An e-Government Project Case Study
Interview based DEMO Axioms' Benefits Validation

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Abstract: This paper has as its background, a practical enterprise change project where the Design and Engineering Methodology for Organizations (DEMO) was used in the initial stage as to give a neutral and concise but comprehensive view of the organization of a local government administration in the process of implementing an e-government project. The main contribution presented in this paper is an interview based qualitative validation of some of DEMO's axioms and claimed benefits – something that, to our knowledge has never been done up to now. Namely, we were able to validate DEMO's qualities of conciseness and comprehensiveness brought about by the transaction and distinction axioms and also the stability of its ontological models which are, by nature, highly abstracted from the human and technological means that implement and operate an organization.

1 INTRODUCTION

This paper has as its background a practical enterprise change project where the Design and Engineering Methodology for Organizations (DEMO) was used in the initial stage with the purpose to give a neutral and concise but comprehensive view of the organization of a local government administration having, itself, the purpose to implement an e-government project. This administration is present in a small island of a European archipelago that is dependent on a main island that has its own autonomous regional government. We chose to apply DEMO in the project, due to its growing use in projects in Europe and purported qualities and benefits given by the method. Such qualities highly fitted our work context which had the need to harness the huge complexity of the government administration target of the project. The fact that, as far as we are aware of, no academic study (qualitative or quantitative) has ever been made to validate DEMO's qualities gave rise to the idea of realizing research presented in this paper. This small local government administration – from now on referred to as SLGA – is a kind of "miniature" replica of almost all government functions from national to regional level and – thanks to having so many functions concentrated in a few persons – was chosen to be a test pilot for the e-government project, later to be extended to all government entities of the main island. This project has three main aspects: (1) the implementation of a work flow system to simplify and automate many operational processes currently paper based and/or – although using Word/Excel documents – lacking in structure and coherence; (2) the development of an online portal to automate as much as possible the interactions and services currently provided at a local physical Citizen Service Desk (CSD), so that the citizens can initiate such interactions in the comfort of their homes; and (3) the development of an IT integration layer with other regional and national government entities that end up executing most of the processes. In this context, our research team was assigned with the responsibility of applying DEMO to model the processes, interactions and information flows occurring in the SLGA, to be used as a base for the production of a strategic roadmap of organizational changes that will have to occur for several alternative scenarios of e-government implementations, according to the possible levels of integration and change in current government entities and/or their IT systems. Our team comprised 4 DEMO experts, 2 working in the project full-time

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and 2 part-time – one 50% and the other 25% – totaling 55 man-days in a month of project execution. Many interviews were made to officials head of each of the SLGA's departments and also to most of the officials responsible for each unit of each department. Interviews were made both for information collection and model validation. A final global workshop with the presence of all interviewees was made for final validation where most models were deemed adequately correct and complete after some small corrections and additions. In the end we specified: 216 transactions – and their associated result types; and 232 fact types – these include classes/categories and fact types and exclude properties. We additionally specified 250 ontological transaction kinds that followed a certain repetitive pattern in certain departments and, because of that, were abstracted into a small subset of generic transactions of the above mentioned 216 transactions set. So, in fact, we specified almost 500 transaction kinds in this project.

Ten months after our main project activities summarized above, we decided to conduct another round of interviews having, as the main purpose, a qualitative evaluation of DEMO's qualities of conciseness and comprehensiveness brought about by the transaction and distinction axioms and also the stability of its ontological models. We took the opportunity to re-validate all previously collected data, and update existing models in case of organizational changes. Very few changes and/or corrections were needed demonstrating the stability of the DEMO models which are, by nature, highly abstracted from the human and technological means implementing and operating an organization. The qualities of conciseness and comprehensiveness were also validated by the vast majority of the interviewees. Regarding the interviews and their analysis, we used a qualitative research method, collecting the data with a previously conceived set of questions specific for this case, most open ended but with short answers. The outcomes in most questions were mostly as expected but there were, however, some peculiar answers.

In the remainder of this paper, section 2 presents our Motivation, problem and research method. In section 3, we present a brief introduction of DEMO - Operation, Transaction and Distinction Axioms. Section 4 has our Case details and Example including some models of this case study. Section 5 explores the Interview questions and results based on our experience and states the intentions behind each question. Section 6 wraps it up with a Results analysis and evaluation, and finally, in section 7, we present our Conclusions.

2 MOTIVATION, PROBLEM AND RESEARCH METHOD

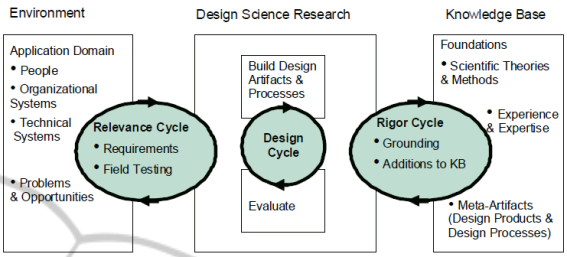

Figure 1: Design Science Research Cycles.

We frame our motivation and research method in the Design Science Research paradigm (Hevner et al. 2004)(Hevner 2007) which claims that all design science research should take in account the three cycles presented in Figure 1.

