Research Proposal
Empirical validation of implementation of organization design based on DEMO transaction and actor role concept

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Abstract. This research proposal is about empirical validation of the implementation of integrated organization / IT design with the Enterprise Engineering (EE) method DEMO. For this research literature from information system sciences, organization sciences and EE is studied. A research approach based on design science is proposed. Based on already performed interviews a case is chosen to empirically validate. In the case chosen the designed artifact is implemented in lots of projects in past, present and future and relevant data are available without extra interventions. In this case it is also possible to differentiate between effects caused by the method and by the project. As technique for data collection process mining is proposed. For evaluation reasons expert sessions with participants in the studied projects are proposed. The result is a continuous improvement cycle within all three cycles of Hevner's three cycle view. In the case chosen it concerns improvements either for the implementation of a standard or for the standard itself.

Key words: Enterprise Engineering, Quality Management, DEMO, continuous improvement

1 Introduction

1.1 Motivation

This document contains the research proposal for our PhD research. This research started in 2012. Main supervisor is Prof. Dr. Hend*erik* A. Proper[1], daily supervisor is Dr. Wolfgang A. Molnar[2] and expert-supervisor is Prof. Dr. Hans B.F. Mulder[3]. We start in this Section with our motivation. In this proposal we follow Dietz [1, p. xi, 23] and use the term *enterprise* for all those entities where

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people work together, so this is the term to denote both for-profit, not-for-profit and governmental entities. The term *organization* is used for the structure of an enterprise, i.e. the way the enterprise is organized in business units, departments, sub-departments, etc.
In our society business is more and more on-line, which means that the contact between customers and enterprise is more and more by on-line IT[4]-applications. So organization design and IT-design become integrated and we see that the impact of IT on enterprises is increasingly acknowledged to be fundamentally strategic [2]. In trying to adapt enterprises perform projects. However, in international surveys[5] it is found that many strategic projects fail. The top 3 causes are lack of involvement of qualified users, lack of support by management (fast decision making) and lack of clear objectives. Tools and infrastructure are in the 10th place. So it seems that design and implementation of the combined organization / IT causes problems for enterprises where the main courses are of organizational and managerial nature.

1.2 Literature Review

An answer to these problems can probably be found with Enterprise Engineering (EE). EE is an emerging field and combines relevant parts of traditional organization sciences and information system (IS) sciences. For this reason we studied literature in the fields as indicated in Table 1. As a first indication for judging whether enough literature is studied and whether there is balance between topics, the number of sources is mentioned. We wrote a position paper [3], here we

Table 1. Fields of literature study

Information System sciences	10
Organization Sciences	15
Enterprise Engineering	13

use in brief the content of this paper and expand towards new literature that has been or will be studied.

IS-Literature IS-literature is studied to find out about research methods. Myers[6] [4] writes about qualitative research methods. Miles & Huberman [5] write about qualitative data analysis. Orlikowski & Baroudi [6] made an inventory of articles for the underlying epistemology (positivism, interpretevism and criticism). March & Smith [7] are studied for presenting IT research as studying artificial phenomena opposed to natural phenomena and for presenting design

[4] Information Technology
[5] International Standish Group 2010
[6] see also http://www.qual.auckland.ac.nz/

science (DS) as devising artifacts to attain goals. Hevner [8] states that IS-research is characterized by behavioral and design science. Hevner also proposed the three cycle view for DS. Van Aken [9] makes the link between design sciences and management sciences in arguing that management sciences can only be relevant if management research is based on the paradigm of design sciences. We studied Argyris, Putnam & McLain [10] on action research. Bunge [11] provides the ontological view of systems. Simon in [12] provides insight in design processes of complex systems. Falkenberg et al. [13] provide definitions of notions in the IS field.

