The Complexity Trap – Limits of IT Flexibility for Supporting Organizational Agility in Decentralized Organizations

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Abstract. In times of digitalization, organizations are transforming to become more agile. Decentralizing decision-making to lower levels of the organization allows firms to better detect changes in their environment and to sense new opportunities. Simultaneously, the digital transformation of a firm is increasingly relying on a flexible IT function. This study explores how decentralization of decision-making power increases organizational agility and to what extent this relationship is dependent on IT flexibility. We conducted a quantitative study using two rounds of surveys with 123 respondents from the consulting industry. Based on covariance-based SEM, we find that too much flexibility of the IT function in combination with decentralized decision-rights creates a complexity trap and, thus, decreases organizational agility. These findings carry several theoretical contributions for organizational agility research and shed new light on the role of IT flexibility for digital transformation.

Keywords: Organizational Agility, Decentralization, IT Flexibility, Detecting Capability, Digitalization

1 Introduction

The concept of organizational agility has been discussed as a solution for organizations to prosper in volatile environments. The term *agility* was coined in the Manufacturing and Information Systems (IS) literature to define a firm's ability to seize opportunities due to changes in the environment [1]. Today, this concept is more relevant than ever: digitalization is creating an increasingly complex and unpredictable environment [2]. Digitalization is "a sociotechnical process of applying digitizing techniques to broader social and institutional contexts that render digital technologies infrastructural" [4 p. 2]. Among others, it changes market boundaries, substitutes physical labor with new technology, eliminates cognitive labor by increased application of software algorithms, and replaces physical products and services with new digital offerings [2].

Trying to compete in such a fast-changing environment is a complex task and organizations struggle to find an efficient organizational design that promotes their

adaptability to those unforeseeable changes [4]. One solution to transform the organization is to delegate responsibilities to lower levels of the organization to increase the employees' ability to respond to changes. Research has shown that increased decentralization has been beneficial towards organizations' ability to respond to change. However, extant theory is scarce in explaining why this relationship exists [5].

Today, firms' operations are highly dependent on IT [3]. In times of digitalization, the importance of digital options has been stressed as an enabler of organizational agility [6], [7]. In this context, Byrd and Turner [8] emphasize the supporting role of the IT function for organizations. Even though the enabling roles of both IT flexibility and decentralization are separately well recognized in the literature, the question remains how they are interrelated with regard to organizational agility. Hence, we derive the following research question: *How does the decentralization of decision-making rights complement with IT flexibility in enabling organizational agility?*

To answer this question, our research uses a structured survey, collecting data at two points in time. We develop a conceptual model based on constructs from extant research. We draw on a sample from the professional service industry and analyze our hypotheses using covariance-based SEM. Our findings uncover the limits of IT flexibility as firms are experiencing a *complexitiy trap* when high decentralization and high IT flexibility interfere. The remainder is structured as follows: section 2 introduces the conceptual model and hypotheses. Afterwards, the sample and measurement development are explained in section 3. Section 4 presents the findings based on the tests of the hypotheses. Finally, we discuss the main implications and conclude the paper.

2 Model Development

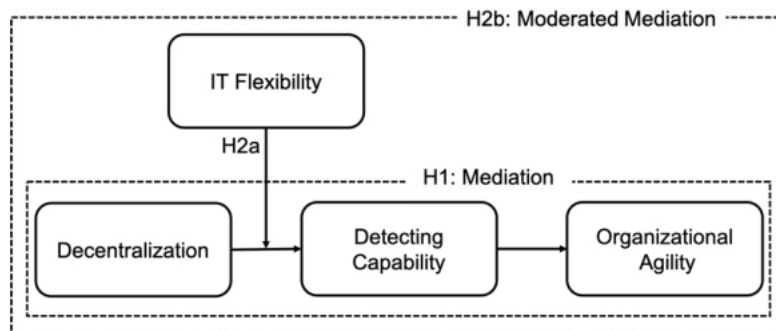Our theoretical model (Figure 1) is derived from extant literature.

Figure 1. Conceptual Model

First, we conceptualize how decentralization of decision rights enhances agility by proposing detecting capability as a mediator. Second, we examine to what extent this relationship is conditional on IT flexibility. Understanding these mechanisms can help designing organizations that rely on the flexibility of IT to face the challenges of digitalization. A summary of all constructs with definitions can be found in Table 1.

