CORDYS

University of Twente

"Agility through Service Orientation/Service Oriented Architecture"

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"Believe nothing just because a so called wise person said it.
Believe nothing just because a belief is generally held.
Believe nothing just because it is said in ancient books.
Believe nothing just because it is said to be of divine origin.
Believe nothing just because someone else believes it.
Believe only what you yourself test and judge to be true."[1]

Attributed to Budha

[1] *http://www.wisdomquotes.com/cat_truth.html*

Foreword

This paper is the ultimate part of a master thesis carried out at the company of Cordys, in Putten, the Netherlands. The thesis is the final part of the study Industrial Engineering and Management (IEM), from the University of Twente, the Netherlands.

Cordys is a young company developing SOA BPM solutions since 2000. For their methodology Cordys@Work the question was raised how companies using SOA (can) become more agile. However, this raised questions on the truth of the claim and the related concepts. Therefore the focus of this thesis is on how Service Orientation and Service Oriented Architecture can address agility of an organization.

This research uses a triangulation of theory, interviews and case studies to find a suitable tool. Such a tool is required for measuring an organization's progress regarding Service Orientation / Service Oriented Architecture and the impact this has on agility issues. Ultimately Maturity Models seem the best candidate, but the current Maturity Models available require improvements. The conclusions provide suggestions for this.

Eager to start with working, the research was combined with part time working at Cordys. From the company of Cordys supervision was provided by Henk ten Voorde. From the University this research was supervised by Professor Jos Hillegersberg, of the university of Twente, and Professor Alea Fairchild, of the university of Brussel. Thanks for their guidance during the thesis project.

Besides my supervisors I would like to thank colleagues, friends and family (especially my dad) for thinking along in the process and their support in various ways.

December 2007,

Deventer / Putten

Summary

The summary consists of two parts. First a management summary is provided in textual form. This is followed by a more detailed summary in the form of a mindmap.

Management Summary

This is a research into the claim that Service Orientation (SO) and Service Oriented Architecture (SOA) makes organizations more agile. The foundations and (theoretical) concepts for this claim are figured out. The focus of this research is on the financial sector. For this a triangulation is made using theory, interviews and business cases from literature and practice. The cases used are from Credit Suisse (literature) and "de Amersfoortse" (practice).

Agility came forward as an aspect of flexibility. Theory regards flexibility at three levels; operational, structural and strategic. Agility is about structural and strategic flexibility of an organization. Theory on agility stresses the need for a balance between responding and sensing capacities. Theory and interviews pointed to more aspects being relevant for agility besides IT systems, especially the human factor is deemed important.

The abstract notion of agility is made more tangible using a list of issues from literature. This is a list of agility gaps (issues hindering agility) for the Dutch financial sector numbering 15 topics ranging from outsourcing, legacy and legislation[2].

Strong overlap between the concepts of Service Orientation (SO) and Service Oriented Architecture (SOA) was found. Overall SO is more regarded as a paradigm focused at organizations, while SOA has its origins in technology and architecture. However, this distinction is not always clear and the exact definition depends on the source, both meanings got overloaded with overlapping (and sometimes contradicting) meanings. The two meanings are frequently intertwined; therefore this research uses the contraction SO/SOA.

