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Application of the Collaboration Facets of the Reference Model in Design Science Paradigm

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ABSTRACT
Current challenges in design science research aim for consisting and detailed phases to guide design science researchers to manage projects in the information systems field. By having taken this challenge, we present a reference model, which serves as the foundation to structure information in construction of business process model artefacts in design science research. It contains activities responsible for literature review, collaboration with practitioners, and information-modelling. In this paper we demonstrate the collaboration with practitioners facet of the model to answer a question of how to construct a business process model artefact with practitioners from the field. The contribution of the paper is that application of the collaboration with practitioners activities in the context of design science supports the quality of design science artefacts, and provides design science researchers with choices of techniques

Keywords
Design Science, Collaboration, Business Processes.

1. INTRODUCTION
Design Science (DS) research methodology has received increased attention in computing and information systems (IS) research [1]. It has become an accepted approach for research in the IS discipline, with dramatic growth in related literature [2]. However, its current stage does not offer consisting and comprehending phases, which will guide researchers in their choice of techniques [3]. Thus, in this paper we refer to the reference model [4] (aka the process oriented reference model) which aims for techniques of meta-design artefacts. We discuss and present its modelling step in the context of business process model artefacts.

This paper is organized as follows. The next section reviews the design science research literature and proposes its challenges and potential ways of further development. Based on that review, the subsequent sections present

the reference model that covers phases for meta-design step in DS. Then, we elaborate in depth and demonstrate one of its phases – collaboration with practitioners activities, in the context of process oriented artefacts. Next, we evaluate the activities by means of the Satisfaction Attainment Theory (SAT) [5] and the elaborated solutions. This paper helps define future directions and phases of design science methodology within the full spectrum of information systems research approaches.

2. DESIGN SCIENCE

Design science focuses on creations of artificial solutions. It addresses research through the *building* and *evaluation* of artefacts designed to meet identified business needs [6]. Understanding the nature and causes of these needs can be a great help in designing solutions [7]. Literature reflects healthy discussion around the balance of rigor and relevance [8] in DS research, which reflects it as a still shaping field [9].

Views and recommendations on the DS methodology vary among papers, e.g. [10,11]. DS methodological guidelines from the precursors Hevner [8] and Walls [12], are seldom 'applied', suggesting that existing methodology is insufficiently clear, or inadequately operationalized - still too high level of abstraction [11]. Descriptions of activities (procedures, tools, techniques) that are needed to follow the methodology are only briefly indicated. By having taken up the challenge, 3 main activities were identified as crucial in the development of DS artefacts [13]. These are: literature review, collaboration with practitioners, and relevant modelling techniques [14]. The reference model [4] examines these activities in terms of development of meta-design artefacts [15]. For a better overview, where it fits in design science methodology, we first introduce our understanding of the current state of the art of DS and its artefacts.

Researchers understand artefacts as "things", i.e. entities that have some separate existence [16]. They can be in form of a construct, model, method, and an instantiation [8]. In construction of the artefact, researchers observed two activity layers [17]: 1) design practice that produces situational design knowledge and concrete artefacts and 2) meta-design that produces abstract design knowledge. " Meta-design can be viewed as 2a) a preparatory activity before situational design is started and 2b) a continual activity partially integrated with the design practice 2c) a concluding theoretical activity summarizing, evaluating and abstracting results directed for target groups outside the studied design and use practices" [17]. The meta-design step concentrates on providing an optimal solution for the domain by trying to cover the whole spectrum. The design practice refers to it, then, by adjusting and applying it to a concrete business scenario (i.e. an instantiation).

As abovementioned, abstract and situational design knowledge can be treated as two individual outcomes of design science. Thus, it seems reasonable to consider two different evaluation methods for each of them; these are – artificial and naturalistic [18]. Meta-design step plays crucial role in constructing the knowledge base for a final instantiation and its utility. Figure 1 illustrates its place in design science research, and the general relationship among IS artefacts [19]. The aim of the reference model was to detail activities [13] that are carried out in that step and then use to guide the design science researchers through it. The three 3 main activities of the reference model were produced by comparing multiple plausible models of reality, which were essential for developing reliable scientific knowledge [20]