Organization and Management Literature In the field of organizational sciences Mintzberg [14, 15] elaborates on strategy and (the impossibility of) strategy planning. Beer & Nohria [16] are studied for change management. Traditionals as Taylor [17], Fayol [18], Weber [19] and Barnard [20] will be studied. We study Simon [21], Galbraith [22] and Argyris [23]. We are selecting organization literature about the present challenges of globalization and rapid adaptation of organizations. In social theory Giddens' structuration theory [24] is studied and Searle [25] for his vision on social reality. For quality management we mention Crosby, Deming and Feigenbaum [26, 27, 28].

EE Literature In the field of EE Dietz *et al.* [29] give an overview of principles of EE. Dietz [30, 1] is about enterprise ontology and enterprise architecture. Hoogervorst [31] is about enterprise governance (EG) and enterprise design (ED). Case studies on EE are found in Mulder [32], Proper [33] and Op 't Land [34]. For the language action perspective (LAP) we use Habermas [35] and the introduction to Habermas in Koningsveld & Mertens [36] that we think is easier readable. Winograd & Flores [37] is about computer science, but also about language and thought because they study what people actually *do* with computers. Taylor & Van Every [38] study enterprises from a communication point of view. Greefhorst & Proper [39] argue that EE is about transformation of enterprises.

Definitions of EE We end this section with three definitions for Enterprise Engineering, one with a function perspective, one with a construction perspective and one where both perspectives are taken into account.
A definition with a function perspective is that given by Chen & Vernadat [40]. They define EE as the art of analyzing, restructuring, designing - or redesigning - and, as much as possible, optimizing whole or part of a business entity with respect to its mission and objectives, where a business entity is any socio-economic system built to produce products or services. Vernadat [41] states that the current challenge is to build agile enterprises, which he describes as systems of cooperating business entities that can belong to different legal entities and that can be easily tailored to fast changing conditions. Business entities are combinations of business processes. The concept of architecture is closely related to engineering according to Chen, Doumeingts & Vernadat [42]. They define Enterprise Architecture (EA) as the description of the basic arrangement and connectivity of parts of a system.

Dietz [1] takes a construction perspective and states that the basic premise of EE is that an enterprise is a designed system and for the design of an enterprise the notions of Enterprise Ontology (EO) and Enterprise Architecture (EA) are crucial. EO provides a means to make a model of the construction of an enterprise at a high level of abstraction, i.e. completely independent of its implementation. EO also has a precise definition of a business process, that consists of transactions and actor roles. EA is defined as the set of design principles that an enterprise applies in designing itself. As is known from engineering practice, without these principles the design freedom would be practically unlimited which is of course not desirable.
In the definition of EE on the AppEER- website[7] both the function and construction perspective are taken into account: EE is defined as the overarching term for the disciplines (among which are EA, EO, EG and ED, as well as business process management, enterprise modeling, enterprise transformation) that study the engineering of socio-technical systems. With socio-technical systems are meant specifically information systems (IS) in full alignment with their human / organizational context.
In the definitions of EE the *design* of an enterprise is a central concept. The design of an enterprise is an *internal* factor. However, the reason of existence of an enterprise lies *externally*: either it is in the environment or it is in some law. We feel it is important to take into account for everything that is done in an enterprise, its relevance for the environment. For this purpose we introduce the concept of quality. For our purpose the relation of quality with end-users of products or services and the notions of process and product quality make that we think that quality is the right concept to take into account the relevance for the environment. As definition of quality we will use the extent to which an end user is satisfied with a product or service.
In the studied EE literature most attention is on the function perspective, the construction perspective is under-represented. Design and Engineering Methodology for Organizations (DEMO) is a method based on EO and has the construction perspective. In literature about DEMO little is described about empirical validation of artifacts, designed with DEMO, which is not surprising for an emerging field, but this is an omission in the judgment whether EE leads to integrated organization / IT designs that help enterprises better adapt to changes. We will elaborate on this in our research questions.

