Cloud Service Quality Model: A Cloud Service Quality Model based on Customer and Provider Perceptions for Cloud Service Mediation

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Abstract: The field of cloud service selection tries to support customers in selecting cloud services based on QoS attributes. For considering the right, QoS attributes it is necessary to respect the customers and the providers' perception. This can be made through a Service Quality Model. Thus, this paper introduces a Cloud Service Quality Model based on a Systematic Literature Review and user interviews as well as providers perceptions.

1 INTRODUCTION

Over the last ten years, the globalization procedure of business structures has been formed in part through outsourcing. Outsourcing is a kind of substitution of internal departments and tasks to third-party vendors who are typically specialized in certain businesses. Contracts are regulating supplies and services and the period of validity between the outsourcing company and the third-party vendor (Norwood et al., 2006). Cloud computing can be seen as a stage of IT outsourcing. The exclusion of internal IT departments including data centers and complex application landscapes can be seen as its main drivers.

Soon, companies will need devices connected to the internet via broadband network access. Other required services like infrastructure, platforms, and applications are placed off-premise by cloud service providers and used on demand. Clients of such cloud services have no control or influence on the cloud service providers' IT infrastructure because they just use the offered service as agreed in SLAs.

Today, companies and organizations planning to use cloud services are facing a huge number of different possible cloud solutions. Because of the immense number of possibilities, it is hard to orient oneself and find a suitable solution and offer. Cloud Brokering companies are offering the provision of optimal service to its customers. This time-consuming process stands in contrast to the cloud paradigms of fast provision and on-demand self-service of a service. Thus, an automated brokerage approach could leverage the advantages of cloud computing and increase companies' agility. However, before a company can realize these advantages, a thorough evaluation of the needs, possible cloud usage scenarios (what type of service and deployment models will meet), a suitable partner (who can understand and implement my needs) should be made in advance. Such a holistic analysis, however, requires a high use of resources, which often cannot be guaranteed, especially in the case of small and medium-sized enterprises, primarily due to a lack of know-how. There are already tools for carrying out internal evaluation and procedural models for the selection of a suitable partner (provider). However, full consideration can usually be provided only with the inclusion of consulting services, which in turn do not pay off especially for small and medium-sized companies.

2 RELATED WORK

With the growth of cloud service offerings, it has become increasingly difficult for cloud service customers to decide which provider can fulfill their requirements for quality cloud services (Dastjerdi et al., 2011; Zheng et al., 2013). For example, each cloud service provider might offer similar services at different prices and performance levels with different sets of features (Wibowo and Deng, 2016). However, while one provider might be cheaper for storage services, they may be more expensive for

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computation. Given the diversity of cloud service offerings, it is an essential challenge for organizations to discover suitable cloud providers who can satisfy their requirements. There may be trade-offs between different user requirements fulfilled by different cloud service providers. As a result, it is not sufficient to discover multiple cloud services. It is important to determine the most suitable cloud service through an evaluation for a specific situation (Garg et al., 2013; Whaiduzzaman et al., 2014; Wibowo and Deng, 2016). The evaluation of available cloud services concerning a set of specific criteria is complex (Bryman and Bell, 2015) due to the presence of the multi-dimensional nature of the evaluation process and the presence of vagueness of the decision-making process (Arpaci et al, 2015).

Kritikos and Plexousakis relate the basic web service discovery and cope with the topic of requirements for web services discovery (Kritikos and Plexousakis, 2009). The core of this process is matchmaking, which enlists the relevant services in the registry. Afterward, the selection is based on the ranking approach. First, various services are filtered and selected as per the user's preference who selects the options they want to use. This service can be very likely using Categorization of Super Matches, exact matches, partially Matches and service that fails. In this approach, the quality criteria are defined through literature, based on OWL Q, and consist of availability, reliability, safety, and security are considered as criteria. However, according to Hema Priya and Chandramathi, (Hema Priya and Chandramathi, 2014), these criteria cannot be considered all together, which reduces the opportunities for restrictions. They use numeric QoS parameters along with their measurement units and methods in OWL-Q. The criteria reflect users' needs and are not considered, and the approach is only tested prototypically.