Regarding the relevance cycle, the motivation of this study is the following problem: it is claimed in (Dietz 2006) that DEMO possesses several qualities but no formal proofs or studies are provided that validate such claims. So our purpose was to validate DEMO's qualities of conciseness, comprehensiveness and stability of the ontological models as to bring more weight and value in practice to this method and associated theories. As for clear definitions of these qualities, we adopt the ones from (Dietz 2006). Namely by conciseness we mean that no superfluous matters are contained in it, that the whole is compact and succinct (Dietz 2006). That is, models should provide a view containing the essence that is a global picture of an organization out of which all details can be properly specified. Comprehensiveness implies that all relevant issues are covered, that the whole is complete (Dietz 2006). That is, all relevant perspectives like the dynamic and static aspects of operation, human responsibilities, operation flow and inter-dependencies should be clearly understandable and covered by the models. Stability of the ontological models is supposedly guaranteed by the implementation independence of DEMO models. And by implementation it is understood the assignment of human and/or computer resources to operationalize an organization (Dietz 2006).

Looking at the rigor cycle we ground our study on the sound formal theories behind DEMO and aim to provide expertise to the Knowledge base while contributing with a validation case study.

In respect to the design cycle, the research reported in this paper aims to apply the DEMO artifact itself and evaluate its claimed qualities by means of interviews with key collaborators on the organization target of study. Regarding such evaluation, qualitative methods can facilitate the study of issues in both depth and detail. They do not have the constraints of predetermined categories of analysis therefore allowing for a bigger depth, openness and detail in the inquiry. On the other end we find that quantitative methods require standardized measures so that the varying perspectives and experiences can fit in a limited number of predetermined response categories to which numbers are assigned (Patton & Patton 2002). The main advantage of a quantitative approach is the possibility to measure reactions of a large amount of people to a limited set of questions, therefore making comparisons and statistical aggregations of data easier, and allowing for it to be presented in a succinct way (Patton & Patton 2002). The qualitative approach produces far more detailed information about a much smaller sample of individuals and cases. The qualitative approach therefore increases the depth of the understanding of the study but reduces the chances of it being generalized (Patton & Patton 2002). The validity of a quantitative research depends on careful instrument construction that assures that what is measured is really what is supposed to be measured. This instrument must be appropriate and standardized according to prescribed procedures. The focus is on the measuring instrument, i.e. the testing of the items, such as survey questions or other measurement tools. In the qualitative inquiry, the researchers are the instruments. The credibility of these methods hinge in a great extent on the skill, competence and rigor of the person doing the fieldwork as well as what's going on in that person's personal life that might prove to be a distraction (Patton & Patton 2002). There is a third approach that consists on mixing both of these methods, by mixing both approaches, in some cases a researcher can provide a better understanding of the problem not using either the quantitative or qualitative methods alone (Creswell & Plano Clark 2007). A research using this third approach is usually named a mixed methods research and can be defined as the "class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study" (Johnson & Onwuegbuzie 2004). By using a mixed methods research, the researchers can provide more comprehensive evidence than either quantitative or qualitative research alone. Thus the researchers are given permission to use all tools of data collection available rather then being restricted to the types of data collection associated with either of the methods alone (Creswell & Plano Clark 2007). Given the dimension of the SGLA target of our project and analysis we have chosen a qualitative method approach as we were limited to a small amount of subjects having the knowledge about the modeled processes.

As previously mentioned to achieve this evaluation we opted to interview the key collaborators involved, using a standardized open-ended format that although lacking flexibility still allowed us the use of open ended questions while facilitating their analyzes furthermore the generalization of the results (Patton & Patton 2002) The interview method used can also be framed in the seven stages of an interview investigation proposed in (Kvale 1996).

1. Thematizing: formulation of a purpose of the investigation and description of the topic being investigated before starting the interviews – in this case the purpose was the validation of the DEMO's axioms in terms of the qualities of conciseness and comprehensiveness and also the stability of its ontological models. We wanted also to evaluate the interview method itself. To achieve this we specified several key points that the interviews should cover, namely: (1) the duration of the interviews, (2) ability by the collaborators to answer the questions in the initial stage of the project both in the terms used by the interviewers and their knowledge of what was being asked for, (3) their opinion on the interview methodology, (4) their current view on the processes and eventual changes, (5) their perception of the modeled workflow and ability to relate to the real workflow in operation, (6) the names used in the models, either in the organizational functions or the transactions, (7) their self knowledge of the organization, (8) the models and their correspondence to current reality after almost a year passed and (9) questions regarding the application of the DEMO methodology and benefits obtained thanks to its axioms.

2. Designing: planing the study taking in consideration all the stages before the interviews take place – to achieve this we devised a set of 43 questions that met the criteria set in the thematizing as to approach all those 9 subjects, being most of them open ended, but with the expectancy of rather short answers considering the extent of the subjects being inquired.