2 Research Objective and Questions

In Section 1 we sketched the role the design of the organization should play in an enterprise. We mentioned both function and construction perspective. We follow Dietz [30] that the construction perspective is about how things are and that the function perspective is about what things are used for. Construction is objective and function is subjective. In enterprises this works out that for

[7] Appeer.ee-team.eu

the daily operation of the enterprise the function perspective suffices, while the construction perspective is necessary for changing the enterprise. Dietz [30, p. 60, 65-70] provides the theoretical proof of this claim, but does this come true in practice? That is not clear at this moment because we noticed that few results are available about empirical evaluation of EE projects.
In section 1 we introduced the concept of quality for its being related to end-users of products and services. According to ISO9000[8] quality "is the degree to which a set of inherent characteristics fulfills requirements". Feigenbaum [28] defines the quality of a *product* as "the degree to which a product in use will meet the expectations of the customer". The quality of a *process* is seen as the way to prevent quality defects instead of detecting defects [27].
Once we have introduced what drives us, it is the right moment to introduce our objectives for research. Our objective is to provide on the one hand practitioners with more insights about the usefulness and necessity of high-level construction models of an enterprise for defining business processes and on the other hand find quality criteria for implementing those business processes. Our central research question is:

> How can integrated designs of organization /IT, based on DEMO construction models, be better implemented using the quality of process and product as an objective measure?

This question is detailed in the following questions:

1. Which are the empirical evaluation results of projects which use EE-method DEMO in general and its transaction and actor role concept in particular?
   a) How does the application in practice of DEMO differ from its intended application?
   b) How do processes, as they evolve in practice, differ from the project goal for which the processes were developed?
   c) How do interorganizational processes modeled with DEMO evolve in practice?
2. How are business processes developed with DEMO, supported by information systems?
   a) Which (parts of) business processes developed with DEMO are supported by an IS?
   b) Which IS functions support those business processes?
3. Which quality criteria play a role in the implementation of processes modeled with DEMO?
   a) How to define quality for implementation of processes modeled with DEMO?
   b) Which role can quality play in the implementation of processes modeled with DEMO?

[8] ISO9000:2000 Quality Management Systems - Fundamentals and vocabulary

3 Research Approach

In [3] we wrote about research approaches for EE. We elaborated [3] on design science research (DSR) and action research (AR). We want to validate empirically DEMO artifacts and that is what is called in design science *field testing*, see Figure 1. Field testing is an activity of the relevance cycle. We will use the results of field testing to reflect on and possibly improve the (implementation of the) artifact concerned. This can also result in additions to the knowledge base. We can conclude therefore that our work is design science research.

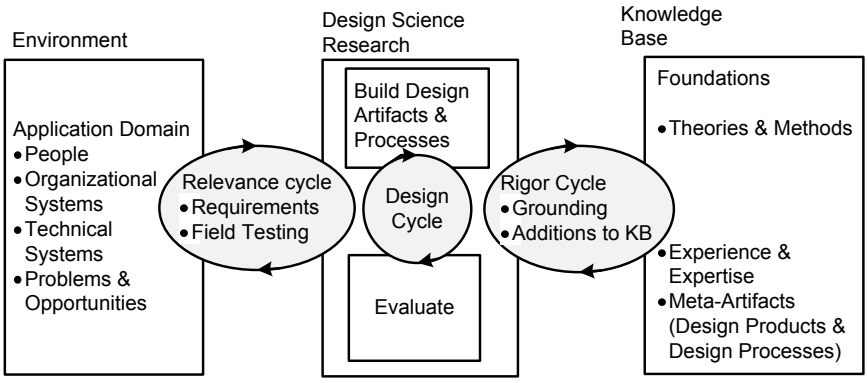

Fig. 1. Three Cycle view of Design Science, Hevner [8]

4 Activities

In this section we describe our activities. We divided the activities in activities that are already performed and future activities.

4.1 Performed Activities

In this Subsection we describe the activities that we already performed.

