Developing a Tool for Self-Assessment of IT Process Maturity: A Design Science Research Initiative

Henn Jaadla[1], Björn Johansson[2]

[1] Swedbank AS,
Liivalaia 8, 15040 Tallinn, Estonia
henn.jaadla@swedbank.ee

[2] Department of Informatics, School of Economics and Management, Lund University
Ole Römers väg 6, 223 63 Lund, Sweden
bjorn.johansson@ics.lu.se

Abstract: Today's IT organizations must ensure that IT services are aligned to business needs and actively support ongoing business processes. This means that internal IT service management processes are under constant improvement. However, to be able to know if the IT service provision develops in the right direction, there is a need to perform some kind of self-assessment of IT process maturity. In this paper we present an initial review of IT process maturity frameworks with a focus on self-assessment models. The main aim of the paper is to present a design science research (DSR) project with the goal of developing a tool for self-assessment of IT-maturity. The context of the project is a large bank and the developed tool should become a permanent part of the toolkit used by the bank, to continuously describe a baseline of current state - "where are we today". Such baseline will assist the IT organization in identifying the gap to a wanted future state, and will thereby become the basis for any improvement plans. This paper presents the first steps in this DSR project and highlights the need and benefits of conducting the project as a DSR project.

Keywords: IT Service Management (ITSM), Self-assessment, CMMI, Design Science Research (DSR), Continuous Improvement

1 Introduction

Many IT Service Management organizations are adopting Agile software development methodologies to improve *time-to-market* [1] and to increase customer satisfaction [2]. However, while an Agile way of working promotes fast feedback loops and better alignment with customer needs, this informal way of working may create gaps in process compliance and maturity [3] – especially during the transition to the new way of working, when process participants are still adjusting to the new roles and responsibilities. Organizational change may impact the control and feedback cycles of IT processes due to low process awareness, incomplete role adoption and

other transitional effects. In addition to that, the differences between Waterfall and Agile may exacerbate the negative effects, if not mitigated properly.

Therefore, when IT enterprises are undergoing organizational changes to Agile way of working, it would be prudent to evaluate IT process maturity throughout the change, to ensure that lapses in process compliance and maturity can be handled swiftly.

This paper introduces a design science research (DSR) project for developing a tool for self-assessment of IT process maturity at a large bank.

Process maturity level is an indication of how well a process achieves its objectives, and whether the process is capable of continuous improvement [4]. Process maturity assessments are commonly used as the starting point for ITIL (a set of practices for IT Service Management; formerly an acronym for Information Technology Infrastructure Library) implementations, to pinpoint the improvements which would bring the most benefit, but they are equally valuable for understanding the *as-is* state for planning continuous improvements and evaluating the overall performance of the IT organization. So, whenever an organization is undertaking a process improvement initiative, or going through organizational change, there is an increased need for process maturity measurement. Furthermore, to gauge the progress of improvements, or the impact organizational changes have to processes over time, the measurement should be applied at regular intervals, across various roles and organizational departments.

The most common maturity assessments, however, are qualitative assessments, conducted through interviews, which are complex, time consuming, and expensive to apply.

The DSR project presented in this paper attempts to design a quantitative assessment based on the Capability Maturity Model Integration (CMMI) framework, which will be conducted by performing a questionnaire-based survey among process participants. The simplified nature of a self-assessment means that the survey can be applied to different organizational units, and performed regularly, to make it useful for monitoring IT process maturity trends in the organization.

The next section of this paper presents an initial review on IT process maturity self-assessment, and describes the need to have a clear picture of IT process maturity in today's organizations.

We then proceed by describing the context for the proposed DSR project, which is the IT organization of a large bank. The way the bank has been working with development of IT is presented, as well as the changes that have recently been implemented since the IT development process has changed into an Agile development process.

The second-last chapter presents the suggested DSR project and describes the steps and activities that are planned, as well as why these activities are suggested.

In the final section we present some concluding remarks on why we believe a DSR project is the most appropriate approach in this case, and describe the benefits that are expected as results from conducting the research in this way.

