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DYNAMIC CAPABILITIES & DIGITAL TRANSFORMATION: A QUANTITATIVE STUDY ON HOW TO GAIN A COMPETITIVE ADVANTAGE IN THE DIGITAL AGE

Research Paper

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Abstract

Digital transformation is establishing itself as a strategic imperative for firms to stay competitive in a digitally disrupted and constantly changing business world. Prior research indicates the connection between a firm's responsiveness to external changes - its dynamic capabilities - and its digital maturity, both enhancing its competitive advantage. This study empirically investigates this relationship by comparing 51 German utility firms via an online survey sent to C-level representatives involved in digital transformation activities. The results show a significant positive effect of dynamic capabilities on digital maturity, and of both concepts on competitive advantage, with digital maturity mediating the performance effects of dynamic capabilities. The study contributes to the body of empirical research on digital transformation by emphasizing the importance of dynamic capabilities and digital maturity for firms seeking to increase their competitive advantage.

Keywords: Digital Transformation, Dynamic Capabilities, Competitive Advantage, Digital Maturity.

1 Introduction

"When digital transformation is done right, it's like a caterpillar turning into a butterfly, but when done wrong, all you have is a really fast caterpillar." - George Westerman, MIT Sloan Initiative on the Digital Economy.

Digital Transformation has become a strategic imperative and a top priority for most executives (Fitzgerald, Kruschwitz, Bonnet and Welch, 2014; Libert, Beck and Wind, 2016; Singh and Hess, 2017; Hess, Matt, Benlian and Wiesböck, 2020). While the opportunities are infinite, so is the threat: Digital technologies have accelerated the speed of change, resulting in ever growing environmental volatility, complexity, and uncertainty (Matt, Hess and Benlian, 2015; Loonam, Eaves, Kumar and Parry, 2018). Despite the fact that more than half of the companies in the Fortune 500 index have disappeared since the year 2000, and the high failure rate of digital transformations (Libert, Beck and Wind, 2016; Rogers, 2016), experts say that digital disruption has only just begun (Nanterme, 2016; Amini, Bienstock and Narcum, 2018). When change might be the only constant in this era of volatility, one of the fundamental questions in management has never been more topical: What distinguishes successful companies from those that fail when facing changing environments?

Recent developments in Digital Transformation research have proposed the concept of digital maturity (Kane et al., 2017) to describe a firm's successful response to changing environments (Vial, 2019). From a strategic management perspective, the dynamic capability view, established by Teece in 1997, can serve as a useful lens to help us understand how firms achieve a competitive advantage through digital maturity (Vial, 2019).

Empirical studies show that dynamic capabilities facilitate the process of building and sustaining a competitive advantage (Ng, 2007; Døving and Gooderham, 2008; Drnevich and Kriauciunas, 2011), especially in contexts with high market dynamism (Jiao, Alon, Koo and Cu, 2013; Li and Liu, 2014). Even though specific intermediate outcomes have already been analyzed in empirical studies (Pezeshkan et al., 2016; Zhou, Zhou, Feng, and Jiang, 2019), the variety of mechanisms that underlie the effects of dynamic capabilities on a firm's competitive advantage remains to be investigated (Fang and Zou, 2009; Pezeshkan et al., 2016; Schilke, Hu, and Helfat, 2018).

Digital disruption is one of the defining dynamics in today's business world. Investigating digital maturity as an intermediate outcome, through the lens of dynamic capabilities, would enhance our understanding of the success factors of digital transformation and of the role played by dynamic capabilities for survival in the digital age. Despite its high academic and managerial relevance, digital maturity as a potential intermediate outcome of dynamic capabilities has received limited scholarly attention, and even less so in the context of a traditional industry where incumbents are starting to "feel" the disruptive force of digitalization.

This study aims to address this opportunity by developing a research scenario applied to the German utility industry. The following research question is addressed using an empirical survey-based design: *What role does digital maturity play in the relationship between dynamic capabilities and competitive advantage in the German utility industry?* Investigating the role of digital maturity in this context adds to the academic research body on digital transformation and dynamic capabilities, while providing valuable managerial implications on the relevance of digital maturity for gaining a competitive advantage, and how dynamic capabilities can help achieve it.

This paper is organized as follows: Chapter 2 outlines the theoretical background on digital maturity in the context of digital transformation and the relation to the dynamic capability view, from which we derive our hypotheses and a conceptual framework. This is followed by Chapter 3 explaining the measurement tools and the methodology used to address the research question. Chapter 4 presents the results of the primary study. In Chapter 5 we discuss and elaborate on the implications, consider the study's limitations and suggest avenues for future research.

2 Related Literature and Hypotheses Development

2.1 Gaining a Competitive Advantage through Digital Maturity

Digital transformation has increasingly received attention from both researchers and practitioners (Hanelt, Bohnsack, Marz and Antunes, 2020). Establishing itself as a constant theme in extensive and diverse academic literature and practitioner conversations, its strategic importance and process-centered nature have recently been especially emphasized (Vial, 2019; Hanelt et al., 2020; Singh, Klarner and Hess, 2020).

Digital transformation is related to "changes digital technologies can bring about in a company's business model, which result in changed products or organizational structures or in the automation of processes" (Hess et al., 2020, p. 124). Addressing the lack of comprehensive understanding and building on the core element of change, Vial (2019, p. 121) developed the conceptual definition of digital transformation as "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies". Conceptual (Chanias, Myers and Hess, 2019) and empirical research (Soh, Yeow, Goh and Hansen, 2019) reinforces this understanding of digital transformation as an ongoing, and ever-changing, process

In response to the proliferation of digital technologies, and intensely dynamic markets it is causing, existing business models are fundamentally altered and new business models created, indicating a process of digital transformation (Bharadwaj, Sawy, Pavlou and Venkatraman, 2013; Fitzgerald et al., 2014). Digital transformation is more than just a technological shift, however, because the process impacts also business models, operational processes, and end-user experience (Henriette, Feki and Boughzala, 2015). Firms that undergo digital transformation must assess their current business model against emerging opportunities and threats and, if necessary, adapt it to the new environment, regardless of industry sector or firm size (Gannon, 2013; Westerman, Bonnet and McAfee, 2014). In so doing, incumbent firms in traditional industries are particularly likely to encounter barriers and challenges while pursuing digital transformation (Demil and Lecocq, 2010; Berman, 2012; Aspara, Lamberg, Laukia and Tikkanen, 2013; Velu and Stiles, 2013; Weill and Woerner, 2015).