A Delphi study conducted by Lang (Lang et al., 2016) defines the most critical criteria for cloud provider selection. Through conducting workshops and panels with industry experts from the cloud computing area, the authors provided a list of important selection criteria. This set of criteria consists of several attributes: certification, contract, deployment model, flexibility, functionality, geolocation of service, integration, legal compliance, monitoring, support, a test of the solution, and transparency of activities. Using all these criteria can provide a comprehensive limitation for a cloud service selection. Nevertheless, they do not offer measures for their criteria nor a matchmaking method to prove the approach. This diminishes the applicability for users as criteria support, tests of solution and transparency of activities are not easy to measure, and thus high expertise in each area is necessary.

A Description Logic-based method proposed by Dastjerdi supports the QoS-aware discovery of IaaS web-services and the automatic deployment of appliances on selected services through a service (Dastjerdi et al., 2011). The proposed service matchmaking process has two parts – ontologies and a matchmaking algorithm. The goal of service matching and five matching operations are first specified, such as the concepts of exact matching, plugin matching, non-matching, etc.

In most cases, the project context provides the language used in the service description. If the language of the service description is an ontology, the matchmaker service is based on ontology fundamentals. In other cases, the service matchmakers use different mathematical methods. However, service matchmakers also differ in other factors: the target service requester, the supported service layer, their definition for the service matchmaking process, the types of requirements, and according to the quality and model used.

Table I examines 20 different service selection projects. Seven of the selected projects focus on the selection of web-services, whereas the other projects focus on Infrastructure or Software Layers. As functional requirements are underlying on the systems input/output, most research work is based on non-functional aspects. Thus, the matchmaking methods focuses on the matching of non-functional requirements, mainly QoS aspects.

In the existing approaches, the service description and quality models stem mostly from the web services context. Some QoS properties that are specific to cloud services are not considered, for example, scalability, elasticity and different price models. Moreover, some matching approaches do not provide concrete examples for the service properties targeted by their service matcher. Considering a quality model, the approaches are beside (Repschlaeger et al., 2012; Wang et al., 2014) linguistic terms most often SMI and OWL-Q. Whereas OWL-Q appears mostly for web-service matching, SMI and CFR are used for the selection of cloud services. As three roles are involved in service selection, the cloud service customer (CSC), the cloud service provider (CSP) and the Selector (S) getting an in-depth look into the research projects, Table 2 shows that 20 projects are focusing on the same roles. Somu (Somu et al., 2017) include the CSP role, beside the CSC as an essential part for building

Table 1: Service Selection Review I.

Research Work	Service Layer	Matchmaking and Selection Context	Type of requirements	Service Quality Model
Garg et al. (2011)	IaaS	Cloud Servives	non-functional	SMI
Liu et al. (2004)	web-services	Semantic web-services	non-functional	WSDL, OWL-S
Sukumar et al. (2012)	web-services	Web-services from IBM UDDI Registries	non-functional	WSDL, OWL-S
Kritikos et al. (2009)	web-services	QoS parameters including parameters and methods from OWL-Q	non-functional	OWL-Q, OWL-S
Wibowo et al. (2016)	SaaS	Cloud Services	non-functional	-
Whaiduzzaman et al. (2014)	IaaS	Cloud services	functional	-
Kang et al. (2011a)	web-services, IaaS	Cloud Services	functional	-
Buyya et al. (2009)	IaaS, SaaS	Cloud services	non-functional	SMI
Lang et al. (2016)	IaaS; PaaS, SaaS	Cloud services	non-functional	-
Sundareswaran et al. (2012)	IaaS	Cloud Infrastructure Servuces	non-functional	-
Dastjerdi et al. (2011)	web-services	Web-services from IBM UDDI Registries	non-functional	-
Wang (2009)	IaaS, SaaS	Service Markeptplace	non-functional	linguistic terms
Sun et al. (2014)	IaaS	SaaS	non-functional	-
Zheng et al. (2013)	SaaS	SaaS	functional	-
Sathya et al. (2010)	web-services	Web-services	non-functional	WSMO
Shetty et al. (2015)	SaaS	Cloud Services Ranking	non-functional	-
Siegel et al. (2012a)	IaaS, PaaS, SaaS	Cloud Services	non-functional	SMI
Mobedpour et al. (2013)	-	Cloud Service Ranking	non-functional	-
Somu et al. (2017)	IaaS, PaaS, SaaS	Cloud Service Ranking	non-functional	SMI
Raeppschlaeger et al. (2012)	IaaS	Cloud Service Evaluation	functional, non functional	CFR

trust with the customer based on the SMI criteria. All other projects consider the matchmaking and the cloud service customer role but excluding the cloud service provider or for some instances, consider it only as the provider of datasets. The sources of the considered requirements of each work are examined: literature is the dominant source of deriving the used criteria. Through its Delphi study, Lang (Lang et al., 2016) conducted panels and interviews with industry (provider) experts to define their criteria.

