

INTRODUCTION

This chapter is dealing with the topic "Leadership in the Digital Enterprise: Lessons from Pioneers." The purpose of this chapter is to provide information technology, business, and management practitioners with a robust theoretical framework that has matured within three studies. A secondary academic journal analysis describes the ecosystem of enterprises transforming into digital companies, facets of mature digital pioneering companies, and the leadership skillset needed. Differences between innovators, digital leaders, and innovation leaders are highlighted. An introduction of the Effective Innovation Leadership (EIL)-Framework occurs, which is the outcome of six years of research published in three peer-reviewed contributions. After the EIL-Questionnaire with 77 items has been presented, the empirical study starts to be described. The descriptive statistics from a pre-test with 59 executives and the correlation analysis in a Sample with Innovation Leadership from successful Technology Companies create up to 89% digital innovations.

This chapter provides input for innovation managers and innovation leaders on what they can do to become effective in the digital enterprise transformation. The author joins the book's target to consolidate innovative knowledge in management and digital enterprise transformation strategy. In order to fathom the subject, the author explores three perspectives. First, an explanation of the environment in which digital companies operate based on peer-reviewed scientific publications takes place. Then effective strategies for transforming into a digital company are described. Finally, there is a dive into the innovation leadership work in digital companies based on empirical studies.

The publication addresses modern problems and solutions for global business. Digital innovations are becoming increasingly important in the global struggle for the survival of companies. In order to approach this complex challenge, the three scientific disciplines, "Innovation Management and Technologies," "Leadership," and "Digital Transformation" are considered together.

BACKGROUND

It follows an examination of the dynamics of the digital revolution at the macro level. The Digital Revolution originated in 1947 and is ongoing ever since. The invention of the Internet, the rise of home computers, and the invention of the World Wide Web and Smartphones and Social Media are core drivers of global digitalization. Today 62% of the world population are cell phone subscribers, and 59% are internet users (Statista, 2020a; Statista, 2020b). Through the Internet and the movements documented in it, companies and consumers generate a wide variety of data that reflect user behavior information.

According to Moore's Law, computing power has doubled every 18 months for more than half a century. Moreover, there is no end in sight. This development has led to the fact that we now have computers capable of performing highly complex tasks. Artificial intelligence's beginnings can already be marveled at here and there, even if the decisive breakthrough in this sector is not expected until around 2045 (Brynjolfsson & McAfee, 2014).

"We are on the cusp of an age of networked intelligence - an age that will produce a new economy, a new politics, and a new society." (Tapscott, 2013)

According to Tapscott (2013), humanity is currently operating in a knowledge economy less based on physical strength and more on people's mental strength. Information connects people across the globe. The combination of electronic data processing, communication, and content creates new branches of industry that make new companies necessary. In the digital economy, competition comes from all

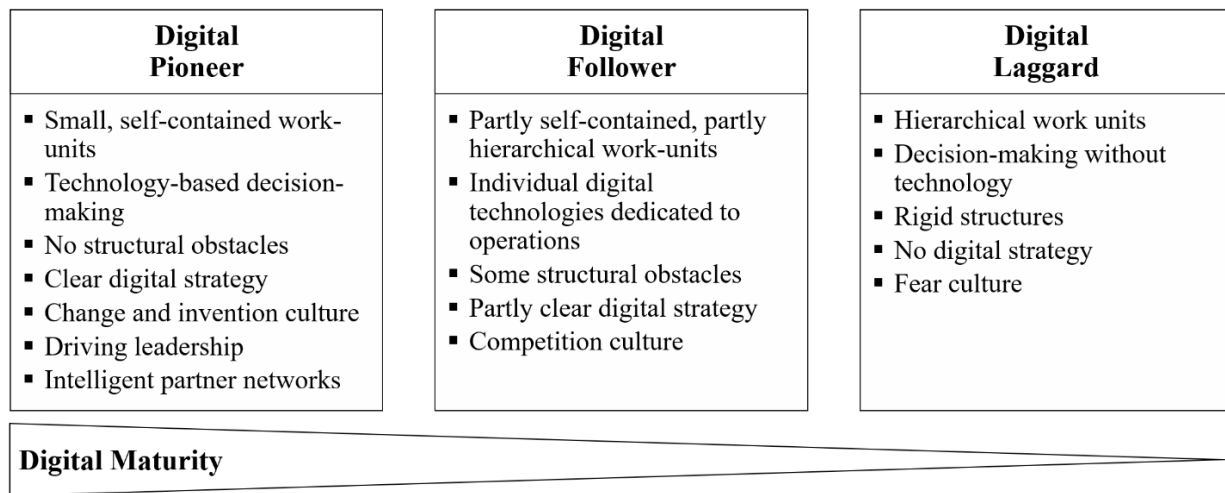
industries, national markets, and company sizes. When information is digital and networked, nobody can hide anymore. Digital pioneering companies such as Google, Apple, or PayPal disrupt already the banking and automotive industry. Competitors of tomorrow can come from anywhere.

Waller and Beswick (2020) encourage established companies to mobilize new digital tools so that managers and technologists alike can make fundamentally better business decisions. Research and managerial interest in digital transformation are burgeoning. Following the research of Hanelt et al. (2020: 20), "Digital Transformation can be best understood as continuous change that can be triggered and shaped by episodic bursts, while the latter are inducing further continuous change." The scientists studied 297 articles to create this definition.

Most innovative digital enterprises that successfully transformed into a digital pioneer are leaving all the rest behind. They lead the market. Their digital engagement is very different from that of the follower or laggards such as construction, healthcare, or governments in general. Digital innovators mostly use network effects to scale. Digital market leaders are characterized by their digital strategy, skills, and culture (Manyika et al., 2016). Companies that continuously create digital innovations usually have time, quality, and cost advantages over their competitors (Power, 2016). That sounds so simple; just how does it work? According to Waller and Beswick (2020), three strategies can enable organizations to perform digital transformations that create value and enable continuous innovation. The first strategy is to remove all structural obstacles that slow the system to adapt to the market conditions. The second strategy is to adopt technology that will help to make better decisions. The third strategy is to provide small, self-contained work units. The authors encourage us to harness the increasing potential of technology to transform organizations.