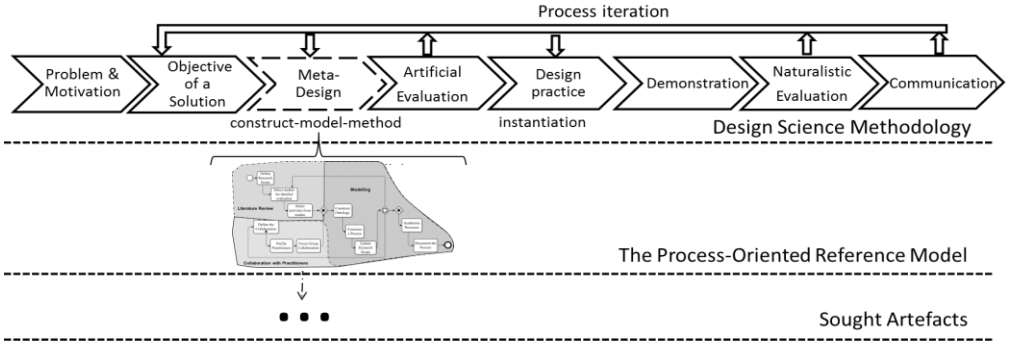

Figure 1 The Reference model in the Design Science Research Methodology - adapted and updated from [11]

Next sections introduce the reference model, and how all activities cooperate to achieve a desired solution. Then they elaborate and demonstrate the collaboration with practitioners activities.

3. THE REFERENCE MODEL

The idea behind the reference model was to deliver the knowledge base, which combines information from two processes: literature review and collaboration with practitioners. Their main roles are to 1) gather information related to the investigated domain of interest, and 2) represent the information in an understandable way to the stakeholders. Before analysis and combination of solutions from these sources take place, each process provides its own solution. Thus, to make the analysis and combination part more effective, the same modelling techniques in both processes are introduced. These are the ontology engineering and domain specific modelling language. The former gives researchers the design rationale of a knowledge base, kernel conceptualization of the world of interest, semantic constraints of concepts together with sophisticated theories [21]. In the context of process oriented IS solutions, the latter introduces business process modelling notation (BPMN). For example, if a

researcher investigates a process of an employee engagement, the ontology engineering technique will represent the gathered knowledge retrieved from those two sources. Then, the BPMN will model it into the desired shape of a process. Figure 2 illustrates the overview of the reference model.

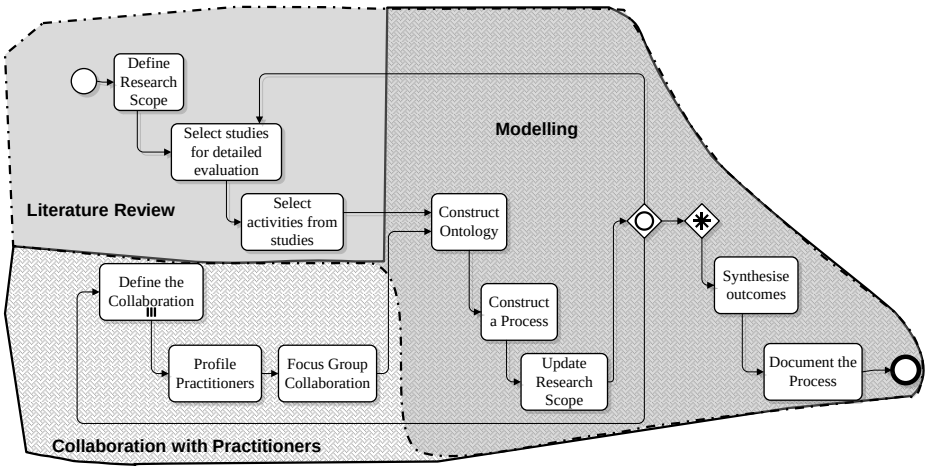

Figure 2 The Reference Model – Overview [4]

Now, we will introduce the collaboration withpractitioners activities of the reference model. We concentrate on the case where the artefact investigated is a business process model. While we acknowledge this iterative nature of the activities involved, we discuss and present the model as a linear sequence of steps to keep the description straightforward.

4. COLLABORATION

Practitioners' best practices and expertise constitute the second source of information for the business process model artefacts in the reference model. This part of the reference model focuses on working along with practitioners to discover and come up with an agreement on a general process activities emerging from various experiences. In line with the findings for activities of meta-design phase, the main goal of the literature review process is to provide information for the artefact coming from literature review, whereas collaboration with practitioners is to provide information coming from industry. Also similarly to the literature review process, the collaboration with practitioners is represented by BPMN. Researchers may use knowledge gathered from literature to prepare for the collaboration, however, it has been found that not disclosing the process based on literature to practitioners at early stages keeps the collaboration open minded. The key is to concentrate on the best practices without the interference from other sources.

To build systematic development of transferable, reusable and predictable collaboration with practitioners, literature review outlined a collaboration engineering approach[22]. It focuses on designing purposeful interaction

within the context of a sequence of phases that helps a group to achieve its goal. Collaboration engineering can be viewed as facilitation, design, and a training approach that aims to create collaboration processes supported by tools such as group support decision systems (GDSS) [23]. This approach was revised and modified to the level presented in the Figure 3 and demonstrated in the following case study.