Within the IS literature, agility had first been used in the software development domain. Later, scholars also applied the concept of agility to the entire organization. They offer new theoretical arguments for how the organizations' ability to thrive in a digitalized world is dependent on IT capabilities. Scholars point out the difference between agility and flexibility [9], responsiveness [10], dynamic capabilities [9] and strategic flexibility [11]. Zhang and Sharifi [12] define the concept of agility as the ability to adequately respond to anticipated or unexpected changes in the environment (like the advent of new market players or digital technologies) and to see change as an opportunity. Additionally, scholars have noted the importance of sensing change for the concept of organizational agility [6], [13].

Table 1. Summary of key constructs

Construct	Definition	Reference
Decentralization	"The extent to which power over decision making in the organization is dispersed among its members" with a focus on vertical decentralization which "refers to the extent to which formal decision-making power is "delegated" down to the chain of line authority."	[15 p. 326]
IT Flexibility	Ability of the IT function to provide and support the business unit with ex-post adjustments to IT applications.	[15]
Detecting Capability	Firm-wide capability to proactively detect sudden changes in the business environment.	[6]
Organizational Agility	"Firm-wide capability to deal with changes that often arise unexpectedly in business environments via rapid and innovative responses that exploit changes as opportunities to grow and prosper"	[8 p. 933]

2.1 Detecting Capability as a Mediator of the Relationship between Decentralization and Organizational Agility

Based on existing research on agility, we have identified two established research streams as foundation for our model: one stream focuses on the importance of detecting capabilities for organizational agility, and the other, stemming from organizational design, looks at the role of decentralized decision making for detecting capabilities.

Detecting Capability and Organizational Agility
First, we follow the initial definition of organizational agility, defined as a "firm-wide capability to deal with changes that often arise unexpectedly in business environments via rapid and innovative responses that exploit changes as opportunities to grow and prosper" [8 p. 933]. The detecting capability, however, is defined as the firm-wide capability to proactively detect sudden changes in the business environment [6].

We argue that the concept of detecting environmental change and the concept of responding to these changes are discriminant in how they are facilitated in organizations. The ability to detect change is formed, e.g., by the capability to track competitors' actions, to identify changes in the customer's demand, or to recognize shifts in the economy [11]. By contrast, the capability to react to change encompasses the ability to

make rapid changes to organizations' products, IT applications, supply chains, resource allocation, or operations [7], [11]. The rationale is that the constant screening of the environment and the detection of possible changes enables organizations to quickly act and capitalize on this change. We conclude that organizations which are aware of threats and opportunities posed in its environment are better able to react to those changes. Consequently, organizations with superior detecting capability are better prepared to react quickly to changes.

Decentralization and Detecting Capability

According to Winkler and Wessel [16], decision rights are concerning different research themes like IT governance and firm structure. We concentrate on the latter theme, which emphasizes the influence of information systems on firm structures [16]. Following Mintzberg [14], there are two distinct types of decentralization on the organizational level: horizontal and vertical decentralization. We focus on vertical decentralization, which describes "the extent to which formal decision making power is 'delegated' down to the chain of line authority" [15 p. 326]. The delegation of decision rights to lower levels of the hierarchy encourages lateral and vertical communication across employees [5] and increases employees' satisfaction and motivation [17]. As Hage and Dewar [18] point out, centralized decision-making power in the hands of a few impedes the flow of creative thoughts across various members within the organizations and blocks innovative ideas. The rationale is that innovative ideas pose threats to the existing distribution of power in organizations. In centralized organizations, innovative ideas must pass several managers along the chain of command before receiving approval or resource support and are, therefore, more likely to be rejected [19].

Therefore, organizations with a decentralized structure, having many empowered employees on lower levels of their hierarchy, show a better flow of ideas concerning the opportunities and threats they are facing. Employees in decentralized structures are also more motivated [17] to screen and understand the complex changes of the now digitalized environment that influence their work. We conclude, organizations with a high level of decentralization can better detect and understand changes in their environment, e.g., in the form of new IT innovation, or changing customer demands.

