

Master's Thesis

# Universiteit Leiden ICT in Business

Combining Lean Six Sigma with the Design & Engineering Methodology for Organizations. - An exploration of opportunities.

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- An exploration of opportunities.

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#### Summary

#### Introduction

Organizations want to continually and structurally improve their processes, in terms of e.g. commitment, maintaining quality, efficiency, effectiveness, and customer satisfaction. To enable those improvements several methodologies have been developed. Lean Six Sigma (LSS) and the Design & Engineering Methodology for Organizations (DEMO) are examples of such methodologies.

#### Reason

LSS combines two worlds. Lean focuses on reduction of waste, doing the right things at the right moment on the right location. Six Sigma is concentrated on improving processes and making them error free. This happens with advanced statistical techniques such as finding correlations and reducing variables.

DEMO has established in its theory a certain mindset and a way of modeling to be able to simply show the essence of organizations. DEMO abstracts from implementation choices such as; in- outsourcing, sharing, and clustering. Therefore its models stay compact, insightful and valuable. However this does not say anything about efficiency. This raises the question: 'How can the strengths of LSS and DEMO be combined?'

This research in terms of the 5-way model, can identify potential benefits and differences in combining LSS & DEMO. The phases of (L)SS are Define, Measure, Analyze, Improve, and Control (DMAIC). LSS does not prescribe a particular modeling method. DEMO lacks in phases, but has well-defined models. Therefore this research focusses on the following research question: "What is a plausible way to combine the phases of (L)SS with DEMO?"

#### Approach

The first part of this research consisted of a literature study on the topic of Lean, Six Sigma, LSS, and DEMO. It appeared that there is literature on LSS, and DEMO. However there has not been any research on the topic of combining or usage of LSS and DEMO together.

Semi-structured interviews were conducted in order identify the possibility of combining LSS and DEMO. The interviews were held with experts of LSS, DEMO, LSS & DEMO and users that have experienced and performed a LSS & DEMO Project (stad Antwerpen). Through comparable results, it was possible to draw certain conlusions about combining the phases of (L)SS and DEMO. These conclusions were taken into consideration when creating the 11 statements. These 11 statements have been rated and discussed. To validate these 11 statements and answer the research question a Group Decision Support Session (GDSS) was held. In this research a GDSS was held with experts in LSS, DEMO and LSS & DEMO. During the GDSS it was decided to brainstorm about the contributions of DEMO within each DMAIC phase.

Combining and processing these sources of data resulted in an answer to the research question. In any case, this research has provided points of interest/discussion for future research in combining LSS & DEMO. Results

The LSS methodology has a wide variety of practical uses and is used worldwide. One of the strengths of LSS is its broad approach and ability to adjust. Also, to use whichever tool or method seems fit for the project/process. However this is also LSS's weakness, the broad approach can give too many diverse options.

The DEMO methodology is defined and explained in well-founded literature. However the practical uses or necessity of some DEMO elements is not always clear for all practicioners. For example the CRISP model has been mentioned in literature but was unknown to several DEMO experts.

The following contributions of DEMO within each DMAIC phase were found.

- 1. DEMO elements (OCD, RGB distinction, and Transaction patterns) can contribute to the (L)SS Define phase by giving a clear insight in the scope of the project/process and actors.
- 2. DEMO elements (TPT and OCD) can contribute to the (L)SS Measure phase by identifying what has to be measured and where the indicators have to be measured.
- 3. DEMO elements (OCD and Transaction pattern) can contribute to the (L)SS Analyze phase by helping to identify the responsibilities and finding the errors/defects on the essential level.
- 4. DEMO elements (OCD and RGB distinction) can contribute to the (L)SS Improve phase by helping to identify what needs to happen after implementation, in terms of removing transactions and identifying new responsibilities.
- 5. DEMO elements (TPT, OCD, RGB distinction, and Transaction patterns) do not specifically contribute to the (L)SS Control phase, but might help by controlling the progress of the changes that have been made in the previous statements.

It is plausible to combine the (L)SS phases to certain DEMO elements. Some of the DEMO elements are more plausible to combine with certain phases (Define, Measure, and Analyze) than others (Improve, Control). For example the Organizational Construction Diagram (OCD) seems to be a great match to be created in the Define phase in order to create insight for defining the project/problem/process/SIPOC. There are more contributions of DEMO in the Define, Measure, and Analyze phases than in the Improve and Control phases. Future research

This research has identified the possible benefits and differences through the 5way model. In order to fully combine LSS & DEMO, the 5-way model could be an evaluation model to compare the methodologies as whole. The 5-way model research, which is focused on theoretical aspects, combined with this research that is focused on practical experiences, could give insight in on how to fully combine LSS & DEMO.

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### Chapter 1

## Introduction

The world is changing quicker than ever and organizations need to be able to (simply, quickly, efficiently, and effectively) adapt to new situations in order to embrace new and changing opportunities [1]. Organizations face many challenges such as: increasing sales, reducing costs, plan for future demand, finding new markets, etc. Even though there are many ways to improve an organization, project, or process there is always room for improvement [2]. Methodologies are created to provide the structure (guidelines, phases, methods, techniques, and tools) to enable the possibility for improvements [3]. As of today there are many methodologies, which pressures them to change as well, to adapt to the new situation.

#### **1.1** Problem statement

Projects nowadays are complex and the percentage of failing projects (Marketing projects, Post merger integrations, IT projects, etc.) is high. There are quite a few issues that should be taken into account during a project. Issues such as commitment, maintaining quality, efficiency, effectiveness, customer satisfaction, and delivering the correct results are leading causes for project failure [4].

In projects or processes a main problem is the complexity. Practitioners started developing systematic approaches for certain practical problems, which resulted in partial techniques and methods. The consolidation of such techniques has resulted in more or less coherent methodologies [5].

Lean Six Sigma (LSS) is known for its broad and comprehensive approach for organizations to focus on continuous improvement. LSS says by looking from the customer- and management aspect, you can answer the questions "are we doing the right things?" or "are we doing the things right?" [6]. This leads to knowing if processes or projects are efficient and effective. Many organizations worldwide report significant improvement in quality, lead-time and results by applying LSS [7].

LSS combines two worlds. Lean focuses on reduction of waste, doing the right

things at the right moment on the right location. Six Sigma is concentrated on improving processes and making them error free. This happens with advanced statistical techniques such as finding correlations and reducing variables.

Design & Engineering Methodology for Organizations (DEMO) has established in its theory a certain mindset and a way of modeling to be able to simply show the essence of organizations. DEMO abstracts from implementation choices such as; in/outsourcing, sharing, and clustering which helps models stay compact, insightful and valuable. However this does not show anything about efficiency.

How can the strengths of LSS and DEMO be combined?

Where DEMO focuses on the essence of business processes (which could set frameworks for a non-efficient implementation) and LSS focuses on an efficient implementation of business processes. They could complement each other because LSS doesn't prescribe any modeling method/tool, where DEMO has a well-defined background, and is explicit in modeling. Another point to take into consideration is that DEMO knows no phases, because the models that are used depend on the problem, whereas LSS has structured phases.

In order to fully combine LSS & DEMO, the 5-way model could be a possible conceptual framework for comparing these methodologies. This 5-way model is introduced by Seligmann, Wijers, and Sol (1989) [5] and further researched by Hostede and Weide (1992) [8]. The theory of the 5-way model is to structure different aspects and interrelated (problem) areas, based on five distinctions: the Way of Thinking, the Way of Modeling, the Way of Working, the Way of Controlling, and Way of Supporting. In Framework for understanding methodologies (5-way model) the 5-way model will be elaborated.

By using the 5-way model as evaluation framework for the LSS and DEMO methodologies, it will be possible to identify its strengths and weaknesses. The 5-way model could offer insight in the possibility of combining LSS and DEMO by comparing these strengths and weaknesses. Whether combining certain aspects of these methodologies can benefit or obstruct each other. Both methodologies are divided into the five distinctions of the 5-way model, which are mentioned below. Note that the 5-way model has been used to identify the problems with combining LSS and DEMO, not to combine the methodologies LSS and DEMO as whole.

#### DEMO:

- 1. DEMO's Way of Thinking is about seeing organizations as actors entering into and complying with commitments. DEMO shows the essence of an organization/process. To show the essence of an organization/process, there are universal transaction patterns. The RGB distinction helps to identify types of transactions and transactions can help to identify responsibilities.
- 2. DEMO's Way of Working has evolved significantly. Knowledge is gradually acquired and represented in all aspect models. The aspect models are produced simultaneously and incrementally.

- 3. DEMO's Way of Controlling itself does not have its own planning and budgeting tools. It advises to connect to common project management methods such as Prince2, ITIL, and SDM.
- 4. DEMO's Way of Modeling is precisely defined and can be divided in four perspectives: the Construction Model, the Process Model, the Action Model, and Fact Model. In DEMO the essence of an organization, process, data and business rules are modeled without implementation choices.
- 5. DEMO's Way of Supporting has/prescribes no tooling of itself, in order to create the models mentioned above. However there are a couple of tools available in order to create DEMO models.

#### LSS:

- 1. LSS's Way of Thinking is about efficiency. Lean focuses on eliminating wastes and improving profitability. Lean asks the question: Does this process add value for the customer? In order to greatly profit from using Lean, the entire organization, from bottom to top, should use Lean. Six Sigma discovers variables that need to be adjusted in the core processes of an enterprise to improve the output of that process.
- 2. LSS's Way of Working is clearly structured by the (DMAIC) phases of Six Sigma.
- 3. LSS's Way of Controlling offers tools for planning (DMAIC), budgeting, etc. but only describes the best uses. LSS does not prescribe any tools.
- 4. LSS's Way of Modeling is not specific. However LSS has a list of recommended list of techniques. For example Visual Stream Mapping, SIPOC, and flow-charts.
- 5. LSS's Way of Supporting has a lot of available tools for supporting the people and processes involved, but only describes them. LSS does not prescribe any tools for supporting.

When comparing the 5-way models of LSS and DEMO in order to combine them:

- 1. The Ways of Thinking are definitely a different approach. Where DEMO thinks about the essence of an organization/process, LSS thinks about the efficiency of an organization/process. These Ways of Thinking do not offer a clear outcome.
- 2. The Ways of Working could benefit by using the phases that are clearly structured in LSS.
- 3. The Ways of Controlling could benefit. LSS can be used for a detailed planning (DMAIC), budgeting, etc. It depends on what is needed for that organization/process/problem.

- 4. The Ways of Modeling could benefit by using the four DEMO perspectives of modeling.
- 5. The Ways of Supporting do not have a standard set of tools that are defined in either methodology. It is unclear if the methodologies would benefit or obstruct in their Way of Supporting.

This research will acknowledge that there is a possibility to combine LSS and DEMO based on the 5-way model. However, the scope and time of this research have been taken into consideration and this 5-way model needs to be researched further in order to discern if LSS and DEMO can be fully combined. A fully elaborated 5-way model combined with this research could give insight in how to fully combine LSS and DEMO. This research in terms of the 5-way model will take the Way of Thinking, Way of Working, and Way of Modeling into consideration. These distinctions have differences and also potential benefits, which will be further researched.

#### 1.2 Relevance

The expected practical relevance of this research is to increase the applicability of LSS and DEMO, the contributions of DEMO to LSS, the contributions of LSS to DEMO, and gave the interviewees the possibility to express their personal opinions and practical experiences about combining LSS and DEMO. The expected theoretical relevance of this research is to introduce new findings on trying to combine the methodologies LSS and DEMO.

#### 1.3 Scope of this research

The scope of this research is specified by the opinions of experts and meetings held with these experts. The initial scope was to entirely combine LSS and DEMO, but due to the time period set for this research that scope would not be possible. After discussing the scope, it was decided the research should focus on one specific part of LSS or DEMO. The conclusion of those meetings was to focus on the phases that are defined in Six Sigma. The phases of Six Sigma add stability, structure and are widely used in Lean Six Sigma projects. DEMO has certain models, elements that could possibly be combined with certain phases. This research starts with a literature review about LSS and DEMO, and stops after brainstorming about the contributions of DEMO within each DMAIC phase.

#### 1.4 Research question

As mentioned before, this research will investigate the possibility to combine LSS and DEMO. The phases of LSS are structured, and DEMO does not have any phases. During the preliminary discussions it was decided see if combining the LSS phases with DEMO would add value. The phases in LSS originated from Six Sigma, this research will specifically focus on the possibility to combine the phases from Six Sigma with DEMO. However since certain Lean aspects will be taken into consideration, this research will mention (L)SS, which will further be explained in section: LSS. This research will validate the outcome of the research question. The main research question for this research is:

What is a plausible way to combine the phases of (L)SS with DEMO?