2 An initial review on IT process maturity self-assessment

The importance of internal services and their impact on the quality of the manufactured products was the principle of the Total Quality Management approach, developed in the '80s by Deming. Today, there appears to be common understanding,

that internal service quality is an influence and a key quality collaborator of external services [5]. Exemplifying this is the multitude of international standards available for managing IT Services.

There is a high demand on IT organizations to deliver value added IT services, and IT services are under constant pressure to become better, faster and cheaper [6]. Therefore, improvement and optimization of an IT organization's service processes is an ever-ongoing work in progress. It is important to have well-working IT service management processes in order to gain edge and maintain competitive advantage. IT Service Management (ITSM) is the discipline that strives to improve the alignment of information technology efforts to business needs and to manage an efficient provisioning of IT services with guaranteed quality [7].

Regardless of where an organization is in the ITSM journey, understanding the current state of IT process maturity is critical when deciding on improvement priorities [7]. To define the current state by establishing an 'as-is'-baseline, several different methods - or combination of methods - are available [8]. One of the most commonly used methods is to do a maturity assessment, which will determine the IT-processes maturity level in an organization compared against a best-practice reference set of processes [9]. IT process maturity is a good indicator for the organization's ability to perform and deliver value added IT services. The whole idea is that a maturity model defines different maturity levels, and the higher up on the maturity scale an IT organization is, the better it performs.

Apart from illuminating areas for improvement, self-assessment provides an important cultural benefit because it encourages an ethos of continuous improvement, promotes a holistic perspective, and allows people to gain a broader understanding of the area in question [10, 11]. Regular use of self-assessment ensures that sound approaches are used and developed in the organization [12].

There is no universal method for such self-assessment. On the contrary, findings indicate that several approaches to self-assessment are successful as long as they fit the organization, are used continuously and foster participation. [13].

One way of performing a maturity self-assessment is qualitatively through conducting interviews and collecting evidence. This is however a long and costly method, as the interview process and data collection is a highly complex and specialized task that needs to be performed by competent assessors. Because of the complexity of these methods, maturity assessment becomes an expensive and burdensome activity for organizations [14].

Therefore it can be more appealing for an organization to select a quantitative approach [7], where a representative selection of the process participants is surveyed using a simplified questionnaire.

From a business perspective, the notion that it is easier to convince top management when a large quantity of people has had a say can also weigh in favor of a quantitative approach [15].

In quantitative assessments, a large number of respondents is surveyed, and therefore it is important that the respondents understand the context and the questions in a similar way. Therefore, to create a suitable assessment tool for the organization, it is important to adjust the questions to set them in the appropriate organizational context.

There are several aspects which impact the choice of assessment method, including the need for independent external validation of results, applicability for benchmarking, cost to business in time, effort and resources, etc. But perhaps the most important factor of choosing the assessment method is whether the assessment method is appropriate to support a long-lasting improvement program.

Laszlo [16]) concludes that few programs can withstand the test of time without appropriate follow-up. Experiences have shown, that organizations that do not manage to control the improvement initiatives they have established will lose focus on achieving the basic organizational objectives [17]. Continued success means that progress must be monitored continually to identify what has gone well and what needs to be improved; then strategies and actions to increase the pace of improvement can be developed [18]. With all this in mind, we next presents a DSR project that aims at developing a tool for Self-Assessment of IT process maturity.

3 The context of the DSR project

The following section of the paper describes the IT organization of the company in question, describes the Waterfall- and Agile-based versions of the company's IT Development Process, as well as the implications that their differences have on the IT processes.

Swedbank is a large multinational financial institution with around 16000 employees. Swedbank's main IT operations are distributed across four countries. The company has a long history of software development, and has utilized different techniques in different projects and developments, including Agile and Extreme approaches. Due to the nature of the business, however, the development of software has been heavily influenced by hardware-oriented development approaches. Due to the need to control the development of complex software-intensive systems, Swedbank's Development Process has historically been built on the Waterfall approach. This process has been well-integrated with IT Governance, Resource Management, and Financial Process. However, for the Business customers, the Waterfall approach has the downside of long lead times and slow feedback cycles.