Based on an MIT Sloan Management Review and Deloitte global study, mature digital enterprises are focused on integrating digital technologies following a clear digital strategy supported by leaders who, in addition to that, drive an organizational transformation towards a change and invention culture (see Figure 1). Less mature digital businesses solve business problems with individual digital technologies dedicated to operations (Kane et al., 2015). The diverse maturity levels speak for differentiation in the later empirical study. The following figure summarizes the findings of Waller and Bentswick (2020), Manyika et al. (2016), Power (2016), and Kane et al. (2015) that were just discussed enriched with the author's insights.

Figure 1. Digital Maturity



Source: (own representation, 2020)

Primary data reveals that managerial and leadership skills are of higher importance compared to technical skills in the context of digital transformations (Gilli et al., 2020). That is why we now deduce what kind of leadership skills in digital transformation are significant. Following Westley & Mintzberg (1989) and Kotter (1990), leaders create and communicate ideas with which they authorize action by speaking of implementing visions or positioning companies for the future. The six leadership approaches most often appearing between 2000 and 2013 as the focal theory are transformational leadership, charismatic leadership, strategic leadership, leadership and diversity, participative/shared leadership, and the trait approach to leadership (Meuser et al., 2016). Transformational leadership creates change and enhances productivity by offering a vision that attracts and inspires followers (Cambridge, 2020). Charismatic leadership suggests that leaders raise followers' aspirations and activate their higher-order values (e.g., altruism) such that followers identify with the leader and his or her mission/vision, feel better about their work, and then work to perform beyond simple transactions and base expectations (Avolio, 1999; Bass, 1985; Conger & Kanungo 1998). Strategic leadership involves learning, the capacity to change, and managerial wisdom (Boal & Hooijberg, 2000). Leadership and diversity claim to go beyond the social and cultural constraints that limit leadership. It is required that leaders should adapt to cultural contexts such as society and organization (Chin & Trimble, 2014). Participative leadership involves employees in decision-making across levels of the hierarchy (Spreitzer, 2007). Shared leadership is distributed among team members rather than focusing on a single designated leader (Carson et al., 2007). Shared leadership is "a dynamic, interactive influence process among individuals in groups for which the objective is to lead one another to the achievement of group or organizational goals or both. This influence process often involves peer, or lateral, influence and at other times involves upward or downward hierarchical influence" (Pearce & Conger, 2005: 1). Shared leadership is becoming more critical in the context of a knowledge-driven era in which firms are distributed across cultures. This insight is relevant to globally acting Technology Companies. Based on Carson et al. (2007), Avilio et al. (2009) state that future research needs to examine how team leaders affect the team's ability and motivation to be self-directed and share in leadership.

All leadership efforts in a digital enterprise are geared towards generating short-term and long-term value for customers. To achieve this, external business partners, in particular, are integrated, and technologies are seamlessly integrated (Nielsen & Meehan, 2015). The success of innovative digital enterprises often depends on the efforts of other innovators in their environment. Therefore, external partners' integration becomes a core task of leaders in a digital enterprise (Adner, & Kapoor, 2010). This insight gives the shared leadership approach a whole new meaning. Because if companies can only become successful if they act in a partner network, then shared leadership becomes a must-have skill. Moreover, if we also consider that digital companies can draw from the local area and the global environment, leadership and diversity also gain more weight.

Leaders in the digital enterprise need to manage the increased pace in the digital ecosystem. They face greater expectations of productivity. There is also a need for flexible and distributed workplaces and a shift in organizational culture. Effective leaders in the digital enterprise need to provide a vision and direction explaining the "why" of actions. They anticipate markets and trends as well as understand technology. Also, they need to adapt to change, take on responsibility for the digital transformation, and empower and enable employees to carry out new initiatives (Kane et al., 2019). The ability to recognize trends was already highlighted by Drucker (2002) as a discipline of innovation. Before technologies can be adopted, they must be understood. So, this ability makes sense in any case. Innovation involves change; it requires employees and managers who take responsibility for its development. The factors mentioned here, which are required for digital managers, are also crucial for Effective Innovation Leaders active in digital enterprises, which the author names Effective Digital Innovation Leaders (EDIL).

New leadership styles arise by integrating aspects such as complexity, shared, collective, or distributed leadership. Avilio et al. (2009) recommend that future research in digital transformation should be dealing with leadership, focusing on virtual team management incorporating motivational elements and diversity of the group. They raise the question of "how existing leadership styles and cultures embedded in a group and organization affect the appropriation of advanced information technology systems." This requirement fits in with other experts' desire to keep an eye on trends and penetrate meaningful technologies or integrate them into decision-making processes. Above that, Avilio et al. (2009) propose to focus the attention not only on individuals neither on the complex interplay of numerous interacting forces. To do that, the researchers suggest field observations and agent-based model simulations. This requirement is reminiscent of the shared leadership concept, which enjoys a high level of attention in leadership research (Pearce & Conger, 2005; Carson et al., 2007).

Leaders in the volatile, uncertain, complex, and the ambiguous world need to face digital transformation holistically. There is a need to create new leadership approaches for digital transformation. Weber et al. (2019) propose a framework based on the competing values framework, according to Quinn et al. (1991), which includes two areas of tension, the internal and external focus and flexibility versus stability. Weber et al. (2019) replace the dimensions of flexibility and stability with relationship-orientation and task-orientation. Based on a classifying study with 42 digital transformation experts, they identify, for example, two relevant roles for the digital transformation – the digital pioneer and the innovator. Both roles are externally focused and task-oriented. The field has the explanation "Identifying needs for change and implementing innovative changes." The primary research with 859 employees shows that innovators create task-oriented outcomes if they perform innovation on the job.

On the other hand, if innovators share their knowledge, this might harm relation-oriented outcomes. Digital pioneers, on the other hand, create task-oriented outcomes if they are digitally mature. A technology overload harms task-oriented outcome. If digital pioneers commit themselves effectively, this has a positive effect on relation-oriented outcomes. To sum it up, innovators push a company's innovation capability forward and are robust in delivery, but their knowledge sharing may decrease team outcomes. Digital pioneers, on the other hand, educate their peers with their digital maturity if they are not overburdening their peers with technologies. This brand-new study shows how closely innovation and digitization are connected and should not be thought of separately.