By interviewing experts in LSS, DEMO, the combination of LSS & DEMO, and users that have experienced a combined LSS & DEMO project, their professional opinion and thoughts will be taken into consideration. The users that have experienced a combined LSS & DEMO project (stad Antwerpen) had different individual cases. These cases can be studied and compared to discover which, if any, phases of (L)SS have been used and discover which, if any, parts of DEMO have been used. More information about the master class can be found in subsection: Interviews.

Through literature study, interviews, and the GDSS the following sub-questions will be answered and these answers will provide the answer to the main research question;

What is LSS and what are the phases in LSS? What is DEMO and which elements does DEMO contain? What are the practical uses of LSS & DEMO? What are the contributions of DEMO within each DMAIC phase?

#### 1.5 Research approach

The approach of the research consists of four different stages: (1) preliminary discussion, (2) literature study, (3) interviews, and (4) GDSS. This approach has been chosen in order to discover experiences and beliefs from LSS, DEMO, LSS & DEMO experts and users. These experiences and beliefs will be collected to be converted into statements, which will be rated and by using these ratings certain conclusions can be drawn.

#### **Preliminary discussions**

To start this research, an approach how to combine the two methodologies was discussed in meetings with experts of LSS, DEMO, and LSS & DEMO. These experts have theoretical and practical knowledge on the methodologies and gave insight in how to combine LSS and DEMO. In these meetings the experts discussed how to validate the research question and outcome of the research, and also how to choose a plausible approach.

#### Literature study

The first part of this research consists of a literature study on the topic of Lean, Six Sigma, LSS, and DEMO. Independently there is literature research on LSS, and DEMO. However there has not been any research on the topic of combining or usage of LSS and DEMO together. Related to the research question, examples of topics are LSS, DEMO, process improvement, maintaining quality, efficiency, essence, and enterprise ontology. The literature found on LSS and DEMO will be discussed, which will lead to an agreement on the definition of the concepts LSS and DEMO.

#### Interviews

In order to validate the possibility of combining LSS and DEMO, semi-structured interviews were conducted. The interviews were held with experts of LSS, DEMO, LSS & DEMO and users that have experienced and performed a LSS & DEMO Project (stad Antwerpen). In total four LSS experts, six DEMO experts, three LSS & DEMO experts, and eight stad Antwerpen employees were interviewed. The population of LSS & DEMO experts is the best possible, since according to all experts whom were present at the preliminary discussions there are only three LSS & DEMO experts within the Netherlands and Belgium.

The employees of stad Antwerpen followed a master class in LSS & DEMO, lectured by LSS & DEMO experts. During this master class, they used their newly acquired knowledge and put that into practice. Each of the participants had to find a process or project in which they would like to apply their LSS & DEMO knowledge. When interviewing the participants they discussed their own individual cases and described in detail their experiences with LSS & DEMO.

The interviews consisted of three phases. First the interview questions were established and discussed. Then the interviews were conducted with the population mentioned above. Subsequently by transcribing and analyzing the results, comparable results were found. Lastly combining input from literature, interviews, and their practical experiences it was possible to establish certain statements about combining the phases of (L)SS with DEMO. These statements were transcribed into 11 statements. In this research the statements formed through the interviews will be described as the 11 statements.

#### GDSS

These 11 statements about combining the phases of (L)SS and DEMO will be rated and discussed. These ratings and discussions will provide the ability to validate the 11 statements and answer the research question.

In a group decision-making environment the GDSS enables improvement. A GDSS is designed to support meetings and group work. GDSS can be used in different time and different place settings. The same time combined with the same place is the most efficient way to use a GDSS. The components of a GDSS are software, hardware, people, and procedures. Software consists of components such as databases and user/system interfaces that are able to give multiple users

access at the same time. Hardware consists of components such as PC's, tablets and a network that connects these devices. People consist of the decision-making participants and facilitator. Procedures are the methods that are used during the meeting. Advantages of a GDSS are: parallel communication, anonymity, automated record keeping, and the ability to quickly and efficiently rate and discuss the statements. [10]

In this research a GDSS was held with experts in LSS, DEMO and LSS & DEMO. During the GDSS it was decided to brainstorm about the contributions of DEMO within each DMAIC phase, which will be further discussed in chapter: GDSS. During this brainstorm session the experts established certain statements. In this research the statements established during the GDSS will be described as the GDSS statements.

Combining and processing these sources of data will result in an answer to the research question. In any case, this research will provide points of interest/discussion for future research in combining LSS & DEMO.

### Chapter 2

## Literature Review

There has not been any research on the LSS and DEMO together and about combining LSS & DEMO. There is however literature on LSS and DEMO separately. In this literature review the methodologies LSS and DEMO will be explained. Interviews were held with experts of LSS, DEMO, LSS & DEMO and users that have experienced and performed a LSS & DEMO Project (stad Antwerpen). Literature research together with these interviews will be used as input to determine if LSS and DEMO can be combined.

LSS and DEMO have more to offer from what is described below. This research focuses on the phases of (L)SS and certain DEMO elements, the literature for this research has been confined to those parts.

This research focuses on combining LSS with DEMO. When in this research is spoken of a project or process, it is always a LSS improvement project or process.

# 2.1 Framework for understanding methodologies (5-way model)

The arcticle 'Analyzing the structure of I.S. methodologies; an alternative approach' [5] explains a framework for understanding methodologies. Also called the 5-way model. Jan Dietz has summarized this article, which is quoted below [9].

"A methodology is a set of recommended practices, worksheets, procedures, diagramming techniques etc. for developing a system. The collective activities aiming at the development of a system is called the development process.

For the purpose of studying, evaluating, and selecting methodologies, it is useful to have a conceptual framework for understanding them. It distinguishes five distinct parts of a methodology.

Way of Thinking

By the way of thinking of a methodology is understood the theory that is ap-

plied for understanding the object system and the context in which it operates. The way of thinking is the most important part of the methodology because it provides the foundation for integrating thoroughly the other parts. Only a common way of thinking can ensure that the other parts fit.

#### Way of Working

By the way of working of a methodology is understood the division of the total development process into phases and sub-phases, and each (sub) phase into steps. A step is considered to be the atomic unit of activity.

#### Way of Controlling

By the way of controlling of a methodology is understood the planning, budgeting, monitoring, and steering of the development process.

#### Way of Modelling

By the way of modelling of a methodology is understood the distinction of aspect models that collectively constitute the complete understanding of the object system. The way of modelling comprises (de) composition rules by which large models can be divided into smaller ones and vice versa.

Way of Supporting

By the way of supporting of a methodology is understood the (software) tools that can be used for supporting the people involved in the development process. In principle, there are tools for supporting the way of working, the way of controlling, and the way of modelling." [9]

#### 2.2 LSS

When '(L)SS phases' are mentioned in this thesis, the phases meant are the Six Sigma phases; Define, Measure, Analyze, Improve, and Control (which abbreviates to DMAIC). Strictly speaking these phases originated in Six Sigma but this research will also take into consideration certain Lean aspects. For that reason this research will mention (L)SS phases.

#### 2.2.1 Lean

Lean started at Toyota as the Toyota Production System[11]. This system was the result of the aftermath of World War II, when the world was in turmoil and economic hardship. This economic hardship led to unsold cars, growing inventories and soon after financial difficulties. By adapting to the situation, and eliminating all wastes Toyota was the first organization to be 'lean' [12]. A few years later, the book 'The Machine That Changed the World' (Womack, Jones and Roos, 1990) resulted in internationally recognition for Ohno and his Toyota Production System, which was also called Lean Production [13]. After this, Lean became a methodology that could be used in any industry, starting with Lean production and Lean manufacturing. Lean has 5 key principles [13]: Understanding of waste, Understanding the Value Chain, Process Mapping, Pull Production and Continuous Improvement/Seek Perfection. Lean's primary focus is to eliminate waste in business processes, to maximize efficiency. The original seven wastes are: Transport, Inventory, Motion, Waiting, Overproduction, Over processing, and Defects, which can be abbreviated to TIMWOOD. Tools that can be used to help achieve Lean's principles are e.g. value stream mapping, 5S, Kanban, and poka-yoke.

#### 2.2.2 Six Sigma

Motorola Inc. invented Six Sigma in 1986 [14], when Bill Smith responded to the increasing complaints from the sales force. They needed to improve their quality levels. To increase their quality levels he established formulas and statistics that would introduce a method to measure the defects per million opportunities (DPMO)[15]. DPMO is used to calculate the Six Sigma metric. The Six Sigma metric together with the Design, Measure, Analyze, Improve and Control (DMAIC) phases, would be the start of the Six Sigma methodology. According to (Schroeder, Linderman, Liedtke, Choo, 2008)[15] the best way to define Six Sigma is; "Six Sigma is an organized, parallel-meso structure to reduce variation in organizational processes by using improvement specialists, a structured method, and performance metrics with the aim of achieving strategic objectives" [16].

#### 2.2.3 Integrating Lean and Six Sigma

Lean and Six Sigma can be defined independently. They could not be defined as an "independent improvement" or "first one then the other" approaches" [17]. With Lean Management alone, the value (from the customer viewpoint) will increase, but the low costs will not be achieved. With Six Sigma alone, the costs (from the producer viewpoint) may be reduced, but a high value will not be achieved. With Lean and Six Sigma together, it will be possible to find the perfect balance between low costs and high value[18]. Integrating Lean and Six Sigma was done by BAE systems in 1997, which started combining Lean and Six Sigma to protect their market share. They achieved substantial improvements in productivity, lead-time and results[19]. When integrating and combining Lean and Six Sigma, this leads to reductions of waste, complexity, defects and improving business processes[20]. It has been proven in multiple occasions that integrating Lean and Six Sigma can have a numerous of benefits [21].

#### 2.2.4 Lean Six Sigma

Defining LSS is a challenge, every organization or person uses it differently. LSS is seen as a business improvement methodology that maximizes shareholder value by achieving customer satisfaction, cost, quality, process speed, and invested capital[17]. Others define LSS as business strategy as well as a methodology, increases performance, customer satisfaction, and results[22]. At Bank One, LSS is used as a strategic business tool, calling LSS a strategic advantage[17]. LSS can be used for creating continuous improvement for an organizations' processes [23] and is therefore fulfilling the growing need for an operations management model that contributes to this[24].

SIPOC is one of the tools that is used in Lean and Six Sigma, SIPOC is an abbreviation and helps identify and determine: Supplier, Input, Process, Output, and Customer. When trying to improve a process, a SIPOC can easily define a process and is mainly created in the Define phase.

Value Stream Mapping (VSM) is tool used by Lean to determine and identify wastes, throughput times, waiting times, and inventory. VSM is frequently used when inventory problems arise.

Critical To Quality (CTQ) is a tool used by Six Sigma to determine and identify the key measurable characteristics of a product of process in order to satisfy the customer.

Root Cause analysis is a tool in used in Lean in order to identify and determine the root causes of a problem.

Voice of the Customer (VOC) and Voice of the Business (VOB) are Six Sigma terms that are used to describe the need or requirements of the Customer or Business. These needs or requirements are needed in order to determine the scope and direction of a project or product.

#### 2.2.5 Phases

According to (De Feo, Barnard, 2003)[25] the phases of Six Sigma are based on Deming's Plan-Do-Check-Act cycle. Where DMAIC is used for projects aimed at improving an existing business process and DMADV is used for projects aimed at creating new products or process designs.

In Lean terms, only if something adds value to your process/project it should be used. Therefore in phases not all elements/tools are mentioned have to be used and there are a lot of possibilities. If another methodology or element/tool provides added value, they can be used in DMAIC. These elements/tools could be very valuable for one process/project, whilst for another process/project adds no value at all.

Define: In this phase the problem, customer, voice of the customer, critical to quality, project targets/goals, project scope, project charter, and the related business processes are defined.

Measure: In this phase the current and required performance and the gap between those is measured. Data is collected to create a process performance capability baseline for project metric. The measurement system is assessed for accuracy precision.

Analyze: In this phase the potential causes of the problem are prioritized, the root causes to pursue in the Improve phase are prioritized. The process inputs are identified and shown how these affect the process outputs. Process maps can be created to help to pinpoint wherein the process the root causes reside.

Improve: In this phase solutions are created, solutions are tested, an implementation plan is created, and improvements deployed.

Control: In this phase the purpose is to sustain the gains. Monitor the improvements to ensure continued and sustainable success.

After the Control phase, the DMAIC cycle starts over with the Define phase. This happens by identifying improvements that can be made in the current project or process.

#### 2.2.6 Methodology

Even though there is a lot of literature about Lean and Six Sigma, researches have different ideas and conclusions of the contents and results of the methodologies. LSS has such a broad approach to its methodology, and it doesn't instruct precisely what elements/tools should be used, the precise points where phases start, and end is not clear. Per fase the goals of a phase and potential purposes of using various tools in a phase are mentioned in Brainstorm: Contributions of DEMO within each of the DMAIC phases.