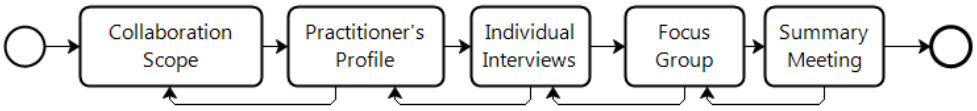

Figure 3 Process of Collaboration with Practitioners

5. CASE STUDY

The following demonstration of a case study describes the application of the collaboration with practitioners process of the reference model for business process model artefacts in design science research. In the period of March 2012 until November 2012, a business process model artefact was constructed that guides senior managements through an innovation process and indicates the points where the value of on-going innovation project can be measured. During the course of the design science research, the process oriented reference model artefact was applied.

The following first introduces the research motivation, problem and briefly findings of the literature review. Then, the course of collaboration with practitioners is described in detail.

Problem identification for this research started during industrial meetings of senior managers. They were facing the challenge of measuring innovation which has to be measured like everything that businesses do which involves the investment of capital and time. However measuring innovation presents problems for the process itself that is to be measured. It was also stated that the risk which the innovation process requires if it is attempted to measure the wrong things at the wrong time. These senior managers coming from various enterprises decided to work together in order to design the desired business process model for measuring innovation. In order to achieve that, they followed design science research and struggled with its execution. This was a good opportunity to show application of the reference model, how it facilitates collaboration with practitioners from different industries and provides the business process model desired.

Following the model, the collaboration scope was narrowed down. The analysis of the process model topic, the involved participants, and resources were conducted. The task analysis was formulated as a business process model capable of measuring the value of innovation realized by a firm. The deliverables was to represent the process in BPMN. Overall, seven

participants from five companies were involved in the focus group collaboration. They participation was voluntarily and motivated by the opportunity to share experience and best practices between parties involved. Finally, the resource analysis concerned the available time. Each company dedicated 90 minutes slot for individual interviews on their site, and 5 hours for a group meeting. One of the company provided software to facilitate online meetings. In addition, mind map software was used to make notes and visualize insights provided by participants. The participants' roles in their organisations were linked close either to facilitation of innovation projects or execution.

The focus group collaboration followed the activities listed in Table 1. In the step 0, questions for individual interviews were prepared. The questions were split into two sections. First section was to understand and determine participant's connection to the innovation process and its measurements. Thus, the questions were formed around their organizational units, daily activities, main responsibilities, and personal understanding of the innovation process. The second section referred to questions that could allowed for further elaboration on participant's expertise regarding the desired process. For example, the questions of the second section regarded a formal measurement methodology in place of a particular organizational unit, people involved in innovation value measurement, milestones and activities of measurement, as well as metrics used. These rather general questions were later decomposed into more detail sub-questions as the interview progressed.

Table 1 Activities Decomposition

Activity of Collaboration	
Step 0. Questions preparation	
A1	Analyse findings from the literature review, participants' profiles, and the scope.
Step 1.Getting individual participants' perspective	
B1	Individual contextual interviews to understand participants' expertise
B2	Individual domain interviews to gain process relevant activities from the participants context
B3	Transcript of the interview to summarize and authorize the information
Step 2. Initial analysis	
C1	Group activities from domain interviews
Step 3. Focus group meetings	
D1	Getting the participants to know each other
D2	Presenting findings from the interviews

D3	Grouping similar activities by participants
D4	Revision of all activities by participants
D4	Consolidation of the Process
Step 4. Conclusion	
E1	Summary of the focus group achievements in relation to the scope of the collaboration.

In the step 1, the interviews with each participant of the focus group were conducted. This phase was divided into two activities (B1-B2). First, questions from the first sections were asked to understand and get to know a participant's expertise and perspective to the process. Hence, the researcher followed laddering interview method and only the first section of questions was asked. Answers were put and visualized on a mind map. There was 40 minutes allocated for this part. At many occasions participants had prepared presentations prior to the interview and additional time was needed. These presentation provided overview of the organisation and the context of innovation they were into. The last 50 minutes of the interview was dedicated to the business process investigated. As the interview was progressing, a sketch of the process was being updated and displayed on the mind map software in order to allow the participants to track correct interpretations of their saying. For the B2 step, semi-structured interviews were chosen. In addition a transcript of each interview was sent for an authorization with a request for clarification of ambiguities that were discovered after the interview took place.

In the step 2, all transcripts of the interviews were summarized and distributed to all participants prior to the focus group meetings. One of the goals was to provide all participants with the same amount of knowledge, so that at the focus group meetings more insights could be delivered. The key finding at this stage of the research was a clear distinguish between measuring innovation as facilitator and technical IT. Along with the summary of transcripts, an overview of the agenda for the focus group meetings was provided.