In conclusion, it can be said that the digital revolution is affecting all industries. The faster a company manages to adapt its organizational culture, strategy, organization, and technologies accordingly, the higher the likelihood of developing a competitive advantage. Those companies that are considered digital pioneers in the market live a culture of the invention implement a digital strategy with agile and small work units that use sensible technologies to advise them on decision-making. To transform a company into a digital pioneer requires technical skills and leadership skills, and these can be described using the concepts of virtual leadership, leadership and diversity, and shared leadership. However, it is elementary to think about creating digitization and innovation together, what we will do now with the EIL-Framework application in pioneering digital companies.

THEORETICAL FRAMEWORK

Let us start with the definition of the most important terms. What is Effective Innovation Leadership? The term emerged during the author's Ph.D. study and is still unique. The innovation leadership movement is gaining attention in the context of digital transformation and the globalized world economy since 2000: Murphy & Murphy (2002), Bossink (2004), Gliddon (2006), Carmeli et al. (2010), Hunter & Cushenbery (2011), Rosing et al. (2011), O'Reilly and Tushman (2013), Kaudela-Baum et al. (2014), Gliddon (2018). The variety of innovation leadership definitions is aggregated in the publication Schork (2020). In this

chapter, the core definition that has arisen from it is given. Innovation leaders are opinion leaders who secure a company's economic success by promoting, initiating and controlling innovations. They research and implement innovations and therefore manage processes and people.

Digital innovations can be defined as the "creation of (and the consequent change in) market offerings, business processes, or models that result from the use of digital technologies" so that "digital innovation management refers to the practices, processes, and principles that underlie the effective orchestration of digital innovation" (Nambisan et al., 2017: 224). Digitalized products, services, or processes are examples of digital innovations in the market.

Effective Innovation Leaders (EIL) in the digital enterprise transform unique ideas and affordable technologies into marketable digital innovations. In this chapter, we call them Digital Effective Innovation Leaders (EDIL). Those digital innovations create value globally. Sustainable acting EILs create digital innovations that give something back to society, economy, or ecology without taking something away. Ethically acting EILs think about the consequences of their actions and proactively handle the societal, ecological, and economic effects of their engagements.

In order to be able to develop innovations, managers have to get their employees behind them. They can do this through charismatic leadership. Innovations can only be successful when a network consists of different partners, so the shared leadership concept is of particular importance. Also, researchers have already recognized that the innovative capacity of teams correlates with increasing diversity and that EILs must therefore be able to manage diversity. The discipline of innovation is about integrating diversity that rubs against each other to develop innovations that create value by covering an unmet need in society through a new idea or technology (MIT OpenCourse, 2013). Diversity is, therefore, also part of digital innovation leadership. Innovations are improvements of the existing without claiming uniqueness or intelligence (Potts, 1944). Change comes through innovations, and trends are the basis of innovations. So basically, all the mentioned leadership skills that apply to the new era are needed. Innovation manages to allow contradictions to exist side by side and use it as a source of ideas (Drucker, 2002 & Hill et al., 2014). The leadership of complexity has its place in digital innovation leadership. EILs operate in an entrepreneurial environment. To take effect, we assume that they make the digital pioneer companies' conditions even more useful. How exactly, we look at that in a primary data collection.

Before we turn to this chapter's primary data collection, let us provide an insight into the EIL-Framework, which has gone through three stages of development over the past six years. As Figure 2 shows, the EIL-Framework resulted from a grounded theory analysis in which five different data sources were iterated. The focus of the grounded theory analysis was the ICT-industry. Two of the four subcategories were quantitatively assessed in an ICT-study with 96 participants. The analysis showed diverse positive and significant correlations. Most importantly, the practices of entrepreneurship and focus have a significant positive effect on business success. Since the categories of the three subcategories values, strengths, and practices were based on a secondary data foundation, a field study was carried out with three executives in digital business units. Based on the data collected in it, enriched by literature analysis, the constructs were concretized practically. The in-field result is that, in particular, the values of openness and trust must be lived in the digital company so that digital innovations can arise. EILs are particularly strong in association (now: creativity), delivery, and perseverance (now: persuasiveness). They practice focus and entrepreneurship, which is in line with the findings of the first study.

Figure 2. EIL-Framework Development Stages

Framework Version	EIL 1.0	EIL 2.0	EIL 3.0
Study Duration	2014-2016	2016-2017	2018-2019
∑ Participants	178	3	1
Research Steps	<ol style="list-style-type: none"> Literature Review Timely leadership theories Qualitative Study Group discussion (N=10) Narrative interviews (N=14) Open questionnaire (N=25) Three case studies (N=33) Item Development Document analysis (N=50) Content Validity Correlation analysis, N=96 	<ol style="list-style-type: none"> Literature Review Concretization of the sub categories descriptions Qualitative Study Three innovation leaders in digital business units Item Development Description of the constructs based on field data 	<ol style="list-style-type: none"> Literature Review Deepen existing innovation leadership definitions Item development Operationalization of sub category definitions Qualitative Study Comparison of the EIL-Framework with entrepreneurial leadership, effectuation, and social entrepreneurial leadership
Core Category	Efficacy		
Sub Categories (Constructs)	Values (7), Strengths (6), Practices (7), Success (5)	Values (2), Strengths (3), Practices (2)	Values (7), Strengths (6), Practices (7)
Key Insights	<p>Innovation culture, organization, strategy, and technology are important to create an innovative digital business.</p> <p>The practices focus, cooperation, reflexivity, and entrepreneurship have a significant positive effect on innovation teams' professionalism.</p> <p>Innovation teams well-being positively correlates significantly with cooperation, context support, and entrepreneurship.</p> <p>The practices focus and entrepreneurship positively affect business performance.</p>	<p>The two values openness and trust are highly relevant for the effectiveness of innovation leaders in digital business units. Both values have an impact on the willingness and drive of employees to innovate.</p> <p>Effective innovation leaders are especially strong in association, delivery, and perseverance.</p> <p>Effective innovation leaders practice focus and entrepreneurship.</p> <p>Ineffective innovation leaders tend to be egoistic, fixed to their convictions, and inflexible. They live conditional trust, are judgmental and are unable to deliver innovations in a focused manner.</p>	<p>Innovation leadership is an individual task that is embedded within the innovation strategy of an enterprise.</p> <p>Unique for innovation leaders is the value transparency, and the practice reflexivity.</p> <p>They need to be strong in creativity, and therefore adapt resisting systems, such power and performance systems.</p> <p>Innovation leaders need decision spaces. They can only be effective with engaged open-minded and flexible team members. Ego, inflexible or fixed mindsets hinder innovation.</p>
Publication	Schork, 2017	Schork, 2018	Schork, 2020