Decentralization on Organizational Agility *via* Detecting Capability

Following the extant literature, the positive relationships of decentralization on detecting capability and of detecting capability on organizational agility are well-established. Still, there are different findings regarding the relationship between decentralization and organizational agility. On the one hand, literature suggests that a high decentralization of decision-making power is associated with high organizational agility [20]. Delegating decision-making rights down the chain of command is believed to increase the speed in decision making allowing for faster reaction to changes. On the other hand, scholars point out that decentralized decision-making limits organizations' ability to respond to immediate threats [21]. If every subunit in the organization has the authority to react independently to external changes, the organization might act in many different and possibly even contrary ways. Hence, decentralization requires additional coordination efforts to manage the independent subunits or employees to overcome increased complexity [22].

Based on the mixed findings regarding the association between decentralization and organizational agility [21], and based on the fact that the relationships between detecting capability and organizational agility [11] and between decentralization and detecting capability [18] are well established, we propose that detecting capability acts as a mediating variable. Thus, detecting capability explains the effect of decentralization on organizational agility. This means that the effect of decentralization on organizational agility is due to the detecting capability. The vertical decentralization of decision rights enhances organizations' ability to detect changes posed in the environment, which increases organizational agility. Accordingly, we suggest that decentralization is not directly increasing organizational agility. In fact, decentralization only indirectly enhances organizational agility by increasing organizations' capability to detect change. We hypothesize a mediating effect:

The effect of decentralization on organizational agility is mediated by detecting capability. (H1)

2.2 The Moderating Effect of IT Flexibility

In times of digitalization, the role of IT units is heavily discussed. We regard IT flexibility as the ability of an IT unit to provide and support the business side with ex-post adjustments to IT applications [15]. This focuses less on a technical understanding (such as: modular, state-of-the-art IT infrastructures), but rather on an organizational understanding (such as: defined responsibilities, IT service processes, and sufficient resources) of IT flexibility and matches the business side's perception of IT flexibility.

The literature holds different perspectives which offer opposite indications on the effect of IT flexibility. Whereas positive effects of IT flexibility are reasoned with more tailored IT applications supporting diverse business units, negative effects of IT flexibility are reasoned with increased complexity caused by too many and unstandardized IT applications which cripple the IT function [23]. While Overby et al. [11] and Sambamurthy et al. [6] propose a direct effect of digital options on organizational agility, we follow the argumentation of Tallon and Pinsonneault [13] that IT flexibility can also act as a moderator variable in agility research. In the context of our study, using IT flexibility as a moderator allows us to conceptualize that organizations with similar degrees of decentralization could have different levels of detecting capability depending on the flexibility of their IT function. This yields new insights into whether the effect of decentralized decision-making on the organizations' detecting capability might be stronger in combination with a flexible or inflexible IT.

Currently, we find two opposite perspectives in the literature about how decentralization and IT flexibility complement each other. Some scholars argue for a positive interaction effect between IT governance decentralization and the degree of IT architecture modularity when it comes to IT agility [24]. The rationale is, that a highly modular IT architecture in combination with a high IT governance decentralization reduces the coordination efforts between different departments and enhances the speed when it comes to decisions regarding the adaptation of new IT applications. However, the idea of decentralizing decision rights in IT governance is distinct to the idea of decentralizing decision rights in the overall firm structure [16]. In addition, our conceptualization

of IT flexibility as the ability of the IT function to support the business side with ex-post adjustments to IT applications is different to the conceptualization of IT architecture modularity, which is defined by loosely coupled subsystems that communicate through standardized interfaces [24]. Another argumentation for a positive interaction effect of IT flexibility and decentralized decision-rights is provided by the increased availability of digital options [13], which allows decentralized business units to reap the benefits of tailored IT applications to improve their process of detecting changes.