To mitigate the downsides of the implemented Waterfall approach, Swedbank has been introducing an Agile approach in some teams over the past several years, and as of 2018, the Agile approach is implemented throughout all Business Areas.

The department-based way of working with clear distinction between IT development and maintenance roles is replaced with cross-functional teams that handle both development and operations, and are working based on a common backlog.

Swedbank's ITSM processes are based on the ITIL framework. The change to Agile development process will affect the ITSM processes by changing the roles and responsibilities, organization structure and the speed of introducing new services into the production environment.

The changed dynamics of the way services are developed and operated will impact the IT process maturity in various ways, and therefore it is important to evaluate the process maturity changes throughout this organizational change, across the different affected teams.

3.1 Swedbank Development Process framework

The existing Swedbank Development Process, which is shown in figure 1, is based on the Waterfall approach.

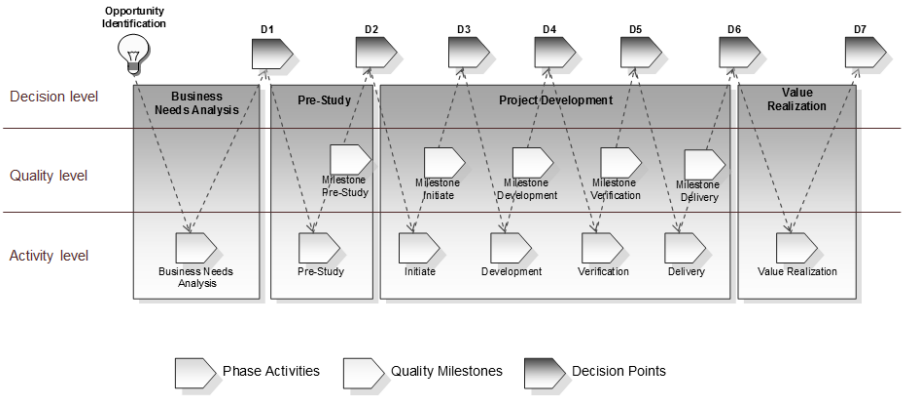

Figure 1 - Swedbank Development Process (Waterfall)

The "Waterfall" development process consists of four phases as shown in figure 1.

Phase 1, Business Needs Analysis aims to capture ideas/identified needs, and prepare a rough Business Case to understand whether it is worth investing in continuing with a Pre-study.

During Phase 2, Pre-study, the new or changed business model and the requirements are analyzed, alternative solutions are assessed and a recommendation on the approach is made. Then the architectural description is prepared and approved, and based on this, the project risks are assessed. Before moving to the next phase, the business case is refined, and the initial value realization plan is created.

Phase 3, Project Development, comprises of the traditional waterfall steps of initiation, development, verification and delivery.

Phase 4, Value Realization, contains the activities in business operations to fully utilize the output of the project, and the measurement of the outcomes and effects to assess the achievement of the business case and for input to future investment decisions.

3.2 Agile Development Process

The new, Agile Development Process is fitted into the same framework, represented in the same three levels. The Agile Development Process framework is only visibly different from the Waterfall Development Process framework in that the Development and Verification phases are combined into a single phase called Iterative Incremental Development. This phase is repeated for each iteration.

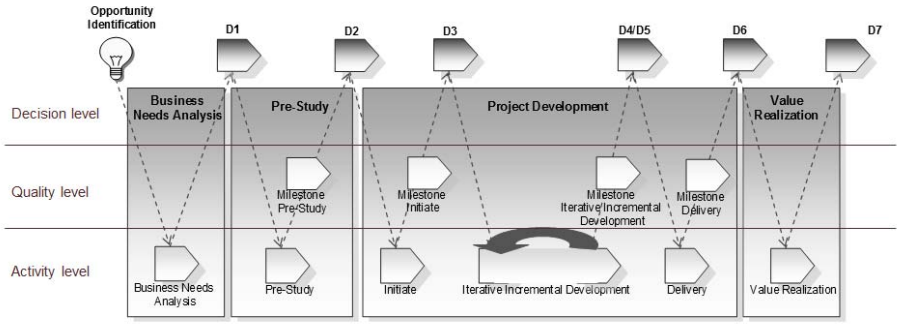

Figure 2 - Swedbank Development Process (Agile)

However, the patterns of work within the project organization, which is comprised of the steering committee and the development team, are quite different in Agile.

