Improving Service Quality using DEMO

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Abstract: Nowadays services account for the biggest part of the world economy, and is a sector that is leading the value creation in organizations. Nevertheless, services have quality gaps that reduce customers' satisfaction and therefore revenues. Of all five service quality gaps, number four states there is a difference between the service delivery and the communication which involves that delivery. In this research we proposed an approach based on Enterprise Ontology (EO) theory to mitigate this gap. Our proposal also includes the development of a software system, based on Design & Engineering Methodology for Organizations (DEMO) and Service Level Agreements (SLA) that promotes an interactive marketing between service provider and customer, the DEMO Engine. We used the Design Science Research Methodology (DSRM) to develop this research. To demonstrate our proposal we applied the DEMO Engine in a Portuguese Public Administration Institute using a web-based prototype. The evaluation was made with feedback collected from eight practitioners from different sectors, and also by evaluating the demonstration at the Portuguese Public Administration Institute.

Keywords: Enterprise Ontology, DEMO, Service Quality, Service Level Agreement, Communications' Gap.

1 Introduction

The services industry has grown exponentially in the last decades. Throughout the years the service sector has become the number one driver to obtain value in the economy [1]. 63.4% of the world's GDP is related to services and 42.4% of world's population work in the service sector [1, 2]. Also, the top 20 of the most successful companies are directly or indirectly related to services [3].

With this impact on the world's economy, it is imperative to ensure that each and every service is done accordingly and satisfies customers' expectations. Achieving customer satisfaction will be dependent on service quality, and this quality will be the major competitive advantage towards other services [4].

Several frameworks and tools were developed to ensure principles that could guarantee service quality like Information Technology Infrastructure Library (ITIL) and Capability Maturity Model Integration (CMMI). Nevertheless, ITIL and CMMI are

based upon best practices which are not necessarily the best options due to their lack of theoretical background on implementation options.

In this research we used the Enterprise Ontology (EO) and the corresponding methodology Design & Engineering Methodology for Organizations (DEMO) [5] as a mean to reduce the service quality gaps and, thus, achieve higher levels of service quality. Our proposal is based on previous works done in the area of Service Level Agreements (SLA) definition [6, 7, 8] that tackled the first three gaps. Now, we continue the research by tackling also the gap number four of service quality. This gap is a result of the difference between the service produced and the service communicated to the customers. This way our solution tackles all the gaps identified by Parasuraman [9]. At first sight EO might not seem related to services but another research in the field brought these two areas closer, since they defined the service concept using EO terms [10].

To validate this research we demonstrated our proposal in a Portuguese Public Administration Institute, the Portuguese Institute of Construction and Real Estate (INCI). We then evaluated the impact of the application of the system and we to collected feedback from 8 practitioners that granted us with valuable, precise and concise feedback.

In this research we used Design Science Research Methodology (DSRM) [11, 12].

The paper is structured as follows. We start by describing the service quality gaps problem (Section 2). Then, we provide a brief overview of the literature on the problem area (Section 3). Afterwards, we introduce the DEMO-based solution to specify the services quality (Section 4). In Section 5, we describe the demonstration of our proposal at INCI. In Section 6, we explain the evaluation process, which uses data from the demonstration, and specify the lessons learned. Finally, we present our conclusions (Section 7).

2 Problem

Service quality is closely related to increased market share and return of investment, but quality is difficult to be measured and to be assured [9]. If organizations cannot measure quality, they cannot know if they already provide services with quality or what is needed to be done to improve.

A. Parasuraman in 1985, proposed a model of the five gaps of service quality [9]. **Gap 1** is the difference between the customer's service expectation and the provider's perception of that expectation. **Gap 2** is the service specification as used by the service provider differs from the expected service as perceived by the customer. **Gap 3** is the difference between the specified service and the delivery of that service. **Gap 4** is the gap between the service delivery and the external communication to costumers of that service. **Gap 5** is the global difference between the customers' expected service and the perceived service they receive.

Our main focus, gap number 4, can be caused by sales overpromising, ineffective management of customers' expectations or inadequate horizontal communication. We

only focus on gap number 4 since the previous research that supports our work [8, 7, 6, 13] has already tackled gaps 1, 2 and 3.

