The Structure of Agility from Different Perspectives

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Abstract—**Agility as a term is widely known today. However, a common understanding of what agility means and what it consists of is missing. Until today, a lot of frameworks have been developed, but they are very heterogeneous regarding content and structure. This paper approaches that issue by conducting a systematic comparison of 28 available agility frameworks out of the domains of agile manufacturing, agile software development, agile organization, and agile workforce. Altogether, 33 concepts related to agility were identified. The results of the comparison show that even within the examined specific domains a lack of consensus is obvious. In addition, the utilized concepts are very ambigious and overlapping. So, the interdependencies between the identified concepts were analyzed in detail. This revealed five recurring "clusters" that each combine several concepts with similar content, but despite the amount of available frameworks, none of it reflects these clusters directly. Hence, the study shows that the factors beyond the construct of agility are not fully uncovered yet.**

I. INTRODUCTION

FOR several years, businesses and organizations have faced a more and more volatile environment, marked with challenges such as increased competition, globalized markets, and individualized customer requirements accompanied with many changes in every organizational field. Such scenarios were already described in the 90s, for instance by Goldman et al. [1] or the Iacocca Institute [2]. As a response, different concepts emerged that should enable organizations to master these challenges. The most recent is the concept of agility, but others like flexibility and leanness are mentioned often, too.

A lot of research activities about agility and its related concepts have been conducted in the meantime. However, until today there exists no common understanding of what constitutes agility. Although many frameworks and models describe agility and its characteristics, they often heavily differ in content and structure. This makes it difficult for both, researcher and practitioner audiences, to build upon the insights obtained until today. On the one hand, researchers are missing a well-founded basis to develop the topic further, on the other hand, practitioners cannot easily uncover what parts of their organizations have to be changed and to what respect they have to be changed to respond to new market challenges.

This is particularly of interest for organizations in the software and information technology (IT) industry. With the appearance of agile software developing methodologies, or in a broader sense agile values and principles (see for instance [3]–[5]), in the early 2000s, the advantages of these new approaches became visible. However, it turned out to be difficult to transfer the experienced benefits beyond the team level [6]–[8]. But this step is necessary so that the whole organization can benefit from agility.

The idea for this paper arose from the attempt to select a suitable agility framework that represents the structure and components of agility in an organization for a further empirical study. Unfortunately, it turned out that due to the aforementioned problem of a lack of consensus, a selection of one framework seemed unsatisfactory. Some were unsuitable to describe the organization as a whole, others specialized on a specific aspect only. Generally, the literature was confusing and inconsistent. Therefore, it seemed necessary to get through the literature and systematically compare available frameworks. The aim of this work is to analyze the frameworks regarding common ground and differences and to search for recurring concepts. Finally, this will create a basis for further work on a common understanding of agility.

A review about agility is already given by Sherehiy et al. [9] which serves as an important starting point for this study, too. However, they mainly included work of the agile manufacturing domain, because publications about the agile organization as a whole were scarce at this time. The aim of the authors was to deduce a summarized framework describing the agile organization. Interestingly later published frameworks again differ heavily from the one developed by Sherehiy et al. That shows that their work was still not sufficient and a further investigation is necessary.

The remainder of the paper is structured as follows: In section II the concept of agility and its history are shortly described and its connections to the principles of lean and flexible are mentioned. Section III introduces the agility frameworks that are analyzed in this paper. The systematic comparison of these frameworks and the discussion of the results are given in section IV. The paper ends with a conclusion and an outlook to further research currently conducted in section V.

II. THE CONCEPT OF AGILITY

Looking up the term agile in a dictionary delivers "having the faculty of quick motion; nimble, active, ready" [10, p. 255], whereby agility is the "quality of being agile" [10, p. 256]. Given this explanation as a basis, a huge variety of definitions emerged today, heavily influenced by context and application domain. A discussion of all available definitions is

beyond the scope of this paper. Different authors already list various definitions of agility, for instance [11], [12]. Another comprehensive collection is given in the appendix of [13].

An extensive definition, which fits well to the context of this work, was developed by Ganguly et al. [14] based on the work of Dove [15], [16]. They define agility as "an effective integration of response ability and knowledge management in order to rapidly, efficiently and accurately adapt to any unexpected (or unpredictable) change in both proactive and reactive business / customer needs and opportunities without compromising with the cost or the quality of the product / process" [14, p. 411]. The handling of change as a fundamental prerequisite for agility is confirmed by Conboy, who named creation of change, proaction in advance of change, reaction to change, and learning from change as components of agility [17].