Contrary to the positive interaction effect between decentralization and IT flexibility, literature suggests a negative interaction effect based on findings about IT silos and shadow IT. In decentralized organizations, employees are empowered to make own decisions. While this is generally associated with positive effects (e.g., satisfaction and motivation), it can be unfavorable when employees are allowed to order many tailored IT solutions through a flexible IT function, because the diversity and number of IT applications in the organization increases complexity [23]. As Tiwana and Konsynski [24] point out, interdependencies of IT applications spanning across the organization pose several threats to IT agility when changes in the existing IT application portfolio are made. Since not all members of the organization have a holistic understanding of the interplay of the organization's IT applications, they cannot recognize the problems that surface when integrating or adapting new IT applications. Thus, negative effects of IT flexibility could kick in and cause organizations to end up in a *complexity trap*, which reduces the alertness for change like new IT opportunities [24]. For example, when employees on the lower level of the organization are delegated to assess the challenges and opportunities of a new product, highly flexible internal IT offerings will likely lead to employees working with different methods based on different IT applications they deem appropriate (they are authorized to decide what is appropriate). Thus, comparing results of the assessment becomes more complex and causes uncertainty in the organizations' detecting process [23].

In summary, there are two opposite predictions about how decentralization and IT flexibility complement each other with regard to the detecting capability of an organization. Hence, we derive the following hypothesis with an unknown direction of the moderating effect of IT flexibility:

The relationship between decentralization and detecting capability is moderated by IT flexibility. (H2a)

The argumentation for a moderation effect of IT flexibility on the relationship between decentralization and detecting capability also suggests moderated mediation. Since we argue, that detecting capability mediates the relationship between decentralization and organizational agility (H1), and the direct relationship between decentralization and detecting capability is moderated by IT flexibility (H2a), we also hypothesize that the mediating effect is moderated by IT flexibility. This means that organizations with the same level of decentralized decision-making end up with different levels of organizational agility dependent on the degree of the flexibility of their IT function. This is, as argued above, because the effect of decentralization on detecting capability is not stable, but changes depending on different levels of IT flexibility:

The indirect relationship between decentralization and organizational agility via detecting capability is moderated by IT flexibility. (H2b)

3   Method

To test our hypotheses, we conducted an empirical study. We developed two structured questionnaires. The first survey contained multiple-item scales for the measurement of three constructs (decentralization, IT flexibility, and detecting capability), the second survey measured organizational agility.

3.1   Sample

Data was collected from the consulting industry. The market for standard consulting services has become increasingly competitive, leading to eroding margins [25]. New technology-based services such as data analytics and artificial intelligence applications are becoming increasingly important and change clients' demand. This forces consultancies to compete in markets that were once solely occupied by technology companies [25]. Compared to other industries, the need to stick to certain IT applications is less rigid in the consulting industry. In the manufacturing industry, for example, applications are interfacing with adjacent firms to a much higher degree. Besides the quick change of clients' demand, Software-as-a-Service offerings by large business providers, such as SAP with S/4Hana Cloud, increase technology companies' grip on IT related services [25]. Since agility allows organizations to stay competitive, it is highly important in the professional service industry. We targeted consultants in both higher and lower hierarchical positions in their respective company to answer our survey. Therefore, all hierarchical levels of the organizations are represented: 50% of the respondents are consultants, 30% are managers, and 15% belong to the top management of their consultancy. About one third of the consultancies have an IT focus, whereas one quarter focuses on auditing and another quarter on strategy and process consulting. Therefore, our dataset encompasses a good mix of the different specializations within the consulting industry. About 40% of the consultants that answered the survey have been working in their consultancy for more than four years, so we assume that consultants in our sample have sufficient knowledge to give reasonable answers to our survey.

3.2   Data collection procedure

An invitation to participate in the first online survey round was distributed through various channels. The first survey round was open for completion from June to August in 2017. Only consultants were allowed to answer the survey. The survey was mainly sent out to consultants in Germany. Consultants were assured that all answers would be kept anonymous. The survey was distributed via the authors' personal networks, the university's network, and professional social networks Xing and LinkedIn. Since consultants were also asked to forward the invitation to their colleagues, we cannot report the final number of contacted consultants. For the second survey round, personal links were sent out to those 181 consultants that answered the first survey *and* left their email address for a second survey. In this second survey, we collected data about the dependent variable organizational agility. The survey was open for completion from May to June in 2018. Ultimately, 123 consultants participated in both of our survey rounds.