3. Interviewing: conducting the interviews based on a guide and with a reflective approach considering the desired knowledge – the round of interviews was conducted with eleven SLGA collaborators, ten that had been previously interviewed, all either head of a department or chief of a division, and one that, although not previously interviewed, was now the current head of the human resources department. Interviews took place individually and were composed by the previously mentioned set of 43 questions, placed after a re-validation of the models that had been created for the interviewee's department. Meetings were previously scheduled and normally had a duration of approximately one hour for all heads of department, and two hours for the two chiefs of division so that they could give their input on all the several departments that they are responsible for.

4. Transcribing: preparing the interview results for analysis; commonly translating oral speech into written text – all answers were written down and later organized into a spreadsheet containing all participants together with the list of questions.

5. Analyzing: deciding, considering the purpose of the interview and the interview material, what methods are appropriate for analysis – in order to facilitate analysis, our answer data was grouped in sets according to common-theme questions. We then studied the outcomes of each of those sets taking in account the devised goals. All answers were also analyzed individually for particularities and properly considered in the presented results.

6. Verifying: ascertain the generalizability, reliability, and validity of the interview findings i.e. the possibility to apply the results in other contexts, the consistency of the results, and if the study meets the intended purpose – the findings of our research are presented in chapter 6 Results analysis and evaluation as also are the considerations relating to those findings.

7. Reporting: communicate the findings and the methods applied in a form that lives up to scientific criteria, while taking the ethical aspects of the investigation into consideration, and that having the results in a readable and usable product for its audience – in our case, to communicate our findings we are using this paper, presenting the background, contextualization and outcomes as well as a description of the process used.

3 DEMO - OPERATION, TRANSACTION AND DISTINCTION AXIOMS

In the Ψ-theory (Dietz 2009) – on which DEMO is based – the operation axiom (Dietz 2006) states that, in organizations, subjects perform two kinds of acts: production acts that have an effect in the production world or P-world and coordination acts that have an effect on the coordination world or C-world. Subjects are actors performing an actor role responsible for the execution of these acts. At any moment, these worlds are in a particular state specified by the C-facts and P-facts respectively occurred until that moment in time. When active, actors take the current state of the P-world and the C-world into account. C-facts serve as agenda for actors, which they constantly try to deal with. In other words, actors interact by means of creating and dealing with C-facts. This interaction between the actors and the worlds is illustrated in Figure 3. It depicts the operational principle of organizations where actors are committed to deal adequately with their agenda. The production acts contribute towards the organization's objectives by bringing about or delivering products and/or services to the organization's environment and coordination acts are the way actors enter into and comply with commitments towards achieving a certain production fact (Dietz 2008b).

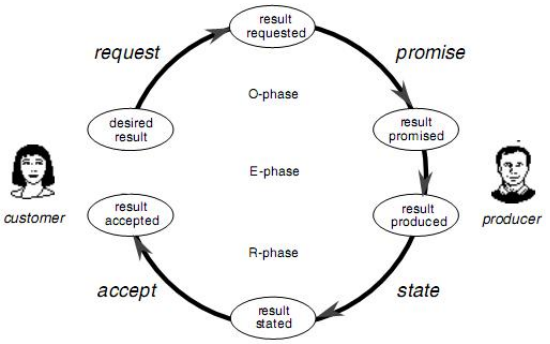

Figure 2: Basic Transaction Pattern.

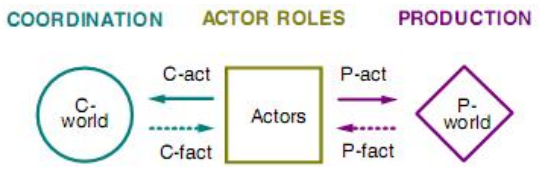

Figure 3: Actors Interaction with Production and Coordination Worlds.

According to the Ψ-theory's transaction axiom the

coordination acts follow a certain path along a generic universal pattern called transaction (Dietz 2006). The transaction pattern has three phases: (1) the order phase, were the initiating actor role of the transaction expresses his wishes in the shape of a request, and the executing actor role promises to produce the desired result; (2) the execution phase where the executing actor role produces in fact the desired result; and (3) the result phase, where the executing actor role states the produced result and the initiating actor role accepts that result, thus effectively concluding the transaction. This sequence is known as the basic transaction pattern, illustrated in Figure 2, and only considers the "happy case" where everything happens according to the expected outcomes. All these five mandatory steps must happen so that a new production fact is realized. In (Dietz 2008b) we find the universal transaction pattern that also considers many other coordination acts, including cancellations and rejections that may happen at every step of the "happy path".

Even though all transactions go through the four – social commitment – coordination acts of request, promise, state and accept, these may be performed tacitly, i.e. without any kind of explicit communication happening. This may happen due to the traditional "no news is good news" rule or pure forgetfulness which can lead to severe business breakdown. Thus the importance of always considering the full transaction pattern and the initiator and executor roles when designing organizations (Dietz 2008b).