II As the cloud service consumer plays a primary role in the cloud service selection; only two projects partially consider the needed criteria from an end-users point of view. In both cases (Lang et al., 2016; Siegel and Perdue, 2012b) the end-user focus is represented through the industry experts. All other projects are not considering any other end-user derived quality criteria. It can be summarized that the (i) existing quality models support the selection of web-services. They can be used for cloud service selection too, but they do not reflect different aspects and characteristics of cloud computing (e.g., elasticity). Only SMI, CFR and OWL-Q are partially in favor of the cloud. (ii) The dominantly used non-functional requirements are derived from academic literature or only from interviews. There exists no synthesis of both approaches. (iii) Service selection consists of the parts customer (CSC), matchmaker (MM) and provider (CSP). However, the focus is on CSC and MM, CSPs are neglected. Thus, this work aims to come up with a Cloud Quality Model, which reflects cloud characteristics to make cloud services with similar functional requirements comparable. The QM considers input from literature, as well as from cloud services consumers and cloud service providers. Furthermore, based on the comparability of the cloud services, the service selection offers also the opportunity to include cloud service providers to benchmark their own services.

3 RESEARCH APPROACH

In the design-science paradigm, knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact. As this research aims to create a Mediation Broker for evaluating and finding appropriate cloud services and thus, creates an artifact, it follows a design-science research strategy. Regarding the Design Science Research Cycle (Hevner and Chatterjee, 2010) the application domain is Cloud Service Selection. Based on a literature review the relevance of the research is examined. The Design Cycle consists of two elements to develop and evaluate. Thus, firstly the development of the cloud evaluation criteria, the cloud service measures, as well as the Mediation Broker prototypes, took place. Followed by the evaluation through a survey and expert interview for the evaluation criteria and the cloud service measures and the benchmarking of the prototypes. There has been extensive and ongoing research in the field of cloud computing services. As cloud computing is considered a service, there are expectations of users which need to be reflected in offers being provided by the providers (Alabool and Mahmood, 2013; Garg et al., 2011). In the current context, the cloud computing services being offered are not clearly measurable, and often it does not match up with the expectations of the users, which creates an environment where a potential user does not get the confidence in the offering (Buyya, Garg, and Calheiros, 2011; Garg et al., 2011; Sun et al., 2014). It then becomes essential that the providers can define their offering, which helps in mapping the expectations of the users with the perceived value of the service provided. Based on these outlines, the following main and sub-research questions can be derived:

Table 2: Service Selection Review.

Research Work	Considered Roles CSP/ CSC /S	Source of considered requirements	End user focused	Matchmaking / Selection Approach
Garg et al. (2012)	CSC, S	literature	no	AHP
Liu et al. (2004)	CSC, S	literature	no	Semantic reasoning
Sukumar et al. (2012)	CSC, S	literature	no	Peano space filling curve
Kritikos et al. (2009)	CSC, S	literature	no	Mixed integer programing
Wibowo et al. (2016)	CSC, S	literature	no	TOPSIS & Fuzzy
Whaiduzzaman et al. (2014)	CSC, S	literature	no	AHP
Kang et al. (2011a)	CSC, S	literature	no	Semantic reasoning
Buyya et al. (2009)	CSC, S	literature	no	AHP
Lang et al. (2016)	CSC, S	Panel, interviews	partially	-
Sundareswaran et al. (2012)	CSC, S	literature	no	Greedy-Opitmization
Dastjerdi et al. (2011)	CSC, S	literature	no	Semantic reasoning
Wang (2009)	CSC, S	user perception	no	Fuzzy Logic
Sun et al. (2014)	CSC, S	literature	no	AHP
Zheng et al. (2013)	CSC, S	literature	no	Greedy-Opitmization
Sathya et al. (2010)	CSC, S	literature	no	
Shetty et al. (2015)	CSC, S	literature	no	AHP
Siegel et al. (2012a)	CSC, S	interviews	partially	-
Mobedpour et al. (2013)	CSC, S	literature	no	Ranking similarity calculation
Somu et al. (2017)	CSC / CSP	literature	no	
Raeppschlaeger et al. (2012)	CSC, S	literature, offer analyses	no	-

RQ 1: What is Service Quality; RQ 1.1: What is Service Quality regarding cloud services

RQ 2: What are Service Quality Models?; RQ 2.1: Are these SQMs designed for cloud services?; RQ 2.2: What are attributes from the user's perspective needs?; RQ 2.3: What are attributes from the provider's perspective needs?