Recent literature has established the concept of digital maturity (Kane et al., 2017), which describes the capacity to respond to digital disruption in an appropriate manner. Digital maturity is about adapting the organization to compete effectively in an increasingly digital environment, which is based on the psychological definition of “maturity” as a learned ability to respond to an environment in an appropriate manner. Beyond implementing new technology, the concept incorporates aligning a company’s strategy, processes, culture, technology, and structure to meet the digital expectations of customers, employees, and partners. Digital maturity is therefore understood as a continuous and ongoing process of adaptation to a changing digital landscape.

The concept differs from digital readiness (De Carolis, Macchi, Negri and Terzi, 2017; Lokuge, Sedera, Grover and Dongming, 2019), which refers to the state before any transformation takes place because it is assumed that the transformation process is an ongoing process. In this context, the level of digital maturity can refer to how well different companies in the same industry respond to any source of digital disruption. However, following Kane et al. (2017) digital maturity is not an end-state, but an ever-evolving operation – at first to promote efficiency and ultimately to innovate new business models. Building on the work of organizational theory research, we follow Kane and colleagues who conceptualize digital maturity as “aligning an organization’s people, culture, structure and tasks to compete effectively by taking advantage of opportunities enabled by technological infrastructure, both inside and outside the organization” (Kane, 2019, p. 47). For instance, companies often start by emphasizing efficiency gains, then move towards focussing on the use of data for decision making, and eventually transform their strategy, culture and business models.

Based on the suggestions by D’Aveni, Dagnino and Smith (2010) one can address competitive advantage as the “state for organizations to cope with environmental change and continuously provide satisfying products or services for customers better than competitors” (Li and Liu, 2014, p. 2795). This definition implies the relatedness of the construct and considers the difficulties of gaining long-term competitive advantage in changing environments by focusing on short-term performance attributes. Digitalization has opened a wide range of possibilities for firms to interact with customers, which has led to new and unexpected business model innovations (Amit and Zott, 2010; Khanagha, Volberda and Oshri, 2014). Several researchers showed that companies that are digitally mature outstrip industry competitors along different dimensions of competitive advantage, especially in contexts of digital disruption (Westerman et al., 2012; Kane, Palmer, Phillips and Kiron, 2015; Schwertner, 2017). For instance, the capacity to respond to digital disruption in the context of digital transformation has been associated with increases in innovativeness (Svahn, Mathiassen, Lindgren and Kane, 2017), financial performance (Karimi and Walter, 2015), firm growth (Tumbas, Berente, Seidel and vom Brocke, 2015), and reputation (Yang, Liu and Davison, 2012; Kane, 2014).

Therefore, firms with a high digital maturity state are equipped to outstrip their competitors by building and sustaining a competitive advantage, which leads to our first hypothesis:

Hypothesis 1: *A high level of digital maturity in an organization positively impacts its competitive advantage.*

2.2 Achieving Digital Maturity through Dynamic Capabilities

As noted by Vial (2019, p. 133), “there is an interesting fit between dynamic capabilities as a conceptual foundation and digital transformation as a phenomenon of interest”. We argue that dynamic capabilities may help us understand how firms achieve digital maturity while they create and maintain these higher-level mechanisms that facilitate their adaptability to digital disruption.

Teece, Pisano and Shuen (1997, p. 516) define dynamic capabilities in their landmark article as “the firm's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments”. Barreto (2010, p. 257), having systematically reviewed the research streams on dynamic capabilities in this “disconnected body of research”, has suggested a new conceptualization of dynamic capabilities as an “aggregated multidimensional construct” (Barreto, 2010, p. 271). Based on previous literature, Barreto (2010, p. 271) defines a dynamic capability as a “firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base”. By making the inclusion of a purpose redundant and using the word “potential” in his definition, Barreto (2010) overcomes the criticism of dynamic capabilities being tautologically linked to success (Williamson, 1999). Further, with the development of four distinct dimension propensities and the corresponding non-dichotomous nature of the concept, this view facilitates the operationalization of the construct and addresses the criticism laid at its door about inherently lacking observation and measurement possibilities (Williamson, 1999; Kraatz and Zajac, 2001). By using four distinct propensities, the definition makes the potential presence of commonalities across firms within some propensities being compatible with a competitive advantage, while the other propensities can remain idiosyncratic (Barreto, 2010).

In line with this definition, the construct of dynamic capabilities can be decomposed into four distinct but interrelated dimensions that, when aggregated, form the overall construct. The propensity to sense opportunities and threats is related to effectively searching for and analyzing internally- and externally-sourced information by sensing and interpreting stimuli or change in the organization's reference framework (Neill, McKee and Rose, 2007; Pandza and Thorpe, 2009). The second dimension - the propensity to make timely decisions - is based on the “process [involved in] quickly formulat[ing], evaluat[ing] and choos[ing] strategic orientations to timely adjust with environmental changes” (Sharfman and Dean, 1997, p. 192). This dimension is consistent with Teece (1997) as it emphasizes the need to efficiently reconfigure existing resources in an adequate response time. The importance of the content of managerial decisions is embedded in the third dimension – the propensity to make market-oriented decisions (Barreto, 2010). Market-orientation as a major content driver of such decisions can be defined by the extent to which a firm systematically pays attention to options that create superior value for their customers (Narver and Slater, 1990; Priem, 2007; Barreto, 2010). The propensity to change the resource base - the fourth dimension – refers to a firm's propensity to create, extend and reconfigure the existing resource base (Barreto, 2010).