There are several solutions that contributed to closing the gaps, but none solved the problem completely. Most of these solutions are function-oriented solutions and these are not sufficient because, they lack of an appropriate, deep understanding of enterprises and enterprises networks. Functional knowledge is appropriate and sufficient for the use and control of enterprises, but in order to change them, knowledge about their construction and operation is needed [14].

We can summarize our research problem on the following research question: ***Does a system that registers all the coordination acts involved in the service exchange diminishes the gap between the service delivery and the related communication?***

Despite the result of this research question seem trivial and there is no research that actually proves the result. Therefore, answering this question, appears as a pertinent and innovative research. Notice that we only intend to tackle with this system the communications with the customer inside the gap number four.

3 Related Work

This section starts by describing the service and quality definitions we will be using in this document. Afterwards, we present the current solutions for specifying service quality and explains why these solutions do not solve the gaps problem [15]. Lastly, we present the theory that is used as the base of this research, EO and some works done with mixing EO with services, such as SLA.

3.1 Service & Quality Definition

ITIL's service is a means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs or risks [16]. CMMI's service is a product that is intangible and non-storable [17]. The Service Marketing says a service is any product that has four essential characteristics: intangibility, perishability, inseparability and heterogeneity. In [10] a service is define as a universal pattern of coordination (c-acts) and production acts (p-acts), performed by the executor of a transaction for the benefit of its initiator, in the order as stated in the standard of a transaction. When implemented it has the ability to get to know the coordination facts produced by the initiator, and to make available to the initiator the coordination facts produced by itself. We will use this definition of service in this research due to its theoretical background.

We use the quality definition proposed by Parasuraman. Quality is defined as the difference between customer expectations regarding a service to be received and perceptions of the service being received [9].

3.2 Service Level Management (SLM)

First looking at SLM, SLM acts as an interface between the customer and the service provider. The objective of SLM is to create a cycle of agreeing, monitoring, reporting and improving the current levels of service quality [18]. SLM comprises three stages: Definition of Service Level Requirements (SLR); Definition of Service Level Targets (SLT); Definition of Service Level Agreements (SLA).

Nevertheless, SLM presents a lack of a strong conceptual foundation caused by SLM being derived from best practices from all over the world. As a consequence of this flaw, we cannot guarantee a consistency in the results from various SLM instances.

3.3 Web-based Solutions

Web Service Based Solutions are based on using Web Service Description Language (WSDL) and Web Service Flow Language (WSFL) to specify and manage services and their quality. Because of the web tunnel vision, important attributes, such as penalty or price, are missing from both WSDL and WSFL.

However, another framework called Web Services Level Agreement (WSLA) was proposed [19]. This framework has four different types of parameters, business metrics, SLA parameters, composite metrics and resource metrics that ensure the ability to focus on business services. Despite these new additions to web service based solutions, they all lack a strong conceptual foundation to support their options.

3.4 Enterprise Ontology

Enterprise Ontology [5] is based on four axioms and the organization theorem. The operation axiom states that the operation of an enterprise is constituted by the activities of actor roles that are elementary chunks of authority and responsibility, fulfilled by subjects, performed by two kinds of acts: production acts and coordination acts.

The transaction axiom states that coordination acts are performed as steps in universal patterns, involving two actor roles (initiator and executer), aimed at achieving a particular result and with three phases: the order phase (O-phase), the execution phase (E-phase), and the result phase (R-phase).

The composition axiom establishes the relationships between transactions. This axiom states that every transaction is either a) enclosed in another transaction, b) is a customer transaction of another transaction, or c) is a self-activation transaction.

The distinction axiom states there are three distinct human abilities playing a role in the operation of actors, called performa, informa, and forma. An ontological act (performa) is an act in which new original things are brought about. An infological act is an act in which one is not concerned about the form but, instead, about the content of the information. Datalogical acts are related to copying, storing, and transmitting data.

3.5 Generic Service Specification Framework (GSSF)

The Generic Service Specification Framework (GSSF) enables the definition of human or Information Technology (IT) services and creates an understandable notation for the providers and customers [15]. GSSF facilitates the search for services that meet their needs and let them know how to deal with a certain service.

In GSSF a service as four main areas of concern, Service Executor, Service Production, Service Coordination and Contract Options.

3.6 DEMO-based SLAs

SLA using EO terms is the proposition that two actors (initiator and executor) build together in the O-phase of any ontological transaction. This proposition is clarified by informative acts [8]. DEMO-based SLAs provides a relation from which we can retrieve SLA information from the EO Models. The correlation is possible, because: first the EO theory describes, very formally, the interactions between customer and provider; and second, SLM acts as the interface between customer and provider.