Source: (own representation, 2020)

To align the EIL-Framework's question batteries more closely with existing research on innovation leaders, an in-depth analysis of the existing definitions of innovation leadership was carried out. Each construct of the subcategory's values, strengths, and practices was broken down into a five-dimensional battery of questions. Also, the EIL-Framework was compared with recognized existing management models from the entrepreneurship discipline. It becomes clear that innovation leaders can only affect if the business environment allows them by comparing the theories. In particular, areas of responsibility play a significant role here, mainly influenced by power and performance systems. Hierarchies and fixed attitudes, as well as egos, can prevent the effectiveness of innovation leaders. EILs often have to enable creativity and thus work with existing systems. Innovation leaders can become effective with a team composed of open-minded and flexible people. Rigidity and compulsion hinder innovation.

The core findings from the three publications just presented are now summarized:

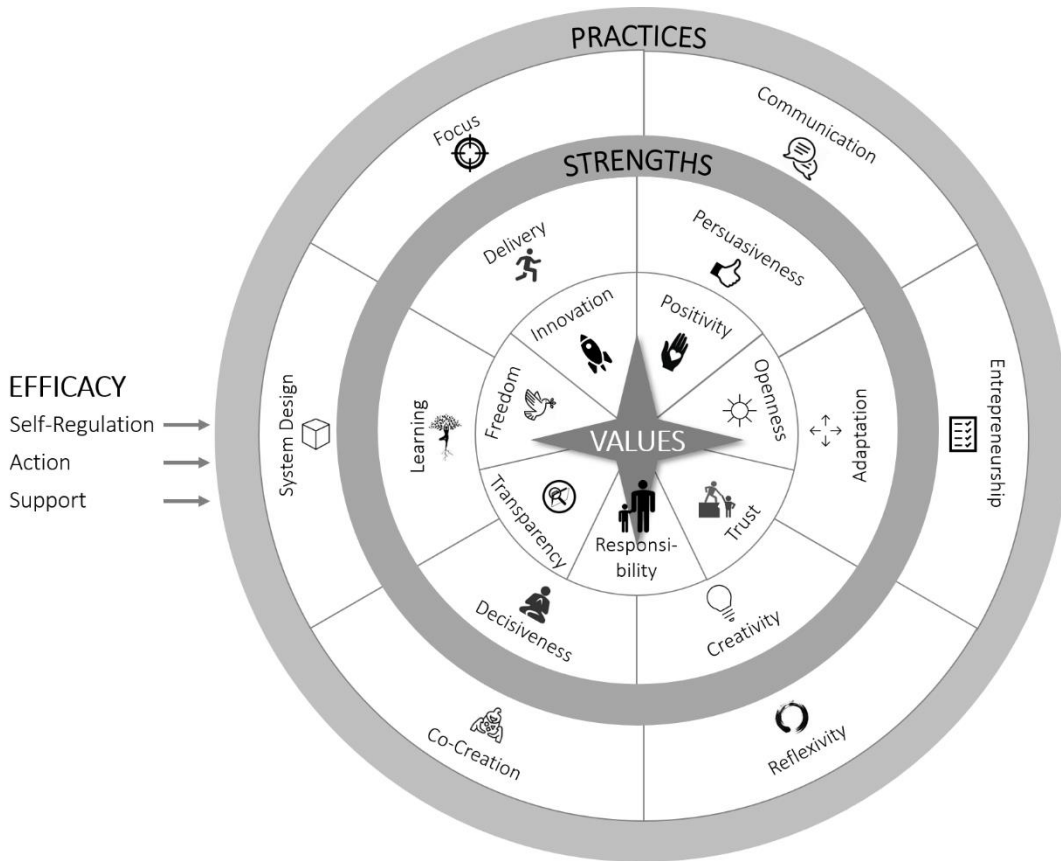
- The value openness positively affects the effectiveness of Innovation Leaders [ILs].
- The value transparency positively affects the effectiveness of ILs.
- The strength association (now: creativity) positively affects the effectiveness of ILs.
- The strength delivery positively affects the effectiveness of ILs.
- The strength perseverance (now: persuasiveness) positively affects the effectiveness of ILs.
- The practice reflexivity positively affects the effectiveness of the effectiveness of ILs.
- The practice entrepreneurship positively affects the effectiveness of ILs.
- The practice focus positively affects the effectiveness of ILs.

Diverse organizational context factors influence a team and company's innovation performance and, therefore, the effectiveness of digital companies' innovation leaders. The most important relationships identified in peer-reviewed scientific papers are aggregated in the following:

- The composition or creative innovation teams affects the innovation performance (Dlugoborskyte et al., 2015).
- Organizational structure affects innovation performance (Dedahanov et al., 2017).
- The organizational culture affects innovation performance (Hogan & Coote, 2014).
- The organizational culture factors positively affecting innovative capacity (Chih et al., 2011).
- The absorptive capacity of an organization positively affects innovation performance (Chih et al., 2011).
- Innovation team climate and team performance are linked (Valls et al., 2016; Bain et al., 2001).
- The innovation strategy affects innovation performance (Wu & Lin, 2011).
- Innovation strategy and specific elements of organizational culture are interrelated (Chen et al., 2018).

Now let us take a closer look at the composition of the EIL-Framework 4.0. It consists of the core category "Efficacy," which drives the three categories "Values, Strengths, and Practices" broken down into nineteen constructs. Figure 3 shows the seven values, six strengths, and six practices.

Figure 3. EIL-Framework 4.0



Source: (own representation, 2020)

In order to better understand each construct, Table 1 summarizes the definition per construct at the meta-level. The definitions are based on the outcomes of the three publications Schork (2017: 192-193), Schork (2018), and Schork (2020: 8-10), in which the definitions were derived from various sources and peer-reviewed journals. As well, Table 2 shows how the EIL-Framework in this study was expanded. Since the core category of effectiveness has only been defined but not operationalized, this will take place in this book's contribution. A battery of questions that have been adequately tested for reliability and validity is used. The survey was developed and researched by Hannah and Avilio (2013). The effectiveness is made up of three constructs of self-regulation, action, and support. Each of which is asked with seven to eight questions. Contrary to the scientists' recommendation, the author uses a six-point-Likert-scale to all EIL-questions in the same way.

