with this same team in the future

Empowering leadership

Leading by example - My manager/supervisor - Sets high standards for performance by his/her own behaviour

Leading by example - My manager/supervisor - Works as hard as he/she can

Leading by example - My manager/supervisor - Works as hard as anyone in my work group

Leading by example - My manager/supervisor - Sets a good example by the way he/she behaves

Leading by example - My manager/supervisor - Leads by example

Participative decision-making - My manager/supervisor - Encourages work group members to express ideas/suggestions

Participative decision-making - My manager/supervisor - Listens to my work group's ideas and suggestions

Participative decision-making - My manager/supervisor - Uses my work group's suggestions to make decisions that affect us

Participative decision-making - My manager/supervisor - Gives all work group members a chance to voice their opinions

Participative decision-making - My manager/supervisor - Considers my work group's ideas when he/she disagrees with them

Participative decision-making - My manager/supervisor - Makes decisions that are based only on his/her own ideas

Coaching - My manager/supervisor - Helps my work group see areas in which we need more training

Coaching - My manager/supervisor - Suggests ways to improve my work group's performance

Coaching - My manager/supervisor - Encourages work group members to solve problems together

Coaching - My manager/supervisor - Encourages work group members to exchange information with one another

Coaching - My manager/supervisor - Provides help to work group members

Coaching - My manager/supervisor - Teaches work group members how to solve problems on their own

Coaching - My manager/supervisor - Pays attention to my work group's efforts

Coaching - My manager/supervisor - Tells my work group when we perform well

Coaching - My manager/supervisor - Supports my work group's efforts

Coaching - My manager/supervisor - Helps my work group focus on our goals

Coaching - My manager/supervisor - Helps develop good relations among work group members

Informing - My manager/supervisor - Explains company decisions

Informing - My manager/supervisor - Explains company goals

Informing - My manager/supervisor - Explains how my work group fits into the company

Informing - My manager/supervisor - Explains the purpose of the company's policies to my work group

Informing - My manager/supervisor - Explains rules and expectations to my work group

Informing - My manager/supervisor - Explains his/her decisions and actions to my work group

Showing concern / interacting with the team - My manager/supervisor - Cares about work group members' personal problems

Showing concern / interacting with the team - My manager/supervisor - Shows concern for work group members' well-being
Showing concern / interacting with the team - My manager/supervisor - Treats work group members as equals
Showing concern / interacting with the team - My manager/supervisor - Takes the time to discuss work group members' concerns patiently
Showing concern / interacting with the team - My manager/supervisor - Shows concern for work group members' success
Showing concern / interacting with the team - My manager/supervisor - Stays in touch with my work group
Showing concern / interacting with the team - My manager/supervisor - Gets along with my work group members
Showing concern / interacting with the team - My manager/supervisor - Gives work group members honest and fair answers
Showing concern / interacting with the team - My manager/supervisor - Knows what work is being done in my work group
Showing concern / interacting with the team - My manager/supervisor - Finds time to chat with work group members

Appendix II: Means, standard deviations, and correlations of sub-dimensions

Appendix II. Means, standard deviations, and correlations of sub-dimensions.

		Mean	St. dev	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1)	Information	3.83	0.47	1																
(2)	Communication	2.59	0.31	0.047	1															
(3)	Collaboration	2.98	0.54	-0.122	0.53**	1														
(4)	Critical thinking	3.84	0.18	-0.279	0.140	0.227	1													
(5)	Creativity	3.23	0.37	0.112	0.72**	0.582**	0.154	1												
(6)	Problem solving	3.30	0.36	0.033	0.555**	0.624**	0.187	0.763**	1											
(7)	Innovation	3.58	0.47	0.219	0.288	0.566**	0.261	0.246	0.440*	1										
(8)	In-group communication	3.79	0.28	0.439*	0.042	0.054	-0.141	0.147	-0.097	0.141	1									
(9)	Performance	4.02	0.31	0.199	-0.009	0.000	-0.142	0.192	0.095	0.437*	0.397*	1								
(10)	Leading by example	3.95	0.34	0.013	-0.033	-0.087	0.110	-0.055	-0.276	0.028	0.478*	0.259	1							
(11)	Participative decision making	4.02	0.45	0.183	-0.190	-0.152	0.127	-0.089	-0.447*	0.063	0.624**	0.296	0.715**	1						
(12)	Coaching	3.65	0.33	0.286	-0.129	-0.082	0.167	0.015	-0.329	0.072	0.551**	0.130	0.672**	0.809**	1					
(13)	Informing	3.60	0.34	0.352	0.011	0.045	-0.147	-0.016	0.070	0.203	0.530**	0.117	0.457*	0.343	0.462*	1				
(14)	Showing concern	3.90	0.35	0.249	-0.063	-0.043	0.139	-0.013	-0.390	-0.024	0.554**	0.132	0.523**	0.739**	0.801**	1				
(15)	Company tenure	5.50	4.94	0.121	-0.078	-0.377	0.319	-0.167	-0.312	-0.102	-0.035	0.148	0.261	0.214	0.156	-0.180	0.346	1		
(16)	Team tenure	1.70	1.20	0.177	-0.074	-0.442*	0.011	-0.228	-0.356	-0.254	-0.223	-0.154	0.033	0.034	0.121	-0.095	0.295	.814**	1	
(17)	Supervisor tenure	1.50	1.06	-0.222	0.064	0.150	0.079	0.006	0.074	-0.137	-0.292	-0.167	-0.232	-0.437*	-0.289	0.038	0.028	0.104	0.213	1

*p < 0.05 ** p < 0.01

Appendix III:

Appendix III. Effects of sub-dimensions.

	Innovativeness						In-group communication						Performance					
	β	s.e.	t-value	p	R	R sq.	β	s.e.	t-value	p	R	R sq.	β	s.e.	t-value	p	R	R sq.
<i>Main effects</i>																		
<i>Empowering leadership</i>					0.54	0.39					0.327	-0.13					0.13	-0.16
Information	0.40	0.17	2.33	0.03			0.26	0.12	2.08	0.05			0.08	0.15	0.52	0.61		
Communication	0.17	0.37	0.46	0.65			-0.15	0.27	-0.58	0.57			-0.29	0.33	-0.88	0.39		
Collaboration	0.52	0.19	2.67	0.02			0.14	0.14	0.98	0.34			-0.02	0.17	-0.14	0.89		
Critical thinking	0.62	0.44	1.40	0.18			-0.04	0.32	-0.14	0.89			-0.20	0.40	-0.51	0.62		
Creativity	-0.68	0.39	-1.75	0.10			0.38	0.28	1.35	0.19			0.40	0.35	1.16	0.26		
Problem solving	0.47	0.34	1.38	0.18			-0.43	0.25	-1.73	0.10			-0.06	0.31	-0.19	0.85		
<i>Digital maturity</i>					0.08	-0.16					0.52	0.39					0.14	-0.88
Leading by example	-0.25	0.47	-0.53	0.60			-0.06	0.20	-0.29	0.77			0.12	0.30	0.42	0.68		
Participative decision making	0.22	0.46	0.47	0.64			0.34	0.20	1.73	0.10			0.35	0.29	1.20	0.25		
Coaching	0.21	0.66	0.32	0.75			-0.12	0.29	-0.41	0.69			-0.34	0.42	-0.81	0.43		
Informing	0.37	0.36	1.02	0.32			0.32	0.16	2.02	0.06			0.06	0.23	0.27	0.79		
Showing concern	-0.40	0.52	-0.78	0.44			0.12	0.22	0.53	0.60			-0.04	0.33	-0.13	0.90		

*p < 0.05 **p < 0.01