The flexibility LSS offers could be a strength or weakness. A strength because of the adaptability, but a weakness because of not knowing how to manage the flexibility.

#### 2.2.7 Conclusion

This comprehensive review of literature has outlined various elements of LSS. This literature review's purpose is to help the reader understand the various elements of LSS that have been used in this research. There has been a lot of practical research concerning LSS, discussing various possibilities involving LSS case studies, etc.

#### 2.3 DEMO

When 'DEMO elements' are mentioned in this thesis, the elements meant are the OCD (Organization Construction Diagram), TPT (Transaction Product Table), RGB distinction (the distinction axiom; Informa, Performa, Forma), and the transaction axiom (specifically the basic transaction pattern). These elements will be explained in the following sections.

#### 2.3.1 Introduction Design and Engineering Methodology for Organizations

DEMO has one clear definition. "Design and Engineering Methodology for Organizations is defined as a methodology for (re)designing and (re)engineering organizations that is fully based on the  $\psi$ -theory" [26]. In Enterprise Ontology [26], Jan Dietz explains DEMO precisely and to a full extent.

In DEMO: Towards a discipline of organization engineering, Dietz explains further: "DEMO is a theory about the 'construction' and the 'operation' of organizations, which is rooted in the Communicative Action Paradigm regarding human communication and action. In this theory, the 'working principle' of an organization consists of the entering into and the complying with commitments between human beings, where authority, responsibility and competence play an important role. The 'construction' of an organization consists of a coherent whole of transactions, i.e., recurrent patterns of communication and action in which the commitments are entered into and complied with" [27].

DEMO's theory is based on the PSI theory. PSI stands for Performance in Social Interaction, which is the basic paradigm of the theory. The elements of DEMO that have been used for this research are explained below according to [26].

#### 2.3.2 Operation axiom

The operation axiom states that the operation of an enterprise is constituted by activities of actor roles, where actors fulfill these actor roles. Actors exist of subjects, people or systems, but not organizational functions such as business analyst, director, etc. An actor can perform two acts, production acts (P-acts) and coordination acts (C-acts) which respectively result in production facts and coordination facts. A P-act has effect in the production world (P-world), also called object world and a C-act has effect in the coordination world (C-world) also called system world.

See figure 2.1 for the graphical representation of the operation axiom. By using the operation axiom, there is no sign of implementation. Subjects that fulfill the actor roles, in a way, which C-acts and P-acts are performed. The figure also shows where authority, responsibility and competence are coupled, which will be explained further in this section.

In figure 2.1, it also mentions competence, authority and responsibility. Competence: In order to be able to execute P-acts, an actor has to have certain



Figure 2.1: Operation Axiom

competences. Where competence means the knowledge and experience that is needed to successfully execute P-acts. Usually competences are coupled to a profession.

Authority: In order to be able to fulfill an actor role, the actor needs to have the authority to perform a certain P-act or C-act.

Responsibility: In order to be able to fulfill the social need from a subject to perform the C-acts, for which he is authorized, in a responsible way.

When a P-act is performed the result can be material or immaterial. For example: Kevin decides to give red roses to Ingrid, is an example of a material result. Whereas Kyle has won the award for best-dressed actor is an immaterial result.

A C-act is about the commitments regarding the performance between two subjects performing a P-act. C-acts exist of two components, the intention (e.g. request, promise, state, and accept) and proposition (P-world fact + time). One actor (performer) performs a C-act, which is directed to another actor (addressee). Every C-act/C-fact has the same structure: performer — intention addressee — product. For example: Maarten — request — Patrick — ownership of a single chair. Another example can be seen in figure 2.2 [26].



Figure 2.2: Standard notation of a coordination act

#### 2.3.3 Transaction axiom

The transaction axiom is about the relation between P-acts and C-acts. C-acts are performed as steps in universal patterns. These patterns are called transactions, and involve two actor roles, the initiator (initiates the transaction) and the executor (performs the P-act/P-fact). A transaction consists of three phases: the order phase (O-phase), execution phase (E-phase), and the result phase (Rphase). In the O-phase the initiator and executor discuss which product or service must be produced and when. In the E-phase the executor produces the product or service. In the R-phase the initiator and executor discuss whether the produced product or service is according to the agreed term from the Ophase. Take into consideration that sometimes a C-act is non-verbal and is still executed. The shortest and most basic transaction pattern see figure 2.3 which exists of:

- 1. The initiator requests the executor for a product at a specified time. (O-phase)
- 2. The executor promises the initiator to deliver the product at the specified time. (O-phase)
- 3. The executor produces the product. (E-phase)
- 4. The executor states to the initiator that the product is produced at the specified time. (R-phase)
- 5. The initiator accepts the product from the initiator. (R-phase)



Figure 2.3: The basic transaction pattern

The basic transaction pattern is very rarely seen in real life, for example due to different expectancies of the product. The basic transaction does not take into account if the initiator or executor declines or disagrees with the other. Therefore a standard transaction pattern has been introduced in order to deal with declines or rejects. This is shown in figure 2.4. A complete transaction pattern could contain up to 21 different C-facts.



Figure 2.4: The standard transaction pattern

#### 2.3.4 Composition axiom

The composition axiom is about transactions that can be enclosed by other transactions (initiated by that transaction), or a client transaction (initiated by the client), or a self-initiating transaction. The result of a successful transaction is the creation of a P-fact and the creation of a P-fact in the P-world is the result of a successful transaction. A product or service exists of one or multiple components. A component structure helps to identify and structure the components. In order to complete a transaction, all components need to be fulfilled or the transaction can't be completed. The composition axiom states that a business process is a collection of causally related transaction types. Each transaction type is represented in the complete transaction pattern shown in figure 2.5.



Figure 2.5: The complete transaction pattern

#### 2.3.5 Distinction axiom

The distinction axiom is about the distinction (human abilities) of actor roles. These distinctions can also work for a part or entire organization. These distinctions are called Performa, Informa, and Forma, which are shown in figure 2.6. [26].

Coordination	Human Ability	Production
Exposing commitment Evoking commitment	Performa	Ontological action (creating, deciding, judging)
Expressing thought Educing thought	Informa	Infological action (reproduce, deduce)
Uttering information Perceiving information	Forma	Datalogical action (storing, transmitting)

Figure 2.6: Summary of the distinction axiom

The ability of Performa is about performing original products acts such as to create, decide, and judge. This leads to the exposing and evoking of commitments.

The ability of Informa is about performing informal production acts, such as to remember, recall, and compute. This leads to the expressing and educing of thoughts.

The ability of Forma is about performing documental production acts, such as to store, retrieve, transmit, and copy. This leads to the uttering and perceiving of information.

#### 2.3.6 Organization theorem

The achievement to extract the essence of an organization is the goal of the axioms. The operation axiom mentions that implementation independent essence of an organization consists of actor roles. These actor roles, the acts and resulting facts are abstracted from implementation. The transaction axiom mentions that the complexity and diversity reduces by unifying patterns of coordination. The distinction axiom mentions that the complexity and diversity of coordination and production in an organization reduces. The organization theorem combines these benefits into one ontological model of an organization. An organization is a heterogeneous system that is built up from three layers of homogeneous systems. These layers are the business organization (B-organization), the intellect organization (I-organization), and the document organization (D-organization). In figure 2.7 is shown how the systems are layered and which system supports the other. A system has a function and this function is not connected to the construction of the system. For example a light has a function to light up when turned on, but this function is not connected to how the light (system) is constructed. If one of the systems uses another system, the function will still be the same.



Figure 2.7: Representation of organization theorem

#### 2.3.7 Modeling

The essential model of an organization is the ontological model of its B-organization that exists of both interaction and interstriction. This can be seen in figure 2.8. Actors influence each other in two ways, through interaction and through interstriction. In performing C-acts, actors create C-events to which other actors have to respond. This way of influencing is called interaction. When responding to a C-event, an actor takes the current state of the world into account. This state consists of facts that are created in earlier transactions. This way of influencing is called interstriction. Interstriction corresponds with the process and state interpretation of transactions. Interstriction is modeled by information links. An information link between an actor role and a transaction kind expresses that the actor has access to the contents of the transactions' conceptual container of C-facts.



Figure 2.8: Modeling the essence of an organization

The following aspect models can be created to help in order to be able to model the essence of an organization see figure 2.9

The construction model (CM) is expressed in the organization construction diagram (OCD), transaction product table (TPT), and the bank contents table (BCT). The first stages (where no information links are present) of an OCD are called an Actor Transaction Diagram (ATD). The CM contains the internal actor roles (composition), the environmental actor roles (environment), the transactions kinds among the internal actor roles, and between the internal and environmental actor roles (interaction structure), and the information links from internal actor roles to internal and external transaction kinds.

The process model (PM) is expressed in the process structure diagram (PSD), and transaction process diagram (TPD). The PM contains the identified transaction kinds, and the process steps through which they are linked. There are two kinds of links, response links and waiting links. The PM also contains all transaction kinds, the process steps, and the existence laws and occurrence laws that apply, according to the complete transaction pattern.

The action model (AM) contains the action rules (AR). Action rules are guidelines for actors.



Figure 2.9: Aspectmodels

The fact model (FM) contains the object fact diagram (OFD), existence law specifications (ELS), and derived fact specifications (DFS). The FM consists of specifying the object classes, the fact types, and result types.

The DEMO elements that have been taken into consideration in this research are: (1) OCD, (2) TPT, (3) RGB distinction, and (4) transaction axiom (specifically the basic transaction pattern). These elements have been chosen because they offer a lot of benefits and are understood and commonly used in projects/processes.

#### 2.3.8 Conclusion

This comprehensive review of literature has outlined various elements of DEMO. This literature review's purpose is to help the reader understand the various elements of DEMO that have been used in this research. There has been a lot of research concerning DEMO, discussing various possibilities involving DEMO case studies, etc.

Since the DEMO methodology created a lot of definitions and elements have changed. This can be seen as a strength because of the ever changing world and it's need to (simply, quickly, efficiently, and effectively) adapt.

### Chapter 3

### Interviews

The interviews held were semi-structured. This method was chosen for the interviewees to formulate their ideas and thoughts about combining LSS & DEMO. The purpose of the interviews was to get information about both methodologies, to ask the experts about their professional opinion in combining LSS & DEMO, and to see if the literature of both methodologies is a good representation of their practical uses.

All LSS experts that were interviewed had at least heard of DEMO or followed a DEMO Awareness course. All DEMO experts that were interviewed were given a brief explanation of LSS and the DMAIC fases. During the LSS and DEMO interviews the opposite methodology of the experts' methodology was explained.

In Appendix B: Interview questions matrix the questions asked at which interview are mentioned. For the LSS and DEMO interviews, the questions were adjusted to the experts' methodology. Depending on which interview, the interviews were structured as following:

- Introduction
- LSS or DEMO or LSS & DEMO
- Phases
- Combination LSS & DEMO
- LSS or DEMO or LSS & DEMO that was not used
- Conclusion and in retrospect.

All the questions that were asked can be found in Appendix B: Interview questions matrix. After the interviews were held, by transcribing and analyzing the results, comparable results were found. These results are anonymized and mentioned below.

#### 3.1 LSS

#### 3.1.1 General

- LSS adds value by structuring the phases. Because LSS is a structured way to find objective data and be able to objectively present and analyze this data (LSS01).
- Lean adds value by offering tools to look at processes in different ways. Because Lean has multiple tools, each tool offers a different added value/view (LSS&DEMO01).
- Six Sigma adds value by offering measurements and statistical observations. Because Six Sigma uses various statistical methods to calculate wastes and variations (LSS&DEMO01).
- LSS adds value by offering a consistent insight in processes. Because the LSS tools used (such as VSM, SIPOC) are perceived the same way and provide insight in different parts of processes (LSS04).
- LSS could add value by quickly coming to results. Because LSS has techniques that forces you to quickly come to the root causes of a problem (LSS03).
- Lean is intuitive, whereas Six Sigma needs more attention. Because anyone can figure out that retyping the same data results in overproduction and is not handy. The same goes for unnecessary waiting. Six Sigma is not as intuitive because there are certain mathematical/statistical calculations which need a data driven approach (LSS&DEMO03).
- The added value of LSS is not just tools or phases. It is about a coherent methodology. Because the philosophy of a methodology offers added value as well (LSS04, LSS&DEMO01).
- The added value of continuous improvement is that an organization can keep up with changes in the world. Because in order for an organization to survive it needs to keep changing (LSS01, LSS02, LSS&DEMO01).

