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Can you help me scale? A Systematic Analysis of Scaling Capabilities of Conversational Agents for Digital Services

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Abstract. Today’s servitized and digitalized society has significant implications for the economic system as value creation increasingly shifts towards digital services. Organizations are increasingly relying on artificial intelligence, which enables them to operate with novel technological artifacts like conversational agents (CA). These human-like AI-driven artifacts open new possibilities and channels for service providers to scale up their business even further and to create a business value or even to make processes more efficient. While we witness the results of that each day, we do not fully understand how such CAs can contribute to scaling up a business. Therefore, we conduct an analysis of service research and popular CAs to determine the status quo and highlight opportunities for scaling services with CAs. We contribute to theory by clarifying the meaning of scalability in combination with CAs and support practitioners by providing an overview about how organizations successfully scale their CAs.

Keywords: Digital Services, Service Scaling, Conversation Agents.

1 Introduction

The continuous digitalization of significantly impacted our society and economical systems including the service industry. Formerly traditional services (i.e., face to face) have become digital to a large extent and this trend is expected to continue – especially in the face of last year’s pandemic crisis that disrupted our everyday lives and forced the industry to adapt their processes and products. Even before the pandemic crisis, the demand for digital services was steadily increasing which is particularly true for services with a tight customer-provider interaction [1, 2]. Indeed, fairly recent surveys from before the pandemic found that about 70 percent of the world GDP is generated by the service industry [3] and 85 percent of companies predict a higher complexity and demand for digital services with customer-provider interactions [4]. The increase in complexity and demand in terms of quality, quantity and intensity of service provisioning presents providers with new challenges that they must address to stay competitive in the future [5]. This ongoing evolution of the economic landscape [6] and

the challenges that come with it are in conflict with the limited amount of time and resources service providers have, including the global players [5]. Particularly interaction heavy service can have a high demand for resources or competence and additionally require individualization or personalization of the service delivery that demanding users expect [7, 8]. Today, users not only expect simple service delivery, but an overall service experience including personalization or individualization and more intense delivery like on-demand services and recommendations for what content or product to consume [9]. This characteristic marks a double-edged sword. On the one hand, there are limitations and challenges that service providers must face but on the other hand, if dealt with properly, there is a significant potential to scale up the service business [10].

Here is where conversational agents (CA) can prove as valuable tool in interaction heavy services. In general, CAs can be defined as a subspecies of smart personal assistants [11] that use AI and natural language to interact with human beings [12, 13]. In doing so, CAs create a human-like interaction during their interaction delivering a more natural and human-like experience to users [14]. This enables CAs to interact in human-like social manner (e.g., by using social cues) like a human service provider would [15, 16]. Moreover, CAs can be configured to deliver personalized services for a wide range of customers that can be served at the same time with equal competence, which can be important factors for high quality scalable services [7, 17]. Thus, from a service perspective, CAs can fulfill tasks, provide assistance and deliver services to users [18] without many hinderances that traditional service delivery would have to face. Studies show that such a human-agent interaction in a service application can positively transform the provider-relationship towards a more beneficial status [19, 20]. Moreover, some even consider the usage of CAs for service delivery as a key component of the future service industry in the face of increasing demands and the fact that both human and natural resources are limited [21, 22]. However, current research and the general understanding of service scaling is still lacking in many areas [23], particularly with regard to CAs. While both research on service scaling and CAs on their own offer a wide and diverse knowledge base, what do we really know about cases where both research streams are required? Therefore, we ask the following research questions (RQ):

RQ1: What is the status quo of service research in the context of scalability?

RQ2: What service scaling factors are reflected by CAs used by leading organizations?