4 SERVICE QUALITY MODEL

Kotler and Armstrong (Kotler and Armstrong, 1999) define service as, "an act of performance that one can offer to another that is essentially intangible and does not result in the ownership of anything. Its production may or may not be tied to a physical product." It is conformance of requirements. "Quality is the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs" (Kotler and Armstrong, 1999).

The quality of service measures how much of the service provided meets the customers' expectations. To measure the quality of intangible services, researchers usually use the term perceived service quality. Perceived service quality is the result of comparing perceptions about the service delivery process and the actual outcome of the service (Grönroos, 1984; Wirtz and Lovelock, 2016).

Wang (Wang, 2014) proposed a service quality management model and service quality evaluation for maintenance service for cloud computing, a method based on the SERVQUAL. Using the same SERVQUAL model, the authors redefined some quality characteristics, as they argued that "SERVQUAL is universally applied in the field of service and cannot reflect the characteristics of maintenance service for cloud computing." Based on the quality management model, this paper proposed a quality evaluation model using some research methods, such as the Delphi method. Furthermore, the paper introduced the application of quality evaluation by considering an actual case. The essence of this paper was to help providers improve their quality management and show them how to deal with challenges of maintenance service of cloud computing. This model helps to "solve the problem underlying in the evaluation of service quality and inseminate theories and methods for evaluating service quality." This paper is more focused on the provision of quality from the provider's side, but no real direct focus on the user's aspect.

Domínguez-Mayo (Domínguez-Mayo et al., 2014) proposed a framework and tool to manage cloud computing service quality. ISO 9000 includes eight quality management principles, on which to base an efficient, effective and adaptable quality management system.

They are applicable throughout industry, commerce and service sectors: "Customer focus, leadership, involving people, process approach, system approach, continual improvement, factual decision-making, mutually beneficial supplier relationships, customer requirements, organizations requirement." The paper proposed a framework for managing Cloud Computing service quality between clients and providers. QuEF (Quality Evaluation Framework) was developed to manage Model-Driven Web Development methodologies quality but later extended to cover the quality management of other areas like cloud computing. Over time, it has been improved with the following phases - Strategy Phase, design phase transition phase, operational phase, quality continuous improvement phase. The purpose of the QuEF is to bring about continuous automatic improvement by generating checklists, documentation, thereby automatically evaluating, and planning in order to improve quality with minimal effort and time. They did SLR (Systematic Literature Review), in order to identify gaps in quality management of Cloud computing, and as per their study, there are no found works focused on frameworks, which ensure quality management in cloud computing service between clients and providers. The framework further offers a set of tools to manage quality effectively and efficiently. Further, more tools help to manage cloud computing quality between clients and providers by means of e-SCM (Capability Maturity Model for service) (Domínguez-Mayo et al., 2015. The article focuses on service quality, but characteristics of cloud computing services are not listed, which is also one of the important aspects of service quality. Zheng, Martin, Brohman, and Da Xu (Zheng et al., 2016) created a quality model named CLOUDQUAL for cloud services. This model is based on SERVQUAL and e-service quality model. It demonstrates quality dimensions and metrics for general cloud services. CLOUDQUAL contains six quality dimensions, namely, “usability, availability, reliability, responsiveness, security, and elasticity.” This paper is focused on validating service quality, and the scope is limited towards only six dimensions. Moreover, CLOUDQUAL does not highlight the main characteristics of cloud computing services, like pay-per-use, interoperability, etc. A service is defined by its characteristics and service quality is based on the characteristics. In this research paper, the scope of the characteristics is limited and a holistic view, on the basis of which service quality can be defined are not covered in this paper. Zheng (Zheng et al., 2013) proposed a cloud service quality evaluation system based on five dimensions: “rapport, responsiveness, reliability, flexibility, security” and extended SaaS-Qual. The index system proposed external metrics with the application of SLA in order to measure users’ requirement of service quality for PaaS and SaaS.