#### 3.1.2 LSS elements

- LSS adds value by using the CTQ and SIPOC because they offer insight and are used to determine what is going to be measured (LSS01).
- Ishikawa offers insight in processes. Because Ishikawa forces to think structurally, enables to come to the essence of a process/problem and discovers causes for a problem (LSS03).
- VSM offers insight in (the value of) processes (waiting times/throughput times) for all people involved. Because VSM shows/maps and gives insight in different activities. This enables problems that are found and that leads to solutions (LSS04, LSS&DEMO02).

- VSM & Root Cause analysis offer insights which lead to enthusiasm and ownership. Because people are part of a problem, they tend to get enthusiastic about solving the problem and take ownership (LSS04).
- In LSS projects the VOC, VOB, VSM, CTQ, Root cause analysis, SIPOC, Ishikawa, Value Chain are tools used. It depends on the problem which tools are used, because different tools offer different added values (LSS01, LSS02, LSS03, LSS04, LSS&DEMO01, LSS&DEMO02, LSS&DEMO03).
- Which LSS tools are used is decided by funneling the tools. First the general tools are used, then dependent on the problem more specific tools are used. Because the tools can be used for a very specific (part of a) problem (LSS01, LSS02, LSS&DEMO01, LSS&DEMO02).

#### 3.1.3 Difficulties

- LSS is complicated, but then again all methodologies are. Because to really understand and being able to use the methodology takes time. For example the statistical analysis part of Six Sigma is complicated (LSS&DEMO02).
- The difficulty of learning LSS depends on your environment (organization) and education. Because the environment (organization) and education help to understand LSS (LSS03).
- Change is difficult, through LSS small/quick results can be achieved. Because of these results people are easier convinced of the added value from LSS (LSS02).
- LSS could focus more on stakeholders. It is not clearly defined by LSS. The improvement comes around sometimes because you have the right stakeholders. Peer reviews help reviewing progress and improvements (LSS&DEMO02).
- LSS mentions change management, but does not offer any tools or methods. Because LSS only describes that change management should be managed but does not prescribe what or how (LSS02).

#### 3.1.4 DMAIC phases

- DMAIC forces you to think in a quick but structured way. Because the DMAIC phases are based on Deming's Plan-Do-Check-Act. Deming's phases are intuitive phases are well structured (SA07). DMAIC cycles can be very fast or long, dependent on the project (LSS&DEMO02).
- In a process improvement project DMAIC phases should always be used. DMAIC offers structure. Because the DMAIC phases offer structure they should not be skipped and all phases should be used (LSS02, LSS&DEMO02).
- The DMAIC phases offer different added values. Define offers insight and a way to deal with the problem at hand. Measure offers in depth fact collecting. Analyze offers a statistical justification on the facts collected,

root causes of a problem. Improve offers to enhance the process and determine if the improvement has been successful. Control offers consistency within the organization/process by documenting. Because this is how the DMAIC phases are structured (LSS02).

- The DMAIC phases or a variation of DMAIC are always used. Because the LSS experts already had knowledge of these phases (LSS01, LSS02, LSS03, LSS04, LSS&DEMO01). Experts also adjusted the DMAIC phases in order to improve their processes (LSS04, LSS&DEMO02).
- The stad Antwerpen employees had been taught to use the DMAIC phases, but the decision to use these phases was up to them. Most did not explicitly use the DMAIC phases, but structured their projects in their own manner which resembled DMAIC in a way. Because they just wanted to improve processes and not strictly document/use the phases (SA01, SA02, SA03, SA04, SA05, SA06).

#### 3.2 DEMO

#### 3.2.1 General

- DEMO adds value by offering coherent insight in an organization, process and transactions (responsibilities). Because it helps to define neutral terms and transactions (DEMO05).
- DEMO adds value by discussion when the DEMO models and way of thinking are shown and involve key figures of an organization. Because this creates coherent understanding/insight in the model and therefore process/project (DEMO07).
- DEMO adds value by offering coherent models. Because everybody has the same view of that process/project and that is very valuable (DEMO08).
- DEMO adds value by offering coherent insight in tasks, competences, authority and responsibilities. Because the DEMO operation axiom distinguishes in competences, authority and responsibilities (DEMO10).
- DEMO adds value by showing the essence of an organization/process. Also adds value by offering a coherent way of communication. Because that contributes to identifying roles and the relationship between roles (DEMO06, LSS&DEMO01, SA05).
- DEMO adds value by abstracting from implementation. Because this helps focusing and gives insight on the essence of a process/project (DEMO09, SA03, SA02).
- DEMO adds value by viewing processes from a higher view (helicopter view). Because this helps by showing the essence of a process/project (DEMO06).
- DEMO adds value by decreasing complexity. Because models are compact and coherent (DEMO08).
- Once DEMO is understood, people tend to think in terms of transactions/coordination pattern. Because it is then intuitive and logical to think in these terms (LSS&DEMO01).

### 3.2.2 DEMO elements

- The coordination pattern and RGB distinction are usually understood because of their intuitiveness. But have not found a specific DEMO model to combine these with (LSS&DEMO01).
- DEMO experts claimed that an Actor Transaction Diagram (ATD) should always be constructed. Because the ATD identifies all the transactions (DEMO07, DEMO08, DEMO09, LSS&DEMO02, SA01, SA05).
- The DEMO model OCD is used because it shows insight in the current situation (transactions, actors and environment) of a process/project. But also because it is a model that is coherent in it's communication and understanding (DEMO05, DEMO06, DEMO07, DEMO08, DEMO09, DEMO10, LSS&DEMO01, LSS&DEMO03).
- An OCD can help (create) as-is situations and to-be situations. Because it shows/identifies transactions in the current situation and can help create future situations (SA01, SA02, SA05).
- The DEMO models AM and FM are not frequently used because they are too complicated or the problem has no need for these models and are too focused on IT (DEMO08, LSS&DEMO02).
- The RGB distinction is used for coherent insight about the process/project. Because this resulted in discussion about this insight and lead to new/different insights (DEMO09).
- Interviewees connected responsibilities to the coordination pattern, but did this subconsciously and not formally. Because they did not feel the need to formally declare responsibilities (DEMO09, LSS&DEMO01, LSS&DEMO02, LSS&DEMO03, SA01, SA07).

### 3.3 Difficulties

- Some think DEMO is complicated, while others don't. It depends on the person if DEMO is complicated. Because it has to do with the person's mindset and education (DEMO09).
- Some DEMO models are too complicated for certain audiences. Because DEMO is too difficult for these audiences to understand (DEMO08, DEMO09, LSS&DEMO03, SA01, SA03).

- Understanding the DEMO models is dependent on the way they are presented/communicated. Because the art of presenting simplifies or complicates things (DEMO05, LSS&DEMO01).
- The symbols in the DEMO models make the models complicated. Because the symbols are difficult to understand and to recognize (LSS&DEMO02).
- To construct DEMO models, proper tooling is missing. Because interviewees tried to use various tooling and these were not useful, easy to work with or representable for management (DEMO08, SA02, SA07, SA06).
- Different mappings are needed to move to an implementation level. Because DEMO is independent of implementation, mappings are needed for a process/project to move to an implementation (LSS&DEMO01).
- DEMO needs to be improved in communication towards target audiences. Because every audience has different needs and DEMO does not describe a method of presenting (DEMO08, DEMO09).

### 3.4 Phases

- It depends on the problem which DEMO models and in which order they are used. Because each model has a different insight and added value (DEMO07, DEMO08, DEMO09, DEMO10).
- DEMO experts did not have a common use of phases. Some stated that it depends on the problem & which phases are used. Some stated that the customer decides the methodologies used and therefore the phases (DEMO05, DEMO06, DEMO07, DEMO08, DEMO09, DEMO10).

### 3.5 LSS & DEMO not used

- In retrospect interviewees wouldn't have used different phases in their projects. Because the approach that was chosen gave clear insight (LSS01, LSS02, LSS03, LSS04, DEMO05, DEMO06, DEMO07, DEMO08, LSS&DEMO01, LSS&DEMO02, SA01, SA02, SA03, SA04, SA05, SA06, SA07).
- Interviewees agreed that the used DEMO elements they didn't use should be used in a different phase. Because it was problem dependent were used (DEMO06, DEMO07, DEMO09, DEMO10, LSS&DEMO01) and the DEMO elements used were used in earlier phases should not be changes (SA01, SA02, SA04, SA05, SA06). However in one instance where DEMO was not embedded or used in any processes, DEMO was wanted in every project (DEMO08).
- Interviewees did not consider other LSS elements. Because they did not have knowledge of these elements (SA01, SA02, SA03, SA04, SA05, SA06, SA07) or knew that the elements were not needed because dependent on the problem elements were already chosen (LSS01, LSS02, LSS03).

- The LSS elements that weren't used, should not have been used. Because it is dependent on the problem, it becomes clear which tools are needed or not (LSS01, LSS02, LSS03, LSS04, LSS&DEMO01, LSS&DEMO02, LSS&DEMO03).
- The DEMO elements that weren't used, should not have been used, because they did not have knowledge of these elements. Or knew that the elements were not needed because elements were already chosen dependent on the problem (DEMO05, DEMO06, DEMO07, DEMO08, DEMO09, DEMO10, LSS&DEMO01, LSS&DEMO03, SA01, SA02, SA04, SA05, SA06, SA07).
- The DEMO elements that were not chosen in a project/process, should not have been used. Because it is problem dependent and the choice and added value of the DEMO elements were clear beforehand and were chosen based on that knowledge or experience (DEMO05, DEMO06, DEMO07, DEMO08, DEMO09, DEMO10, LSS&DEMO01, SA01, SA02, SA04, SA05, SA06).

### 3.6 Combination LSS & DEMO

- The phases chosen are dependent on the problem, customer, management and/or goals (LSS01, LSS02, LSS04, DEMO05, DEMO06, DEMO07, DEMO08, DEMO09, DEMO10, LSS&DEMO01, LSS&DEMO02, LSS&DEMO03, SA01, SA02, SA03, SA04, SA05, SA06, SA07).
- Creating enthusiasm improves possibility for a methodology to thrive. Because enthusiasm enables commitment to a project/process/organization (LSS04, DEMO05, DEMO09, LSS&DEMO03).
- How difficult a methodology is perceived depends on the way it is presented. Because different people need different approaches (LSS&DEMO01).
- SIPOC + Coordination could be a good combination. Because they can both identify/mention responsibilities (LSS02, LSS03).
- VSM + Construction model could be a good combination. Because VSM offers a lot of insights and oversight in what we are actually doing, which problems are we going to find, which are the most important problems. Together with the construction model it could identify the essence of a process/organization (LSS04, DEMO05, LSS&DEMO01).
- It would be possible to combine the phases of (L)SS with DEMO. Because the way of thinking is used throughout all phases are used, the DEMO models in the D, M and A phases (LSS02).
- The DEMO models would add the most value in the Define phase. While the coordination pattern and RGB distinction could be used throughout all phases. Because Lean adds value by removing non-essential things and DEMO does that as well (DEMO06, DEMO10).

- The construction model would fit in the Define phase because it defines the scope of the process/project. This could add a lot of added value (DEMO08, LSS&DEMO02, LSS&DEMO03).
- LSS and DEMO should not be combined as whole. Because LSS and DEMO are two different methodologies, approaches. Where LSS focusses on processes/projects while DEMO focusses on processes/organizations. But certain aspects, models, etc. could be interchanged in either methodology (SA01, SA02, SA03, SA04, SA05, SA06, SA07).

Lastly combining input from literature, interviews, and their practical experiences it was possible to establish certain statements about combining the phases of (L)SS with DEMO. These statements were transcribed into 11 statements that will discussed in the GDSS.

## Chapter 4

# GDSS

GDSS is an abbreviation for Group Decision Support Session. GDSS is a tool that helps to quickly, effectively, efficiently brainstorm, discuss, help make decisions, and validate results. For this research the GDSS was a crucial point to effectively and efficiently validate and rate the 11 statements. At the GDSS, experts in LSS, DEMO and LSS & DEMO were present. In Appendix A: GDSS report, the contents of the GDSS are shown, but the results will be discussed in the section: Results. During the GDSS the statements that needed further discussion will be reviewed in the section: Discussion.

Some of the LSS experts had limited DEMO knowledge. Some of the DEMO experts had limited LSS knowledge. In order to discuss the combination of LSS & DEMO, all the experts needed to have a basic introduction in LSS and DEMO. The GDSS therefore started with brief presentations of the methodologies LSS and DEMO.

The 11 statements were rated on a scale from '1' to '4'. This scale was chosen to make the experts decide between agreeing and disagreeing. A '1' means to completely disagree and a '4' means to completely agree. If the statement was not clear or too difficult to answer, the experts could also abstain from answering.