The work on DEMO-based SLAs also granted us with a match between the service quality gaps and the EO transaction pattern: Gap 4 is caused by a difference between the production fact, the state fact and the accept fact.

4 Proposal

This section corresponds to the design and development step of DSRM. Our proposal is to bring together knowledge from DEMO [5], GSSF [15] and DEMO-based SLAs [8] in order to reduce gap number four of service quality. To reduce the communication's gap, we propose to implement the following features: **Service Intangibility** – To create a simple service catalogue that can be understood by the customer using both GSSF and DEMO-based SLAs; **Management of Service Promises** – EO actor roles ensure that employees have a promise jurisdiction. Customers perceive the "DEMO brand" and know what to expect of the service; **Management of Customer Expectations** – The arguments of the DEMO-based SLA ensure that customers know what requesting. The initiator/executor clarifies which actors are participating in the service. All acts are recorded, giving transparency to all the service delivery process; **Customer Education** – Both the customer and the provider responsibilities are stated in the DEMO-based SLA. Customers can add custom services/SLAs to the provider's catalogue to better match their needs. Additionally, the EO transaction patterns are always the same so the customer always knows about the existing choices; **Internal Marketing Communications** – All services, DEMO-based SLAs and acts are visible to all employees to increase communication inside the organization.

With these solutions in our system, we wanted to endow our proposal of characteristics in order to be able to reduce gap number four and answer our research question. The next section explains how we tried to validate this premise.

5 Demonstration

This section corresponds to the demonstration phase of DSRM. We demonstrate the proposal at INCI with a software prototype that was developed to support the proposal in practice.

5.1 Prototype

The prototype was developed using the SCRUM methodology [20]. The prototype includes the following features: **Service Catalog Management** – create, read, update and delete services and SLAs. The services can be specified using the GSSF [15] and the SLAs using the DEMO-based SLAs [8]. This management is done in collaboration with the providers and the clients; **Organization Resources Management** – connection between an organization's resources and the actor roles of a DEMO model; **Service execution management –** execution of services according to the EO transaction patterns; **Notification Management** – configure the notifications by user, having the opportunity to select the frequency of the e-mails. When the SLAs have performance targets to be fulfilled, calendar appointments are included in the e-mails; **Information exchange management –** every act and every service execution is registered and visible to the interested actors.

During the prototype development, the prototype was used by two researchers to request services between them. These two researchers provided weekly feedback that was included in the prototype features.

5.2 Public Institute Demonstration

This demonstration occurred in the Portuguese Institute of Construction and Real Estate (INCI), a public regulator entity of the construction and real estate sectors. INCI employs 127 workers and has jurisdiction over all the Portuguese territory. INCI had a problem of managing their services inside the organization, there is no formal communication (only e-mail) when requesting services and that prejudices the communication in the organization. In INCI we used our system to create, manage and execute services related to the infrastructure management of INCI's headquarters. These services comprise, the cleaning of the building, maintenance of facilities and office equipment, etc.

For this demonstration we had three different employees registered in our web-based prototype. These employees acted as both customers and providers of the services, exchanging service executions between them.

In the week we deployed the system there were three services created, one related to receiving support on the DEMO Engine and two with the management of infrastructures. Figure 1 represents the workflow of the execution of one of these services.

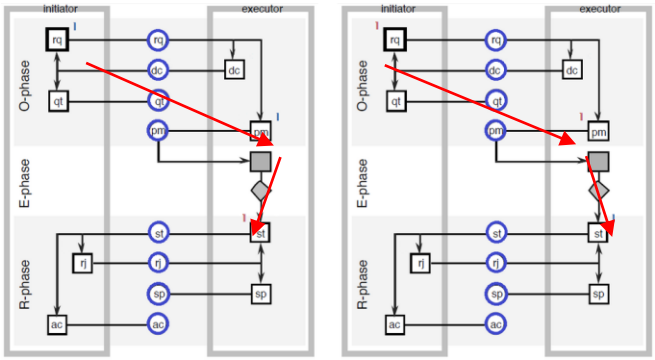

Fig. 1. Service Execution at INCI (left - customer view, right – provider view).