The approaches recommended and proposed by researchers have mainly been for service selection, but most of them have not focused on service quality, required for cloud service users and providers. Another aspect related to service quality is non-functional attributes like accountability, reliability, etc., but none of the literature provides a holistic view of related non-functional attributes of cloud computing services. The approaches proposed to cover only one kind of service, or some of them are useful for either cloud users, providers or intermediaries. The service quality researches have been done in other areas of services such as catering, airline, etc., using the famous SERVQUAL model, but the same has not been extensively used in cloud computing services. There is a need to design classification based on non-functional attributes of cloud computing services, a scheme, which can provide qualitative as well as a quantitative view for providers as well as users of cloud computing services and measures to evaluate the same.

5 CLOUD SERVICE QUALITY MODEL

To define a set of quality criteria, to reflect literature, customer and providers perception, a systematic literature review based on 46 academic papers, which have been published in the time frame between 2009 and 2018 was conducted. Out of these papers seven projects were published between 2009 and 2014, 39 sources were published from 2015 – 2018. Alabool and Mahmood reflect in its meta-study already 40 papers considering the most cited criteria from 2009 to 2012 (Alabool and Mahmood, 2013). Their findings are also included in this research. In the vein of the search resources, the ScienceDirect (Elsevier), SpringerLink, ACM Digital Library, and IEEE Xplore have been considered as the main digital libraries for cloud computing (Lang et al. 2016; Sun et al. 2014) for performing search processes. Google Scholar search engine has been used to find some of the archival journals, technical reports, and conference proceedings.

The keywords that have been used to perform a search over the digital libraries have been selected based on evaluation theory activities (Lopez, 2000) that covers the concepts that represent the cloud evaluation and selection methods domain such as Cloud Service Evaluation, Cloud Selection Criteria or Factors, Attributes or Functional Requirements or Non-Functional Requirements. Based on these findings in a second step interviews are conducted to receive in-depth feedback to the quality attributes (QAs) and its components elaborated within this work. A short introduction into the general topic of Cloud Service Selection, Service Quality Models and the derived QAs gives the interviewees an overview. The interviews are held through Skype calls and face-to-face in German and are semi-structured. Semi-structured interviews are based on a semi-structured interview guide, which is a schematic presentation of questions or topics and needs to be explored by the interviewer (DiCicco-Bloom and Crabtree, 2006).

This kind of interview offers the advantages of providing rich data, different ways of data analysis, to gain more insights about relational aspects and to the interviewee’s perceptions about the QAs.

The first interviewee is a Service Manager for a central infrastructure provider and ensures the flow of information and money between banks, traders, merchants, investors and service providers worldwide. The interviewee has worked for Payment and Card Services, Finance and Insurance, Healthcare, and Transport industries for more than ten years and gained experiences in various specialist fields such as Project & Quality Management, Agile Service & Product Development, Business Intelligence, Requirements & Service Management. The interviewee is a certified cloud expert. The interviewee is involved in projects for evaluating cloud services for its company but also in delivering cloud services to their customers and thus represents the provider's point of view.

The second interviewee is an experienced Service Manager with a demonstrated history of working in the insurance industry. Strong support professional skilled in Configuration Management, Incident Management, Service Delivery, Problem Management, ITIL, and Business Process Improvement. Currently, she is working for a Swiss IT-provider for banking services.

The third interviewee is Lead Software Engineer at an international financial software development company. Besides his strong skills in developing cloud services, he gained in his former roles also a deep insight into IT-Service Management, especially in the field of Cloud Sourcing for banking institutes. He represents the customer point of view.

Forth interviewee is Program Test Manager at an international IT consulting company. She has a strong background of quality testing for IT services and thus experiences in quality and metrics. She represents, in general, the customer's point of view but gives also general feedback on QAs aspects. Most of the attributes are recommended as suitable for Quality Attributes by the interviewees. An exception is the usability attributed, which is declared as hard to measure by two interviewees. Additionally, the questionnaire shows that the derived attributes are at least suitable for a Cloud Service Quality Model. Thus, except the attribute usability, the other attributes are considered as Quality Attributes.

Besides these QAs, the interviews and survey show that there is a need for additional attributes.