### 4.1 Statements

The first 11 statements were about DEMO and LSS elements, without considering in which phase of (L)SS this would happen. The 11 statements can be found in Appendix A: GDSS report. After discussing these 11 statements the possible outcomes were; agreeing, disagreeing or needs to be discussed/researched further.

Initially there were other statements created. 'Using the DEMO element throughout LSS phase(s) creates added value in a project.' As previously mentioned there are 4 DEMO elements, 6 LSS possible phases and 2 kinds of added value. This resulted in 48 statements. At this point in the GDSS, the experts dis-

cussed these statements. A quick review made clear that these statements were well devised, but had predictable outcomes. It was considered more fruitful to discuss other ideas.

### 4.2 Brainstorm: Identifying the contributions of DEMO within each of the DMAIC phases

During the previously mentioned discussion it became clear that DEMO can be used throughout all the phases and is not limited to just one phase. This research focuses on the LSS phases where DEMO can be used, the choice was to brainstorm and discuss the contributions of DEMO within each DMAIC phase. The experts decided to brainstorm and discuss the following statement "Identifying the contributions of DEMO within each DMAIC phase". The experts had the possibility to add their own brainstorm statements on the contributions of DEMO within each phase. After all brainstorm statements had been collected to validate the result, they were discussed. If a brainstorm statement was not clear or an expert disagreed with it, the expert that had written the brainstorm statement clarified and/or discussed the brainstorm statement. The conclusion of discussing a brainstorm statement could end in agreeing, disagreeing, or needs to be discussed further. It was briefly noted it all experts agreed with a brainstorm statement.

### 4.3 Validation

The population of the GDSS was not a representive population. Therefore at a later time LSS, DEMO, and LSS & DEMO experts were asked separately to rate the same 11 statements and brainstorm about the contributions of DEMO in each DMAIC phase. After they brainstormed about the contributions of DEMO in each DMAIC phase, their thoughts were compared to the results of the GDSS brainstorm. These comparisons were briefly discussed to determine why some results were the same and some were different. This way the experts that were not present during GDSS could express their thoughts through agreeing, disagreeing or needs to be discussed further. By comparing their answers and the outcome of the GDSS, the results are validated with multiple experts.

### 4.4 Discussion

During the GDSS certain statements lead to discussions. There were some conclusions drawn during this discussion. These conclusions are mentioned below.

Jargon in LSS and DEMO can have different meanings which resulted in confusion on the statements made. Examples of such jargon are: root cause analysis, optionalities, and defects. When using such jargon, it is necessary for both parties to use the same definition in order to prevent confusion. When talking about complexity in terms of LSS or DEMO, the context of a project complexity depends on somebody's experiences and varies based on that experience. The statement claims that DEMO reduces a project's complexity, the experts almost all agreed and it scored very high. Whereas the statement claiming that LSS reduces a project's complexity scored low and had a decent variability. When using complexity in terms of DEMO the context is clear, but when using complexity in terms of LSS the context is unclear. The notion of a project's complexity needs to be defined clearer.

The DEMO methodology is defined and explained in well-founded literature. DEMO has quite a few elements. The precise definitions of an element are not used practically. Elements are left out because initially the uses of some elements may not be clear. For instance only a few experts knew about the CRISP model, but the experts that knew about the CRISP model did not use it. Another instance, the theory behind transaction patterns where a transaction can be divided into different kinds of types, was also unknown. Some experts did not know about the different types of (Forma, Informa, and Performa) transactions.

The LSS methodology has a wide variety of practical uses and is used worldwide. One of the strengths of LSS is its broad approach and ability to adjust and to use whichever tool or method seems fit for the project/process. However this is also LSS's weakness, the broad approach can give you too many opportunities to structurally try and combine LSS with DEMO.

## Chapter 5

# Results

As mentioned in the previous chapter, during the GDSS there were 11 statements rated. After these ratings, it was decided to brainstorm about the statement 'Identifying the contributions of DEMO within each DMAIC phase.' All brainstorm statements made about the contributions of DEMO within each DMAIC phase can be found in the Appendix A: GDSS report. These brainstorm statements can be divided in two categories: (1) The results were obtained from the brainstorm statements on which all the experts agreed. This will be discussed in this chapter. (2) The brainstorm statements where the experts had different opinions will be discussed in the chapter: Discussion.

Due to the small population of the GDSS, the variability of ratings, as seen in Appendix A: GDSS report is skewed. If only one person had voted a '3' and the others a '4', there would already be a variability of 29%. If the population had been bigger, the variability would have been smaller. Therefore the experts that were not present at the GDSS were asked to rate the same 11 statements. After the 11 statements were rated, there was a discussion to discover the reasons for this variability. In the results mentioned below all experts (experts present GDSS and not present at the GDSS) have been taken into consideration.

To rate all of the 11 statements, the variability and the maximum scoring percentage were taken into consideration. If an expert gave a '4' as rating, it means he completely agreed and scored 100 points. If an expert gave a '3' as rating, is means he slightly agreed and scored 75 points. If an expert gave a '2' as rating, it means he slightly disagreed and scored 25 points. If an expert gave a '1' as rating, it means he completely disagreed and scored 0 points. If an expert abstained from voting, his score was nullified. The total scores given by the experts divided by the maximum scoring capacity gives the percentage scored.

The variability percentage, scoring percentage, and discussion combined will show detailed results.

### 5.1 11 statements

#### DEMO:

1. 'By using the construction model, transaction pattern, and RGB distinction, a project's complexity reduces.'

This statement scored very high, 92% of the maximum scoring capacity. Four experts completely agreed and two experts agreed with this statement. This means a slight variability.

This resulted in the experts agreeing that these DEMO elements reduce a project's complexity.

2. 'By using the construction model, transaction pattern and RGB distinction you are able to achieve better results (in terms of Duration, Money, and Quality).'

This statement scored well, 67% of the maximum scoring capacity. This gives a skewed result. Two experts completely agreed, two experts agreed, and two experts slightly disagreed. This means a high variability.

After discussing this point it became clear that the DEMO elements do not directly develop in better results (in terms of duration, money, or quality). These DEMO elements can only help achieve those results. The experts agreed on a modified statement, namely 'Using the construction model, transaction pattern and RGB distinction contributes to achieving better results (in terms of Duration, Money, and Quality).'

LSS:

3. 'By using the phases of (L)SS, a project's complexity reduces.'

This statement scored low, 46% of the maximum scoring capacity. Three experts slightly agreed, two slightly disagreed, and one completely disagreed. This means a decent variability.

After discussing this point it became clear that LSS has such a broad approach to its phases that a project's complexity does not necessarily reduce when using the phases. It depends on the project, how much time is given and which tools are used for that project. This statement resulted in disagreement.

4. 'By using the phases of (L)SS, you are able to achieve better results (in terms of Duration, Money, and Quality).'

This statement scored well, 71% of the maximum scoring capacity. Four experts slightly agreed, one expert slightly disagreed, and one expert completely agreed. This means a slight variability.

After discussing this point it became clear that LSS has such a broad approach to its phases, that it does not directly develop in better results (in terms of duration, money, or quality). After discussing this point it became clear that this result was full of assumptions. The experts agreed on a modified statement, namely 'Using the phases of (L)SS, contributes to achieving better results (in terms of Duration, Money, and Quality).'

LSS & DEMO:

5. 'In a LSS & DEMO project the responsibility for DEMO (models, way of thinking, RGB distinction) within a process improvement project lay with the process owner.'

This statement scored low, 55% of the maximum scoring capacity. One expert completely agreed, two experts slightly agreed, one expert slightly disagreed, one expert completely disagreed, and one expert abstained from voting. This means there is a high variability.

After discussing this point it became evident that this statement was unclear and/or too difficult to answer. This statement was therefore not included in the results of this research.

6. 'Using the transaction pattern together with SIPOC, increases the validity of at least S, I, O, and C.'

This statement scored high, 79% of the maximum scoring capacity. Three experts completely agreed, two experts slightly agreed, and one expert slightly disagreed. This means there is a decent variability.

After discussing this point it became clear that the transaction pattern could help complete the S, I, O, and C, but this could close areas of thinking. This might be helpful or needed. This statement resulted in agreement, with a note to be mindful closing areas of thinking when combining the transaction pattern and SIPOC.

7. 'Using the construction model (OCD) together with SIPOC, increases the validity of at least S, I, O, and C.'

This statement scored very high, 96% of the maximum scoring capacity. Five experts completely agreed and one expert slightly agreed. This means there is a slight variability.

After discussing this point it became clear that the S, I, O, and C should at least be discussed while creating the OCD. The S, I, O, and C can also be observed in the OCD. This statement resulted in agreement.

 'Using the construction model (TPT) together with SIPOC, increases the validity of at least S, I, O, and C.' This statement scored high, 83% of the maximum scoring capacity. Four

experts completely agreed, one expert slightly agreed, and one expert slightly disagreed. This means there is a decent variability.

After discussing this point it became clear that the LSS expert that slightly disagreed, did not have sufficient knowledge of the TPT to make a valid

decision. The TPT shows precise results in which the S, I, O, and C can be found, but the OCD offers more information regarding initiator and executor. This statement resulted in agreement.

9. 'Using the RGB distinction together with SIPOC, increases the validity of at least S, I, O and C.'

This statement scored low, 54% of the maximum scoring capacity. Four experts slightly agreed, one expert slightly disagreed, and one expert completely disagreed. This means there is a decent variability.

After discussing this point it became clear that the RGB distinction could help identify the S, I, O, and C, but it does not clearly define them. This statement resulted in agreement.

10. 'By using the construction model, transaction pattern and RGB distinction in a project where the phases of (L)SS are used, the project will have reduced complexity.'

This statement scored high, 79% of the maximum scoring capacity. Three experts completely agreed, two experts slightly agreed, and one expert slightly disagreed. This means there is a decent variability.

After discussing this point it became clear that the DEMO elements and (L)SS phases are useful tools in helping to decrease the complexity, by structuring and/or giving insight. This statement resulted in agreement.

11. 'By using the construction model, transaction pattern and RGB distinction in a project where the phases of (L)SS are used, the decision makers in the project are able to come to better results (in terms of Duration, Money, and Quality).'

This statement scored high, 75% of the maximum scoring capacity. Five experts slightly agreed and one expert abstained from voting. This means there is no variability.

After discussing this point it became clear that all the experts think that this is not directly influenced by DEMO elements or (L)SS phases. However eventually, the DEMO elements together with the (L)SS phases will lead to better results (in terms of duration, money, and quality). This statement resulted in agreement.

### 5.2 Brainstorm: Contributions of DEMO within each of the DMAIC phases

Per DMAIC phase, the goals of a phase and potential purposes of using various tools in a phase are mentioned. Then the potential contributions of DEMO are listed. If there are any comments about the brainstorm statements, they will be mentioned second. Thirdly, an explanation about which DEMO elements contribute to which phase and how it contributes. If experts disagreed on a statement, the number will be missing in the lists and will be discussed in the chapter: Discussion. Lastly each statements will be connected to one of the phase's goal.

### 5.2.1 Define

The goal of the Define phase is to define the problem to be solved, customer impact and potential benefits. [28] In the Define phase various tools are used to: identify and map relevant processes, determine and prioritize customer needs and requirements; classification of customer requirements into dissatifiers, satisfiers, and delighters, identify concerns important to customers, and adjust the on-line quality control system keep track of processed products [29].

- 1. Define:
  - 1.1. Scope of the system (organization)
  - 1.2. Who are the actors?
  - 1.3. Identify products between actors
  - 1.4. TPT names the precise results, in which the LSS-project should deliver the benefits.
    - 1.4.1. Especially the KPI's
  - 1.5. Identify who are the suppliers and who are the customers of the products
  - 1.6. Insight/overview of transaction products and parties involved
  - 1.7. The business process trees (bill of materials) as an end-to-end definition of the product/service (T1)
  - 1.8. Transaction pattern to define a complete process

The DEMO element TPT can contribute during the Define phase by establishing precise results. This could be coupled to KPI's. Through these precise results the TPT can also be used to define the I, P, and O from SIPOC.

The DEMO element OCD can contribute greatly during the Define phase. Through defining the S, I, O, and C from SIPOC. The OCD also provides insight in transactions (processes and products between actors), actors, parties involved, and scope of the system. It shows the essence of an organization/process.

The DEMO element RGB can contribute during the Define phase by restricting to Red (original) actors roles and transactions.

The DEMO element Transaction pattern contributes during the Define phase by defining who requests, promises, states, and accepts in a process. The transaction pattern can be used to define the S, I, O, and C from SIPOC.

All statements mentioned here contribute to the goal mentioned above of the Define phase. Through defining the problem (1.1, 1.2, 1.3, 1.5, 1.6, 1.7, 1.8), potential benefits (1.4, 1.7, 1.8), and dentifying relevant processes (1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8).