In the previous section we referred to digital transformation as a process whereby digital technologies create an impetus for organizations to implement responses to gain and maintain a competitive advantage (Vial, 2019). Hence, it is crucial for organizations to sense disruption at the right time, assess the opportunities and threats attached to it, seize them and reconfigure their resource base towards integrating digital in their strategy, business model, processes, culture and in the use of technologies. Dynamic capabilities equip firms to respond to digital disruption in a dynamic manner and enable changes in the resource base with a view to developing digital maturity.

Attributes of digital maturity like technological capabilities, digital platform capabilities, and technological innovation capabilities have been studied and empirically proven to be potential outcomes of high dynamic capability levels (Protogerou, Caloghirou and Lioukas, 2011; Karimi and Walter, 2015; Zhou et al., 2019). Other studies have broadened this view towards the role of dynamic capabilities within the digital transformation process. Warner and Wäger (2019) and Velu (2017), for instance, found that firms must build a system of dynamic capabilities for digital transformation. Matarazzo et al. (2021) show that digital transformation utilized dynamic capabilities to create

consumer value. Applied to small- and medium-sized enterprises, Soluk and Kammerlander (2021) investigate the role of dynamic capabilities needed throughout different stages of the digital transformation process.

Hence, we assume that firms achieve digital maturity through building dynamic capabilities, which leads to our second hypothesis:

Hypothesis 2: *A high level of dynamic capabilities in an organization positively impacts its digital maturity.*

2.3 Digital Maturity and its mediating role in gaining a Competitive Advantage through Dynamic Capabilities

Given that dynamic capabilities have an overall positive effect on gaining a competitive advantage (Pezeshkan et al., 2016) one can extract three main approaches concerning the assumed relation about the way dynamic capabilities create a competitive advantage: Firstly, several studies support the view of a direct positive impact of dynamic capabilities on firm performance (Griffith and Harvey, 2001; Makadok, 2001). However, most of the conceptual studies proposing a direct link between dynamic capabilities and competitive advantage face the problematical tautology of defining dynamic capabilities with competitive advantage. The second category contains studies that propose a more indirect effect, assuming that dynamic capabilities have an indirect positive impact on firm performance (Zott, 2003; Zúñiga-Vicente and Vicente-Lorente, 2006; Ng, 2007; Wang and Ahmed, 2007; Døving and Gooderham, 2008; Ambrosini and Bowman, 2009; Drnevich and Kriauciunas, 2011). Building on several conceptual studies the literature has empirically addressed the impact of dynamic capabilities on intermediate outcomes, the impact of such intermediate outcomes on competitive advantage, and the role of moderating effects. Thirdly, one can categorize those studies that do not see a necessary positive impact of dynamic capabilities on firm performance (Eisenhardt and Martin, 2000; Zahra, Sapienza and Davidsson, 2006; Arend and Bromiley, 2009). The reasoning behind this approach is that the creation of dynamic capabilities comes with opportunity costs and a higher chance of failure which may even damage rather than improve a firm's performance. However, as evaluated by Drnevich and Kriauciunas (2011, p. 258) one can assume that firms “attempt to limit the downside risks [of dynamic capabilities] just as they do with ordinary capabilities” and therefore abandon or replace dynamic capabilities as soon as performance feedback falls under a certain threshold. Following this argumentation, we adopt the view of an indirect positive effect of dynamic capabilities on competitive advantage for our study.

In alignment with this view, researchers have addressed the impact of dynamic capabilities on several intermediate outcomes which can explain more about the causal mechanism of the overall effect on competitive advantage, such as unrelated diversification (Ng, 2007; Drnevich and Kriauciunas, 2011), related diversification (Døving and Gooderham, 2008), digital platform capabilities (Karimi and Walter, 2015), technological and market innovation (Zhou et al., 2019), and operational, marketing and technological capabilities (Protogerou, Caloghirou and Lioukas, 2011). In those studies, resource changes are the causal mechanisms through which dynamic capabilities affect performance outcomes (Schilke, Hu and Helfat, 2018).

Following the suggestions by Helfat and colleagues (Schilke, Hu and Helfat, 2018, p. 406), we therefore “do not treat organizational change [expressed by an organization's digital maturity] as the final explanandum, but model a multi-step causal chain”, in which the resource change is the intermediate outcome of dynamic capabilities and builds the causal mechanism through which dynamic capabilities create a competitive advantage.

Hence, an indirect positive effect of dynamic capabilities on competitive advantage through digital maturity is the most plausible, which leads to the third hypothesis:

Hypothesis 3: *The positive impact of a high level of dynamic capabilities on competitive advantage is mediated by an organization's digital maturity.*

Beyond its indirect nature, the overall effect of dynamic capabilities on competitive advantage is likely to be influenced by a range of contextual factors. Moderators such as industry sector (Pandza and Thorpe, 2009; Piening, 2013), geographical area (Brouthers, Brouthers and Werner, 2008; Parente, Baack and Hahn, 2011), competitive intensity (Cui, Griffith and Cavusgil, 2005), and environmental dynamism (Schreyögg and Kliesch-Eberl, 2007; Romme, Zollo and Berends, 2010; Jiao et al., 2013; Li and Liu, 2014, p. 2795) can significantly influence the effect of dynamic capabilities on competitive advantage. Dynamic capability theory sees environmental dynamism as a central contingency variable (Helfat and Winter, 2011; Schilke, Hu and Helfat, 2018). Given these moderating influences, the mediating role of digital maturity is best analyzed within a single industry with characteristics that alter the overall effect size.