The concept of agility is nothing new. Early works are already found within social sciences and date back to the 1950s [18]. However, agility gained significantly more attention in the 1990s, especially after the so called "Lehigh report" [2] was published explaining a new idea of manufacturing strategies. This development was accompanied by the increasing emphasis on customer orientation and proactivity instead of reactivity. Later on, mainly after the year 2000, process orientation was focused on additionally and led to an examination of agility from an organizational perspective [13]. Simultaneously, agility became well known within the software industry, whereby the "Agile Manifesto" [3] triggered a lot of research in this field.

While research about agility progresses continuously, there are two other closely connected and underlying concepts: flexibility and leanness. Although both share some common ground with agility, they are not the same and should be distinguished. A detailed discussion is given in [17], which is shortly summarized here. First, flexibility is very similar to agility. The main differences of flexibility lie in issues like the lack of speed and rapid action, continual change instead of a one-off change, a missing inclusion of knowledge and learning, and the application as single practices in specific parts of the company instead of an organization-wide view. The difference of leanness, however, is much more straight forward. In contrast to agility, leanness is unsuitable to variability and uncertainty and emphasizes simple cost reduction over value-related issues, mainly value for the customer [17].

III. AGILITY FRAMEWORKS

A review of the literature revealed a variety of frameworks and models describing the concepts that determine agility or at least proposed different items to measure agility. Finally, 28 frameworks or similar concepts could be identified that can be categorized into four domains and will shortly be introduced in the following:

- Agile Manufacturing,
- Agile Software Development,
- Agile Organization/Agile Enterprise, and
- Agile Workforce.

A. Agility Frameworks Focusing on Agile Manufacturing

As explained in section II, the concept of agility mainly originates from the manufacturing domain. Hence, ten of the identified frameworks focus on agile manufacturing [11], [19]–[27].

One of the earlier frameworks was developed in 1999 by Sharifi & Zhang [19]. The core idea is the distinction between Agility Drivers, Agility Capabilities, and Agility Providers. Drivers are mainly changes in the environment. Capabilities like responsiveness, competency, flexibility, and speed are the the required abilities of the company to respond to these changes. Providers are the means to achieve these capabilities in the areas of organization, technology, people, and innovation [19]. This framework was refined and extended later by Sharifi et al. [20], however, the main structure remained stable. Finally, it led to a theoretical approach to develop an agile manufacturing strategy [21].

A similar structure was chosen by Vázquez-Bustelo et al. [22], by grouping the elements of their conceptual model into Agility Drivers, Agility Enablers (or Practices), and Outcomes. The core concept is the Agile Enablers, which are similar to the Capabilities mentioned above, but are further detailed into Human Resources, Value Chain Integration, Concurrent Engineering, Technologies, and Knowledge Management [22].

Two other early frameworks were developed by Gunasekaran [23] and Yusuf et al. [24], whereby both identify four major dimensions affecting the agile manufacturing system. Gunasekaran mentions Strategies, Technologies, People, and Systems [23]. Yusuf et al., however, state Core Competence Management, a Capability for Reconfiguration, a Knowledge-driven Enterprise, and the formation of Virtual Enterprises as core concepts. They furthermore detail them into 32 attributes [24]. In 2002, Gunasekaran & Yusuf published another framework of agile manufacturing strategies and techniques that implemented concepts of both predecessors [11].

The remaining three frameworks show different approaches. Meredith & Francis propose a so called "Agile Wheel" structuring agility into Strategy, Processes, Linkages, and People each with four sub-practices [25]. Agarwal et al. focus on the agile supply chain by stating four main characteristics dealing with Market, Information Integration, Process Integration, and Planning [26]. Addditionally, Kisperska-Moron & Swierczek conducted an exploratory factor analysis with Polish companies and obtained a framework built of the four factors Relation with Customers, Relation with Suppliers, Relation with Competitors, and Intensity of IT Use [27].

B. Agility Frameworks Focusing on Software Development

Research about agile software development is much younger. As described in section II, the Agile Manifesto [3] can be seen as a trigger for further studies. The 17 initiators postulate four key values of agile software development with an emphasis on individuals and interactions, working software, customer collaboration, and response to change. These values are further detailed into 12 principles [3]. Afterwards, in the years 2008 and 2009, five frameworks dealing with the topic of

agile software development were identified [28]–[32], whereby they often focus only on specific issues within the domain.