### 5.2.2 Measure

The goal of the Measure phase is to identify the critical-to-quality charistics (CTQs) of the product or service. Verify measurement capability. Baseline the current defect rate and set goals for improvement. [28] In the Measure phase various tools are used to: select one or more CTQs, determine operational definitions for CTQs and requirements, validate measurement system of the CTQs, process capability analysis, asses the current process capability, and adjust the on-line quality control system keep track of prossed products [29].

- 2. Measure:
  - 2.1. Number of process steps and interaction between actors
  - 2.3. Errors/defects: identification of transactions where errors occur
  - 2.4. TPT names precise results to be measured, both for which the LSSproject should deliver the benefits (generally: KPI's) and for important variables influences these KPI's (generally: CSF's).

Brainstorm statement 2.1 needs to be defined more precisely.

The DEMO element TPT contributes to identifying what needs to be measured during the Measure phase.

The DEMO element OCD can contribute to the number of process steps and interaction between actors. If naming the transactions has been precisely established, the OCD helps by defining indicators that need to be measured.

The DEMO element RGB distinction has no clear contribution during the Measure phase. Experts could not think or did not mention a clear contribution.

The DEMO element Transaction pattern has no clear contribution during the Measure phase. Experts could not think or did not mention a clear contribution.

All statements mentioned here contribute to the goal mentioned above of the Measure phase. Through identififying CTQs (2.1, 2.3) and verifying measurement capabilities (2.4).

### 5.2.3 Analyze

The goal of the Analyze phase is to understand root causes of why defects ocur; identify key process variables that cause defects. [28] In the Measure phase various tools are used to: identify potential unfluence factors; identify process inefficiencies, adjust the on-line quality control system; keep track of processed products, and select vital few influence factors; keep track of influence factors [29].

- 3. Analyze
  - 3.1. Responsibilities, competences and authorization of the actors involved in the business process are to be discussed and analyzed

- 3.2. The transaction states of an end-to-end process are to be analyzed
- 3.3. Identify transactions, which are responsible for errors
- 3.4. Provides insight in transactions, identifying waste
- 3.5. OCD clarifies the cause-effect chain, both for interactions (transactions) and for influencing by non-participating actors (information), which simplifies a part of the root-cause analysis (only on essential level).
- 3.6. Clarify responsibilities in each step of transaction pattern
- 3.8. The transaction pattern helps detect missing / tacit actions, which might cause errors in the current process.

Statement 3.3 needs to be clarified more, what does an error mean? Statement 3.8 could also be placed in the improve phase. It depends if you find the missing / tacit actions during the analyze phase or after implementation.

DEMO provides insight into transactions, but this cannot be used to identify wastes. To help identify wastes (TIMWOOD) is used. DEMO is abstracted from implementation and does not show these wastes, e.g. overproduction or inventory. Therefore DEMO cannot be used to identify wastes, but can help identify defects.

DEMO defines three important notions (responsibilities, competences and authorization) that can be found in actors roles. By using DEMO during a project/process these notions need to be discussed and analyzed.

The DEMO element TPT has no clear contribution during the Analyze phase. Experts could not think or did not mention a clear contribution.

The DEMO element OCD contributes to potentially finding where process errors/defects happen on the essential level in an organization. This does not say anything about finding the root causes of a problem. If the project/process has a hitch in the data, the OCD could contribute.

The DEMO element RGB distinction has no clear contribution during the Analyze phase. Experts could not think or did not mention a clear contribution.

The DEMO element Transaction pattern clarifies the responsibilities in each step of an organization or process. This can be useful when trying to determine which part of an organization or process needs to be improved. If a part is improved, this will result in benefits described at the start of the project/process. The transaction pattern helps to define end-to-end. Starting with an actor requesting to ending when an actor rejects or accepts.

All statements mentioned here contribute to the goal mentioned above of the Analyze phase. Through understanding root causes of why defects ocur and identififying the key process variables that cause defects (3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.8).

### 5.2.4 Improve

The goal of the Improve phase is to generate, selecting, and implementing solutions [30]. In the Improve phase various tools are used to: quantify relationship between influence factors and CTQs, design improvement actions; determination of specification levels for influence factors, design improvement actions, and adjust the on-line quality control system; keep track of processed products [29].

#### 4. Improve

- 4.1. Redesign of the OCD, and the tree of transactions (Bill of Materials)
- 4.2. Customers satisfaction by improving the request and accept process steps in order to limit the number of declines and rejects
- 4.3. Eliminate transaction types or process steps in order to improve process through put times
- 4.4. Discuss the process on 1 a4 with a customer panel in order to identify the enablers of customers satisfaction
- 4.5. Eliminate transaction types in order to reduce costs
- 4.8. Earlier initiation by changing business rules / conditional information links
- 4.10. Use distinction of RGB in the realization of the business processes within the scope of the system
- 4.11. By connecting the actor roles from the OCD with the people accountable and responsible in the organization, it becomes clear who could best take the responsibility for improvement.

The brainstorm statement 4.1 and 4.5 could be combined. Both statements are about redesigning the OCD, eliminating transactions.

The brainstorm statement 3.8 and 4.2 could be combined. Both statements are about the transaction pattern and can be used to improve missing or excessive actions/responsibilities.

DEMO contributes to earlier initiation of changing business rules / conditional information links, through: removing transaction types, changing the optionality of transaction types, the parallelization of transaction types, and modifying the conditional relations between transaction types.

The DEMO element TPT has no clear contribution during the Improve phase. Experts could not think or did not mention a clear contribution.

The DEMO element OCD contributes to connecting actor roles with responsibilities in the organization/process.

The DEMO element RGB distinction contributes by identifying the differences in human abilities. Using the RGB can help identify the possibility to improve on Performa activities. This can be useful, because trying to start improvement on Informa and Forma level could be challenging. However using the RGB many improvements could be achieved. The DEMO element Transaction pattern can contribute during the Improve phase by identifying new responsibilities of the coordination pattern.

All statements mentioned here contribute to the goal mentioned above of the Improve phase. Through generating (4.4, 4.8), selecting (4.1, 4.2, 4.5, 4.10, 4.11), and implementing solutions (4.3).

#### 5.2.5 Control

The goal of the Control phase is to implement ongoing measures and actions to sustain improvements [30]. In the Control phase various tools are used to: determine the new process capability; demonstrate improvement, adjust the online quality control system; keep track of processed products [29].

- 5. Control
  - 5.1. Relative simple overview of the transactions that helps by sustaining the result

The DEMO element TPT has no clear contribution during the Control phase. Experts could not think or did not mention a clear contribution.

The DEMO element OCD contributes by sustaining the results, based on redesign and measuring the progress of improvements.

The DEMO element RGB distinction has no clear contribution during the Control phase. Experts could not think or did not mention a clear contribution.

The DEMO element Transaction pattern has no clear contribution during the Control phase.Experts could not think or did not mention a clear contribution.

All statements mentioned here contribute to the goal mentioned above of the Control phase. Through implementing ongoing measures and actions to sustain improvements (5.1).

## Chapter 6

# **Conclusion and Discussion**

In section Research question one main research question was identified, and split in 4 sub questions. First the answers on the 4 sub questions are given, then the answer on the main research question will be answered in Conclusion.

### 6.1 Answered sub questions

What is LSS and what are the phases in LSS?

As shown in section: Literature Review, Lean's primary focus is to eliminate waste in business processes to maximize efficiency. The original seven wastes are: Transport, Inventory, Motion, Waiting, Overproduction, Over processing, and Defects, which can be abbreviated to TIMWOOD. Tools that can be used to help achieve Lean's principles are e.g. Value Stream Mapping, 5S, Kanban, and poka-yoke.

To increase the quality levels, formulas and statistics are established that would introduce a method to measure the defects per million opportunities (DPMO)[15]. DPMO is used to calculate the Six Sigma metric. The Six Sigma metric together with the Design, Measure, Analyze, Improve and Control (DMAIC) phases, are the start of the Six Sigma methodology.

SIPOC is one of the tools that is used in Lean and Six Sigma, SIPOC is an abbreviation for: Supplier, Input, Process, Output, and Customer. When trying to improve a process, a SIPOC can easily define a process and is created in the Define phase.

#### What is DEMO and which elements does DEMO contain?

As shown in section: Literature Review "Design and Engineering Methodology for Organizations is defined as a methodology for (re)designing and (re)engineering organizations that is fully based on the  $\psi$ -theory" [26]. In Enterprise Ontology, Jan Dietz explains DEMO precisely and to a full extent. Enterprise Ontology is about the organization of enterprises. Actor roles are used in stead of functions or tasks and are measured in authority, responsibility and competence. Production and coordination come together in transaction (action and interaction between actors) patterns. DEMO exists of four axioms and one theorem. When 'DEMO elements' are mentioned in this thesis, the elements meant are the: OCD (Organization Construction Diagram), TPT (Transaction Product Table), RGB distinction (the distinction axiom; Informa, Performa, Forma), and the transaction axiom (specifically the basic transaction pattern).

What are the practical uses of LSS & DEMO?

As shown in section: Interviews during the interviews with the LSS & DEMO experts and stad Antwerpen projects/processes where LSS & DEMO had been combined were discussed. Every year the stad Antwerpen has a master class LSS & DEMO. The participants of this master class each have their own individual case and use their newly acquired knowledge and put that into practice. So, each year there are roughly 30 LSS & DEMO projects.

LSS & DEMO experts had different approaches to their projects/processes and used various DEMO elements in various phases. In the stad Antwerpen projects the OCD was used during the Define phase. All the LSS & DEMO experts and stad Antwerpen employees that had used the OCD in the Define phase said that this was very valuable.

### 6.2 Answered research question

What are the contributions of DEMO within each DMAIC phase?

As shown in section: GDSS.

Define: DEMO elements (OCD, RGB distinction, and Transaction patterns) can contribute to the (L)SS Define phase by giving a clear insight in the scope of the project/process and actors.

The DEMO element OCD can contribute greatly during the Define phase. Through defining the S, I, O, and C from SIPOC. The OCD also provides insight in transactions (processes and products between actors), actors, parties involved, and scope of the system. It shows the essence of an organization/process.

The DEMO element RGB can contribute during the Define phase by restricting to Red (original) actors roles and transactions.

The DEMO element Transaction pattern contributes during the Define phase by defining who requests, promises, states, and accepts in a process. The transaction pattern can be used to define the S, I, O, and C from SIPOC.

Measure: DEMO elements (TPT and OCD) can contribute to the (L)SS Measure phase by identifying what has to be measured and where the indicators have to be measured.

The DEMO element TPT contributes to identifying what needs to be measured during the Measure phase.

The DEMO element OCD can contribute to the number of process steps and interaction between actors. If naming the transactions has been precisely established, the OCD helps by defining indicators that need to be measured.

Analyze: DEMO elements (OCD and Transaction pattern) can contribute to the (L)SS Analyze phase by helping to identify the responsibilities and finding the errors/defects on the essential level.

The DEMO element OCD contributes to potentially finding where process errors/defects happen on the essential level in an organization. This does not say anything about finding the root causes of a problem. If the project/process has a hitch in the data, the OCD could contribute.

The DEMO element Transaction pattern clarifies the responsibilities in each step of an organization or process. This can be useful when trying to determine which part of an organization or process needs to be improved. If a part is improved, this will result in benefits described at the start of the project/process. The transaction pattern helps to define end-to-end. Starting with an actor requesting to ending when an actor rejects or accepts.

Improve: DEMO elements (OCD and RGB distinction) can contribute to the (L)SS Improve phase by helping to identify what needs to happen after implementation, in terms of removing transactions and identifying new responsibilities.

The DEMO element OCD contributes to connecting actor roles with responsibilities in the organization/process.

The DEMO element RGB distinction contributes by identifying the differences in human abilities. Using the RGB can help identify the possibility to improve on Performa activities. This can be useful, because trying to start improvement on Informa and Forma level could be challenging. However using the RGB many improvements could be achieved.

The DEMO element Transaction pattern can contribute during the Improve phase by identifying new responsibilities of the coordination pattern.

Control: DEMO elements (TPT, OCD, RGB distinction, and Transaction patterns) do not specifically contribute to the (L)SS Control phase, but might help by controlling the progress of the changes that have been made in the previous statements.

### 6.3 Conclusion

The conclusions drawn from this research will be discussed below. The Discussion section will include brainstorm statements where the experts disagreed. The brainstorm statements will be mentioned first, followed by why the experts disagreed on the contribution of DEMO in which phase.

As shown in section: Discussion, jargon in LSS and DEMO can have different meanings which resulted in confusion on the statements made. Examples of such jargon are: root cause analysis, optionalities, and defects. When using such jargon, it is necessary for both parties to use the same definition in order to prevent confusion.