The EIL-Questionnaire contains a battery of seventy-seven questions about the leadership values and behaviors (including question batteries by Hannah et al. 2012 & Hannah et al. 2008), twelve questions about the organization, and five questions about the participant's demography. Most of the questions are queried using a six-point Likert scale (99: I do not know, 1: Not applicable at all; 2: Not applicable; 3: Less applicable, 4: Rather applicable, 5: Applicable, 6: Very applicable).

Table 1. EIL-Framework Definitions

Category	Dimension	Definition	Number of Questions	Scale
Values	Freedom	Make decisions free from specific personal or social ties	1	6-Point-Likert, including no information
	Innovation	Create something new	1	
	Openness	Perceive situations without judgment	1	
	Positivity	Assume that life and people mean well with us	1	
	Responsibility	Take personal responsibility for innovations	1	
	Transparency	Make actions visible and comprehensible	1	
	Trust	Trust people unconditionally	1	
Strengths	Adaptation	Adapt to changes (i.e., needs, technology, processes, circumstances)	4	
	Creativity	Solve problems in original ways	4	
	Delivery	Disciplined implementation of tasks	4	
	Decisiveness	Independent, calm decision making	4	
	Learning	Intrinsic lifelong learning	4	
	Persuasiveness	Convincing others	4	
Practices	Communication	Creating common sense with sufficient communication	4	
	Co-Creation	Joint development of solutions	4	
	Entrepreneurship	Implementation of competitive ideas in the market	4	
	Focus	Focus on desirable, feasible and profitable initiatives	4	
	Reflexivity	Evaluation of diverse perspectives	4	
	System Design	Creating an agile working setting	4	
Efficacy	Self-Regulation	Think through complex situations and motivate oneself to enact solutions	7	
	Action	Effectively execute by motivating, coaching and inspiring followers	8	
	Support	Draw upon own work environment to enhance leadership	8	

DESCRIPTIVE STATISTICS

Is the newly created EIL-Framework stable? The author examines this in the following pre-study. Therefore, executives within a German management association fill out the online EIL-Questionnaire in April 2020. As a result, fifty-eight executives from different companies and industries participate. With 43% of women and 57% men, we recognize a balanced gender mix. A heterogeneous population was deliberately chosen to check the question batteries' stability and differences in response behavior. Fifty participants indicate their age, which varies from 31 to 74. The leadership experience ranges from a few months to forty years. The executives rate the innovative ability of their company very differently. The range from 'not applicable at all' to 'very applicable' is exhausted. The average value of enterprise innovation capability is 3,6. The value stands for less to relatively applicable.

Cronbach's Alpha [CA] on the construct level shows internal consistency. The CA is the most well-known measure of the scale reliability in quantitative surveys (Leedy & Ormrod, 2013). CA assumes that

all factor loadings are equal. In reality, this is seldom the case. With this, CA systematically underestimates the reliability. The Cronbach's Alpha can be measured using the following formula:

$$\alpha = \frac{N^2 \overline{cov}}{\sqrt{\sum s_{item}^2 + \sum cov_{item}}}$$

\overline{cov} = average covariance between items;
 N^2 = number of elements in the square
 s_{item}^2 = Item variances;
 cov_{item} = Item covariances

(1.0)

The variance is the squared deviation from the mean. Furthermore, covariance is a non-standardized measure of relationship that is used to describe linear relationships.

Since the values are only queried with an item, no CA value is measured for this. Brosius (2013: 826) requires a minimum CA value of .7. Only the constructs 'learning' with .765 and 'action' with .748 achieve this required minimum value. It looks different if only those executive profiles which indicate that their organization is (very) innovative (n=14) or those executive profiles that indicate that their organization is not innovative (at all; n=8) are examined (see Table 2). In both subgroups, the construct's learning is stable with a CA >.7. In the executives who state that they work in an innovative company, communication, entrepreneurship, and action have a CA value >.7. The executives who state that they work in a non-innovative company, the constructs decisiveness, persuasiveness, co-creation, focus, and support have a CA value >.7.

Table 2. Cronbach's Alpha in the Pre-Test Sample

Category	Dimension	CA, n=58	CA, n=14	CA, n=8
Strengths	Adaptation	-.061	.604	-.030
	Creativity	.463, excl. C1	.536	.649
	Delivery	.389, excl. D1	.521	-.536, excl. D3
	Decisiveness	.481, excl. D2	.007	.760, excl. D2
	Learning	.765	.752	.829
	Persuasiveness	.643, excl. P2	.012	.781
Practices	Communication	-.059	.825, excl. C4	-.269
	Co-Creation	-.072	.599, excl. CC2	.782, excl. CC2
	Entrepreneurship	-.112	.846	.309
	Focus	.629	.004	.800
	Reflexivity	-.093	-.674, excl. R1	.757, excl. R1
	System Design	.296, excl. SD3	.690, excl. SD3	.396
Efficacy	Self-Regulation	.485, excl. SR8	.667, excl. S8	.394
	Action	.748	.848	.612
	Support	.485, excl. S6	.603, excl. S3	.776

The author takes a closer look at the profiles of innovation leaders working within two successful digital enterprises. The digital enterprise sample was carried out between May and June 2020. Company A is headquartered in the U.S. and employs around 40.000 people. Company B is headquartered in Germany and employs around 100.000 people. Twelve DILs from company A and eight DILs from company B participate in the study (see Table 3). All digital innovation leaders are working in German-speaking

markets. All twenty participants state that their company is innovative (Median: 5.00, Mean: 4.75). The participants of company A are aged between 40 and 58 and are all male. They state that their company produces 89% digital innovations. The participants of company B are aged between 23 and 52. Half of the participants are male and half female. They state that their company produces 86% digital innovations. Since both companies are classified as innovative and mainly produce digital innovation, they are referred to as digital pioneers.

Table 3. Overview of the Digital Pioneer Sample

Company	Industry	Participants	Origin	Employees
A	Technology	12	USA	40.000
B	Technology	8	Germany	100.000

Table 4 aggregates the CA values generated in the Digital Pioneer Sample. The strength persuasiveness and the efficacy construct support show a CA > .7 in the complete Digital Pioneer Sample and the two company subgroups. The strength creativity and the two practices communication and co-creation show a CA > .7 in the combined sample. Since this result does not show in the split-up subgroups, stable constructs are not assumed.