To answer our RQs, we first conduct a systematic literature analysis of service research in the context of scalability of digital services. Second, we analyze the currently most popular implementations of CAs based on the Forbes 100 list of most valuable brands in terms of their ability to scale up digital services and match our results from literature against the results from our analysis on CAs. Finally, we then provide implications for research and practice based on our findings

2 Related Research

2.1 Scalability of Digital Services

To provide clarity, we first want to establish a shared definition of what scaling or scalability in terms of digital services is, because depending on the target audience, there may be a plethora of different understandings and definitions. Depending on the business mode, business to business (B2B) or business to customer (B2C), definitions and understandings may also differ. Generally speaking, digital services can be broadly defined as an application or process that aims to create value for users (i.e., private customers, B2C) by using the service or enabling other elements of an organization to create further value using a service (i.e., commercial customers, B2B; e.g., using an API service to create additional value for own services) [24, 25]. “Scaling” or “scaling-up”, is typically used in two different contexts [26]. First, scaling can describe the effectiveness of a product or service, where scaling-up implies a raw positive change in the quantity or quality of value delivery, regardless of its relationship to other factors. Second, scaling can also refer to the efficiency of a product or service, i.e., the relationship between the reaped benefits and the invested resources. To summarize scalability of digital services for our research, it can be defined as a min-max business approach to minimize investments while maximizing revenue by adapting the business model or leveraging technology. Nevertheless, scalability does not only refer to technical capabilities but rather encompasses the entirety of the digital service business including its delivery and presentation (e.g., through a CA).

Anyhow, in research scaling-up can be and usually is defined as a process that increases the productivity of an organization with the goal to adapt to changing circumstances and overcome economic challenges in order to transition it’s business to a higher level [27, 28]. From a socio-economic perspective the term of scaling-up translates to sharing something that is effective (e.g., practices or ideas) including a larger group of individuals (i.e., users, customers or contributors) who can experience the benefits of a product and service and consequently share it with their peers [29]. From a purely economic perspective scaling-up services translates into refining the already existing value propositions and revenue streams or finding new channels to reach new groups of customers e.g., through the usage of CAs. Here, it can be critical to find a scalable solution without an elevated level of risk (i.e., rejection from customers). To be able to do this, service providers have to be flexible and adaptable in both their service logic and technical capabilities so that they can meet changing or new requirements. This is where CAs can prove useful to support digital service delivery and scale up the business as they can provide the necessary flexibility for time, place and ideally platform independent service provisioning. Thus, helping service providers to scale up their digital service business.

2.2 The Role of Conversational Agents for Digital Services

Smart technical object is an umbrella term for technical artifacts that make use of AI to deliver value and can range from simple chatbots to more advanced CAs (e.g., Alexa)

[11]. The general idea behind these artifacts is a technology-based approach to provide humans with assistance that is available around the clock and fulfills the needs of the person [13, 30]. Therein CAs can provide assistance in task support, collaboration or domain specific support [31]. To provide assistance or services to users CAs use either voice or more commonly text to interact with people [32]. Because of their characteristics, such as human-like interaction, ability to use natural language and their availability [12, 33], CAs can act as semi-autonomous surrogates that replace humans during service provision (e.g., when no personal is available) [34]. By taking up such a surrogate role, CAs can function as social actors [15]. To be able to act in such a social role and in a human-like fashion, CAs can make use of features like social cues that mimic true human behavior [16]. Thus, making the human-agent interactions and service provisioning more natural feeling and human-like. This in return enables service providers to use CAs to facilitate interactions with people (e.g., consumers) to create value [35]. In this regard, CAs can for example identify, localize, connect and compute relevant information during an interaction with the user and in doing to provide a semi-autonomous service to fulfill the users' needs [22, 36]. These characteristics of CAs are important for the role they can play in digital services and service scaling. Since scalability translates to flexibility and adapting to changing requirements [37, 38], CAs can offer a potential solution. CAs can be created modular so that they can quickly be adapted to the needs of service providers. Furthermore, CAs can be viewed as a technology-based approach to outsource high-cost tasks (i.e., customer service) to an agent and thus provide a customizable self-service to consumers [39]. Another way to scaling up a business is to scale up the user base [40]. Due to their availability and ability to easily reach out to many existing and possible new customers CAs can effectively adapt the service capacity [41] of the service provider, thus also scaling the providers infrastructure and connection to users [42]. Overall, the role of CAs for digital services and scaling services is an enabling technology [42]. However, service providers may adapt their value creation processes and business logic depending on their current business model [23, 39].