As dynamic capabilities have been defined as “the potential to systematically solve problems” (Barreto, 2010, p. 271), the existence of problems relates to the necessity of environmental change or dynamism for dynamic capabilities to be needed. When analyzing the effect of dynamic capabilities on digital maturity as an intermediate outcome, the industry must be sufficiently affected by digital dynamics serving as a mediator-specific exogenous shock and indicating the existence of environmental dynamism. Further, firms within the industry should be at the beginning or at the intermediate stage of their responsive adaptation process with potential opportunities and threats evolving from the dynamism for the effect to be sufficiently investigated. The German utility market is affected by strong environmental dynamics with disruptive potential (Castaneda, Franco and Dyrer, 2017). New business models evolve frequently, environmental changes and actions of new entrants are difficult to predict, the technology applied in the industry progresses quickly, and environmental demands are constantly changing. Consequently, one can assess the overall environmental dynamism of the German utility industry, especially with regard to digital dynamics, as moderate to high, and this industry as a favorable context in which to investigate the hypothesized effects.

Building on the previous argumentation and on our hypotheses, we create the following conceptual framework:

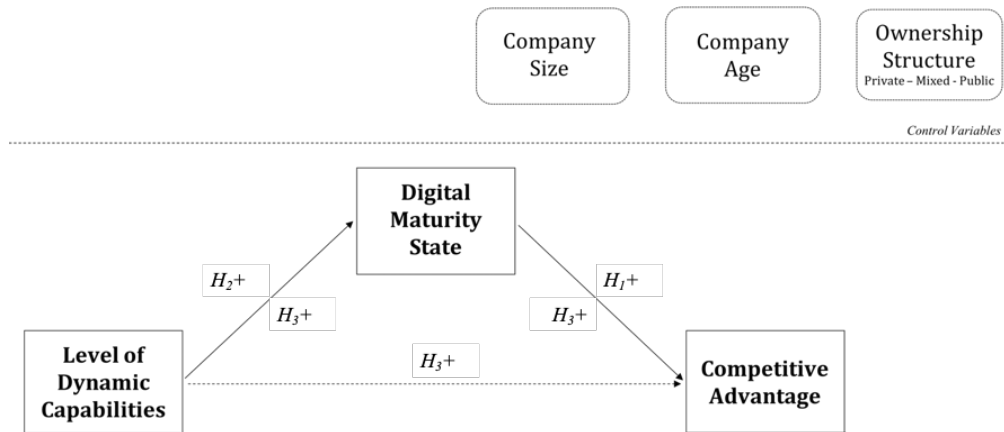


Figure 1. Conceptual framework developed for this study.

3 Methodology

This study employs an online survey method for data collection. One can assume that self-reported data from CEOs or senior executives would be reliable and not affected by common method bias. Firstly, the survey addresses the dynamic capability level of energy providers which can only be obtained through self-reporting. Secondly, the dependent variable “competitive advantage” requests information about relative performance such as financial and non-financial indicators rather than absolute numbers which can only be obtained from CEOs or high-level executives.

To measure the components of the concepts we develop an initial list of items based on our extensive review of literature and existing scales (see section 3.1). Then, in order to review the measurement

items, this study carries out interviews with an IT-expert working for a German energy provider, with the CEO of a German consultancy that focuses on digital transformation projects and with an expert in the academic research field of dynamic capabilities.

For the pre-test, the study requested input from two faculty members with expertise in strategic management and digital transformation, and three CEOs of German energy providers. Their role was to examine whether these revised measurement items are necessary, sufficient and clear. Minor changes in wording and number of items were adopted accordingly. Finally, this study checks item-to-total correlations to refine the measurements. A final summary of the survey items can be found in the appendix. To ensure a full understanding of the organization and to enhance data quality, the survey participants should be CEOs or senior executives of German energy providers who have been working in the same enterprise for at least two years. Participants were gathered by approaching 21 regional state groups of the German Federal Association of Energy and Water Management (BDEW) and the German Association of Municipal Companies (VKU). In addition, 61 CEOs of German energy providers were randomly chosen and individually invited to participate in the online study via email over a one-week period. In the online survey, participants were instructed to answer the questions as representatives of their organization. Job titles of respondents and how many years they have been working for their organization were obtained for further data control. Over a one-month period, the study invitation link was sent to a total of 639 potential participants.

3.1 Variables and Measures

This study uses the level of dynamic capabilities as independent variable and competitive advantage as dependent variable. Digital maturity as an intermediate outcome of dynamic capabilities is assumed to be a mediator variable. Firm size, firm age and ownership structure are used as control variables. To ensure the accurate measurement of the theoretical constructs the measurement scales for this study were adopted from existing scales from past research, and adapted where needed. Because the scope of the study was regionally limited to German energy companies, all scales and instructions were translated into German. Participants were asked to respond to the items on a 5-point Likert-type scale ranging from 1 = “strongly disagree” to 5 = “strongly agree” with the fallback option “I cannot answer this”.

In line with Barreto’s (2010) definition, the **dynamic capability** construct was measured on a dimensional level where several items are used to assess the four different dimensional scores that will be aggregated to form the overall construct. As proposed by Barreto (2010, p. 274), “the operationalization of the dimensions-related constructs [...] might be based on survey data, which can provide direct assessments of the propensities involved”. Accordingly, this study uses self-assessment survey data to measure the firm-specific level of dynamic capabilities. The word “propensity” used by Barreto (2010) to define the dimensions of dynamic capabilities refers to “the usual way of doing things” in an organization. Hence, the dimensional items should neither be time- nor context-specific but ask for the usual characteristics and habits of an organization. This study applies the meaning of “propensity” to the item’s wording, framing those items with the word “usually” where interpretation could be inconclusive. In addition to using existing scales (Li and Liu, 2014, p. 2795; Janssen, Castaldi and Alexiev, 2016), we developed an adapted set of items that is mostly based on Barreto (2010), Schreyögg and Kliesch-Eberl (2007) and Lin & Wu (2014). All items in the dynamic capability assessment that were adopted from existing scales have been framed accordingly. Dynamic capabilities are conceptualized in this study as an “aggregate multidimensional construct” (Barreto, 2010, p. 271). Therefore, firstly, dimensional scores are calculated independently from each other using the arithmetic mean of the coded item scores in the same dimension. As the overall construct comprises four dimensions, no single dimension can represent the whole. Hence, this study anticipates a multiplicative nonlinear function of the dimensions rather than an additive one. Using a multiplicative function takes into consideration the interrelations between and the dependencies of the dimensions described in the theoretic part of this study (Barreto, 2010). Consequently, in a second

step, the geometric mean of the dimensional scores is calculated to obtain the overall dynamic capability level.