3.3 Measures

The survey contained multiple-item scales for the measurement of decentralization, IT flexibility, detecting capability and organizational agility. Adaptations to the original questions were made to reflect the consulting industry's specialties and to improve the consultants' understanding of the questions [26]. An overview of the constructs and items can be found in the appendix. The items were developed in English; we followed the standard translation and back-translation procedure to create German equivalent versions of the measures. All items were pre-tested in both languages with potential participants and fellow researchers to ensure content validity. Means, standard deviations, and correlations among the latent variables are presented in Table 2.

Table 2. Constructs measures and quality criteria

	Variable	1	2	3	4	CA	CR	AVE
1	Decentralization	*.684* [a]				.719	**.**724	.468
2	IT Flexibility	.285*	*.768*			.803	.810	.590
3	Detecting Capability	.623**	.459**	*.771*		.710	.814	.594
4	Organizational Agility	.296*	.376**	.636**	*.737*	.779	.780	.543

[a] Square roots of the AVE reported on the diagonal in italic, N = 123, * p < .05 / ** p < .001
CA = Cronbach's Alpha, AVE = Average Variance Extracted

Measures for the independent and dependent variables were collected at two different points in time: First, the perceived horizontal decentralization of consultancy was measured with a five-point Likert scale, using a three-item measure from Claver-Cortés et al. [27]. Decentralization in this research is the extent to which a consultant experiences decision rights being distributed to lower levels of the chain-of-command. Consultants rated the perceived flexibility of their IT on a five-point Likert scale, using a three-item measure from Martin et al. [15]. IT flexibility in this research is the extent to which the IT function is able to provide and support ex-post adjustments to IT applications. The detecting capability of organizations was measured with a seven-point Likert scale as this construct is a dependent variable. Based on Ahsan and Ngo-ye [28] and Sambamurthy et al. [6] we derived three items. Detecting capability comprises proactively detecting changes in the business environment. Lastly, organizational agility is defined by Lu and Ramamurthy [7] with two dimensions: market capitalization agility and operational adjustment agility. To maintain a clear conceptual separation between the idea of detecting and reacting to change, we focus on operational adjustment agility. This dimension emphasizes the reactivity of operational activities as an enabler of innovative initiatives in times of change [7] and, thus, represents the original idea of organizational agility by focusing on the organizations' ability to react to changes [12], [13]. Additionally, the measurement model would not structurally change when using a first-order construct for organizational agility with two dimensions (market capitalization agility and operational adjustment agility). We measure organizational agility using the three items of the operational adjustment dimension by Lu and Ramamurthy [7].

3.4 Testing for Biases

Although a time-lag design (surveys at two points in time) mitigates the concern of common method variance, several additional procedural and statistical remedies as suggested by Podsakoff et al. [26] were taken into consideration. Participants were assured anonymity and confidentiality of their responses to limit concerns about evaluation apprehension and social desirability. Buffer items, not relevant for this research model, were included in the survey. We also checked for nonresponse bias. The first 30% of the responses were compared with the last 30% of the responses for both survey rounds. The independent sample t-test found no statistically significant difference ($p < .05$), indicating that nonresponse bias is not an issue in our study. Finally, comparing the responses for the German and English version of the survey did not result in any statistically significant difference ($p < .05$).

4 Results

4.1 Validation of Measurement Model

We run a confirmatory factor analysis with Mplus (Version 8.1) to test whether the collected data reflects the hypothesized measurement model [30] and to establish convergent and discriminant validity of our measures. Following Hu and Bentler [31], the overall model fit was very good ($\chi^2 (48) = 49.34$, CFI = .997, TLI = .996, SRMR = .038, RMSEA = .015). All of our fit indicators are above the threshold of .95 for the CFI and TLI value and below the thresholds of .08 and .06 for the SRMR and RMSEA value, suggesting a good model fit [31]. Each item loaded on its appropriate factor, all standardized factor loadings were significant ($p < .000$) and larger than .59. The correlation among all latent constructs were all substantially smaller than 1, and the square root of the AVE for each construct was larger than its highest correlation with any other construct (see Table 2), indicating that our constructs are sufficiently discriminant.