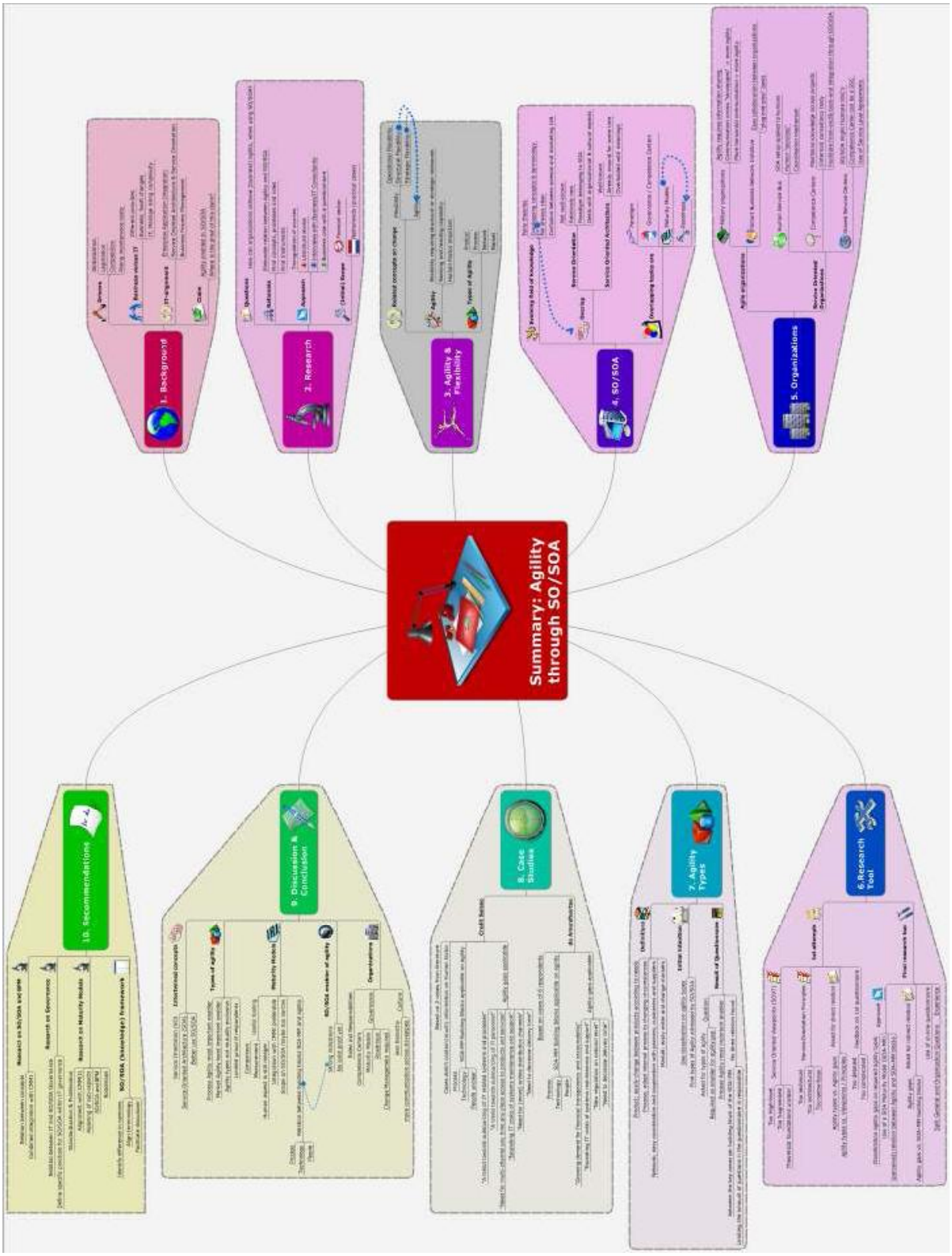
For measurement and comparison a maturity model offers distinct advantages, however the currently available maturity models for SO/SOA are not mature themselves. Especially the human aspect is very meager compared to the technical aspects. Also integration with established maturity models like the Capability Maturity Model Improved (CMMI) is scarce or lacking. Therefore additional developments and research are required before SOA Maturity Models can become truly useful as a tool for comparison and measurement.

For analyzing the case studies a tool including a SOA Maturity Model was used. The lack of cases prevents solid conclusions; however the results from both cases (Credit Suisse and "de Amersfoortse") indicate an positive effect of almost all building blocks of the SOA Maturity Model on the applicable agility gaps. This could be perceived as a confirmation that SO/SOA is one (of more) enabler of agility. More case studies could back this claim further.

Mindmap Summary

On the following page you'll find a more detailed summary of this research in the form of a mindmap.