The distinction axiom from the Ψ-theory states that three human abilities play a significant role in an organization's operation: (1) the forma ability that concerns datalogical actions; (2) the informa that concerns infological actions; and (3) the performa that concerns ontological actions (Dietz 2006). Regarding coordination acts, the performa ability may be considered the essential human ability for doing any kind of business as it concerns being able to engage into commitments either as a performer or as an addressee of a coordination act (Dietz 2008b). When it comes to production, the performa ability concerns the business actors. Those are the actors who perform production acts like deciding or judging or producing new and original (non derivable) things, thus realizing the organization's production facts. The informa ability on the other hand concerns the intellectual actors, the ones who perform infological acts like deriving or computing already existing facts. And finally the forma ability concerns the datalogical actors, the ones who perform datalogical acts like gathering, distributing or storing documents and or data. The organization theorem states that actors in each of these abilities form three kinds of systems whereas the D-organization supports the I-organization with datalogical services and the I-organization supports the B-organization (from Business=Ontological) with informational services (Dietz & Albani 2005). By applying these axioms, DEMO is claimed to be able to produce concise, coherent and complete models with a reduction of around 90% in complexity, compared to traditional approaches like flowcharts and BPMN (Dietz 2008a).

4 CASE DETAILS AND EXAMPLE

The SLGA currently has two divisions (had three at the time of the first round of interviews in the beginning of our project) which include ten main departments. The first of those two is the Division of Natural Resources Management (DNRM) that includes the Veterinary, Fish, Parks and Agriculture departments, all with a collaborator in charge, being that the chief of the DNRM division is also in charge of the Veterinary department. The second division is the Division of Administration Finances, Maintenance and Infrastructure Management (DAFMIM) and comprises the departments of Human Resources, Supply, Finance, Fleet, Maintenance and the Citizen Service Desk, each also with a different collaborator in charge. Each of these departments deals with specific different aspects of the SLGA. For example, the Veterinary department has the only available veterinarian on the island and deals mostly with farm animals health, safety and well-being, and food safety issues regarding animal based food and animal food itself. The Fish department makes the bridge between the local fisherman and the local commerce but also deals with matters related with fishing boats diesel oil, the selling of ice to local businesses and cold storage units rental. On the DAFMIM division we find the department of Human Resources that deals with the allocation of the workers to the different departments, their vacations, their evaluations, and training programs in their unit as well as their day to day task management realized by the head of each department. The CSD, although included in the DAFMIM is barely connected to the other departments as it works as a local proxy for services offered by multiple regional divisions located at the

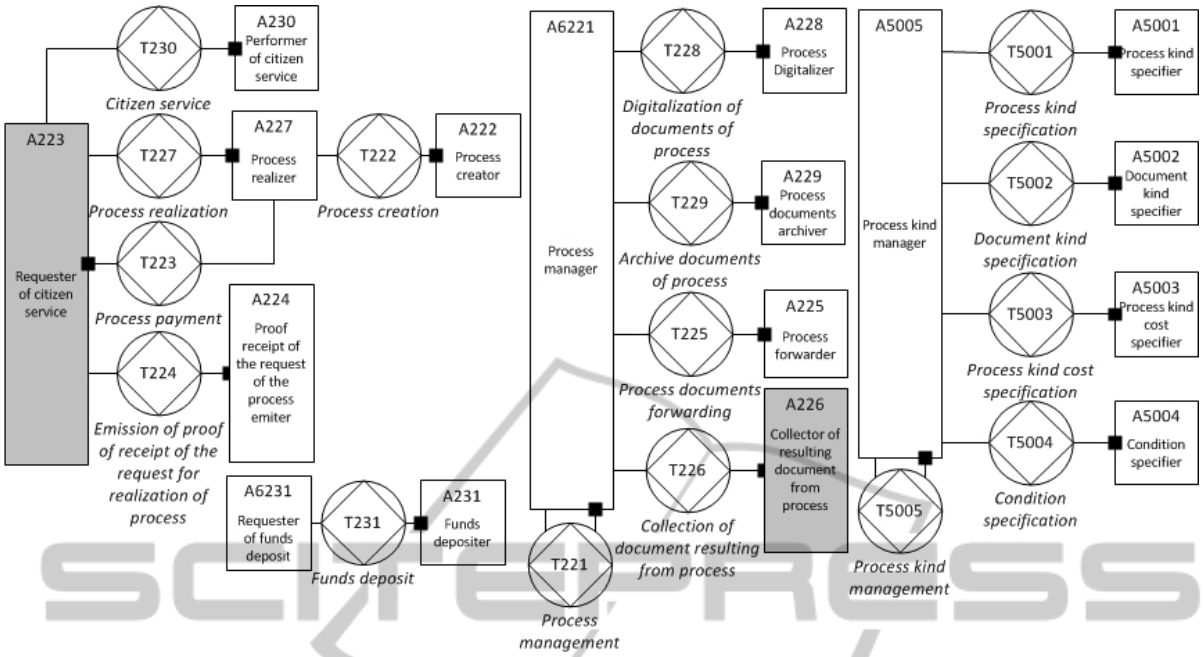

Figure 4: CSD - Actor Transaction Diagram.

main island, such as employment related issues, housing, driving related issues and so on. In Figure 4 we can see, an excerpt of the Actor Transaction Diagram, produced for one of the SLGA departments, the CSD, and the description can be found in the following paragraphs.