Two of the more general frameworks dealing with success factors of agile development practices are given by Chow & Cao [28] and Misra et al. [29]. Both publications show comprehensive lists of success factors grouped in different dimensions. Chow & Cao use organization, people, process, technical, and project factors [28], whereby Misra et al. only distinguish between organizational and people factors [29]. However, both narrow down these lists to six (delivery strategy, proper agile software engineering techniques, high team capabilities, good agile project management process, agile-friendly team environment, and strong customer involvement) [28] and nine (customer satisfaction, customer collaboration, customer commitment, decision time, corporate culture, control, personal characteristics, societal culture, and training and learning) [29] critical success factors via empirical investigations, respectively.

In contrast, Chan & Thong [30] ask what affects the acceptance of agile methodolgies. In this context, they build a conceptual framework where acceptance is dependent from the characteristics of the agile methodologies and knowledge management-related activities like creation, retention, and transfer of knowledge and experience. They furthermore identify three concepts affecting knowledge management: factors related to abilities, motivation, and opportunities [30].

Agility in the specific domain of distributed development teams was analyzed by Sarker & Sarker [31]. They distinguish three different dimensions of agility. First, Resource Agility that mainly consists of people and technology. Second, Process Agility that includes aspects like methodology, environmental awareness, or bridging time zones. And finally, Linkage Agility that is based on cultural and communicative issues [31].

Furthermore, Kettunen [32] did not develop a framework in a stricter sense, but compared practices of agile manufacturing to those of agile software development. For this purpose, he used a comparison matrix covering five concepts: Organization, Process, Product, Operation, and People. He concludes that issues of all manufacturing concepts are covered in different amounts by agile software development models, too [32].

C. Agility Frameworks Focusing on Agile Organization/Agile Enterprise

Research about the agile organization as a whole unit started contemporarily to research about agile manufacturing in the 90s. However, a concentration can be seen at the time the interest in agile software development grew. Additionally, the newest publications (from 2010 and 2011) of all analyzed frameworks belong to this group. This might be an indicator that it becomes more important to understand the effects of agility to the overall organization beyond single development teams or the manufacturing domain. All together, 11 frameworks were identified covering the topic of the agile organization [1], [9], [33]–[41].

One of the first and a well-known publications is the book of Goldman et al. [1]. They label agility as "A Framework for Mastering Change" and define four dimensions to stay competitive: enriching the customer, cooperating to enhance competetiveness, organizing to master change and uncertainty, and leveraging the impact of people and information [1].

Besides this, different approaches dealing with organizational agilty have been developed. A part of the literature focuses on measurement tools. Ren et al. [33], for instance, propose a measurement system utilizing the Analytical Hierarchy Process (AHP) based on the four dimensions of Goldman et al. [1], [33].

Other authors utilize fuzzy logic as a measurement tool. Tsourveloudis & Valavanis [34] name a set of parameters to measure agility by assessing the infrastructure of production, market, people, and information [34] whereas Lin et al. [35] closely connect their fuzzy logic model to the concepts of agile manufacturing with agility enablers, capabilities, and drivers (see section III-A) [35]. Later on, Tseng & Lin use this model to introduce an agility development method [36].

The use of agile manufacturing concepts can also be observed in other publications. Eshlagy et al. [37] again use the distinction in agility enablers, capabilities, and drivers in their research. They finally identified 12 factors that have an effect on organizational agility by applying path analysis. Interestingly, the most significant are leadership, organization commitment, and job satisfaction while typical manufacturing issues like supply chains and the like play a less important role [37]. In a similar way, Bottani [38] uses the framework of Yusuf et al. [24] to conduct an empirical study with the aim of analyzing what profile agile companies have and which tools they use [38].

A comprehensive work to develop a measurement scale with qualitative and quantitative studies can be found in Charbonnier-Voirin [39]. The given scale consists of four factors that can be seen as a framework for agility, too. The factors are somewhat similar to the dimensions of Goldman et al. [1]. They are named practices directed towards mastering change, practices valuing human resources, cooperative practices, and practices of value creation for customers [39].

Similar to section III-B, there also exist some publications dealing with very specific topics. Tallon & Pinsonneault investigate the impact of strategic IT alignment on agility [40]. Zelbst et al. show that the utilization of RFID technology enhances agility [41]. Both additionally identify a positive effect of agility on the performance of the firm [40], [41].