Similar to this, **digital maturity** is conceptualized as an aggregated multidimensional construct that is best operationalized using several items that form the construct's dimensions. This has the advantage of ensuring higher measurement accuracy and greater variance. The main orientation for the development of dimensional items is the catalogue of characteristics of the digital maturity model for telecommunications service providers by Valdez-de-Leon (2016) and the general digital maturity model developed by Rossman (2018). Applying the dynamics and opportunities in the utility industry, revised by the industry experts, and supplemented with the aggregation of other digital maturity models (Matt, Hess and Benlian, 2015; Berghaus and Back, 2016; Erol, Schumacher and Sihn, 2016; Gill and VanBoskirk, 2016; Rename, Hanelt, Wiesboeck and Kolbe, 2017; Kontić and Vidicki, 2018), this study identifies "strategy", "culture", "processes", "technology", and "business models" as relevant dimensions of digital maturity in the energy provider industry. The majority of items are based on the statements from Valdez-de-Leon (2016) with minor changes in wording and industry application. As the multidimensional construct of digital maturity is formed by interrelated dimensions that alone cannot form the overall construct (for instance, culture enables digital business models and the use of technology depends on processes and strategy) digital maturity level is calculated using the geometric mean of the dimensional scores.

The use of subjective indicators to access **competitive advantage** is commonly used in strategy-related research (Dess, 1987; Tippins and Sohi, 2003; Protogerou, Caloghirou and Lioukas, 2011; Li and Liu, 2014, p. 2795) and mostly applied in studies when financial statement data are unavailable or not accurate as is the case with a majority of regional energy providers in Germany. In line with the argument that competitive advantage can be measured with subjective data (Dess and Robinson, 1984; Powell, 1992; Spanos and Lioukas, 2001) this study uses perceived measures to operationalize competitive advantage in terms of two indicator dimensions: financial, and non-financial indicators. Competitive advantage is measured with six items reflecting profit growth, revenue growth, operating costs, market share, customer satisfaction and quality of products and services relative to competition. The items are directly adopted from the data structure to measure competitive advantage as an outcome of dynamic capabilities developed by Li and Liu (2014) and have not been modified. Also referring to Li and Liu (2014), the overall construct is calculated using the arithmetic mean of the coded item scores.

4 Data Analysis and Results

In total, 82 participants accessed the online study through the provided link, accounting for a response rate of 13%. Of these 51 participants completed the questionnaire. No participant had to be excluded as the minimum number of years a participant was working for the recent company was 3 years, thus above the stipulated level of 2 years. The majority of participants, 69%, were CEOs. The remaining 31% cited "Director" or "Head of" positions as their professional title. Hence, all 51 participants fulfilled the required maturity level in their professional title to provide high-level information about the company. The minimum company age was 17 years, which ensured that no start-ups or new entrants were among the participants. The companies' minimum customer base ranged from 2,900 to 900,000 indicating sufficient variety in the size of the companies represented in the sample.

A first analysis of correlations showed a significant positive correlation between dynamic capabilities and digital maturity, between dynamic capabilities and competitive advantage, between digital maturity and competitive advantage, and between firm size and competitive advantage. For reliability analysis, Cronbach's alpha was calculated to assess the internal consistency of the subdimensions of dynamic capabilities and digital maturity and the subscales for competitive advantage. Cronbach's alpha in our data is never less than .70, which is above the critical level, indicating acceptable internal consistency for all subscales. A Harman one-factor test was conducted to assess the potential for common method bias (Podsakoff and Organ, 1986). By applying the eigenvalue-greater-than-one criterion to a Scree plot, 13 factors were extracted which in an unrotated factor analysis of all items

accounted for 69% of the total variance, with the first factor accounting for 30% of the variance. The results of the tests indicated that no single factor accounted for a majority of the variance. Hence, common method bias is unlikely.

The four-step approach by Baron and Kenny (1986), including linear regression analyses, was used to test the hypotheses. Before running regressions, an analysis of the prerequisites for a linear regression showed that all requirements were met: The P-P Plots of the regression standardized residuals indicated normality, the Durbin-Watson values are close to 2 (indicating that the models' residuals are independent), the Durbin-Watson for digital maturity is 2.025, the scatterplot of the residuals was checked, conducting a Breusch Pagan test showed no signs of heteroscedasticity, $p = .440$, and all VIFs were below 10, indicating the absence of multicollinearity.

In a first step, in order to test the foundation for our hypotheses, a multiple linear regression (Model 1) was carried out to investigate whether a high level of dynamic capabilities positively impacts competitive advantage. A scatterplot showed that there was a strong positive linear relationship between the two, which was confirmed by a significant Pearson's correlation coefficient of .68. The model included firm size, firm age and ownership structure as control variables, as they have the potential to affect firm performance and, thus, a firm's competitive advantage as well as a firm's digital maturity state. In addition, a comparison between Model 4, which includes control variables, and Model 5, which excludes them, showed a higher R^2 for Model 4, $R^2 = .641$. Hence, the control variables were included in the regression models. A significant regression equation was found for Model 1 ($F(5, 45) = 9.412$, $p < .001$), with an R^2 of .511. Results indicated that the level of dynamic capabilities was a significant predictor of competitive advantage when controlling for firm size, firm age and ownership structure, $\beta = .736$, $SE = .127$, $p < .001$, which supports the foundational assumption underlying the stated hypotheses and corroborates the findings from existing studies. Further, the control variable "firm size" was a significant predictor of competitive advantage when controlling for dynamic capabilities, firm age and ownership structure, $\beta = .089$, $SE = .048$, $p < .01$.