- The project budget and time are fixed at the beginning; functionality is prioritized to deliver business value.
- Requirements are initially described in the form of user stories, in simple business language. There is less detail upfront than in a Waterfall project; detailed documentation may be created at the end of project, if needed.
- Development of the solution is performed in time-boxed iterations. Detailed planning is made at the beginning of the iteration, although there is no detailed plan for whole project.
- All team members are jointly responsible for the planning and for the monitoring of progress of the iteration. A business representative is part of the development team throughout the project.
- Agile specific techniques and tools are used for project planning and management, e.g. estimation using abstract story points, planning using the task backlog, status reporting in daily stand-ups and burn-down charts.

3.3 Challenges of an Agile approach

There are several risks arising from the organizational transition from centralized, waterfall-based way of working to decentralized, Agile way of working [3].

Among the transitional effects are the incomplete role adoption, low process awareness and team motivation issues during the formation of the new cross-functional teams.

Decentralization may lead to uneven performance between different business units due to different adoption speed of new way of working. Additionally, the decentralization may result in inefficiencies and duplication of control and management activities.

However, the biggest change of introducing Agile way of working is made to the way Business areas, departments and teams are structured. Previously, the development and maintenance teams were mostly separated, and all IT teams belonged to the IT divisions linked to the Business Areas.

In the Agile setup, Business Areas are divided into value streams, which in turn are divided into Agile teams, which handle both development and maintenance of the services. The teams will belong directly to the Business Areas, and there will be a dedicated Business representative in each team. This will give the teams increased autonomy in how they build and maintain their services.

As a result, ITSM processes will also be directly affected by this change, as both development work and maintenance tasks will be handled by the same cross-functional team, and the prioritization for the tasks will be done in one backlog. This creates a risk, that maintenance, lifecycle management, and service operation tasks may be under-prioritized in favor of development tasks.

3.4 Swedbank approach to measuring IT process maturity

In order to manage the impact that the transformation has to the IT Service organization, there is a need to measure the effect this move has to process compliance and IT process maturity.

Process maturity assessments take a comprehensive look at how an organization integrates people, processes, tools, products, and management. This detailed understanding is commonly used for identifying and prioritizing process improvements [7]. However, in this case, the goal is to identify a trend of process compliance and maturity.

To be able to gauge the impact of organizational changes to the IT process maturity level, the maturity assessment needs to be performed regularly, to identify trends and provide feedback while the new way of working becomes the norm. A full Capability Maturity Model Integration (CMMI) assessment is unsuitable for establishing trends in a short timeframe due to the cost, disruption and long feedback cycle. Therefore, the IT Process Maturity Assessment project at Swedbank aims to implement a survey-based self-assessment, which can be applied repeatedly across a broad spectrum of roles and business areas within the IT organization.

4 The design science research project

Swedbank aims to improve on the off-the-shelf maturity assessments by establishing a Swedbank-specific, recurring IT process maturity assessment program. The assessment will build on the CMMI framework, but will be adjusted to the Swedbank context and supplemented with questions regarding motivational and business benefit aspects.

Swedbank IT process maturity self-assessment tool will be developed as a design science research project. This approach will allow us to formalize the design, testing and verification steps, and to ascertain validity, reliability and accuracy of the results.

The reasons for our choice of the DSR method is that the method itself aims to create an artifact (e.g. a method, models, constructs, instantiations) and therefore is suitable for the purpose of our research.