3 Methodology

In order to answer our RQs we first conduct a systematic literature analysis and follow the recommendations given by Webster and Watson (2002) [43] as well as Vom Brocke et al. (2015) [44]. An overview of our literature search process can be seen in Figure 1.

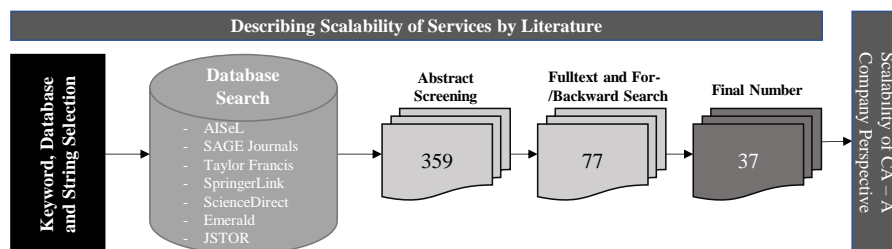


Figure 1. Literature Search Process

To identify relevant literature, we first defined relevant keywords from which we constructed our search terms. Here, we focused on the domain of service research and included the keywords “scale”, “scaling” and “scalability” as well as “service”, “servitization” and “as a service” to address the target topic of scalable services. Furthermore, we additionally included terms like “taxonomy”, “factors” and “requirements” to account for potentially existing literature about scaling factors, scaling requirements and service taxonomies in the service domain that could be relevant for our research. If such literature exists, we will compare the results of our research and present implications according to our results and existing works.

- (scale OR scaling OR scalability) AND (service OR servitization OR “as a service”)
- (scale OR scaling OR scalability) AND (taxonomy OR factors OR requirements)

We included AISEL, SAGE Journals, Taylor Francis, SpringerLink, ScienceDirect, Emerald and JSTOR to cover a wide range of different important outlets. After going through all databases, we found a total of 359 articles to be potentially relevant. We then used these papers as foundation for the following full text analysis and forward/backward search. We then selected those articles that discussed service research in the context of scaling and its characteristics. Each study had to have scaling of services at its core, studies that only used either topic as context were excluded. Highly technical studies that focused on just the technical aspects of scaling (i.e., scaling the information technology) were also excluded. This is also the reason why we did not include ACM or IEEEExplore into our search as these databases focus more on technical, computational and engineering aspects which is not our main interest. However, we do acknowledge the importance of these factors and will discuss them in the following sections.

The next step in our research process is to analyze the most popular CAs in the context of service scalability. We use the *world’s most valuable brands*¹ Forbes top 100 list as starting point to determine what CAs we include in our research. We then analyze all CAs of the list that we can access by either literature, white papers or the CA application itself. Our goal here was to compare and map commonalities of service scaling attributes from our systematic literature analysis. Further, we also highlight the difference between our findings from literature and the implementations in practice. We will then provide an overview of the potential strengths, weaknesses, opportunities and threats that should be considered when using CAs to scale up digital services. Based on these findings we then also provide propositions for scalable services and an assessment of these based on our findings.

¹ <https://www.forbes.com/the-worlds-most-valuable-brands/>

4 Results

4.1 Status Quo of Service Scaling in Research

As a first step, we describe the application domains of the service scaling research we analyzed. The results can be found in Table 1.