Table 4. Cronbach's Alpha in the Digital Pioneer Sample

Category	Dimension	CA, Digital Pioneers	CA, Company A	CA, Company B
Strengths	Adaptation	.319	.487	.256
	Creativity	.768, excl. C1	.632	.615 (.821, excl. C1)
	Delivery	.408	.652	-.208
	Decisiveness	.545, excl. D3	.568, excl. D3	.687, excl. D3
	Learning	.545	.234	-.356
	Persuasiveness	.806, excl. P4	.721, excl. P4	.889, excl. P4
Practices	Communication	.706, excl. C4	.607	-.273
	Co-Creation	.746, excl. CC1	.695, excl. CC1	.554, excl. CC1
	Entrepreneurship	.312	.638	.415
	Focus	.280	.244	-1.44
	Reflexivity	.687, excl. R3	.831, excl. R3	.607, excl. R3
	System Design	.497	.602, excl. SD3	.775, excl. SD2
Efficacy	Action	.352	.445	.321
	Self-Regulation	.326	.631, excl. SR7	.545, excl. SR1
	Support	.843	.729	.921

The two samples' very different results conclude that the question-batteries need to be improved to measure the same thing, no matter in which sample they are used. The following analyzes are carried out at the item level.

The standard deviation is a measure of dispersion in descriptive statistics, which measures the "mean deviation from the mean." Francis Galton introduced it in 1860 (Cleff, 2008: 59-60). The standard deviation (s) is calculated from the square root of the variance.

The formula for the standard deviation [SD] is as follows (Homburg et al., 2008b: 220):

$$s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}$$

x_i = value of the participant;
 \bar{x} = group mean;
 n = sample size

(2.0)

Deviations from the average are weighted more heavily by squaring $x_i - \bar{x}$. The group mean (\bar{x}) is the sum of the observed values x_i divided by the number n of observations (Field 2013: 23):

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

x_i = value of the participant;
 \bar{x} = group mean;
 n = sample size

(3.0)

The group mean (\bar{x}) is the sum of the observed values x_i divided by the number n of observations (Field 2013: 23):

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

x_i = value of the participant;
 \bar{x} = group mean;
 n = sample size

(4.0)

Table 5 shows that both companies' digital innovation leaders value innovation, openness, and transparency the most and disagree on classifying the value of freedom (see Standard Deviation >1.0). The participants of company A value responsibility higher and freedom lower than the participants of company B. The participants of company A disagree regarding the values of positivity and trust (Standard Deviation >1.0). The standard error of the mean value is relatively small (see columns 4 and 5).

Table 5. Overview of the Digital Pioneers Sample

Value	Mean		Standard Error // Mean		Standard Deviation	
	Company A	Company B	Company A	Company B	Company A	Company B
Innovation	5.17	5.38	.21	.38	.72	1.10
Openness	5.33	5.25	.22	.31	.78	.89
Positivity	4.33	4.88	.38	.13	1.30	.35
Trust	4.25	4.71	.39	.36	1.36	
Responsibility	5.58	4.75	.15	.56	.52	1.58
Transparency	5.67	5.75	.14	.16	.50	.46
Freedom	4.50	5.13	.42	.40	1.45	1.13

What do executives from the pre-test value? A comparison is made between the participants who rate their company as innovative (n=14), who rate their company as moderately innovative (n=36), and those who rate their company as not innovative (n=8). Table 6 shows that the Pre-test sample rates innovation, responsibility, and transparency as the most important. Unlike the digital pioneers, the executives from the pre-test value less strongly openness and more strongly responsibility. The pre-test sample disagrees about the values of openness, positivity, trust, and freedom (Standard Deviation >1.0).

Table 6. Overview of the Pre-Test Sample

Value	Mean			Standard Error // Mean			Standard Deviation		
	Low	Med	High	Low	Med	High	Low	Med	High
Innovation	5	5.13	5.07	.33	.14	.29	.93	.86	1.07
Openness	4.37	4.02	4.0	.50	.23	.32	1.4	1.4	1.15
Positivity	4.62	4.54	4.5	.50	.14	.34	1.4	.85	1.29
Trust	4.62	4.16	4.42	.57	.18	.42	1.6	1.1	1.55
Responsibility	5.5	5.21	5.42	.19	.13	.23	.53	.79	.85
Transparency	5.75	5.19	5.29	.25	.12	.16	.71	.7	.61
Freedom	4.38	4.17	4.92	.18	.23	.42	.52	1.36	1.50

CORRELATION ANALYSIS

Since only a few of the 77 EIL-Questionnaire items are normally distributed, only 42 moderate deviation and all question batteries are interval scaled, and therefore metric, a correlation analysis according to Pearson is carried out first. The correlation analysis does not require a normal distribution as a pre-requisite. The range of the Pearson correlation coefficient is limited to -1 to +1. The correlation coefficient is a measure of the degree of common variation of the two variables x and y (homburg et al. 2008a: 223) and is calculated from the covariance of two variables.

The covariance of x and y (S_{xy}) is divided by the multiplied standard deviation of x and y (Cleff 2008: 110):

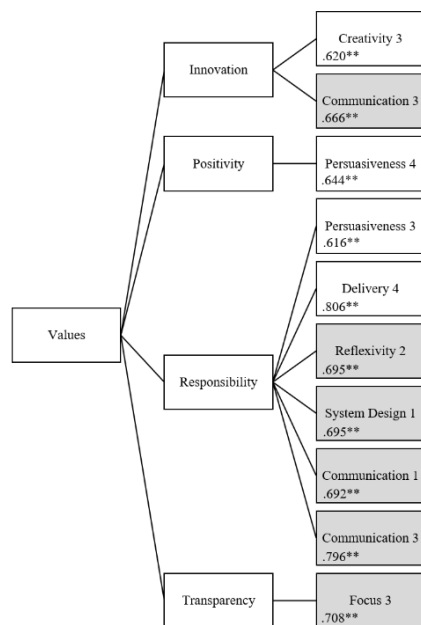
$$r = \frac{s_{xy}}{s_x s_y} = \frac{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\left(\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2\right) \left(\frac{1}{n} \sum_{i=1}^n (y_i - \bar{y})^2\right)}} \text{ mit } -1 \leq r \leq +1$$

s = covariance;
 n = size of sample (x_i, y_i);
 $(i = 1, \dots, n)$ value pairs;
 \bar{x} = sample mean of all measures of the variable x;
 \bar{y} = sample mean of all measures of the variable y