In a second step, a multiple linear regression (Model 2) was carried out to investigate the relationship between dynamic capabilities and digital maturity. A related scatterplot showed that there was a strong positive linear relationship between the two, which was confirmed with a significant Pearson's correlation coefficient of .77. A significant regression equation was found ($F(5, 45) = 14.325$, $p < .001$), with an R^2 of .614. Results from Model 2 indicated that the level of dynamic capabilities was a significant predictor of the digital maturity state when controlling for firm size, firm age and ownership structure, $\beta = .743$, $SE = .327$, $p < .001$, which supports Hypothesis 2. Moreover, a mixed ownership structure was a significant predictor of digital maturity when controlling for dynamic capabilities, firm size and firm age, $\beta = .627$, $SE = .358$, $p < .01$.

In a third step, a multiple linear regression (Model 3) was carried out to investigate the relationship between digital maturity and competitive advantage. The related scatterplot showed that there was a strong positive linear relationship between the two, which was confirmed with a significant Pearson's correlation coefficient of .75. A significant regression equation was found ($F(5, 45) = 15.287$, $p < .001$), with an R^2 of .629. Results from Model 3 indicated that the level of digital maturity was a significant predictor of competitive advantage when controlling for firm size, firm age and ownership structure, $\beta = .881$, $SE = .115$, $p < .001$, which supports Hypothesis 1. Further, firm size was a significant predictor of competitive advantage when controlling for digital maturity, firm size and firm age, $\beta = .110$, $SE = .041$, $p < .001$. Step 1 to 3 showed the existence of zero-order relationships among the variables. As there were significant relationships from Step 1 through to 3, we could proceed.

In a fourth step, a multiple linear regression (Model 4) was carried out to investigate the relationship between dynamic capabilities, digital maturity, and competitive advantage whilst controlling for firm size, firm age and ownership structure. A significant regression equation was found ($F(5, 45) = 13.037$, $p < .001$), with an R^2 of .641. Results from Model 4 indicated that the level of digital maturity was a significant predictor of competitive advantage when controlling for dynamic capabilities, firm size, firm age and ownership structure, $\beta = .717$, $SE = .108$, $p < .001$. Further, firm size was a significant predictor of competitive advantage when controlling for dynamic capabilities,

digital maturity, firm size and firm age, $\beta = .100$, $SE = .358$, $p < .005$. These results support the mediational hypothesis (Hypothesis 3). The level of dynamic capabilities was no longer a significant predictor of competitive advantage after controlling for the mediator, digital maturity, $\beta = .203$, $SE = .395$, ns, which indicates full mediation.

The effect size based on this four-step approach was calculated by subtracting the regression coefficient for dynamic capabilities obtained in Model 4, $\beta = .203$, from the regression coefficient for dynamic capabilities obtained from Model 1, $\beta = .736$ resulting in an indirect effect of $\beta_{\text{indirect}} = .533$. To account for type two error according to Baron and Kenny's (1986) approach, and in order to test the significance of this indirect effect, we applied the Monte Carlo Method used in the R-package mediation by Tofghi & MacKinnon (2011). Unstandardized indirect effects were computed for each of the 10,000 samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. White's heteroskedasticity-consistent estimator for the covariance matrix (vcovHC; Zeileis 2006) was not needed to be included, as a studentized Breusch-Pagan test showed that heteroscedasticity was not present, $p = .441$. The average causal mediation effect (ACME) was .533, and the 95% confidence interval ranged from .23 to .87 which is in line with the effect size calculated with the four-step approach by Baron and Kenny (1986). The results showed a significant effect of digital maturity on the relationship between dynamic capabilities and competitive advantage, (ACME = .533, 95% CI = .23, .87, $p < .001$) with no direct effect of dynamic capabilities (ADE = .204, 95% CI = -.14, .55, $p = .24$) and significant total effect (Total Effect = .737, 95% CI = .49, .99, $p < .001$) supporting full mediation. To verify this result, the comparison has been analyzed with the percentile bootstrap method with 10,000 samples (Shrout and Bolger, 2002), showing the very same effect size and significance. A sensitivity analysis confirmed the absence of unobserved pre-treatment covariates.

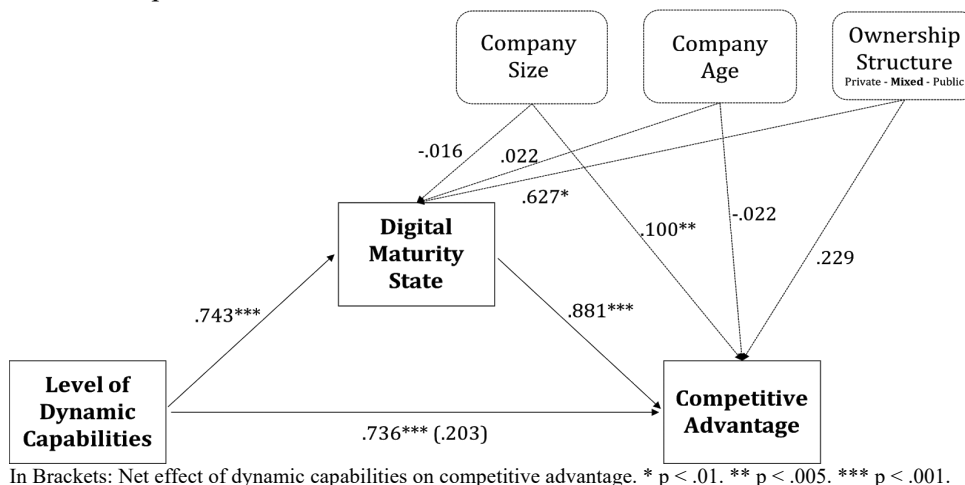


Figure 2. Final model with standardized regression coefficients.

5 Discussion of Results, Limitations, and Outlook

The ability to adapt to increasingly digital environments and to disruptive external forces through digital transformation is crucial for nearly every organization. Yet, few organizations appear to be making the fundamental changes necessary to achieve digital maturity and to gain and sustain their competitive advantage. This study aimed to understand what role digital maturity plays in the relationship between the level of dynamic capabilities and the competitive advantage of firms, by analyzing a sample of companies from the German utility industry. Applying the dynamic capabilities lens to explicate how digital transformation can help firms increase their competitive advantage enhances our understanding of digital transformation and of its success factors, and shows that digital maturity, achieved by developing dynamic capabilities, plays a key role for ensuring survival in the digital age.