They see the attributes Compliance and Geo-Location as important criteria while considering the service quality. Customizing, Reputation, Costs per

Category	Attribute	Suitable for Selection	Not suitable for Selection	n	% suitability	Important	Not important
Financials	Costs	21		21	100,0	7	
	Additional Costs	14	6	20	70,0		5
	Costs per user	13	8	21	61,9		3
Security	Data integrity	12	7	19	63,2		1
	Data confidentiality	17	4	21	81,0		
	Security Management System	15	6	21	71,4		2
Availability	Availability	21		21	100,0	7	
Performance	Data throughput	11	8	19	57,9		
	Performance Management System	12	7	19	63,2		
Flexibility	Scalability	19	2	21	90,5	2	
	Elasticity	12	6	18	66,7	1	3
Interoperability	Interoperability	12	8	20	60,0		1
	Portability	14	6	20	70,0		
Customization	Customization	12	7	19	63,2		2
Trust	Reputation	14	5	19	73,7		4
	Compliance	17	2	19	89,5		2
	Reliability	12	5	17	70,6		
	Assurance	10	7	17	58,8		
	Active customers	13	8	21	61,9		5
	Certifications	19	2	21	90,5		
Support	Support duration	16	1	17	94,1	1	1
	Incidents	10	11	21	47,6		4
Location	Geo-Location	19	1	20	95,0	5	1

Figure 1: Quality Attributes Validation Results.

Costumer and additional Costs are attributes, which must be considered from the customers and providers point of view. Based on these findings the categories and QAs for a Cloud Service Quality Model are derived in Fig.1. For defining the Cloud Service Quality Model as a next step, the identified attributes now are collocated to the different categories. Therefore, the reviewed attributes from the SLR are used, and additionally, the additional attributes form the interviews and survey. As the additional attributes consist of 50% attributes which are only named once, only the attributes with at least 25 % frequency (three nominations) are considered. In total these attributes are, excluding the attributes which are now a category: cost, additional costs, costs per user, availability, scalability, elasticity, interoperability, portability, customizing, reputation, compliance, reliability, assurance, number of active users, certificates, geo-location. As all attributes assigned to one category, the category of Security, Performance, and Support to not inherited any attributes. As mentioned before these groups can have different attributes and can be generalized through different attributes (e.g., Security and Privacy). Within the interviews that for example for the category of Support metric can be the number of incidents per year and the average support time. Derived from these metrics the attributes are Support duration and Incidents. For the category of Security, the triad of confidentiality, integrity, and availability can be considered. As availability reflects an own category, the preferred attributes are Data confidentiality and integrity. The Trusted Cloud Label (Verein Kompetenznetzwerk Trusted Cloud eV, 2016) and the Service Measurement Index (Siegel and Perdue, 2012b) are selection models that can be used to measure cloud services according to given criteria. Both are defining also the Security Management System (if in place or not) as an important criterion. Thus, these three attributes are considered as attributes for the Security category.

As the metrices and measures are broadly discussed in the literature already, existing metrics and measures can be considered. For example, the measurements of the Trusted Cloud label and SMI are considered as guidelines (where applicable) because both tend to develop a comprehensive criteria catalog which covers the defined evaluation criteria within this work. Furthermore, both approaches are ensuring that the criteria are suitable to request and analyzing them in the context of self-service and self-test from the provider (Siegel and Perdue, 2012b; Verein Kompetenznetzwerk Trusted Cloud eV, 2016) which is in the alignment of this work.

6 VALIDATION

For validating the findings, a panel discussion with 21 cloud experts shows the suitability of the QAs for cloud service selection.

The validation shows that there is a space for additional attributes for cloud service quality besides the traditional literature derived attributes. The attributes derived from providers and customers view have in general suitability or acceptance over more than 60% even if attributes like Additional Costs and Active users are also seen as not important. This discrepancy lies in the drawback of this work, which is the limited number of interviews held with customers and users. Additionally, more interviews could have led also to additional attributes which now are not considered.

7 CONCLUSION

Literature and a survey have shown that the process of finding a suitable cloud service is not trivial. Small businesses often do not have the knowledge to define their requirements and find a suitable cloud service. As literature describes, there are already many research initiatives that have been or are still in progress. However, they usually focus on a specific domain, such as matching, service selection, service description, or are applicable only to a service or deployment model. As the concept of service quality is still not widely prevalent in the cloud computing services, this study investigates on the service quality of cloud services, which can be used for cloud service selection. Thus, following a design science research approach, a list of the most common cited cloud service quality attributes has been identified. Based on these literature derived attributes, the cloud customer's and cloud provider's perception was collected. Within interviews and a questionnaire, the topic has been discussed and further attributes were identified. In a next step, the attributes supported the creation of according categories. Furthermore, simple metrics have been identified, where applicable, to derive a Cloud Service Quality Model.

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