(5.0)

Positive values of the correlation coefficient show a similarly directed relationship between two variables (the larger x, the larger y), negative values show an opposite relationship (the smaller x, the smaller y). There are different scientific aids to interpret the Pearson correlation coefficient. The most common is the classification by Brosius (2013: 523). It says that a correlation coefficient greater than .6 indicates a strong correlation. These correlations between metrically scaled items are now considered per sub category. Figure 4 summarizes strong significant correlations between values, strengths, and practices within the digital pioneer sample. The values of a digital innovation leader show significant correlations with strengths (white boxes) and practices (light grey boxes) in the survey, but not with aspects of effectiveness, other values or organizational aspects. The four correlating values are innovation, positivity, responsibility, and transparency.

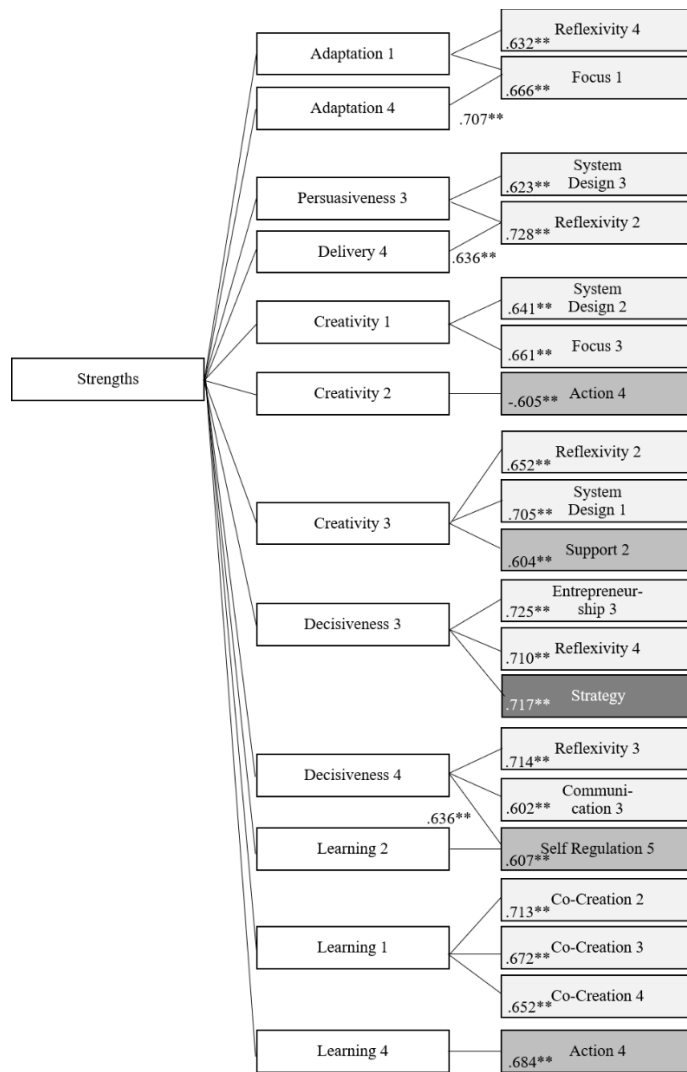
Figure 4. Pearson Correlation Coefficients - Values



Source: (own representation, 2020)

The correlations of the items that query strengths are now considered in figure 4. Items from all six strengths (white boxes) are correlating with items of all six practices (light grey boxes) and with items of all three effectiveness measurements (grey boxes). One item of decisiveness is correlating innovation strategy which is part of the organizational context (dark grey boxes). Three items are correlating each of learning and creativity as well as co-creation, system design, and reflexivity. Two items each correlate of adaptation, decisiveness, and focus. One item each correlates from persuasiveness, delivery, action, self-regulation, support, and entrepreneurship. The practice entrepreneurship 4 (striving to find competitive ideas) is positively correlating with self-regulation 3 (.826**) and innovation-friendly organizational culture (.717**). Reflexivity 3 (openly challenging the perspectives of others) is negatively correlating with an existent innovation strategy (-.734**). Self-regulation 3 (a adapting to the real customer perceptions) is positively correlating with an innovation-friendly organizational culture (.638**).

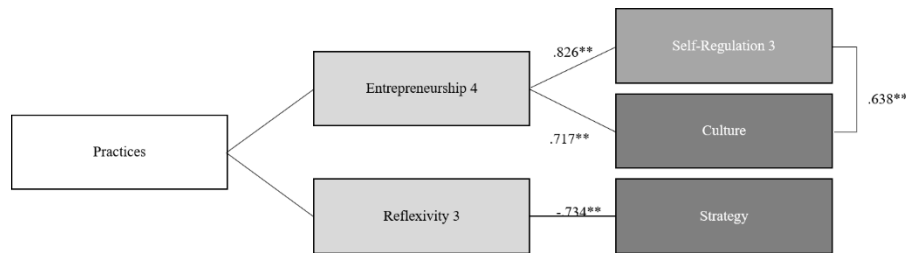
Figure 5. Pearson Correlation Coefficients - Strengths



Source: (own representation, 2020)

The practice entrepreneurship 4 (striving to find competitive ideas) is positively correlating with self-regulation 3 (.826**) and innovation-friendly organizational culture (.717**). Reflexivity 3 (openly challenging the perspectives of others) is negatively correlating with an existent innovation strategy (-.734**). Self-regulation 3 (adapting to the real customer perceptions) is positively correlating with an innovation-friendly organizational culture (.638**). The correlations just mentioned are aggregated in the following figure 6.