4.2 The Mediating Role of Detecting Capability

We applied covariance-based structural equations modeling (CBSEM) to examine the relationships among the latent variables. Following Cheung and Lau [32], we used a three-step approach for testing moderated mediation with latent moderated structural equations (LMS). This procedure produces more accurate parameter estimates and confidence intervals than commonly used regression-based approaches, which rely on observed variables and do not correct for measurement errors [32]. We used Mplus with maximum likelihood estimation to examine the moderated mediation model.

First, because the LMS approach does not provide the usual fit indices, we assessed the overall model fit without the interaction (moderation) term following Cheung and Lau [32]. The fit indices indicate that the suggested model fits the data very well ($\chi^2(49) = 50.19$, CFI = .998, TLI = .997, SRMR = .039, RMSEA = .014).

In a second step, we evaluated the whole model (Figure 2) including the interaction between decentralization and IT flexibility. 2,000 bootstrap samples were generated to examine the model. Standardized path coefficients (β) are reported in Figure 2. Our model explains 44 percent of the variance in detecting capability ($R^2 = .435$) and 49 percent of the variance in reacting agility ($R^2 = .489$).
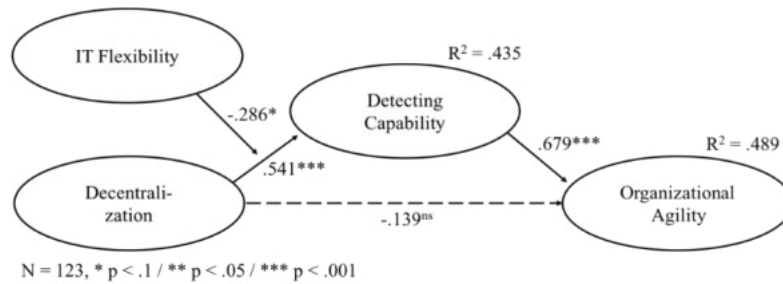

Figure 2. Estimation of the measurement model

To test the mediating effect of detecting capability on the relationship between decentralization and organizational agility (H1) we test the two direct effects between decentralization and detecting capability as well as between detecting capability and organizational agility. Decentralization has a statistically significant, positive relationship with detecting capability ($\beta = .541$, p = .000), and detecting capability has a statistically significant, positive relationship with organizational agility ($\beta = .679$, p = .000). Subsequently, we test the direct effect between decentralization and organizational agility, and the indirect effect of decentralization on organizational agility via detecting capability. The direct relationship between decentralization and organizational agility is positive and significant ($\beta = .300$, p = .008). However, the inclusion of the mediator variable detecting capability leads to a statistically non-significant relationship between decentralization and organizational agility ($\beta = -.139$, p = .485). We conclude that the relationship between decentralization and organizational agility is fully mediated by detecting capability (confirming H1).

4.3   The Boundaries of IT Flexibility

Hypothesis 2 proposes a moderating effect of IT flexibility on the positive relationship between decentralization and detecting capability (H2a) and an indirect effect of decentralization on organizational agility through detecting capability conditional on IT flexibility (H2b). Thus, we report the p-value of the moderation and the mediation effect. Moreover, we follow the widely acknowledged argumentation, that since the sampling distribution of the product of two path coefficients is not normal, the sampling distribution of moderation and mediation effects is not normal either [33]. Therefore, using a t-test or a Sobel test would not be appropriate to evaluate the estimates' significance, because it requires a normal distribution. Consequently, we additionally use a non-parametric procedure to interpret the statistical significance of the moderation and mediation effects. The bias-corrected bootstrap confidence interval (CI) produces more accurate results than parametric tests (e.g., t-test) since it allows the interaction term

and the indirect effect to be non-normally distributed. A particular effect is deemed statistically significant if the bias-corrected bootstrap confidence interval does not contain zero [33]. Based on these quality criteria, we find in our analysis:

First, the interaction effect between decentralization and IT flexibility on detecting capability is statistically significant, since the bootstrap confidence interval does not contain zero, and negative (H2a: β = -.286, 95% CI [-.648, -.022], p = .057). We find that IT flexibility acts as a moderator on the relationship between decentralization and detecting capability (confirming H2a).