The present study empirically supports the hypothesis that digitally mature firms outperform their peers, showing that digital maturity positively impacts competitive advantage. Thereby, this study adds to the body of empirical research supporting the positive performance effects of digital maturity (Westerman et al., 2012; Kane et al., 2015; Schwertner, 2017) and enhances our understanding on success factors for digital transformation. Our findings corroborate current managerial calls that emphasize the benefits to organizations developing their digital maturity, especially in turbulent market environments.

Beyond underlining the effects of digital maturity on competitive advantage, our findings reveal that firms with a high level of dynamic capability have a higher level of digital maturity than those with a low dynamic capability level. With this direct relationship between dynamic capabilities and digital maturity we contribute to explaining how digital maturity can be achieved. Becoming a digitally mature organization requires leaders to continuously rethink their entire business. We show that to build a path toward digital maturity, organizations should consider embracing the dynamic capabilities of their organization. This finding is in line with assumptions and research made previously in the context of other markets (Protogerou, Caloghirou and Lioukas, 2011; Karimi and Walter, 2015; Zhou et al., 2019). An explanation for the highly significant positive effect found in this study may lie in the particular dynamics of this particular industry, with its high level of market dynamics. Those firms with a higher dynamic capability level were digitally more mature than their peers at the time the study was conducted. Dynamic capabilities can be seen as an enabling factor for successful digital transformation processes in the given industry environment. This finding is plausible, as digital transformation processes are change processes and strong digital dynamics in the German utility industry can be seen as exogenous shocks that intensify the need for successful digital transformation for firms' survival and for the creation of competitive advantage.

From the perspective of dynamic capability research, the study supports existing empirical studies on the performance effects of dynamic capabilities by showing that a high level of dynamic capabilities positively impacts a firm's competitive advantage. German utility firms altering their dynamic capability level by 1 increase their competitive advantage score by 0.74 on a scale from 1 to 5, which shows that such context-specific performance effects exist. Firms that have an advantage over others in terms of having greater dynamic capabilities can identify and respond to opportunities and threats in the German utility market environment in a more effective and agile way, which is in line with the findings from Makadok (2001, 2010), Chmielewski and Paladino (2007), and Zou, Fang and Zhao (2003). As already shown in other markets, such responsiveness can lead to increased revenue or decreased costs and thereby to competitive advantage (Haeckel, 1999; Drnevich and Kriauciunas, 2011). Another explanation for the strong positive effect on performance found in this study is that firms with a high level of dynamic capabilities, especially with a high score in the market-oriented dimension, can profit from a better understanding of consumer markets and the environment they face (Neill, McKee and Rose, 2007). As changing consumer expectations and behavior are currently one of the major dynamics in the German utility market, a firm's comprehensive market-orientation is particularly necessary. The dynamics in the utility industry favor those firms with a high level of dynamic capabilities, as they can respond to the constantly changing environment in a faster, more effective and more efficient way (Hitt, Bierman, Shimizu and Kochhar, 2001; Chmielewski and Paladino, 2007; Tallon, 2008).

Connecting the investigated concepts and relationships towards a multi-step causal chain, this study reveals the role played by the level of digital maturity for the performance of dynamic capabilities. The significant mediation effect revealed in our study shows that digital maturity can be seen as the causal mechanism that can explain the positive performance effect of dynamic capabilities in the underlying research scenario. The findings support full statistical mediation, as the impact of dynamic capabilities on competitive advantage when controlling for digital maturity - the net effect - was no longer significant. This finding is surprising as other mediators have been found to explain the mechanism of the performance effects of dynamic capabilities in previous studies (Kale and Singh, 2007; Ng, 2007; Døving and Gooderham, 2008; Drnevich and Kriauciunas, 2011; Protogerou,

Caloghirou and Lioukas, 2011; Karimi and Walter, 2015; Zhou et al., 2019). However, full mediation can be explained by the high intensity of digital market dynamics in the German utility industry.

The study also helps to assess which intermediate outcomes of dynamic capabilities deserve more attention in future research. The results contribute to a more thorough understanding of the variety of mechanisms through which dynamic capabilities affect firm performance and reveal the crucial role of digital maturity for gaining a competitive advantage in this context.

For practitioners, we offer two major parameters that carry practical implications: First, identifying and altering the level of dynamic capabilities is both a foundation and a requirement for successfully handling exogenous shocks and disrupting dynamics. And second, with respect to the contextual digital dynamics, identifying and altering the digital maturity state helps to gain and sustain a competitive advantage. In order to improve their level of digital maturity, practitioners should not only work on their use of new technologies or the digitalization of processes, but should also enshrine digital in their strategy, their culture and the nature of their business model. To successfully respond to digital disruption requires a digital mindset that is fully embedded into the corporate culture, as well as a decision-driving and cross-sectional digital strategy, in combination with collaboration activities with other ecosystem partners and the implementation of digital business models, among other parameters. In light of our findings - that under high digital market dynamism digital maturity fully mediates the performance effects of dynamic capabilities - the key for a dynamic-specific strategy is to use dynamic capabilities to catalyze the digital transformation process. That is, managers should place a greater emphasis on considering dynamic capabilities and intermediate outcomes such as digital maturity.

The present study is subject to certain limitations: As the applied research design limits the overall generalization of our findings to the German utility industry, it would be interesting to extend the investigation to other countries, industries or markets, and with an increased sample size. The preselection of a seniority level guarantees valuable information about sensitive information. The measurement accuracy can be further improved by replicating this study, whilst aggregating the answers from several employees of the same company to overall firm-specific construct scores. In this context, it would be interesting to investigate whether the seniority level of the representing employees affects the self-assessment of the constructs by conducting multilevel research, which offers a means to explore the micro-foundations of dynamic capabilities. With the intention to increase the participant rate and to lower the sensitivity of the data asked for, this study used self-reported relative data to measure competitive advantage. To avoid possible biases due to the common method used and to mitigate perceptual bias inherent in self-reporting, future research could extend the present study by adding secondary financial data from annual reports as a dependent variable or by measuring the level of dynamic capabilities and the digital maturity state asking different employees in the same company.