Regarding our specific research we have used the framework of Hevner, March, Park [19] and adapted it to our research context (Figure 3). The environment defines the problem space [20] and here we find the goals, problems, and opportunities that define requirements, as they are perceived by people within the Swedbank IT organization.

Design science addresses research through the building and evaluation of artifacts designed to meet the identified business need [19]. The purpose of our research is to create the artifact to be evaluated in collaboration with the IT organization in an iterative way. In this way the project is also related to Action Design Research (ADR) as presented by Sein, Henfridsson, Purao [21].

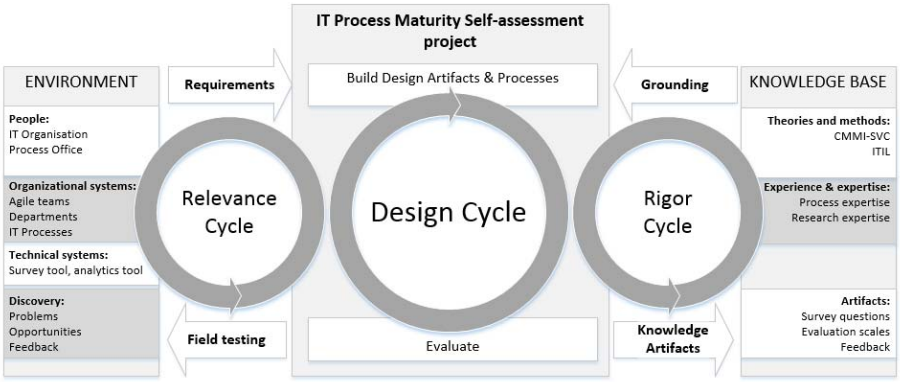

Figure 3 - DSR framework for the project

The Relevance Cycle provides input from the contextual environment of the research project to the design science activities. The Rigor Cycle bridges the design science activities with the knowledge base of scientific foundations, domain experience, and expertise that provides guidance to the research project. The central Design Cycle iterates between the core activities of building and evaluating the design artifacts and processes of the research [19].

4.1 The Relevance Cycle

An application domain consists of the people, organizational systems, and technical systems that interact to work toward a goal. The application domain determines the requirements and acceptance criteria for the research.

In this case, the people perspective consists of IT organization, Process Office and Agile teams, the organizational systems are the departments and the IT Service Management framework, and the technical system is the survey tool and the analytics tool used to gather and process the results.

The scope of the maturity assessment will be the IT Service Management processes, and the assessment will be based on the Capability Maturity Model Integration for Services (CMMI-SVC) model, gauging the IT process maturity and performance on Process Area level, with the topics divided into three dimensions: People, Process and Technology.

The questionnaire will be created in cooperation with the Process Office to engage the subject matter experts in tailoring the CMMI framework for Swedbank context.

The output from the design science research will be returned into the environment for study and evaluation in the application domain, i.e. the maturity assessment will be carried out on a test group in the organization, and the results verified and validated with the participants and subject matter experts from the Process Office.

The results of the field testing will determine whether additional iterations of the relevance cycle are needed. The new artifact may have deficiencies in functionality or in its inherent qualities (e.g. performance, usability) that may limit its utility in practice. Another result of field testing may be that the requirements input to the design science research were incorrect or incomplete with the resulting artifact satisfying the requirements but still inadequate to the opportunity or problem presented.

4.2 The Rigor Cycle

Design science draws from a knowledge base of scientific theories and engineering methods that provides the foundations for rigorous design science research. As importantly, the knowledge base also contains additional knowledge: firstly, from the experiences and expertise that define the state-of-the-art in the application domain of the research, and secondly, from the existing artifacts and processes found in the application domain and the artifacts and processes developed in the iterative design cycle.

The proposed approach builds on the CMMI-SVC framework, which represents the best practice approach. This choice was based on the fact that CMMI is an established model widely recognized in the industry, and that it allows the tailoring of the model to better suit specific projects [22].

There are several works concerning the usefulness of IT process self-assessments, which will provide a foundation for the improvements to be made in the design cycle [5, 15].