Second, supporting the idea of a moderated mediation effect, the analysis is based on the index of moderated mediation [34]. We find the interaction effect between decentralization and IT flexibility on the mediated relationship (decentralization on organizational agility through detecting capability) to be also statistically significant and negative (H2b: β = -.194, 95% CI [-.454, -.009], p = .075). We find that IT flexibility acts as a moderator on the mediation effect of decentralization on organizational agility via detecting capability (confirming H2b).

Additionally, to provide a more nuanced analysis of H2b, we inspect the moderated mediation effect at various levels of IT flexibility. This procedure allows us to understand the nature of the moderated mediation effect in more detail [35]. For low levels of IT flexibility (one standard deviation below the mean) the effect of decentralization on organizational agility is high and significant (estimate = .534, 95% CI [.211, .968]). For levels of IT flexibility around the mean, the effect of decentralization on organizational agility through detecting capability is considerably lower and significant (estimate = .368, 95% CI [.150, .788]). Finally, for high levels of IT flexibility (one standard deviation above the mean) the effect of decentralization on organizational agility through detecting capability is considerably lower, but not significant (estimate = .201, 95% CI [-.024, .673]). To gain a deeper understanding of the magnitude and significance of the mediation effect at different levels of IT flexibility, we visualize the conditional indirect effect in Figure 3.
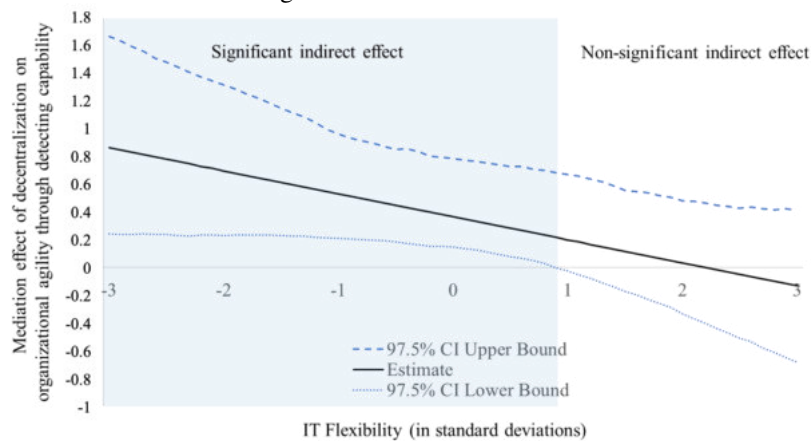

Figure 3. Mediation effect conditional on IT flexibility

A lower IT flexibility resulted in a higher mediation effect of decentralization on organizational agility through detecting capability. However, the mediation effect was only significant when IT flexibility was lower than +.8 standard deviation from the mean (shaded area in Figure 3). To safeguard the moderated mediation, we can report that the path coefficient between IT flexibility and detecting capability is positive and significant (β = .361, p = .001), and that the path coefficient between IT flexibility and organizational agility is statistically not significant (β = .114, p = .325).

5 Discussion

Our study supports earlier studies that show organizations with decentralized decision-making rights are better able to detect changes in their environment as the natural flow of innovative ideas is encouraged [18] and more employees are involved in the process of screening future changes [17]. Using this as a foundation, we provide two main contributions to the discussion from our analysis:

First, we uncover detecting capability as a mediator between decentralization and organizational agility. We show that the effect of decentralization on organizational agility is not only due to the fact that more employees can react to experienced changes by altering internal routines and processes independently. Instead, we find that the effect of decentralization on organizational agility is due to the increased capability to detect change. The decentralization of the organizational structure increases organizations' accumulated and shared knowledge about possible changes, which increases the organizations' ability to respond to these changes by appropriate actions. This provides a better understanding of how decentralization affects organizational agility.