Interviewing finished DEMO projects The first activity was to get acquainted with finished DEMO projects. With this purpose we interviewed people who were member in finished projects with DEMO. This activity was performed together with Céline Décosse, a fellow PhD student from CRP Henri Tudor. First, we inventorized projects that used the DEMO method, see table 2 for a short characterization of the inventorized projects. Next we planned a round of interviews to learn more about the projects in general. We selected people who

Table 2. Projects investigated for their application of DEMO

Project name / Project organization	Characteristics
VISI	Development of a model of large construction projects and a model for software for exchange of messages for coordination between project partners
SGC	Development of a uniform and essential busines model that applies to 22 different committees
KLM Air France	Choice of information system for the merger of the two cargo divisions
Rijkswaterstaat	Application Portfolio Rationalization
ING	Implementation of Shared Service Center Securities in a bank

fulfilled the different roles in the projects. The interviews were semi-structured with open questions. In the period May-June 2012 we conducted 12 interviews, in Table 3 the interviewees are summed up by their first name and with the role they performed in the DEMO project. The results of these interviews are described in Décosse [43] and presented at the EEWC 2014.

Selection of a case All projects in Table 2 were considered successfull by the interviewees. We are looking for validation results and none of the projects has been evaluated some time after the closing of the project. The projects KLM Air France, Rijkswaterstaat, ING and SGC are all separate cases and are finished already a number of years ago. The VISI project has delivered a standard for the process of building objects. The standard itself contains a DEMO construction model. This case offers the opportunity to differentiate between the influence of the method DEMO and the project where it is applied, because the project applies a standard (VISI) and the standard is based on DEMO. This standard is presently in use and has already been applied several thousand times. This offers ample occasion to evaluate in actual situations the use of a DEMO model. We choose this case for further research. We will now first describe shortly what the case is.

VISI project The VISI project is characterized in Table 2. The VISI project was about the development of a standard for communication in large infrastructure projects. In the time line in Figure 2 we see that the development of the VISI standard was from 1998 till 2004 in an investigation and a try-out phase and the use of the VISI standard was from 2004 onwards. In 2012 the VISI standard became also an international ISO standard, ISO 29481. To avoid confusion we will use the name of ISO 29481 for the VISI standard if we write about a building project that uses the VISI standard and we will reserve the name VISI project exclusively for the project that developed the VISI standard. ISO 29481 is since 2012 a mandatory standard in the Netherlands for building projects and it is applied several thousands of times. During meetings with people who are

Table 3. Roles of the interviewees

Nr.	Name	Role
1.	Cees	Strategy Advisor of large construction firm
2.	Anton	External management consultant for part of the Ministry of Infrastructure
3.	Hans1	Head of R&D and IT department of part of the Ministry of Infrastructure
4.	Jan	Founder of DEMO and professor at Technical University Delft
5.	Johan	DEMO consultant who worked in the VISI project for the right application of DEMO and PhD student
6.	Piet	DEMO consultant and scientist at TU Delft
7.	Henk	Program manager VISI
8.	Jos	External management consultant and initiator of the VISI project
9.	Paul	Enterprise Architect
10.	Hans2	Director for development and process support for the department of revenue management
11.	Martin	External Principal Consultant and Global Architect
12.	José	Professor of Information Systems
13.	Hans3	External consultant, PhD student and DEMO expert

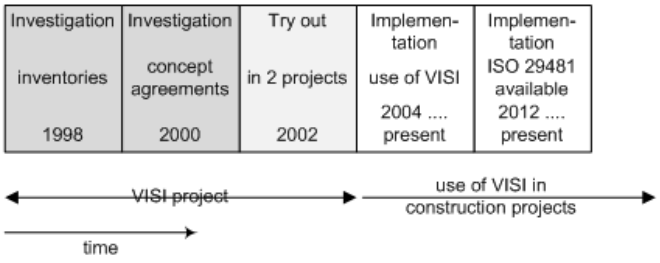

Fig. 2. Time line of the VISI project, extended with ISO standard; the VISI project ended in 2004, after that year the implementation started

involved in projects where ISO 29481 is applied, it became clear that there were problems in the application of the standard. In a first inventory we could relate these problems to the following deviations from the DEMO theory:

1. VISI applied the DEMO theory in a different way by defining other transaction statuses than DEMO, see Table 4.
2. VISI applied DEMO not completely. VISI doesn't recognize the possibility of revoking a communication act.
3. VISI focuses solely on *coordination*, while coordination and production should be considered combined.
4. In projects the process is set up in a departmental way instead of with actor roles.
5. During the use of VISI attention shifted towards an IT based approach for defining and supporting the communication scheme of a project, which resulted in the definition of messages that don't fit in the transaction pattern according DEMO.