As we can see in the picture at INCI the service executions performed always followed the basic transaction pattern and no negative options were chosen. After an initial request from the customer, the provider always answered with a promise and afterwards a state. To conclude the execution the customer accepted the service.

6 Evaluation

This section corresponds to the evaluation phase of DSRM. To do so we used the framework proposed by [21], feedback collect in interviews with practitioners and the evaluation of the demonstration at INCI.

6.1 Evaluation Strategy

According to [21], a design science research must identify what is actually evaluated, how is evaluated and when the evaluation takes place. **What is actually evaluated?** The artifact evaluated is the proposed system elaborated in Section 4 (a design product), the results achieved by creating a prototype and the feedback collected among practitioners. **How is it evaluated?** The feedback given from practitioners proves valuable to evaluate our system. We also identified an organization that would benefit from implementing our proposal. This represents a naturalistic evaluation since the research was conducted using a real artifact, the DEMO Engine, in a real-world organization. **When was it evaluated?** The evaluation was made ex post, that is, after the design product was developed.

We can summary this evaluation as naturalistic and ex post, with the process being interviews with practitioners and the criteria the tackling of the 5 communication challenges.

6.2 Interviews' Feedback

We interviewed 8 practitioners from different organizations. Interviews started with an explanation of the research problem and a service execution example to elaborate on the DEMO Engine. Then, the interviewees were asked to answer a questionnaire with 12 questions divided by 4 sections: Service Intangibility, Management of Service Promises, Management of Customer Expectations, Customer Education and Internal Marketing Communications. In each question the interviewees had to answer from 1 to 5, comparing DEMO Engine with systems used at their companies.

First, we went to a Portuguese software company. We interviewed two employees, the Principal Software Engineer, and a Software Engineer. While they could see the benefits of the DEMO Engine, adaptation to a software company context proved very difficult. Also, the overheads created by the constant register of coordination acts might not seem adequate in an agile environment.

We also evaluated the DEMO Engine with a Portuguese Telecommunication company. We reached out for a Service Desk Support Engineer working there. In the feedback collected in this interview, Service Intangibility and Management of Service Promises challenges were given high classifications. Nonetheless, by trying to make a more generic system, we do not give the providers and customers enough information about the world state before and during the execution of the service. Also, regarding Customer Education, there is a clear notion of what, when and how the customer should act but the why (the context) is missing and would be important to add to the system.

We also analyzed a Portuguese Cloud Services Provider by interviewing the CEO, the Outsourcing Services Director and the ServiceDesk Manager. The major downfall we received was the integrations needed between real-world systems and the DEMO Engine. On the other hand, a great contribution of this research is the reduction of e-mail usage to communicate inside a company. The c-facts ensure that both the customer and the provider know what is happening in the service and cannot claim ignorance of some fact. Lastly, the Customer Education was the communication challenge that was better addressed using the DEMO Engine.

Communication Challenge	Average
Service Intangibility	3.8
Management of Service Promises	4
Management of Customer Expectations	4.1
Customer Education	3
Internal Marketing Communications	4.2

Table 1. DEMO Engine Questionnaire Results.

Table 1 shows the results of the qualitative evaluation did with practitioners. We can see that Internal Marketing Communications is the most addressed challenge and Customer Education the least.

6.3 INCI

At INCI, we gathered feedback that shows us that the DEMO Engine is better when using on fast-execution services, this is services whose execution time (the creation of the p-fact) is reduced. This derives from EO not being focused on the execution aspects of a transaction, but rather on the coordination aspects.

Another important contribution of this evaluation was the importance of the SLA attributes in a service execution. Being a public institution, INCI does not charges employees for their services, nevertheless the penalty and bonus can be used with other benefits in order to ensure the service is properly done. Related to these attributes is also the Response date and the Resolution date that can be used as important tools when controlling various executions and to see which services are behind schedule. Furthermore, the notification on every c-fact created (by e-mail) was considered important so that the parts involved in a service exchange know what is happening.

By analyzing the use of the DEMO Engine at INCI we can see that, with few knowledge on EO, DEMO, GSSF or DEMO-based SLA the employees could use and configure the DEMO Engine to their needs. In particular, the record keeping of every communication act was appreciated to create responsibilities for services and people that executes them.

7 Conclusion

This research is focused on reducing the difference between the expectations and perceptions of customers when requesting services. We take off from work done tackling other service quality gaps [7, 6, 13, 8] and focus on the difference between the service delivery and the communication of that delivery, the gap number 4 of service quality.