The following step 3 describes activities of the focus group meetings. An ice breaker and focus group work methods were applied. Since, some participants could not attend the meeting in person; the meetings were carried out through an online collaboration tool. All participants in the room had a logged in PC to the tool and all questions and summary of answers were put through that tool. The online tool generated reports of all typed in words so that enhanced the analysis of the meeting at later stage. The meeting began with an introduction of the meeting agenda followed by allocation of 5 minutes for each participant to introduce their organisation,

roles, and relation to the innovation process. This was a result of a simple ice breaker method to catch up with each other. The participants knew each other from the time the focus group was established. The rest of the focus group meeting was structured accordingly to the focus group work method [24]. Each participant was provided with the process of measuring innovation derived from their interviews. Then, each participant presented and described the process model to the rest of the group so that everyone got an overview of possible perspectives to measure value of innovation projects. Anyone was allowed to ask questions to the presenter after each presentation. In addition, after each presentation, there was 5 minutes brainstorming, so that some additional insights could be added to the model, e.g. metrics, activities. Once all the business process models were presented a poll was introduced. The most comprehensive process model was selected as a core to which additional activities from other process models were added. The following activity required from participants to work together to build the business process model of measuring innovation value based on the most voted process model and the other ones presented. The most voted business process model was displayed and participants could make suggestions what else should be added. If majority of participants did not raise any objections the suggestion was added. The mind map software was used to move activities of the process for the final consensus. The focus group meeting ended roughly after 5 hours including 30 minutes break. For the step 4, a short 40 minutes conclusion meeting was organized at which the business process model for measuring innovation value was presented.

6. EVALUATION OF THE COLLABORATION

The collaboration with practitioners activities were evaluated from three different perspectives: perceived net goal attainment, satisfaction with the meeting outcome as well as satisfaction with the meeting process. These three perspectives constitute the Satisfaction Attainment Theory which was used with participants who conducted these activities and were asked to elaborate on the business process model artefacts modelled. Participants of these activities were stakeholders of a public organisation. The organisation provided IT services for various departments. The practitioners in the numbers of 9 were between 23-40 years of age (M 33, SD 2.5). The gender was split in 5 males, and 2 females. Their work experience in the organisation was between 3 to 9 years (M 5, SD 1.3). Their roles were mainly business analysts from fields of information systems and computer science. Participants took part in these activities willingly, and therefore, it was assumed their responses to the questionnaire were genuine.

Table 2 summarizes the results of the evaluation of the meeting satisfaction. We used 11-point Likert questions (11=best), relating to each of the elements of the Satisfaction Attainment Theory

Table 2 Evaluation of the collaboration with practitioners activities

Dimension	Mean	n
PerceivedNetGoalAttainment(PGA)	8.7	9
Satisfactionwith the Meeting Process(SP)	9.5	9
Satisfactionwith the Meeting	10.1	9

The values for the means indicate a high satisfaction of the participants with each of the three dimensions from the Satisfaction Attainment Theory. Each element was measured by five questions in the questionnaire. All fifteen questions can be found in the appendix A of [5].

Feedback received upon and observations made during this case study enabled a further refinement of the reference model. Participants suggested that the transcripts of the interviews should be in a narrative form and divided into two documents. First document summarizes individual interviews and is sent to relevant interviewees for approval. The second one sums up the approved content and is distributed among the others participant who will attend the focus group collaboration meetings. In terms of the agenda planning, it was observed that the approximate time from the interview taking place to the approval took around 4 elapsed weeks. Hence, this has to be taken into account when drawing up schedules. It was challenging to keep the meetings of the focus group in the time constraints. Participants, from time to time happened to choose a topic for a discussion which was not strictly related to the scope of the meeting. These situations were handled diplomatically and the researcher role was to keep the time allotted in mind at all time. Finally, almost all participants had some slides already prepare prior to the interviews. Thus, the extra time for such unexpected circumstances has to be included in the agenda of the reference model.

The business process artefacts built with the collaboration with practitioners activities of the reference model scored explicitly as well as the process of execution the activities. This concludes the usage of the model for the main purpose, which was to provide researchers with a structure way to help conduct and communicate the research outcome with the stakeholders. We claim that the collaboration activities of the reference model constitute a consistent method for the meta-design phase in design science research methodology to guide the design science researchers to manage information systems projects.

7. CONCLUSIONS

We observed challenges in structuring and standardizing phases of design science research methodology, which would guide the design science researchers in their choices of techniques that might be appropriate at each stage of the project and also help them plan, manage, control and evaluate information systems projects. We introduced how to construct a business process model with collaboration with practitioners from the field. The activities outlined were a part of a reference model that helps structure and model knowledge in design science research. Our future work involves revising the model, based on users' feedback, and concentrating on evaluation techniques of its outcome. Hopefully, this will increase the efficiency and quality of artefacts, while containing or further decreasing the cognitive effort involved.

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