In Figure 4 we can notice four clear clusters in the ATD diagram, the first being the transactions initiated by the citizen; it starts with a citizen service that may or may not lead to a process realization – e.g. the case that what the citizen needs is not provided at this desk but in another specific government office. If there is a process realization then there will be a creation of process. The process realization may have an associated cost communicated in the process payment transaction. But there are many processes with no costs associated that may be target of an emission of proof of receipt of the request for the realization of the process. Hence why a step that usually would simply be the state act of a payment transaction deserves to be a transaction on its own. The second cluster is the funds deposit cluster, this one is isolated from the rest due to its nature. It is a daily transaction that can only be done by one CSD coordinator at the end of the day.

The third cluster is the process management cluster, here are the transactions related with the process done in the back-office when the CSD collaborators are free from attending citizens. Two of the datalogical transactions, the scanning of documents of the process and archiving of these documents of the process take place whenever the CSD collaborators have free time, while the forwarding process documents may vary depending on the process forwarding method. If it's sent by fax it takes place at the time of scanning. If it is sent by paper through the ferry boat it takes place every afternoon sometime before the ferry trip. The last transaction in this cluster also takes place when the CSD collaborators have free time, but it does not happen every day as many of the CSD processes have no returning documents, and in most that do, those documents are sent directly to the citizen by postal mail instead of returning to the CSD building. Finally in the fourth cluster we have the process kind management and its related transactions that, as we previously stated, are meant to deal with the constant change in processes and their related documents and conditions.

The diagram described previously is a typical example of contents presented to the interviewees and already give an idea of the conciseness quality of DEMO, something to which, as we will see just next, almost all interviewees agreed to.

5 INTERVIEW QUESTIONS AND RESULTS

The research pool for this interviews was rather

small with only eleven individuals but, considering their positions within the organization and the objectives of these interviews, this was a very significant and useful sample. As previously mentioned, the interview's questions were mostly based on open ended questions, although most with short sentence responses. When a simple yes or no question was made, the usual follow up question consisted in asking the reasons for such answer.

Out of 43 questions made in the interviews 20 are listed below in Table 1 with a summary of the multiple outcomes. The other 23 questions were not relevant for the focus of this paper, as they mostly focused on: our interview method, approach and language used in the first round of interviews in the beginning of the project; as well as on comparisons with results of two other modeling initiatives that had occurred prior to ours. Unfortunately we were unable to obtain enough information to compare our approach with the others, as the key collaborators involved in these other initiatives were no longer working at the SGLA. Therefore, the other 23 questions are not present here, not only due to the mentioned reasons but also due to space constraints. The results obtained from these other questions will be target of another paper. As many of the placed questions were open ended, we have opted to summarize and group the related answers in order to present them in a more compact and intuitive manner. For each question presented in the following table, we present the number of interviewees that answered with each of the alternative or generally given responses, as well as the total number of collaborators that in fact answered to each specific question. After the table we explain the goals and/or reasoning for each question asked while already providing some comments on the results. In the next section we do a more thorough analysis on the outcome.

Table 1: Interview Answers.

7. Have you ever felt difficulty with the framing of the questions that were made to you? (Regarding the terms used)		14. How do you evaluate the workflow in the models when compared with the real operational flow of your work?	
Had difficulty	1/10	Corresponds to the real Work flow	11/11
Had no difficulty (or quickly answered)	9/10		
15. Looking at the names assigned to the transactions would you change any?		16. Which one(s) would you change?	
		Specification of intervention	1/3

Table 1: Interview Answers. (cont.)

Yes	3/11	Expense process	1/3
No	8/11	Records for statistical purposes	1/3
17. Looking at the names assigned to the organizational functions would you change any?		18. Which one(s) would you change?	
		DGMI responsible	1/3
		Requester of vehicle	2/3
Yes	3/11	Names of the regional offices	1/3
No	8/11	Warehouse responsible	1/3
19. Can you identify anything produced in your organizational area that you cannot find described in the models?		20. (If yes) 16. What?	
		HACCP Control (fishery)	2/5
		Management of lighting and air. (multi-purpose pavilion)	1/5
		Technical opinion (supply and finances)	1/5
Yes	5/11	Registration of commitment	1/5
No	6/11	Decision of the selection of budgets (supply and finances)	2/5
21. In your personal opinion, do you feel that these models can give you a concise and unambiguous notion of what goes on in the organizational area where you perform your work?		28. Do you agree with all transactions in the areas under your responsibility?	
Yes	11/11	Yes	11/11
No	0/11	No	0/11
29. (If no) Which are the ones you do not agree with?		30. Can you find any of your transactions, or one in an area under your responsibility that you had a different perception of the actors involved before this modeling?	
		Yes	0/11
Answers	0/0	No	11/11
31. Which one (s)?		32. Do you consider that the models that were produced still describe the reality of performed transactions and involved actors?	
		Yes	11/11
Answers	0/0	No	0/11

Table 1: Interview Answers. (cont.)