Finally, a review of concepts related to enterprise agility is given by Sherehiy et al. [9]. They reviewed a number of frameworks, models, and measurement tools of agility and extracted a list of characteristics of the agile enterprise. They distinguished into characteristics related to global strategies including customer, cooperation, organizational learning, and culture of change as well as characteristics related to organization and workforce including authority, rules and procedures, coordination, structure, human resource management, proactivity, adaptivity, and resiliency [9].

D. Agility Frameworks Focusing on Agile Workforce

Within the domain of agile workforce, only one publication could be identified [42]. However, in its content specializing on people without referring to manufacturing or software development, it forms a unique sub-domain of agility. Breu et al. identify ten key attributes of an agile workforce that are grouped into the five capabilities intelligence, competencies, collaboration, culture, and information systems [42].

IV. SYSTEMATIC COMPARISON OF AGILITY FRAMEWORKS

A. Procedure

To achieve a systematic comparison of the frameworks introduced in section III, the following procedure has been applied: First, the core concepts (for instance "customer," "processes," "change," etc.) of the first framework were listed. Then, the core concepts of the next frameworks were assigned to appropriate existing ones or they were added to the list, if they were new. If there were only different labels, but the the same content (for instance "people" vs. "workforce" vs. "teams" vs. "employees") these concepts were treated as one. This step was repeated for every framework. At the end, this resulted in a list of 33 concepts of agility.

As mentioned in section III, the concepts sometimes were detailed into further indicators, attributes, etc. This information was used afterwards to assess whether or not two or more concepts were linked to each other content wise. As a result, a network could be drawn showing the interdependencies between the concepts.

B. Mapping of the frameworks

Figure 1 shows the complete mapping of the analyzed frameworks to the extracted concepts of agility. The numbers on the right side show how often a concept was used over all frameworks. It becomes clear that the concepts and frameworks are very ambigious. In none of the domains is there a more or less stable structure. This indicates that despite the ongoing research, there is still no common understanding of what constitutes agility.

A few of the concepts are prevalent in every domain. Most used was the concept "Workforce/Teams." That seems obvious, because workforce plays an important role when talking about agility. Closely connected are the "Organizational Competences/Abilities," which are also often used and nearly equally distributed over all domains. In addition, two other concepts are interesting: "Cooperation" and "Technology" are among the most used concepts. However, they are both only once named within the domain of agile software development.

Figure 2 summarizes the mapping per domain. The numbers in the cells represent the number of frameworks that use the corresponding concept. Figure 2 reveals that the domain of the agile organization is the most comprehensive one by covering 30 of the 33 identified concepts. But, as mentioned in section III-C, many of the frameworks in this domain utilize structures of agile manufacturing. This is also visible by the fact that every concept of the manufacturing domain is used at least once within the domain of the agile organization.

However, Eshlaghy et al. showed that pure manufacturing related concepts had the least significant effects on agility from an organizational perspective [37] (see section III-C). So, one should ask, if it is useful to simply transfer the concepts of agile manufacturing to the agile organization.

Another interesting fact lies in the domain of the agile workforce. Of course, the number of concepts is the lowest, because only one framework was identified. However, two concepts, namely "Intelligence" and "Collaboration," are only present in this domain. This is surprising, because it could be assumed that these workforce-related concepts are important in every domain.

At this point it becomes clear that the inherent ambiguity makes it difficult to compare the frameworks in more detail. Of course, concepts that occur only once may also be covered by differently named concepts. For instance, "Adaptivity," "Resiliency," "Collaboration," or "Intelligence" may also be covered by "Organizational Culture" or others. Also the fact that for instance "Workforce/Teams" is not used in every framework may be an indicator that it is also covered by other concepts. Hence, as described in section IV-A, the links between the concepts are analyzed further.

C. Interdependencies of agility concepts

After looking into the details of every concept, it was possible to determine connections between them. Some are on higher abstraction levels, so that they include others. In other situations, two concepts overlap in some parts (for instance "Customer" and "Market," or "Education" and "Intelligence"). Yet, they could not be merged, because both also covered unique content. Generally spoken, a connection between two concepts means that they are linked to each other content wise, but without a further semantic specification. After identification of every connection, a network was drawn visualizing the interdependencies. This network was created with the open-source tool Gephi [43] using the layout algorithm ForceAtlas 2 with the concepts as nodes and the connections between them as unweighted edges. The resulting graph is given in figure 3.