Table 4. VISI transaction statuses compared with statuses according to DEMO

DEMO	VISI
	start
requested	requested
declined	
promised	promised/execution
	change/hold
stated	stated
rejected	
accepted	accepted/end

Items 1,2 and 3 are about the way VISI applied the DEMO theory. Item 4 is about the implementation of the standard. Item 5 seems to indicate that people who don't have the right knowledge about the VISI standard, apply it, which can easily lead to messages that don't support communication acts in the right way.

4.2 Future Research

VISI case Projects that apply ISO 29481 use software that enforces the communication that is prescribed by ISO 29481. Such software is "VISI certified". The certificate is provided by the organization that is the owner of the VISI standard, CROW[9]. This software is for the exchange of messages with the included attachments, but precisely those messages that support the communication as it is contractually agreed by the partners in the building project of concern. The

[9] CROW, Galvanistraat 1, 6716 AE Ede, The Netherlands; www.crow.nl

VISI software logs all messages, because in case of (legal) dispute, the log files are used to reconstruct what has actually happened. We want to use the log files of VISI projects for determining what has actually happened with respect to the communication. We will use a technique called *process mining*, see Van der Aalst [44] and Figure 3 in a new way. Originally process mining is meant to reveal the process model of some real-life situation from log files that are available in the software applications, used in that real-life situation. In our situation we do have the process model as a VISI framework. So we can compare the process model that is revealed with process mining with the VISI framework, because the VISI software is the implementation of the communication acts that are defined in the framework. We will analyse what has happened and subsequently interview the involved persons about the analysis results.

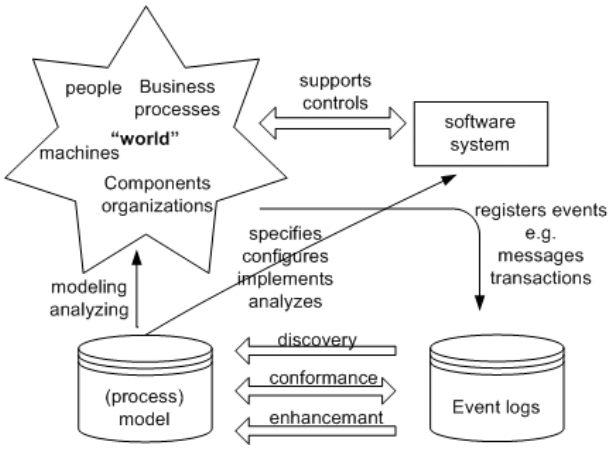

Fig. 3. Process mining

With process mining we reveal the communication that has actually happened and we compare it with the communication as it was intended by applying ISO 29481 (and defined in the so-called project specific framework) and with DEMO theory. This leads to the next planned activities:

- Do process mining with log files from VISI software and make findings about the process;
- Organize expert sessions with people from the analyzed building projects;
- Draw conclusions for projects and, if apprpropriate, VISI and knowledge base;

The added value is that the communication that happened is objevtively determined. In the expert session, the experts (remember that they are project members) reflect on the facts which can lead to improvements in the project. This is in one particular project. In terms of the three cycle view (see Figure

1) this is part of the relevance cycle. If the results for several or all projects are assembled, it is possible to draw conclusions about the implementation of the VISI standard, which is important for future building projects. This is part of the design cycle. This means that a process of continuous improvement has come into existence. In last resort the conclusions can be used in the rigor cycle to add to the knowledge base.

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