33. (If no) What has changed?		35. Can you find any reason for these models be considered an important resource in the knowledge of the organization for their own employees?	
		Yes	8/11
Answers	0/0	No	3/11
37. Suppose you had a new employee under your supervision and you had to explain his roles within the organization. Would you consider using any of these models as an aid in this explanation?		38. Do you think these models give you a comprehensive and summarized vision of the organization's operation?	
Yes	9/11	Yes	11/11
No	2/11	No	0/11
39. Why?		40. Do you believe that is useful that these models give a view abstracted of implementation (regarding people, technology, technical, implementation channels)?	
All is discriminated and summarized.	8/11		
Reflects the steps and processes and who performs the tasks.	1/11		
Properly diagrammed.	2/11	Yes	10/11
Generalized view.	1/11	No	1/11
41. Why?		42.Do you think that the fact that these models differentiate the initiator and executor actor roles and include the acts of request, promise, execute, accept and state a transaction help understand and clarify the responsibilities of each member of the organization?	
Because there is constant change in those items.	9/11		
Because it is more practical.	1/11	Yes	9/11
It makes it difficult to give credit to the proper person.	1/11	No	2/11
43. Why?			
Because it clarifies responsibilities	8/11		
Needs to be well explained so that information does not get lost	1/11		
Can be used for assigning blame	1/11		
There is no need because the process is treated as a whole	1/11		

Question 7 tried to determine if the terms used by us in the interviews were of difficult understanding for the participants. By terms used, we refer to more technical words such as actor, role, and transaction, widely used in the DEMO methodology. Nine of the participants stated that either had no difficulty, or, if in fact some doubt arose, it was promptly clarified by the interviewer's explanation of the terms. One of the collaborators however stated that she had in fact difficulty during the questions as she had been “caught off guard”.

Question 14 had the intention to validate the workflow modeled in the process step diagrams in comparison to the real workflow in order to find any flaws or changes in it. All the eleven collaborators who answered this question agreed that the workflow in the models was in fact similar to the reality of their processes agreeing to what was modeled in every step of each transaction.

Questions 15 and 16 were related to the names specified for the transactions. Although there had been already some discussion and validation on this point around one year ago, we decided to re-evaluate the appropriateness of these given names. Three of collaborators found, each, just one name that they would change in their department's models.

Questions 17 and 18 were on their turn related to the names assigned to the organizational functions. Three collaborators said they would change one or more names. In fact it was somehow surprising that one of the collaborators told us that some names were not “generic” enough. As the positions within the organization are in constant change the DAFMIM chief of division did not agree that that position was used as an organizational function, but instead suggested that we used chief of said department. In the same way, it was also suggested to change the names of the regional authorities, as they also suffer changes when another government is elected. In this case it was suggested that we changed to “regional direction with tutelage of said service”. The other two suggestions by the other collaborators were related to names that are more commonly used, instead of the originally proposed ones.

Questions 19 and 20 intended to identify possible missing items that failed to be modeled originally. Five of the collaborators were able to find items that were not modeled. In the fish department the Hazard analysis and critical control points (HACCP) Control was not modeled initially as the head of the department did not find it important at the time, but as the paper print left in the process was significant both him and the chief of the division in charge now

qualified it as significant. Finally on the supply and finances department there were just three new transactions proposed to be integrated in the current steps of the product acquisition process. All-in-all, the number of new items identified was quite small compared to the vast amount of transactions that kept stable during this whole year.

On question 21 we tried once again to receive input by the members of the organization on how DEMO was appropriate for the modeling, by asking them if they found the models of their departments concise and unambiguous. Every collaborator that answered to this question confirmed this quality.

Questions 28 and 29 aimed at reinforcing the comprehensiveness quality while confirming if all collaborators agreed with all the listed transactions in the models deeming them as needed or even as essential.

With questions 30 and 31 we intended to find any eventual discrepancy between the collaborators' perception of reality compared to the modeled transactions. No interviewed person had a different perception of what was modeled, further reinforcing the comprehensiveness quality.

Question 32 intended to capture the validity of the work produced nearly one year before, and how it was still applicable to the current reality. Even though some collaborators and documents used changed, all eleven interviewees agreed that all models still correctly described the reality of the organization.

Question 35 aimed to get a perception on the relevance given to the DEMO models by the collaborators. The answers here varied, and although most collaborators said yes, three couldn't find any reason for the models to be relevant and another one stated that their activities were already so mechanic that the models were of little use.

Question 37 had the intention to obtain the predisposition to use these models to explain someone who was not familiarized with the organization and their new tasks. Answers were somehow similar to the previous question. Most collaborators said yes, but one questioned the ability of someone new to understand these models, although another also mentioned that the actor transaction diagram, would be a good model to explain the procedures without complications. Still another person that also said "no" mentioned also that the models could be complicated, and it would be more profitable time wise to show them the real operations in practice.

With questions 38 and 39 we intended once more to validate one of the claimed qualities of DEMO models, and their perception by the organization's members. To do so, we asked if the models gave a comprehensive and summarized view of the organization's operation. All interviewees answered yes, and when asked why they thought like that, there was little variation in their answers. Most replies focused on how everything was discriminated and properly summarized, others stated that it was properly diagrammed and reflected their department of the organization, one also mentioned that it gave a generalized view of everything, and finally it was also stated that it clearly reflected step by step the processes of each collaborator and their respective tasks.