The first noticeable issue is the high number of linkages between the single concepts. This again underlines the fact that a common understanding of agility is missing. However, by arranging the network with the layout algorithm mentioned above, some "clusters" that have connections to a lot of other concepts become visible. These are illustrated as colored ellipses in figure 3 and are namely:

- Organizational Culture,
- Workforce,
- Customer,
- Organizational Abilities, and
- Technology.

Comparing the analyzed frameworks with this new structure, it turns out that only seven cover concepts of all five clusters [20], [21], [24], [33], [35], [37], [38]. These seven frameworks are out of the domains of agile manufacturing or the agile organization. In contrast, nine frameworks only cover concepts from three out of the five clusters: four frameworks in the

Concept	Agarwal et al. (2007) [26]	Gunasekaran (1999) [23]	Gunasekaran & Yusuf (2002) [11]	Kisperska-Moron & Świerczek (2009) [27]	Meredith & Francis (2000) [25]	Sharifi & Zhang (1999) [19]	Sharifi et al. (2001) [20]	Vázquez-Bustelo et al. (2007) [22]	Yusuf et al. (1999) [24]	Zhang & Sharifi (2007) [21]	Breu et al. (2001) [42]	Agile Manifesto (2001) [3]	Chan & Thong (2009) [30]	Chow & Cao (2008) [28]	Kettunen (2009) [32]	Misra et al. (2009) [29]	Sarker & Sarker (2009) [31]	Bottani (2010) [38]	Charbonnier-Voirin (2011) [39]	Eshlaghy et al. (2010) [37]	Goldman et al. (1995) [1]	Lin et al. (2006) [35]	Ren et al. (2000) [33]	Sherehiy et al. (2007) [9]	Tallon & Pinsonneault (2011) [40]	Tseng & Lin (2011) [36]	Tsourveloudis & Valavanis (2002) [34]	Zelbst et al. (2011) [41]	Σ
Customer				X						X		X			X				X	X	X			X	X	X			10
Market	X		X						X											X		X	X		X	X	X	X	10
Product			X											X												X		X	4
Quality									X			X		X						X		X	X					X	7
Cooperation	X		X	X	X			X	X	X		X						X	X	X	X	X	X	X	X	X		X	18
Organizational Culture							X		X	X		X			X	X	X		X	X		X		X					11
Structure																			X					X					2
Coordination																	X							X					2
Authority																								X					1
Change									X			X						X	X	X		X	X	X					8
Integration	X								X	X									X			X	X			X			7
Organizational Learning								X					X											X					3
HRM Practices									X											X				X					3
Processes	X				X				X			X		X	X		X									X		X	9
Innovation							X		X																	X			3
Strategy		X			X																							X	3
Workforce / Teams	X	X			X		X		X	X		X	X	X	X	X	X	X	X	X	X	X	X				X		19
Proactivity									X															X					2
Adaptivity																								X					1
Resiliency																								X					1
Org. Abilities / Competences						X	X		X	X	X	X	X			X		X		X		X	X			X		X	14
Intelligence												X																	1
Collaboration												X																	1
Motivation													X							X									2
Welfare									X											X		X	X						4
Education									X											X		X	X						4
Technology		X	X	X	X			X	X	X						X	X			X		X	X		X	X		X	16
Systems		X	X						X																		X		4
Information								X												X						X	X		4
Project														X		X													2
Responsiveness						X	X		X											X						X			5
Flexibility						X	X		X											X						X			5
Quickness						X	X		X											X						X			5

Legend

Focus Agile Manufacturing	Focus Agile Organization / Enterprise	Focus Agile Software Development	Focus Agile Workforce

Fig. 1. Mapping of agility frameworks and agility concepts

domain of agile manufacturing [19], [23], [26], [27], two in the domain of agile software development [28], [32], and three in the domain of the agile organization [36], [39], [40].

There are also differences between which clusters are missing within the frameworks. The cluster that is covered by most frameworks is "Customer." Only three frameworks are missing any concept of this cluster. Five respectively six frameworks do not cover concepts of the clusters "Organizational Abilities" and "Workforce." The remaining two clusters are missing most within the frameworks. Eight do not share concepts of "Organizational Culture" and even ten neglect "Technology."