As shown in section: Discussion, when talking about complexity in terms of LSS or DEMO, the context of a project complexity depends on somebody's experiences and varies based on that experience. The statement claims that DEMO reduces a project's complexity, the experts almost all agreed and it scored very high. Whereas the statement claiming that LSS reduces a project's complexity scored low and had a decent variability. When using complexity in terms of DEMO the context is clear, but when using complexity in terms of LSS the context is unclear. The notion of a project's complexity needs to be defined clearer.

As shown in section: Discussion, the DEMO methodology is defined and explained in well-founded literature. DEMO has quite a few elements. The precise definitions of an element are not used practically. Elements are left out because initially the uses of some elements may not be clear. For instance only a few experts knew about the CRISP model, but the experts that knew about the CRISP model did not use it. Another instance, the theory behind transaction patterns where a transaction can be divided into different kinds of types, was also unknown. Some experts did not know about the different types of (Forma, Informa, and Performa) transactions.

As shown in section: Discussion, the LSS methodology has a wide variety of practical uses and is used worldwide. One of the strengths of LSS is its broad approach and ability to adjust and to use whichever tool or method seems fit for the project/process. However this is also LSS's weakness, the broad approach can give you too many opportunities to structurally try and combine LSS with DEMO.

The following conclusions can be made based on the 11 statements and brainstorm statements:

- 1. A project's complexity is reduced by using DEMO elements. It would be valuable to use DEMO in any project/process. All experts agreed on this statement in the GDSS.
- 2. To fulfill the SIPOC in the Define phase, transaction patterns can be used to validate the S, I, O, and C. After discussing this point in the GDSS it became clear that the transac-

After discussing this point in the GDSS it became clear that the transaction pattern could help complete the S, I, O, and C, but this could close areas of thinking. This might be helpful or needed. With a note to be mindful closing areas of thinking when combining the transaction pattern and SIPOC

3. To fulfill the SIPOC in the Define phase, the OCD helps (through modeling) to identify the S, I, O, and C.

After discussing this point in the GDSS it became clear that the S, I, O, and C should at least be discussed while creating the OCD. The S, I, O, and C can also be observed in the OCD.

- 4. To fulfill the SIPOC in the Define phase, the TPT helps (though precise results) to identify the I, P, and O. After discussing this point in the GDSS it became clear that the TPT shows precise results in which the S, I, O, and C can be found, but the OCD offers more information regarding initiator and executor.
- 5. DEMO elements (OCD, RGB distinction, and Transaction patterns) can contribute to the (L)SS Define phase by giving a clear insight in the scope of the project/process and actors.

The DEMO element OCD can contribute greatly during the Define phase. Through defining the S, I, O, and C from SIPOC. The OCD also provides insight in transactions (processes and products between actors), actors, parties involved, and scope of the system. It shows the essence of an organization/process.

The DEMO element RGB can contribute during the Define phase by identifying the actors and products between actors.

The DEMO element Transaction pattern contributes during the Define phase by defining who requests, promises, states, and accepts in a process. The transaction pattern can be used to define the S, I, O, and C from SIPOC.

6. DEMO elements (TPT and OCD) can contribute to the (L)SS Measure phase by identifying what has to be measured and where the indicators have to be measured.

The DEMO element TPT contributes to identifying what needs to be measured during the Measure phase.

The DEMO element OCD can contribute to the number of process steps and interaction between actors. If naming the transactions has been precisely established, the OCD helps by defining indicators that need to be measured.

7. DEMO elements (OCD and Transaction pattern) can contribute to the (L)SS Analyze phase by helping to identify the responsibilities and finding the errors/defects on the essential level.

The DEMO element OCD contributes to potentially finding where process errors/defects happen on the essential level in an organization. This does not say anything about finding the root causes of a problem. If the project/process has a hitch in the data, the OCD could contribute.

The DEMO element Transaction pattern clarifies the responsibilities in each step of an organization or process. This can be useful when trying to determine which part of an organization or process needs to be improved. If a part is improved, this will result in benefits described at the start of the project/process. The transaction pattern helps to define endto-end. Starting with an actor requesting to ending when an actor rejects or accepts. 8. DEMO elements (OCD and RGB distinction) can contribute to the (L)SS Improve phase by helping to identify what needs to happen after implementation, in terms of removing transactions and identifying new responsibilities.

The DEMO element OCD contributes to connecting actor roles with responsibilities in the organization/process.

The DEMO element RGB distinction contributes by identifying the differences in human abilities. Using the RGB can help identify the possibility to improve on Performa activities. This can be useful, because trying to start improvement on Informa and Forma level could be challenging. However using the RGB many improvements could be achieved.

The DEMO element Transaction pattern can contribute during the Improve phase by identifying new responsibilities of the coordination pattern.

9. DEMO elements (TPT, OCD, RGB distinction, and Transaction patterns) do not specifically contribute to the (L)SS Control phase, but might help by controlling the progress of the changes that have been made in the previous statements.

#### What is a plausible way to combine the phases of (L)SS with DEMO?

It is plausible to combine the (L)SS phases with certain DEMO elements. Some of the DEMO elements are more plausible to combine with certain phases (Define, Measure, and Analyze) than others (Improve, Control). For example the OCD seems to be a great match to be created in the Define phase in order to create insight for defining the project/problem/process (SIPOC). There are more contributions of DEMO in the Define, Measure, and Analyze phases than in the Improve and Control phases.

### 6.4 Discussion

The brainstorm statements that require more research and discussion:

2. Measure

2.2. Throughput time (of all transactions)

The DEMO CRISP model is not well known and should get more attention during the education of DEMO. The CRISP model is a first step towards implementation, showing lead-times that could help in the Measure phase.

3. Analyze

3.7. Identify FORMA activities (waste)

The DEMO element RGB distinction could or could not be used to identify Forma activities and identify waste. This brainstorm statement lead to a discussion. The definition of waste is important to take into consideration. In LSS terms (TIMWOOD), waste is about doing things that have not been requested and doing things that are not necessary or add no value. For example, if a client asks you to write down the same thing three times. Depending on the point of view this could be considered waste and not waste. These three copies might seem redundant, but if the client has a purpose for these three copies, it could not be considered waste. Do those three copies add value for the customer? Another example is determining if somebody is creditworthy. A person has always paid his/her invoices on time and has been creditworthy for months (for years). Rules and regulations require that a creditworthy check has to be performed before every transaction. This creates unnecessary work for both parties. Is this considered waste or a necessity?

Forma activities are about performing documental production acts, such as to store, retrieve, transmit, and copy. Experts claimed that there is a possibility that Forma activities could be identified as wastes quicker than the Performa and Informa activities. But other experts claimed that Forma activities could be full of wastes as well.

The experts could did not agree, therefore this discussion needs further research in the definitions of waste combined with the different types of transactions and how these can be combined.

4. Improve

4.6. Design simultaneous process execution instead of sequential processes in order to reduce through put times

The experts that agreed think that DEMO enables the possibility to design these processes. However opposing experts did not agree on this statement and had different opinions. These experts believe that DEMO does not have insight in processes that provide throughput times. According to those experts, that is not a part of DEMO.

4.7. Introduce optionalities to improve throughput times

Optionalities has multiple interpretations and this statement should be rephrased. Optionalities could mean different options. Optionalities could also mean reducing the business rules in a transaction.

4.9. Improve the allocation of actor and delegates to persons and parties This brainstorm statement needs to be rephrased because it says nothing about competences, responsibilities and authority an actor needs to fulfill an actor role.

5. Control

There were no brainstorm statements in the control phase that led to a discussion. However an expert did mention that DEMO could contribute to the control phase by keeping progress on redesign. This still needs to be discussed with other experts.

## Chapter 7

# **Future research**

The research for trying to combine LSS & DEMO has just begun. The approach to this research began with combining LSS & DEMO as a whole, but the complexity of combining the two methodologies exceeded the time given to do this research. As mentioned in the Results section, there are definitely certain aspects that add value in combining LSS with DEMO. In the future a greater depth of information can be obtained by expanding the GDSS population.

During the interviews, some interesting new ideas for future research were presented. Combining certain models such as LSS's VSM together with DEMO's CM (Eric Bunk) and LSS's root cause analysis (Ishikawa) together with DEMO's CM (Tijmen Kwakkel, Roland Ettema).

In future research some of the 11 statements mentioned in the Results section were inconclusive and need to be researched further. All statements mentioned in the Discussion section need to be researched futher to be able to combine the LSS and DEMO methodologies.

This research stops after brainstorming about the contributions of DEMO within each DMAIC phase. For future research the next step would be to prioritize these brainstorm statements with each expert, in order to see which contribution of DEMO is most important in which phase.

In order to fully combine LSS & DEMO, the 5-way model could be a possible evaluation model to compare the methodologies, which was mentioned in section: Problem statement. The 5-way model research, which is focused on theoretical aspects, combined with this research that is focused on practical experiences, could give insight on how to fully combine LSS & DEMO.

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Chapter 8

# Appendix A: GDSS report

02 March 2015 Brett Lee



# LSS & DEMO

De Group Decision Support Session took place at Capgemini headquarters (Reykjavikplein 1, 3543 KA Utrecht) in room; N.4.10.3 from 13:30 to 16:30.

The agenda 13:30 Introduction - Brett Lee. 13:40 Presentation DEMO - Martin Op 't Land. 14:00 Presentation LSS - Brett Lee. 14:15 Start GDSS - Brett Lee (with help from Hans Mulder). 14:30: Round 1 - Define 14:50: Round 2 - Measure 15:10: Round 2 - Measure 15:10: Round 3 - Analyze 15:30: Round 4 - Improve 15:50: Round 5 - Control 16:10: Round 6 - DMAIC 16:30 End

### 1. Contents

- 1. Contents
- 2. Participant list
- 3. Agenda overview
- 4. 13:30 Introduction Brett Lee
- 5. 13:40 Presentation DEMO Martin Op 't Land
- 6. 14:00 Presentation LSS Brett Lee
- 7. Statements (Flipboard)
- 8. Statements on a scale of 1 to 4 (Voting)
- 9. Criteria (Flipboard)
- 10. Criteria on a scale of 1 to 4 (Voting)
- 11. DMAIC phases (Flipboard)
- 12. Identifying the contributions of DEMO to each DMAIC phase (Brainstorm)
- 13. Lost and found (Brainstorm)

## 2. Participant list

- 1. Geert Brandt
- 2. Hans Mulder
- 3. Martin Op 't Land
- 4. Tijmen Kwakkel

### 3. Agenda overview

- 1. Manual: Agenda overview
- 2. Manual: 13:30 Introduction Brett Lee
- 3. Manual: 13:40 Presentation DEMO Martin Op 't Land
- 4. Manual: 14:00 Presentation LSS Brett Lee
- 5. Flipboard: Statements
- 6. Voting: Statements on a scale of 1 to 4
- 7. Flipboard: Criteria
- 8. Voting: Criteria on a scale of 1 to 4
- 9. Flipboard: 14:30: Round 1 Define
- 10. Voting: Round 1 Define
- 11. Flipboard: 14:50: Round 2 Measure
- 12. Voting: Round 2 Measure
- 13. Flipboard: 15:10: Round 3 Analyze
- 14. Voting: Round 3 Analyze
- 15. Flipboard: 15:30: Round 4 Improve
- 16. Voting: Round 4 Improve
- 17. Flipboard: 15:50: Round 5 Control
- 18. Voting: Round 5 Control
- 19. Flipboard: 16:10: Round 6 DMAIC
- 20. Voting: Round 6 DMAIC
- 21. Flipboard: DMAIC phases
- 22. Brainstorm: Identifying the contributions of DEMO to each DMAIC phase
- 23. Brainstorm: Lost and found

## 4. 13:30 Introduction - Brett Lee

## 5. 13:40 Presentation DEMO - Martin Op 't Land

## 6. 14:00 Presentation LSS - Brett Lee

### 7. Statements (Flipboard)

### Item list

- 1. By using the construction model, transaction pattern and RGB distinction, a project?s complexity reduces.?
- 2. By using the construction model, transaction pattern and RGB distinction you are able to achieve better results (in terms of Duration, Money and Quality).?
- 3. By using the phases of (L)SS, a project?s complexity reduces.?
- 4. By using the phases of (L)SS, you are able to achieve better results (in terms of Duration, Money and Quality).
- 5. In a LSS & DEMO project the responsibility for DEMO (models, way of thinking, RGB distinction) within a process improvement project lay with the process owner.
- 6. Using the transaction pattern together with SIPOC, increases the validity of at least S, I, O and C.
- 7. Using the construction model (OCD) together with SIPOC, increases the validity of at least S, I, O and C.
- 8. Using the construction model (TPT) together with SIPOC, increases the validity of at least S, I, O and C.
- 9. Using the RGB distinction together with SIPOC, increases the validity of at least S, I, O and C.
- 10. By using the construction model, transaction pattern and RGB distinction in a project where the phases of (L)SS are used, the project will have reduced complexity.
- 11. By using the construction model, transaction pattern and RGB distinction in a project where the phases of (L)SS are used, the decision makers in the project are able to come to better results (in terms of Duration, Money and Quality).
## 8. Statements on a scale of 1 to 4 (Voting)