Author(s)	Research Application Domain							Service Research Topic					
	Transportation	Education	Health	BizFin	IT & IS	Management	GenAcademic	Automation	Servitization	Platformization	Strategy/Models	Innovation	Scalability
Ahmad/Andras [45]					X			X					X
Arantes [46]		X							X	X	X		
Barret et al. [47]							X					X	
Barros et al. [48]					X						X		X
Bharadwaj et al. [49]						X	X			X	X		
Böhmman et al. [50]					X		X	X					X
Böhmman et al. [28]					X	X		X					X
Di Pietro et al. [41]						X					X	X	
Engelhardt et al. [51]						X					X	X	
Gupta/Basu [52]			X						X	X			
Hein et al. [53]				X						X			X
Hein et al. [54]				X						X			X
Hinz/Bernhardt [55]					X						X		
Jewell et al. [56]						X					X		X
Jin Zhang et al. [23]						X	X						X
Huang/Rust [57]					X						X		
Huang/Henfridsson [40]						X						X	X
Kastalli/Van Looy [5]							X		X		X	X	
Kern et al. [58]						X					X		
Kleinschmidt et al. [10]							X					X	X
Kuula et al. [59]				X									X
Labes et al. [60]						X					X		X
Lacity/Reynolds [61]						X							X
Lewis et al. [42]						X					X		X
Lusch/Nambisan [62]							X					X	X
Mohan et al. [63]				X									X
Peters et al. [64]						X							X
Raja et al. [65]						X			X		X		
Scheuerle/Schmitz [66]						X					X		X
Sjödín et al. [67]							X		X				
Sjödín et al. [68]							X				X	X	
Täuscher/Abdelkafi [39]						X					X		X
Turetken et al. [69]	X										X	X	
Vorisek [70]					X						X		X
Wang et al. [71]				X					X				
Werth et al. [72]					X				X				
Woudstra et al. [73]					X						X		
Sum (n = 37)	1	1	1	5	9	15	9	3	7	5	19	9	20

Table 1. Service and Scalability Research Results

Here we find that the majority of research is focused on a total of four major application domains. First, business and finance (BizFin), where we define business as retail, sales, marketing and related topics in a more traditional sense and finance as any financial service including but not exclusive to transaction, banking, credit or payment services. The second major application domain is management. In this regard we define management as any topic that deals managerial implications and outcomes of service scaling specifically, regardless of context. The third major domain we find is what we call the general and academic domain (GenAcademic). This domain includes research that is either targeted towards academics or presented as a general-purpose research article without any further domain of application or context. The fourth domain focuses on information technology (IT) and information systems (IS). Additionally, to these three major application domains we found several more that are in small number, including transportation, education (e.g., e-learning, training) and (e-)health.

Alongside the application domains we also analyzed the research topics of the articles. Here we could identify six distinct topics. First, automation which refers to automating tasks or services using technology. Second, servitization which deals with turning traditional non-service tasks into services or adapting existing services in order to make them scale better. One example here are micro-services where services are partitioned and tailored to fractions that can be recombined to novel services. Third, platformization, which deals with platforms and ecosystems of services and how to scale them. Fourth, strategy and models that also include processes on how to scale up services. Fifth, innovation which mainly refers to service innovation. Sixth, scalability itself as an academic research topic which include reviews (e.g., meta reviews). It is noteworthy that the majority of service research topics that deal with scaling services are concerned with topics around strategies, models and processes of scaling as well as the phenomenon of scalability itself. Moreover, we can see that innovation seems to play a significant role for scaling up digital services (i.e., service innovation).

4.2 Scaling Factors

As next step we derived service scaling factors (SFF) for digital services (see Table 2). The first SSF we found is **service automation** (n=4). This factor targets specifically the full or partial automation of service delivery. In the context of CAs this would mean to outsource task partially or fully to CAs. Here, we found one research article discussing this option (see [50]). Next, we found **service design** (n=9) as second SSF. This factor focuses on the design of the service and its delivery, however this does not only relate to actual (visual) design, but instead service design also includes the engineering of the service itself. A good example is the design and engineering of an educational service with user engagement, where the user base is actively engaged in the service (see [46]). Accordingly, the third SSF we found is **user engagement** (n=10). This SSF includes all activities or mechanisms that engage the user base, including customer outreach (e.g., social media), using network effects or reaching out to the user in any other form or shape. This is where we see a major opportunity for the usage of CAs to scale up services since they can engage users through multiple channels,

independent of time or place. Researchers already acknowledge this possibility, however overall research seems scarce (e.g., [50]).