Figure 6. Pearson Correlation Coefficients - Practices



Source: (own representation, 2020)

SOLUTIONS AND RECOMMENDATIONS

Based on the secondary data collection, the following findings can be summarized. Companies named as digital pioneers make technology-based decisions. They work in small self-contained work-units, follow a digital strategy, and live a change and invention culture driven by leadership. The faster a digital enterprise adapts its organizational structure, culture, strategy, and technologies to the surrounding, the higher the likelihood of staying competitive. Leaders in the digital enterprise need to manage the increased pace in the digital ecosystem. They face greater expectations of productivity. Leadership skills are more important than technical skills. Leadership styles discussed between 2000-2013 were transformational, charismatic, strategic, diverse, participative, and trait. In a digital transformation, leaders want to create customer value. Success in the digital ecosystem depends on partner integration or cooperation. That is why distributed, collective or shared leadership in the context of intelligent networks is gaining attention. Innovation leaders are opinion leaders securing the success of a company. Effective Innovation Leaders transform unique ideas and affordable technologies into marketable digital innovations with which they give something back to society, economy, and or ecology without taking anything away. Innovation leaders can only become effective if the performance and power system allows them to be responsible for innovation. Effective innovation leaders have a team consisting of open and flexible minds, not egos with fixed mindsets following hierarchies. Digital Innovation Leaders explain the "why" behind their decisions, anticipate trends, and understand when technology makes sense to support decision-making processes.

This chapter's primary data collection aim was to determine which values, strengths, and practices are actively lived by innovation leaders in digital companies. Because both technology companies were rated as innovative by the participants and are developing up to 89% digital innovations, the author named them digital pioneers. In the Pre-Test Sample, differences in executives' response behavior from more and less mature digital companies could already be identified. The core findings of the Digital Pioneer Sample

are now summarized. Digital innovation leaders value innovation, responsibility, openness, and transparency. The four values correlate with items from the practices and strengths -> however, not with an IL or the organizational environment's effectiveness. The constructs of creativity, learning, system design, co-creation, and reflectivity show strongly significant correlations. The value of openness distinguishes innovation leaders from classic executives. There is disagreement about the value of freedom in the Digital Pioneer Sample. Moreover, there is disagreement about the values of positivity, trust, and openness in the Pre-Test Sample. The hypothesis that entrepreneurship as a practice, and the strength of creativity positively affects the effectiveness of DIL is confirmed in this study. No significant direct correlation of values on the effectiveness of DILs can be demonstrated. However, indirect effects via the mediator creativity are possible (Innovation => Creativity 3 => Support 2). The triangle effect of the practice entrepreneurship 4, the efficacy item self-regulation three, and innovation culture are exciting. The triangle effect of the value innovation, the strength creativity 3, and the practice communication 3 is fascinating. Creativity (support 2 and action 4) and learning (self-regulation 5 and action 4) have two connections to the efficacy of DILs. The practice reflexivity directly connects to the innovation strategy and five different strengths (adaptation, persuasiveness, delivery, creativity, and decisiveness).

A few EIL-Questionnaire optimizations about the questionnaire have already been identified but still have to be subjected to further investigations. E.g., some aspects of the system design-construct can also be located in an organizational context. Items that correlate with one another from different constructs could be combined to form a new one. The two values, freedom and trust, could be excluded from the future EDIL-Survey. Two strengths could be added, such as technology-based decision making and recognizing trends. One practice could be added, which includes explaining why behind activities.

It can be seen that the effectiveness of innovation leaders in digital companies correlate in particular with their strengths. In the digital innovation context, the values of innovation, positivity, responsibility, and transparency seem to be particularly important. Since only four items of the three different efficiency constructs correlate in the collected sample, a separate survey and analysis is carried out to determine which construct combinations provide statistically relevant results. It cannot be denied that the EIL Questionnaire is still in its infancy and will continue to develop in subsequent studies. Some items from system design will be examined in combination with the organizational context, and the triangle effects will also be examined more closely.

FUTURE RESEARCH DIRECTIONS

Due to the small sample size, it is recommended to test the EIL-Questionnaire validity and reliability in a larger digital pioneers' population and rename it then into EDIL-Questionnaire. The items should be adjusted so that the highly correlated ones are further preserved and expanded so that factors with high KMO measures are stable in different samples. Factor analyses and regression analyses could be carried out on a broad basis as soon as stable factors exist. The aim should be to shorten the EDIL-Questionnaire if possible, thus filtering out the most meaningful values, practices, and strengths or working out differences between digital companies' degrees of maturity. A few suggestions have already been made in

the previous paragraph (excluding the values freedom and trust, integrating two new strengths and one practice).

Thought could also be given to expanding the individual perspective of an innovation leader with peer perspectives or achieved performance metrics so that the assessments have a 360-degree character. Field studies could enrich the individual perspectives of enterprise members with a more objective second-order perspective of scientists. Findings made in the field could then be further developed in agent-based model simulations.

Furthermore, the three leadership styles, shared leadership, leadership, leadership, and diversity, should be considered when researching digital companies' innovation activities. As well, networked intelligence is a topic that should be deepened.

Further EDIL research should investigate differences between more and less mature digital companies.

CONCLUSION

The brand-new secondary data lead to new insights into digital companies' characteristics or transformations towards digital companies. Digital pioneering companies are characterized by an innovative corporate environment (clear digital strategy, change and invention culture, no structural obstacles, technology-based decision making, and small, self-contained work units) and a high proportion of developed digital innovations.

New leadership models from Innovation Management & Technology and leadership research bring additional perspectives for the EIL-Framework 4.0, which should be expanded to include new aspects in the future. The application of the EIL-Framework in digital companies leads to a renaming of the EDIL-Framework.

The pre-test within the empirical study reveals that digital companies' degree of maturity influences participants' response behavior. The Digital Pioneer Sample shows that innovation, responsibility, responsibility, and positivity are essential to DILs. These are strong in creativity and learning and employ reflexivity, communication, environmental design, and entrepreneurship. DIL's behaviors correlate highly significantly with the innovation culture and the innovation strategy.

Only constructs learning, support, and persuasiveness show a high CA value. This is not enough for a stable questionnaire, which is why time should be invested in the investigation and the development of stable factors in the future. Three items each within the pre-defined constructs creativity and learning correlate strongly. The constructs in which only two items were correlated should be expanded further, and the individual correlating items should be combined to form new constructs.

This contribution has brought together findings from innovation management & technology, and leadership and organization research worked out new findings from them and made suggestions on how these can be merged into the existing EIL-Framework to form a new EDIL-Framework. There is also a clear recommendation to continue the empirical research in a larger sample to work out apparent factors that can be used in diverse global technology companies. Leadership theories on diversity, leadership, and shared leadership and aspects of networked intelligence, should be integrated.

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