Interestingly, all but one framework of agile software development are missing the latter one. The only one covering the technology aspect is [31]. The reason may be that in agile software development technologies and systems are basic prerequisites and therefore not seen as factors affecting agility. Also the gaps in "Organizational Abilities" are prevalent in frameworks of the software development domain [28], [31], [32]. There are studies reporting a lot of problems when adopting agile methods beyond the development team (see, for instance, [6]–[8]). The gaps in the analyzed frameworks regarding organizational abilities may be a cause of these problems.

A similar accumulation of gaps can be observed for the cluster "Organizational Culture." Four frameworks within agile manufacturing do not cover concepts of this cluster [11], [20],

	Agile Manufacturing	Agile Workforce	Agile Software Development	Agile Enterprise / Organization
Customer	2	-	2	6
Market	3	-	-	7
Product	1	-	1	2
Quality	1	-	2	4
Cooperation	7	-	1	10
Organizational Culture	2	1	5	3
Structure	-	-	-	2
Coordination	-	-	1	1
Authority	-	-	-	1
Change	1	-	1	6
Integration	3	-	-	4
Organizational Learning	1	-	1	1
HRM Practices	1	-	-	2
Processes	3	-	4	2
Innovation	2	-	-	1
Strategy	2	-	-	1
Workforce / Teams	6	-	6	7
Proactivity	1	-	-	1
Adaptivity	-	-	-	1
Resiliency	-	-	-	1
Org. Abilities / Competences	4	1	3	6
Intelligence	-	1	-	-
Collaboration	-	1	-	-
Motivation	-	-	1	1
Welfare	1	-	-	3
Education	1	-	-	3
Technology	7	1	1	7
Systems	3	-	-	1
Information	1	-	-	3
Project	-	-	2	-
Responsiveness	3	-	-	2
Flexibility	3	-	-	2
Quickness	3	-	-	2

Fig. 2. Number of frameworks regarding agility concepts

[26], [27]. Surprisingly, the other four frameworks missing any concept of organizational culture are to be found in the domain of the agile organization [34], [36], [39], [40]. However, these frameworks cover many more concepts of the clusters "Workforce" and "Organizational Abilities."

Besides, another issue draws attention. The two concepts "Processes" and "Change" have a very central position with many connections to other concepts, but it is difficult to identify new clusters around them. Change itself is often named as one of the key drivers of agility. Processes are an important internal element of every organization. Without changing processes, it will not be possible to change the way of work. Hence, their central position may be an indicator

that many authors consider it relevant within other concepts. However, this issue has to be examined in more detail in future studies.

V. CONCLUSION AND OUTLOOK

This study identified and systematically compared 28 frameworks of agility. These covered the domains of agile manufacturing, agile software development, agile organization, and agile workforce. As the observations in section IV clearly reveal, it is difficult to draw a sharp line between the five identified clusters. Furthermore, there is absolutely no consensus of what really constitutes the construct of agility. The analyzed frameworks are very different regarding their structure and content. Even within the specific domains of agility, the frameworks vary a lot.

This has significant implications for research. Due to the lack of consensus, it is difficult to conduct empirical studies or to build upon existing frameworks. When researchers have to decide between one or another of the available frameworks as the basis for their research, they will most likely miss some concepts of agility, as shown in section IV-C.

Hence, this study may serve as a good starting point to choose one of the frameworks, because it will give the reader an overview of the covered concepts of every framework. It sharpens awareness that the frameworks have gaps and gives the reader the opportunity to close these gaps with parts of other suitable agility frameworks. However, to date there is no empirical study that delivered a comprehensive picture of agility in an exploratory way. So it remains unclear, which concepts of the frameworks are prevalent in practice and how the factors behind agility are composed.

Of course, some of the analyzed publications included exploratory studies, but they all show some limitations. Examples are the works of Kisperska-Moron & Swierczek [27] and Charbonnier-Voirin [39] that both also conducted exploratory factor anaysis. However, both are missing some important concepts (see section IV-C). Apart from that, other authors conducted empirical studies, too, but only used a specific framework that, again, does not cover all identified agility concepts. For example, Bottani [38], who used the framework of Yusuf et al. [24], or Zhang & Sharifi [21], who used their own developed framework [19]–[21].