There is a question of accuracy of quantitative process maturity self-assessments, when compared to full qualitative process maturity assessments. Quantitative assessments have a tendency to score maturity higher than it actually is, especially in the people and process dimensions, but also in the tools dimension, which all require specialist knowledge of the area in question [15]. The same tendency has been identified in health sciences [23]. It is important to be aware of this upward bias, especially when identifying improvements to implement on the path towards the next maturity level.

It can also be questioned, whether IT process maturity alone is a good framework for covering compliance, performance, value, quality and effectiveness of IT processes. It may be insufficient to rate effectiveness of IT without the context of business customer viewpoint. The IT capability maturity needs to be assessed against actual business needs, and the value the processes provide to Business in terms of cost and organizational risk. Also, the actual practice or operation of processes is strongly affected by culture and behavior of the participants. The CMMI framework does not specifically address the topics related to culture and motivation.

In the rigor cycle the data and artifacts from the design cycle are collected, stored and analyzed. This includes the coding and mapping of questions for each iteration, the functional setup of the survey tool, the interpretation and reporting artifacts of the survey results, and the detailed feedback received from project participants.

4.3 The Design Cycle

The internal design cycle is central part of the science research project. This cycle of research activities iterates between the construction of an artifact, its evaluation, and subsequent feedback to refine the design further.

The goal of this cycle is to generate design alternatives and evaluate the alternatives against requirements until a satisfactory design is achieved (Simon 1996). As discussed above, the requirements are defined in the relevance cycle and the design methods and theories are provided in the rigor cycle.

The IT process maturity assessment tool will contain two main components. The data collection functionality will be developed as a web-based survey, using a common survey platform. This platform will store the questionnaire, recipient lists and raw results data.

The second component is the translation table for the results, where the processing and aggregation of results is performed. This will initially be built in excel, with more advanced tools considered as the project continues.

The questions will be based on CMMI-SVC, modified to suit the organization's processes and language. The questions are mapped to a CMMI process area and maturity level, Swedbank process, and the respective dimension of People, Processes or Tools.

To cover the culture and motivation perspective not specifically addressed by CMMI-SVC, the People dimension will be extended with questions relating to team collaboration, motivation and self-improvement aspects. The Process dimension will be supplemented with questions about process relevance to business goals.

The focus of interest is on the roles that are most frequent participants of the operational processes: Cross-Functional Team managers, Cross-Functional Team members and Agile Product Owners.

The results will be aggregated by business area and role in the new organization. The assessment results are mainly an input for the Process Office, which is the organizational unit in charge of IT processes at Swedbank. Process Office will validate the results against the process documentation. Where the results indicate shortcomings and issues, the Process Office will with the help of the tool be able to identify the likely causes of process gaps, and propose the appropriate countermeasures, e.g. process training, updates to documentation and work instructions, or process improvements.

5 Concluding remarks

Designing an IT process maturity self-assessment tool is essentially a pragmatic exercise due to its emphasis on relevance – the outcome has practical utility for the application environment.

However, practical utility alone does not provide a good solution and therefore it is suggested to conduct the project as a design science research project. It is the synergy between relevance and rigor and the contributions along both the relevance cycle and the rigor cycle that define good design science research [24], but, also produce a solution that is both relevant and practical.

By utilizing the DSR approach in designing an IT process maturity assessment tool, we hope to develop a tool that is both useful and theoretically sound, to make sure that the assessment results will reflect the true maturity state of the organization.

We hope that by engaging the line organization in the relevance cycle, and process experts from the organization in the rigor cycle, we will succeed in creating a tool that is based on Swedbank way of working and matched to CMMI-SVC maturity model.

The initiative is part of a long-term commitment to process improvement by Swedbank. As the self-assessment of IT process maturity is developed into a continuous practice, we hope that it will foster awareness, participation and a continual improvement culture. We also hope that the project as such will provide both practical and theoretical contribution into the area of assessment of IT process maturity as well as into design science research and action design research.

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