#### Active participant list

- 1. Hans Mulder
- 2. Martin Op 't Land
- 3. Tijmen Kwakkel
- 4. Geert Brandt

#### Graphic view



#### Table view

#	Item	Rating	Α	Variability	С
1	Using the construction model (OCD) together with SIPOC, increases the validity of at least S, I, O and C.	3.8	0	29%	
2	By using the construction model, transaction pattern and RGB distinction, a project?s complexity reduces.?	3.8	0	29%	
3	Using the transaction pattern together with SIPOC, increases the validity of at least S, I, O and C.	3.8	0	29%	
4	By using the construction model, transaction pattern and RGB distinction in a project where the phases of (L)SS are used, the project will have reduced complexity.?	3.5	0	33%	
5	Using the construction model (TPT) together with SIPOC, increases the validity of at least S, I, O and C.	3.3	0	55%	
6	By using the phases of (L)SS, you are able to achieve better results (in terms of Duration, Money and Quality).	3.3	0	29%	
7	By using the construction model, transaction pattern and RGB distinction in a project where the phases of (L)SS are used, the decision makers in the project are able to come to better results (in terms of Duration, Money and Quality).	3.0	0	0%	

8	By using the construction model, transaction pattern and RGB distinction you are able to achieve better results (in terms of Duration, Money and Quality).?	2.8	0	55%
9	In a LSS & DEMO project the responsibility for DEMO (models, way of thinking, RGB distinction) within a process improvement project lay with the process owner.	2.7	1	83%
10	Using the RGB distinction together with SIPOC, increases the validity of at least S, I, O and C.	2.5	0	58%
11	By using the phases of (L)SS, a project?s complexity reduces.?	2.3	0	55%

## 9. Criteria (Flipboard) Added Value

#### Item list

- 1. Customer satisfaction
- 2. Cost reduction
- 3. Defect reduction
- 4. Throughput time reduction
- 5. Time to market reduction
- 6. Revenue increase
- 7. Customer retention / conversion
- 8. Effectiveness to goals
- 9. Increase hit rate

## 10. Criteria on a scale of 1 to 4 (Voting)

Active participant list

1	2	3	4	5	6	7	8	9	
		Sc	ale: Rate fro	m 1 to 4. Nur	mber may be	reused			

Table view						
#	ltem	Rating	Α	Variability	С	
1	7. customer retention / conversion	0.0	0	0%		
2	8. Effectiveness to goals	0.0	0	0%		
3	9. Increase hit rate	0.0	0	0%		
4	6. revenue increase	0.0	0	0%		
5	5. time to market reduction	0.0	0	0%		
6	2. cost reduction	0.0	0	0%		
7	3. defect reduction	0.0	0	0%		
8	4. throughput time reduction	0.0	0	0%		
9	1. customer satisfaction	0.0	0	0%		

## 11. DMAIC phases (Flipboard)

#### Item list

- 1. Define
- 2. Measure
- 3. Analyze
- 4. Improve
- 5. Control

# 12. Identifying the contributions of DEMO to each DMAIC phase (Brainstorm)

#### Active participant list

- 1. Hans Mulder
- 2. Geert Brandt
- 3. Martin Op 't Land
- 4. Tijmen Kwakkel

#### **Topic list & items**

#### 1. Define

- 1.1. Scope of the system (organization)
- 1.2. who are the actors?
- 1.3. Identify products between actors
- 1.4. TPT names the precise results, in which the LSS-project should deliver the benefits.
  - 1.4.1. especially the KPI's
- 1.5. Identify who are the suppliers and who are the customers of the products
- 1.6. Insight/overview of transaction products and parties involved
- 1.7. The business process trees (bill of materials) as an end-to-end definition of the product/service (T1)
- 1.8. Transaction pattern to define a complete process

#### 2. Measure

- 2.1. Number of process steps and interaction between actors
- 2.2. Throughput time (of all transactions)
- 2.3. Errors/defects: identification of transactions where errors occur
- 2.4. TPT names precise results to be measured, both for which the LSS-project should deliver the benefits

(generally: KPI's) and for important variables inlfuences these KPI's (generally: CSF's).

#### 3. Analyze

3.1. Responsibilities, competences and authorisation of the actors involved in the business process are to be discussed and analyzed

3.2. The transaction states of an end-to-end process are to be analyzed

- 3.3. Identify transactions which are responsible for errors
- 3.4. Provides insight in transactions, identifying waste

3.5. OCD clarifies the cause-effect chain, both for interactions (transactions) and for influencing by non-participating actors (information), which simplifies a part of the root-cause analysis (only on essential level).

- 3.6. Clarify responsibilities in each step of transaction pattern
- 3.7. Identify FORMA activities (waste)

3.8. The transaction pattern helps detect missing / tacit actions, which might cause errors in the current process.

4. Improve

4.1. Redsign of the OCD, and the tree of transactions (Bill of Materials)

4.2. Customers satisfaction by improving the request and accept process steps in order to limit the number of declines and rejects

- 4.3. Eliminate transaction types or process steps in order to improve process through put times
- 4.4. Discuss the process on 1 a4 with a customer panel in order to identify the enablers of customers satisfaction
- 4.5. Eliminate transaction types in order to reduce costs
- 4.6. design simultaneous process execution instead of sequential processes in order to reduce through put times
- 4.7. introduce optionalities to improve through put times
- 4.8. earlier initiation by changing business rules / conditional information links
- 4.9. Improve the allocation of actor and delegates to persons and parties
- 4.10. use distinction of RGB in the realisation of the business processes within the scope of the system

4.11. By connecting the actor roles from the OCD with the people accountable and responsible in the organization, it becomes clear who could best take the responsibility for improvement.

#### 5. Control

5.1. Relative simple overview of the transactions that helps by sustaining the result

### 13. Lost and found (Brainstorm)

#### Active participant list

- 1. Hans Mulder
- 2. Geert Brandt

#### **Topic list & items**

- 1. Lost and found
  - 1.1. Good session which illustrates the differences in terminilogy between DEMO and LSS
  - 1.2. Quality of the question is determining the results to a large extend
  - 1.3. OCD, TPT, RGB is not to be related to the DMAIC phases
  - 1.4. Further clarification between waste as defined by LEAN and FORMA activitities (as defined by DEMO)
  - 1.5. The items to be discussed have to be checked by a survey

Chapter 9

## Appendix B: Interview questions matrix

#### Interview question matrix

	LSS	DEMO	LSS & DEMO	stad Antwerpen
Introductie	x	х	х	x
1. "Vertel over jezelf en je werk?"	x	х	х	x
2. "Vertel over een project waar DEMO is toegepast?"	x	Х	х	Х
3. "Wat was je rol in dat project?"	x	х	Х	x
4. "Welke verbetering beoogde jullie te bereiken?"	X	х	х	х
5. "Hoe hebben jullie dit aangepakt?"	X	х	х	х
LSS				
6. "Kun je aangeven waar LSS aan heeft bijgedragen?"	X		x	
7. "Was/is LSS ingewikkeld/overzichtelijk?"	x		Х	
8. "Welke onderdelen van LSS zijn er gebruikt?"	X		х	
9. "Wat leverde deze onderdelen op? Toegevoegde waarde (bv. overzicht/inzicht)> doorvragen	x		х	
10. "Wat voor toegevoegde waarde (bv. overzicht/inzicht) heeft dat dan opgeleverd?"	x		х	
11. "Welk onderdeel uit LSS maakt dat je deze toegevoegde waarde (bv. overzicht/inzicht) hebt	x		х	
6 "Kun ja sangevan waar DEMO aan heeft hijgedragen?"		x	x	
7. "Waskis DEMO indewikkeld/overzichtelijk?"		x	x	
Washs DElvic higewinketuoverzionenja: "Welke onderdelen van DEMO zijn er gebruikt?"		x	x	
"Wat leverde daze enderdelen en? Teogevegede wearde (by everzicht/inzicht) > deenvragen		×	×	
10 "Wat woor toggevoerde waarde (by, overzicht(inzicht) heeft dat dan ongeleverd?"		x	x	
10. Wat voor toegevoegde waarde (ov. overzicht/mzicht) heer dat dan opgeleverd :		x	x	
gekregen?"		~	~	
Fasering	×	~	~	~
12. "Welke fasen zijn er tijdens een van je projecten gebruikt?"	X	X	X	X
13. "Hoe is er voor deze fasen gekozen?"	X	X	X	X
14. "Waarom is er juist voor deze fasen gekozen?"	X	X	X	X
15. "Zijn er andere fasen gebruikt tijdens een ander project?"	X	X	X	
16. "Zo ja, waarom zijn er toen voor andere tasen gekozen?"	X	X	X	
17. "Terugblikkend, zou je nu voor andere fasen hebben gekozen?"	X	X	X	X
18. "Aan de hand van de DEMO faseringen: Hoe bepaal je de volgorde van faseringen?"		X		
19. "Waarom kies je voor deze volgorde?"		х		
Combinatie LSS & DEMO				
18. "In welke fase zouden de DEMO modellen (CM, etc) passen?"	X			
19. "In welke fase zou de denkwijze toegepast kunnen worden?"	X			
20. "In welke fase zou het coördinatie patroon passen?"	X			
20. "Welke DEMO modellen zouden in welke fase passen?"		х		
21. "Waarom dan wel of waarom niet?"		х		
Combinatie LSS & DEMO + Ervaringen				
24. "In welk van deze tasen heb je (of is er) DEMO gebruikt?"			X	X
25. "Welk model uit DEMO is er gebruikt (en in welke fase)?"			X	X
26. "Hoe heb je de bruikbaarheid van DEMO in deze fase(n) ervaren?"			X	X
27. "Wat leverde je dat op?" Toegevoegde waarde (bv. overzicht/inzicht)> doorvragen			X	X
28. "Wat voor toegevoegde waarde (bv. overzicht/inzicht) heeft dat dan opgeleverd?"			X	x
29. "Welk onderdeel uit DEMO maakt dat je deze toegevoegde waarde (bv. overzicht/inzicht) hebt gekregen?"			x	X
30. "Heb je daarvan een voorbeeld?"			х	x
31. "Terugblikkend, zijn er DEMO onderdelen die je hebt toegepast die je niet had willen toepassen of in			х	х
een andere fase toepassen?"				
LSS/ Niet gebruikt	v		×	
22. "Zo ja, waarom is uiteindelijk gekozen om van deze modellen alsnog geen gebruik te	x		x	
maken?"				
23. "Terugblikkend, zou je nu een van andere LSS onderdelen alsnog bij de fasen gebruiken?"	x		х	
DEMO/ Niet gebruikt				
22. "Heb je overwogen om een van de andere DEMO modellen ook te gebruiken?"		х	Х	x
23. "Zo ja, waarom is uiteindelijk gekozen om van deze modellen alsnog geen gebruik te maken?"		х	X	x
24. "Terugblikkend, zou je nu een van andere DEMO onderdelen alsnog bij de fasen gebruiken?"		х	Х	x
Conclusie + Terugblik				
24. "Welke verbetering heb je met dit project gerealiseerd?" (evaluatie vraag 4)	X	Х	X	X
25. "Welke verbetering zijn er gerealiseerd waarvan het niet de bedoeling was?"	X	Х	X	
26. "Wat heb je nou extra gedaan, naast het toepassen van LSS fasen om die verbeteringen rond te krijgen?"	X		X	
27. "Wat heb je nou extra gedaan, naast het toepassen van DEMO denkwijzen/modellen om die verbeteringen rond te krijgen?"		х	х	
27. "Wordt er nog steeds gebruik gemaakt van het projectresultaat?"	x	х	х	х
28. "Wat gebeurt er nog hetzelfde en wat is er veranderd? en waarom?"	x	х	х	х
29. "Wat had er beter gekund (met betrekking tot de fasering, de onderdelen van LSS)?"	x		х	
30. "Wat had er beter gekund (met betrekking tot de fasering, het gebruik van DEMO, de onderdelen van		х	x	x
DEMO)?" 30 "Wat is een plausihele manjer om de fasen van (Lean) Siv Sigma te combinaren met DEMO?"	x	x	x	×
ov. The is deriphausibele manier om de lasen van (Lean) ok Signia le combineren met DEWIO?	^	^	^	^