Due to this limitation, the author of this paper currently is conducting an empirical study about the question of what constitutes an agile enterprise at an organizational level. Hence, the identified agility concepts were merged into a questionnaire with 68 items. The final aim is to conduct a factor analysis to uncover the structure that lies behind the construct of agility. The currently focused target group are both general and IT-related decision makers in companies of the software and IT-service industry. In contrast to the aforementioned studies, it contains all of the concepts given in figure 1. Therefore, it will deliver a comprehensive and, to date, not available view on agility. According to Conboy, who states that "the search for a definitive, all-encompassing concept of agility might not be found simply through an examination of
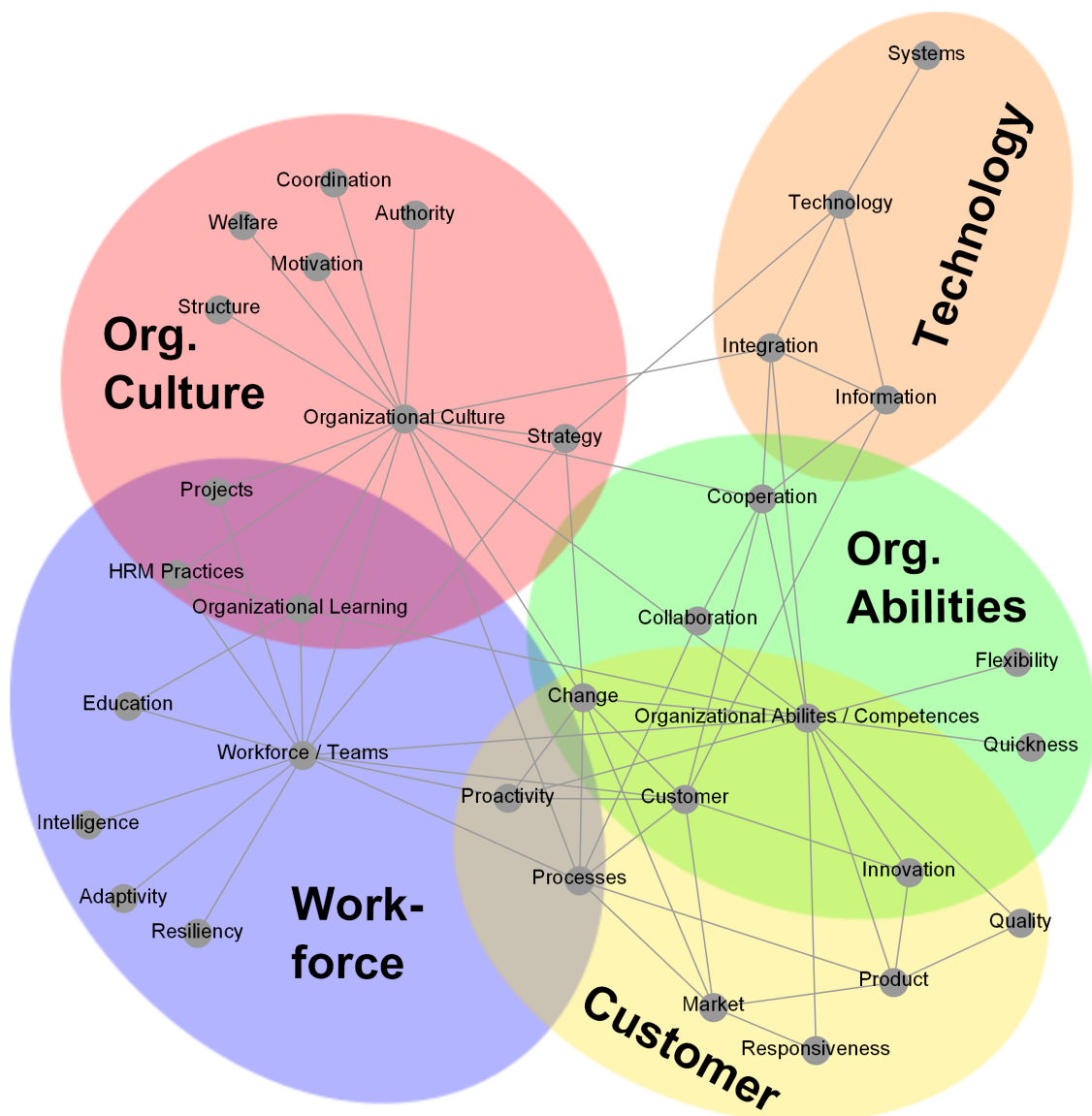
Fig. 3. Interdependencies of agility concepts

agility in other fields" [17, p. 334], this ongoing research will ideally solve the contradictions identified within this paper and contribute to an increasing consensus of what constitutes agility.

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