The objective of question 40 was to validate the level of abstraction used in DEMO and understand to what extent this is assimilated by the collaborators of an organization. Ten out of the eleven interviewees answered that it was useful to use this level of abstraction, while one said otherwise. When asked why the responses showed the understanding of the reasons as they were mostly based on the fact that the organization is in constant change, new employees join, old employees leave and the documentation is also under constant updates, therefore this level of abstraction allowed for the models to remain correct after a long period of time, and still reflect the reality of the organization, as also demonstrated in the previous questions of the interview. Although most answers were centered in these aspects, one of the collaborators had a very different opinion that may reflect some difficulty understanding the method, as the reason used to justify the "no" was that this level of abstraction makes it difficult to give proper credit to a collaborator when its due, because no person names are used, but instead only the organizational functions.

The last question of this interview focused on determining if the collaborators found important the fact that, in the models, there was a differentiation between the initiator and executor roles as well as the specification of each transaction's main steps of request, promise, execute, state and accept. Nine of the answers were positive, eight focused on how this helped indeed to clarify the responsibilities, and how important it is to know who is responsible for what within each department. One answer had a different justification: the organization needs to be well explained so that information does not get lost, and this way of modeling did exactly prevent that. There were two collaborators on the "no" side, one stating that there was no need for this differentiation in their department because a single collaborator usually did

most of the transactions as being a single process, and the other stated that clarifying the responsibilities isn't always good, as the goal of the employees is to properly do their work, as such, they normally don't do mistakes on purpose. And, that being the case, they should not look to assign blame but instead work together as a group to fix what went wrong.

6 RESULTS ANALYSIS AND EVALUATION

With these interviews we were able to validate the importance and relevance of the Ψ-theory's operation, transaction and distinction axioms and the qualities they bring about in the application of DEMO. We will now see how these axioms affected the modeling outcome and the perception the interviewees have of their organization and of its respective models, thus, validating the DEMO qualities target of research in this paper.

In Table 2 we have a summary of our results analysis where we present the three DEMO qualities that we intended to validate in the research reported in this paper, along with the questions (presented in the first column) and the validating outcomes (presented in the second column). The reasoning of how the outcomes validate each quality can be found after this table.

Table 2: Demo qualities analysis.

DEMO Quality - Concise	
21. In your personal opinion, do you feel that these models can give you a concise and unambiguous notion of what goes on in the organizational area where you perform your work?	100% Yes
38, 39. Do you think these models give you a comprehensive and summarized vision of the organization Operation?	100% Yes
40, 41. Do you believe that is useful that these models give a view abstracted of implementation (regarding people, technology, technical, implementation channels)?	91% Yes 9% No
DEMO Quality - Comprehensive	
7. Have you ever felt difficulty with the framing of the questions that were made to you? (Regarding the terms used)	10% Yes 90% No
14. How do you evaluate the workflow in the models when compared with the real operational flow of your work?	100% Corresponds fully

Table 2: Demo qualities analysis. (cont.)

19, 20. Can you identify anything produced in your organizational area that you cannot find described in the models? (Note: in this question, although almost half of the interviewees found missing items, the percentage of missing items in their area of responsibility varied only from 1% to 6% and the other half reported 0% of missing items)	45% Yes 55% No
28, 29. Do you agree with all transactions in the areas under your responsibility?	100% Yes
30, 31. Can you find any of your transactions, or one in an area under your responsibility that you had a different perception of the actors involved before this modeling?	100% No
35. Can you find any reason for these models be considered an important resource in the knowledge of the organization for their own employees?	73% Yes 27% No
37. Suppose you had a new employee under your supervision and you had to explain his roles within the organization. Would you consider using any of these models as an aid in this explanation?	82% Yes 18% No
38, 39. Do you think these models give you a comprehensive and summarized vision of the organization's operation?	100% Yes
42. Do you think that the fact that these models differentiate the initiator and executor actor roles and include the acts of request, promise, execute, accept and state of a transaction help understand and clarify the responsibilities of each member of the organization?	82% Yes 18% No
DEMO Quality - Stable	
14. How do you evaluate the workflow in the models when compared with the real operational flow of your work?	100% Corresponds OK
15, 16. Looking at the names assigned to the transactions would you change any?	27% Yes 73% No
17, 18. Looking at the names assigned to the organizational functions would you change any?	27% Yes 73% No
32, 33. Do you consider that the models that were produced still describe the reality of performed transactions and involved actors?	100% Yes

Question 7 was relevant to make sure that the participants were at ease with the main concepts of the DEMO approach – like actor and transaction – leading to a correct comprehension of the models.

The strong positive result in this question supports the comprehensiveness quality of DEMO.

Question 14 was a very important question in order to demonstrate 2 points. By having a unanimous answer on how the process step diagram models reflected the proper workflow of the organization's departments, we realize the great importance of the transaction axiom. Thanks to the structuring of the many essential and common process steps in the transaction pattern, we managed to uncover some "hidden" (in the minds of the persons) transactions and, on the other hand, because the collaborators become aware that a single transaction "automatically" includes the many kinds of social interactions that can happen regarding some production, they end up evaluating the modeled process fully corresponds to their daily work. Thus, this outcome also validates DEMO's comprehensiveness. We were also able to verify that the models remained current even after multiple changes in the organization in terms of persons and documentation, demonstrating DEMO's quality of model stability, brought about thanks to the distinction axiom and its separation of the human abilities, where we normally abstract from information processing, communication and document aspects.