Author(s)	Service Scaling Factors										CAs mentioned or used
	Service Automation	Service Design	User Engagement	Value Creation	Individualization	Flexibility	Standardization	Technology	Speed and Timing	Novelty/Uniqueness	
Ahmad/Andras [45]	X										
Arantes [46]		X	X								
Barret et al. [47]								X			
Barros et al. [48]								X			Yes
Bharadwaj et al. [49]			X	X					X		
Böhmman et al. [50]	X		X								Yes
Böhmman et al. [28]	X				X						
Di Pietro et al. [41]				X							
Engelhardt et al. [51]							X				
Gupta/Basu [52]			X	X							
Hein et al. [53]				X			X	X			
Hein et al. [54]				X			X				
Hinz/Bernhardt [55]				X							
Jewell et al. [56]		X					X				
Jin Zhang et al. [23]		X	X				X				
Huang/Rust [57]					X		X	X			
Huang/Henfridsson [40]			X						X	X	
Kastalli/Van Looy [5]		X		X						X	
Kern et al. [58]			X			X					
Kleinschmidt et al. [10]										X	
Kuula et al. [59]				X		X	X				
Labes et al. [60]						X			X		
Lacity/Reynolds [61]						X		X	X		
Lewis et al. [42]					X			X			
Lusch/Nambisan [62]										X	
Mohan et al. [63]			X		X	X	X				
Peters et al. [64]			X	X							
Raja et al. [65]		X					X				
Scheuerle/Schmitz [66]			X								
Sjödin et al. [67]		X			X	X	X				
Sjödin et al. [68]	X	X								X	
Täuscher/Abdelkafi [39]		X		X			X				
Turetken et al. [69]										X	
Vorisek [70]								X			
Wang et al. [71]							X				
Werth et al. [72]		X		X				X			
Woudstra et al. [73]								X			
Sum (n = 37)	4	9	10	11	5	6	12	9	4	6	2

Table 2. Scaling Factors for Digital Services

As fourth SSF we found **value creation** (n=11). This SSF included mechanisms like value co-creation, crowd-working, focus on monetarization of services and any other activity that has value creation as primary goal. In terms of scaling up this factor focuses on maximizing the value of services with different ways of value creation. For example,

a CA could include a service the user can be offered that helps the user with purchases through the CA. The fifth SFF is **individualization** (n=5). This SFF focuses on breaking down services to tailor personalized or individualized services to each customer. From a production point of view this translates to service delivery with batch size of one. This may seem counterintuitive when thinking about scaling up services as it implies more work, however, if the service provisioning can be automated and outsourced to smart systems, like CAs, providers may be able to circumvent this issue. As sixth SFF we **found flexibility** (n=6) of services and service provisioning which means service providers must be able to adapt to ever changing circumstances and requirements in order to scale up their services. Static, nonelastic and inflexible services or providers may not be able to fully adapt to changing customer needs. **Standardization** (n=12) is the seventh SFF we found. This SFF focuses entirely on standardizing components related to the service or the service itself. The idea behind this is to reduce the required effort and simplify processes and services. **Technology** (n=9) is another relevant SFF we found. This SFF sets the technological systems and requirements as main goal to scale up services. With regard to CAs this SFF would directly translate into the technical aspects of implementing a conversational service agent to scale up service businesses. One example here are platforms or frameworks that are offered as a service to create and deploy CAs. The ninth SFF we could find is **speed and timing** (n=4) which means the required time of a service provider to get a (new) service to the market, the time the service takes to be fully delivered and the timing for when exactly the service is delivered in a situation. Here we see another potential application for CAs as they effectively exist without time since they can be accessed at any time. **Novelty and uniqueness** (n=6) as last SFF translates to the degree of innovation of a service. Novel and unique services may put the provider in the role of a first mover and allow the provider to effectively dominate the market with a strong monopoly.