Current solutions, ITIL, CMMI, and others, fail when providing consistent and sustained solutions. They also fail to focus on the customer needs and achieving completeness in their solutions. Our approach being based on EO, DEMO and GSSF mitigates the lack of sustain in the decisions and also ensures the consistency, completeness, coherency and conciseness between different solutions.

We evaluated the impact of using the communication patterns of EO to close gap number 4. For that purpose, we developed a system that enables transparency, readiness and easiness in communication between the customer and the service provider. Our system is implemented in a software prototype that enables an overall better service exchange between the customer and the provider. In order to specify the contract of each service, we use also SLA knowledge. The last step of DSRM, communication, is being achieved through scientific publications aimed at the practitioners and researchers within the service science area.

As future work, we intend to create integrations between the DEMO Engine and real-world systems (CRM, ERP, ticketing systems, etc.) to provide more useful information (like service context) and to enable chain of service executions between employees of the same company, or even between companies.

References

1. Central Intelligence Agency, The World Factbook, Washington, DC: Central Intelligence Agency, 2011.
2. International Monetary Fund, "World Economic Outlook Database," [Online]. Available: http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx. [Accessed December 2012].
3. Forbes, "The Forbes Global 2000," [Online]. Available: http://www.forbes.com/global2000/list/. [Accessed December 2012].
4. J. S. Henry Chesbrough, "A Research Manifesto for Services Science," *Communications of the ACM*, vol. 49, no. 7, pp. 35-40, 2006.
5. J. Dietz, Enterprise Ontology - Theory and Methodology, Delft: Springer, 2006.
6. M. Almeida, "Specifying Customers Expectations using DEMO-based SLAs," MSc Thesis - Instituto Superior Técnico, Lisbon, 2012.
7. J. Ferreira, "Implementação de Gestão de Serviços de Informática," MSc Thesis - Instituto Superior Técnico, Lisbon, 2010.
8. C. Mendes and M. Mira da Silva, "DEMO-Based Service Level Agreements," *Exploring Services Science*, vol. 103, pp. 227-242, 2012.
9. A. Parasuraman, V. Zeithaml and L. Berry, A Conceptual Model of Service Quality and its Implication for Future Research, Journal of Marketing, 1985.
10. A. Albani, L. Terlouw, G. Hardjosumarto and J. Dietz, "Enterprise Ontology Based Service Definition," *4th International Workshop on Value Modelling and Business, Amesterdam, The Netherlands*, 2009.
11. A. Hevner, S. T. March, J. Park and S. Ram, Design Science in Information Systems Research, MIS Quarterly, 2004.
12. K. e. a. Peffers, A Design Science Research Methodology for Information Systems Research, Journal of Management Information Systems, M. E. Sharpe, 2008.
13. C. Mendes, "A Method Based on DEMO for Managing Service Quality," PhD Thesis, Instituto Superior Técnico, Lisbon, 2013.
14. A. Albani and J. Dietz, Enterprise ontology based development of information systems, International Journal of Internet and Enterprise Management, Vol.7, No.1, pp.41-63, 2011.
15. L. Terlouw and A. Albani, An Enterprise Ontology-Based Approach to Service Specification, Transactions on Services Computing, IEEE Computer Society, 2011.
16. J. Bon, "Foundations of IT Service Management based on ITIL v3," Van Haren Publishing, 2007.
17. CMMI Product Team, *CMMI for Services, Version 1.3 (CMU/SEI-2010-TR-034)*, Software Engineering Institute, Carnegie Mellon University, 2010.
18. L. Lewis and P. Ray, "Service Level Management: Definition, Architecture and Research Challenges," *Global Telecommunications Conference*, pp. 1974-1979, 1999.
19. A. Keller and H. Ludwig, "The WSLA Framework: Specifying and Monitoring Service Level Agreements for Web Services," *Journal of Network and Systems Management*, vol. 11, pp. 57-81, 2003.
20. K. Schwaber, "Proceedings of the Workshop on Business Object Design and Implementation at the 10th Annual Conference on Object-Oriented Programming Systems, Languages, and Applications," 1995.
21. J. Pries-Heje, R. Baskerville and J. Venable, Strategies for Design Science Research Evaluation, 16th European Conference on Information Systems (ECIS), pp. 255-266, 2004.