Questions 15 to 18 allowed us to demonstrate how the naming's determined for both organizational functions and transactions were quite adequate for the collaborators that realize the respective transactions, something that sometimes proves difficult when gathering this kind of information. There were three suggestions of transaction name changes and four organizational function changes, but taking in account the huge number of almost 500 transactions that had been modeled and the number of twice as much actor roles involved (even though many repeat themselves multiple times), the amount of change suggestions is of very small significance. This outcome strongly validates the stability of DEMO models.

Questions 19 and 20 demonstrated that, although the DEMO approach seems to be a very good approach compared to other methods, it is not infallible and, as such, these questions allowed us to detect some transactions that were not modeled on the first round of interviews around one year ago. But to give the due relevance to the amount of new transactions found in a more precise fashion, we now analyze the answers of each of the five collaborators that answered this question individually. One of the collaborators, the chief of the division DAFMIM, identified three lacking transactions while 317 transactions were modeled as being under his responsibility, that is, not much more than 1% of missing items. The other chief of division (DNRM) identified only one missing transaction in the set of 162 transactions modeled for the areas under her responsibility. Again a percentage close to 1%. The other three collaborators – all department heads – identified as missing transactions in their area of responsibility, respectively: 1 out of 18, 1 out of 26 and 1 out of 31, that is, percentages from 6% to 4%. The other 5 department heads could not find any missing item, leading to 0% of missing items. These figures also highly contribute to validate DEMO's quality of comprehensiveness.

With question 21 we validated the conciseness quality thanks to a unanimous response on how the models really gave a concise and unambiguous notion of each of the organizational areas to their respective heads

Questions 28 and 29 demonstrated the importance of the operation axiom on how it allowed that interviewees' interactions within the organization were correctly modeled, by having a once again unanimous positive outcome when asked if they agreed with all the transactions under their areas of responsibility, thus also contributing to comprehensiveness.

Questions 30 and 31 helped to demonstrate the importance of the transaction axiom because all modeled transactions had all the proper responsible participants identified, thus also contributing the comprehensiveness quality.

Questions 32 and 33 demonstrated the importance of the distinction axiom by proving that all models were still up to date thanks to the separation of the ontological, infological and datalogical aspects, thus reinforcing the validation of the stability quality.

With questions 35 and 37 we tried to understand if the models could be considered useful both for existing collaborators and to help train new ones. The outcomes were not always the expected but the answers confirmed that the models were considered important for the collaborators to have, not only knowledge of their individual tasks, but also of other tasks all over the organization. Although some interviewees pointed out that some of the diagrams could be difficult to understand and thus answered negatively, the outcome is strong enough to also contribute to validate the comprehensiveness quality.

Finally, the block of questions from 38 to 43 allowed us to demonstrate the understanding by the

organization's members of some key aspects of DEMO such as the focus on abstraction from implementation and the separation of the transaction steps. Although not unanimously, the majority of interviewed collaborators found these aspects important and considered them a good quality of this modeling process, as it can be seen from some of the opinions we transcribed. So 38 and 39 clearly both validate the qualities of comprehensiveness and also conciseness. 40 and 41 distinctly validate the conciseness quality, while 42 ends up also validating comprehensiveness thanks to the clarification provided by the clear identification of organizational responsibilities.

7 CONCLUSIONS

Following the tenets of Design Science Research we presented a relevant and needed contribution of an interview based qualitative validation of some of DEMO's axioms and claimed benefits – something that, to our knowledge has never been done up to now. Namely we looked at the qualities of conciseness, comprehensiveness and stability of DEMO's ontological models. This was done in the context of a large scale practical DEMO project and, to our knowledge, no publicly available study exists that practically demonstrates such qualities. And such studies like these – based in large scale projects – are essential to contribute to a more widespread and mainstream acceptance and adoption of DEMO in enterprise change projects. We interviewed 11 key departments and division heads involved in a large e-government project where around 500 ontological transactions were specified. Our research was able to demonstrate that indeed DEMO's Ψ-theory and its axioms contribute to provide a concise and comprehensive view of the essential dynamic and static aspects of an organization and that, even after a year has passed, the majority of DEMO models were still up to date and only needed to be subjected to some minor changes. Our study has limitations since the DEMO approach was evaluated individually. In future studies we will apply also other modeling approaches such as simple flowcharts and/or BPMN based so that we can also evaluate them in the same dimensions of analysis target of this paper and we can compare the performance of each approach according to the perception of the organization's members. Furthermore, the number of interviewees in the research presented in this paper is not enough for a pure quantitative validation which is something that has to be done also to bring up even more solid arguments supporting DEMO's claimed qualities. We expect that, as the project advances from the pilot stage in the small island to the full fledge stage in the main island, then we will again apply DEMO for modeling further processes to be implemented in the e-government project and we will have a sample of interviewees big enough for a pure quantitative validation.

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