Second, we explain the impact of IT flexibility on the relationship between decentralization and organizational agility via detecting capability. For organizations trying to improve their detecting capabilities by decentralizing decision-rights, high IT flexibility comes at a cost. Interestingly, too much flexibility of the IT function in combination with vertically distributed decision-rights decreases organizational agility. We attribute this to the fact that, if organizations have many employees at lower levels of the hierarchy allowed to make individual decisions, and at the same time an IT department flexible enough to satisfy the individual demands of those employees, organizations end up in a *complexity trap*. We find that decentralized decision-making combined with too many individual IT applications or components (provided through the flexible IT function) makes information and new solutions throughout the organizations less comparable. The *complexity trap* hinders the development of a shared understanding of future changes in the market and, hence, weakens organizations' agility. Nonetheless, we do not dismiss the widely acknowledged argumentation that IT capabilities have a positive effect on organizational agility [6], [11]. For example, Tiwana and Konsynski [24] found a positive interaction effect between IT governance decentralization and IT architecture modularity with regard to IT agility. Still, we provide theoretical and empirical evidence to the limits of IT flexibility. A highly flexible IT function in combination with highly decentralized decision rights decreases the capability to detect change, and,

in turn, decreases also the ability to react to change. The *complexity trap* illustrates that providing many different IT applications in an organization with spread-out decision making, eliminates the potentially positive effects of the two measures due to complexity. Hence, we urge that potential harmful effects of (too extensive) IT flexibility and the complexity coming along with it should play a more prominent role in further organizational agility research. Additionally, further research should explore how decentralization and IT flexibility can be enhanced without increasing harmful complexity. We encourage research to analyze if a "fit" makes sense: the degree of decentralization must match the degree of IT flexibility.

As our study carries some substantial contributions, it also has some limitations that bear mentioning as well. First, our sample size is relatively small due to the fact that our study design required respondents to answer two surveys at different points in time. Second, our results indicate that a lower IT flexibility reduces the effect of decentralization on organizational agility through detecting capability. However, there is no statistically significant mediation effect when IT flexibility is very high (+.8 standard deviation from the mean). Strictly speaking, our results do not support the idea that a very high IT flexibility leads to a very low mediation effect. However, Figure 3 shows that the mediation effect conditional on the moderator is stable. Therefore, we are confident that our results are also valid for high levels of IT flexibility, and that the insignificance for very high levels of the moderator is rather due to the relatively small sample size and thereby a lack of statistical power. Third, our study relies only on data from the consulting service industry. Future research needs to extend our findings to different industries to validate our findings, to allow for generalization, and to find more explanations of the possible adverse effects IT flexibility.

6   Conclusion

In this study, we provide a theoretical explanation as well as empirical evidence for both how and why decentralization relates to organizational agility and to which degree this relationship depends on the IT flexibility. Based on our findings, we recommend managers undergoing a digital transformation to provide decentralized structures that empower employees to increase their understanding of possible changes that are likely going to affect the firm. This will increase organizations' ability to react to those changes, e.g., through improvements and additions to their internal processes.

However, we have to stress that decentralization in combination with a highly flexible IT should be treated with caution. We find that the effect of decentralization on the capability to detect changes is significantly reduced in organizations with a highly flexible IT function. We do not claim that IT flexibility is generally harmful to the detecting capability of organizations and thus agile organizations. However, managing the digital transformation of organizations requires to carefully consider the level of IT flexibility and decentralization to avoid the *complexity trap*. Furthermore, our analysis indicates that further research is necessary to investigate what causes possible drawbacks, and how IT flexibility and decentralization can be reconciled to support agility.

Appendix

Table 3. Overview Items and Loadings

Name	Item Label	Loading	Reference
DEC1	In your consultancy, managers and consultants can independently from top management decide about priority of projects and clients.	.718	
DEC2	In your consultancy, managers and consultants can independently from top management decide about working overtime.	.594	[27]
DEC3	In your consultancy, managers and consultants can independently from top management decide about employee recruitment and layoff	.732	
ITF1	Our IT unit/provider reacts flexibly to change requests from the consulting team.	.878	
ITF2	The IT unit/provider realizes change requests from the consulting team in appropriate time.	.745	[15]
ITF3	If there are critical bugs in our IT applications, they get fixed in a timely manner.	.667	
DET1	We seek novel approaches to satisfy future clients' needs.	.735	
DET2	The screening for unforeseeable changes is implemented in all our business activities.	.732	[28] [6]
DET3	We are constantly looking for opportunities to add new value to our clients.	.841	
OA1	We quickly capitalize changes and apparent chaos as new opportunities for services.	.686	
OA2	We are quick to make and implement appropriate decisions in the face of client changes.	.715	[7]
OA3	We are quick to react to new services launches by competitors with appropriate changes.	.804	

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