4.3 How Conversational Agents Can Scale Up Services

Our first finding is that most CAs are based on either a framework or existing CAs which essentially makes these agents a derivative of other agents. Therefore, we filtered the list of agents for these derivatives and only used them to support our results on their parent CAs, thus effectively excluding all derivatives from our results. Next, many CAs on that list are built for one and only one specific task. Followingly, we will describe such specialized CAs in digital services according to their domain (e.g., banking, customer service). However, we chose to exclude these agents from our list because they are too specific to be assessed by our general SFF. The final list of CAs can be found in Table 3.

First, financial service providers generally use a common type of CA that is tailored to do fulfill one task or one specific set of tasks for the users during service provision. Most commonly we find that these specialized CAs focus on services around online banking, including but not limited to transactions, financial information and accounting. Examples of these CAs include the Bank of America, Citi Bank and PayPal. In terms of scaling potential these agents reduce the load on the service providers

resources, including banking personnel. In essence, these service providers use the core assets of CAs to scale up their business models (e.g., automation). This is not reflected in our literature results as research in the BizFin sector is focused on platformization besides scalability, potentially highlighting a gap between research and practice. Next, internet service providers and mobile service providers (e.g., AT&T, Verizon, Telekom/T-Mobile) also use a specialized type of CAs similar to their counterparts in the banking sector with some differences. Here, we could not even find a single research article for this domain, underpinning the potential gap. Overall, these CAs can help to scale in a comparable way the CAs in the BizFin sector scale.

CAs	Service Scaling Factors										B2B or B2B Application
	Service Automation	Service Design	User Engagement	Value Creation	Individualization	Flexibility	Standardization	Technology	Speed & Timing	Novelty/Uniqueness ^{SS}	
Apple Business Chat	X		X	X	X	X	X	X			B2B
Apple Siri	X		X	X			X	X			B2C
Google Assistant	X		X	X			X	X	X		B2C
Google Dialogflow	X			X			X	X	(X)	(X)	B2B
Microsoft Bot Framework	X		X		X	X	X	X	X	X	B2B
Microsoft Cortana							X				B2C
Amazon Lex	X			X	X	X	X	X			B2B
Amazon Alexa	X	X	X	X			X	X	X	X	B2C
Chatfuel (Facebook)				X			X				B2C
Bixby (Samsung)	X			X							B2C
Toyota Assistant (LINE)	X	X	X	X							B2C
Oracle Intelligent Bots	X					X	X	X			B2B
MasterCard Bot	X	X		X			X	X	X	X	B2B
eBay Shop Bot	X		X	X							B2C
Sum (n = 37)	11	3	7	10	3	4	10	8	4	3	-

Table 3. Scaling Factors for Digital Services

The exception to this trend is Mastercard. The CA of Mastercard is based on their own platform which Mastercard offers to banks and other financial service providers as a B2B service. In other words, Mastercard has become a *scaling as a service* provider to other financial service providers helping them scale their businesses. This puts Mastercard in a novel and unique position on the B2B market, effectively leveraging the SSF of uniqueness and novelty which translates directly to scaling up by innovation.

The most interesting CAs however are the ones offered by the major players, namely Apple, Google, Microsoft and Amazon. In contrast to domain specific CAs these CAs are not restricted to a specific set of tasks. These CAs fulfill the role of a true personal assistant that covers a wide range of tasks and services. For example, Amazon Alexa is an overall very advanced piece of technology that engages the user, automates the users tasks and creates value for Amazon by selling Alexa related products (e.g., Amazon Dot or Echo) as well as integrating features that allow the user to make purchases directly via Alexa. From a business perspective Amazon is effectively the first provider who managed to market such a CA service, thus putting the organization in a dominant position by speed and timing, paired with an at the time unique offering.

Considering purely B2B offerings, Microsoft Bot Framework is probably one of the most popular and widespread platforms that are currently being used to create CAs, including Microsoft's own CAs. Making this platform basically available to everyone, Microsoft introduced a well standardized and CA framework to the market that allows for flexible and personalizable CAs. In doing so, Microsoft effectively scales its business as users are more or less tied to the Microsoft ecosystem and related services (e.g., Microsoft Azure) if they chose to use Microsoft Bot Framework, thus allowing Microsoft to scale its service business independently. In contrast to Microsoft Bot Framework, Google Dialogflow is not as easily accessible and was only bought by Google instead being developed from scratch. Considering its potential for scalability however, it offers similar capabilities but hidden behind a paywall, potentially giving Microsoft Bot Framework the edge.