In conclusion, the present study offers insights about how to gain a competitive advantage in the digital age and emphasizes the role of dynamic capabilities when turning digital transformation efforts into a competitive advantage. Future research should build on these findings and further investigate how dynamic capabilities for digital maturity can be built.

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Appendix

Construct	Dimension	Items	C α
Dynamic Capabilities	Propensity to sense opportunities and threats	Please assess to which degree the following statements are true regarding to the usual way of doing things in your organization. (1) "Usually, we can perceive environmental change before competitors." (2) "We continuously scan our and our competitor's capabilities." (3) "Usually, we can feel the major potential opportunities and threats to our organization." (4) "Usually, we can fully understand the impact of internal and external environment." (5) Usually, we have good observation and judgement abilities regarding market dynamics and best practices.", [1=strongly disagree, 5=strongly agree]	.81
Dynamic Capabilities	Propensity to make timely decisions	Please assess to which degree the following statements are true regarding to the usual way of doing things in your organization. (1) "Usually, we can quickly deal with conflicts in the strategic decision-making process." (2) "Under many circumstances, we can make timely decisions to deal with strategic problems." (3) "Usually, we can remedy quickly to unsatisfactory customers, malfunctions or service requests." (4) "Usually, we can reconfigure resources in time to address environmental change." (5) "Usually, our strategic changes can be efficiently carried out.", [1=strongly disagree, 5=strongly agree]	.79
Dynamic Capabilities	Propensity to make market-oriented decisions	Please assess to which degree the following statements are true regarding to the usual way of doing things in your organization. (1) "Usually, we analyze the actual use of our services and products." (2) "Usually, our organization is strong in distinguishing different groups of users and market segments." (3) "We change our practices when customer feedback gives us a reason to change." (4) "Usually, we have meetings to discuss the market demand on a regular basis.", [1=strongly disagree, 5=strongly agree]	.76
Dynamic Capabilities	Propensity to change the resource base	Please assess to which degree the following statements are true regarding to the usual way of doing things in your organization. (1) "Usually, good cooperation exists among different functions in our organization." (2) "Usually, the procedure of creating new resources is clear." (3) "Usually, the procedure of extending our resources is clear." (4) "Usually, the procedure of reconfiguring our resources is clear." (5) "We systematically analyze the needs of our customers.", [1=strongly disagree, 5=strongly agree]	.82
Digital Maturity	Strategy	Please assess to which grade the following statements about digitization at your organization are true. (1) "In our organization we have a comprehensive, cross-sectoral digitization strategy." (2) "A common digital strategy is shared across our organization at all levels." (3) "Our digital strategy is well developed and drives our organization's strategical direction." (4) "Our digital strategy has for some time been driving management and investment decisions." (5) Digital initiatives have been implemented across our organization, including cross-departmental projects.", [1=strongly disagree, 5=strongly agree]	.88
Digital Maturity	Culture	Please assess to which grade the following statements about digitization at your organization are true. (1) "In our organization we regularly held meetings in which the digitization state is recorded and controlled." (2) "The interest of our employees / my colleagues to actively shape the digitization of our organization is high." (3) "Management is continuously communicating the digital strategy and advances in its implementation across the whole organization." (4) "A digital mindset is fully embedded in our corporate culture." (5) Our organization is flexible and adapts to changes in the market in an agile way.", [1=strongly disagree, 5=strongly agree]	.72
Digital Maturity	Processes	Please assess to which grade the following statements about digitization at your organization are true. (1) "Digital-specific IT architecture supports our business agility through flexible tools and supporting processes." (2) "Third-party services are being integrated and supported by our digital enterprise IT architecture and related tools." (3) "The degree of automation in mass processes (e.g. invoicing, B2B-procurement processes, settlement with other market communication members) is high." (4) "In our organization we have fully analyzed processes regarding their digitization possibilities." (5) Our technical infrastructure is suitable for digital innovations.", [1=strongly disagree, 5=strongly agree]	.70
Digital Maturity	Technologies	Please assess to which grade the following statements about digitization at your organization are true. (1) "In our organization we have already analyzed individual new technologies (e.g. cloud-computing, big data, mobile computing, blockchain) regarding their application possibilities." (2) "Collaboration with other ecosystem partners regarding the use of new technologies and digital transformation is well established in our organization." (3) "Analytics technologies are being used for optimization of services and processes." (4) "Pilots are constantly conducted to test new digital tools and platforms in our organization." (5) We regularly use advanced technology to analyze market dynamics.", [1=strongly disagree, 5=strongly agree]	.73
Digital Maturity	Business Models	Please assess to which grade the following statements about digitization at your organization are true. (1) "In our organization we have employees who systematically search for new methods and business models." (2) "The investment volume for developing new digital business models is relatively to our organization's size high." (3) "Our organization offers digital non-core products or services (e.g. related to smart home solutions, e-mobility solutions, decentralized power generation, smart grids & controls, insurances, bonus programs)." (4) "New business models have been implemented with pure digital elements." (5) Digital services account for a significant share of total revenues.", [1=strongly disagree, 5=strongly agree]	.74
Competitive Advantage		Please assess to which degree the following statements apply to your organization. (1) "Compared with our competitors, we have a higher profit margin." (2) "Compared with our competitors, we have a higher revenue growth." (3) "Compared with our competitors, we have lower operating costs." (4) "Compared with our competitors, we have better product and service quality." (5) Compared with our competitors, we have an increasingly higher market share." (6) "Compared with our competitors, we have more satisfied customers.", [1=strongly disagree, 5=strongly agree] (Li & Liu, 2014)	.80