5 Discussion

To scale services, it is worth to first consider the domain and context of an organization. Our results demonstrate both are highly relevant to the characteristics of scaling and the potential CA solutions for scaling up services. There are different distinct types of CAs in use that share some domain specific characteristics. For example, CAs in the telecommunications industry are used for more simple tasks like customer support or internal usage. Similar, business chatbots (e.g., McDonalds, Starbucks) are used as simplistic text-based chatbot without specialized design features is sufficient.

Looking at smart CAs (e.g., Alexa, Siri), scaling is getting more complex, because they are more advanced and do not focus on specific tasks as they are designed as a jack of all trades tool – a conversational Swiss army knife. These bots offer different ways to scale up services, such as possibility of developing plugins, using APIs or other interfaces for service provisioning. This enables service providers across all service sectors to take already existing CAs or legacy systems and develop a specific interface, add-on or extension. This allows for a more efficient service scaling by using standardized and often automated tools. Such an approach could also prove as design-independent solution that relies on existing CA designs and simply extends their functionality. Moreover, most big players like Microsoft offer easily accessible platforms as a service for B2B customers to develop their own scalable CA solutions for their services. These platform providers essentially become “scalability as a service” (ScalaAS) providers with this approach. What this means is that, from a service provider point of view, CAs themselves can be offered as a service to scale up businesses of B2B customers. Thus, enabling these B2B ScalaAS providers to offer specialized and individually tailored CAs via a standardized interface (e.g., API) to their customers. While the CA itself would be standardized, because of the nature of API applications the design could still be adapted to the context like simplistic concepts for simple business or highly specialized domain or context specific concepts. The most expressive example of such a ScalaAS approach is Mastercard. With the lack of specialized CAs for banking and specifically credit card services, Mastercard recognized the opportunity and became a first mover ScalaAS provider in the FinBiz

domain. Mastercard could become the go to template for offering ScalAAS based on CAs as they offer a novel and unique selling point that is highly valuable to the industry.

Overall, we think that this kind of ScalAAS approach will increase over the next years as many service providers, especially smaller players, may lack the resources and knowledge to come up with an appropriate solution on their own. By taking up this ScalAAS proposition, smaller players could then focus on the domain or application specific design and implementation instead dealing with the potentially overwhelming task of developing such CAs on their own. Moreover, with this approach, companies like Mastercard can effectively scale up businesses without risking their own position by getting entangled in unnecessary competition. In the case of credit card providers there is no direct competition between the service providers like Bank of America, Citi Bank or PayPal as all these providers are restricted to basically Mastercard or Visa if they want to offer credit card services.

6 Conclusion

With our research we provide an overview on the status quo of service scaling research, highlight the relevant application domains, research topics, and derived our service scaling factors. Referring to our RQ1, we point out that current research streams focus on management, models and strategies in terms of scalability, leaving out the other potentially relevant areas, thus creating a significant research gap. In research scaling is so far not discussed in detail, while in practice we can observe the majority of successful companies using CAs. This apparent rift between academic research and real-world practical applications should be studied more closely. Regarding RQ2 we found that CAs themselves depend on their application domain and context, although we also found generalized solutions with high potential for scaling digital services. The most noticeable example here includes Amazon Alexa for private users, Microsoft Bot Framework as general B2B CA framework and Mastercards ScalAAS solution. In this context we also highlighted the opportunity to create scalability as a service business models and gave potential implications for future development of CAs for scalability as well as ScalAAS. From an academic point of view, research is needed discussing how scaling factors work (i.e., explaining the underlying mechanisms) and how these translate into appropriate designs which could present a promising research stream for design science research approaches. From a practitioners point of view we predict that due to the development of the recent years and our research results service CAs will continue to gain momentum and facilitate novel business opportunities like ScalAAS.

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