[2] *A complete list of agility gaps can be found on page 35.*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Conclusion

The complete discussion and conclusion can be found in chapter 12, below the most important conclusions are stated:

- Agility and flexibility are related concepts on dealing with changes. Agility is extreme flexibility, requiring structural and strategic measures of an organization. Flexibility is then regarded as the capability to deal with "normal" change using the existing capacity and means available.
- Agility is a form of flexibility and needs to be specified in concrete topics, this research used the list of agility gaps for the financial sector. However, any organization should research it's own obstacles for agility.
- There is not a clear distinction between Service Orientation and Service Oriented Architecture. The first is relatively new and not well known, while the second is better known but overloaded with interpretations. This part of literature has to be developed further, currently the technical aspects are dominating. Adding to this is that SO/SOA concepts are too often presented as a breed of their own, while they are more of a continuation of best practices and developments in the IT industry.
- Researching the impact of SO/SOA can best be done using a maturity model, because this can cover a range of topics and can deal with various levels of maturity. However, the current maturity models available are not mature itself, being incomplete, vague , acking clear procedures or being overly simplistic on certain aspects. Integration/Alignment with "standard" maturity models like CMM(I) could contribute to a better usability and comparability of Maturity Models. This can also contribute to embedding SO/SOA in existing IT frameworks and practices. Also objective metrics could be included in the analysis.
- For the agility gaps deemed applicable to cases, advancements on the building blocks of the SOA Maturity Model used where found to be helpful for addressing the gap. This could be perceived as an indication that SO/SOA is one (of more) enabler of agility. However, the number of cases of this research is limited. Therefore more research is required to make more solid statements or this.
- For organizations in general, addressing agility requires an iterative process of analysis (using (derivatives of) the Deming's cycle and maturity models). Wherever possible, the analysis should be complemented with objective measures. The set of priorities derived from the analysis can be laid down in a roadmap.

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Part I – Startup of a Research

"If we knew what we were doing, it would not be called research, would it?"[4]

Albert Einstein

1879 – 1955

[4] *According to quotationpage.com*

1. Introduction

The introduction explains the context of this theoretical model; how the business and IT are two opposite worlds. Because the world is big, it's problems even bigger and the time for a thesis too short, the focus of this research is explained. Also the structure of the remainder of the thesis is explained.

1.1 Business versus IT

Globalization, legislation and fierce competition are just a few of a range of challenges organizations have to deal with nowadays. Organizations often use Information Technology (IT) to help their businesses address these challenges. Strategic Information Systems (SIS), Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) are only some examples of systems set up to assist businesses.

When these systems come of age, they are often deemed legacy systems. While still essential for current business processes, they cannot deal with current requests for changes, a lack of flexibility shows. Maintenance of legacy systems may consume so many resources, that these stand in the way of new more adaptable applications[4]. Let us even not mention adaptations of legacy…

The supportive IT has then become, instead of a solution, a part of the problem for an organization. Business cannot easily adapt to changes due to limitations set by lagging IT.

Adding to this, IT and business are currently too often two distinct disciplines. Businesses are more focused on organizing their processes. IT on the other hand is more focused on their systems and applications. While IT should be in a supporting role, it has often become a discipline of it's own. Sometimes this results in different priorities, or even mutual incomprehension.

Business IT Alignment

Numerous proposals have been made to make these worlds come together, a well known example is "strategic alignment" model proposed by Henderson and Venkatraman[5].

However, the attempts to align IT and business strategy are not widely perceived as successful according to research of 'The Economist'[6][7]. Various sources agree on the existence of a gap between the perceived objectives by IT departments versus the objectives of the management of business[7]. IT still has a strong focus on obtaining and facilitating cost reductions, while business is expecting more enablement of revenue generation.

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[4] *In their article Red et al. thoroughly explain the importance and limitations legacy systems impose on organizations. [Red, p5-7]*
[5] *In their article they propose an alignment model to match business and IT strategy [Henderson]*
[6] *Only about half of the respondents (54%) stated that "…IT has been an important contributor to their firms success in executing strategic initiatives." [Borzo, p6]*
[7] *According to research of 'The Economist', sponsored by Cap Gemini, Cisco Systems and SAP [Borzo, p2-3]*

Service Orientation / Service Oriented Architecture

In this context intertwined concepts like Service Orientation (SO) and Service Oriented Architecture (SOA) are entering the field. Many views and opinions exist on SO and SOA. Often these are not clearly defined, more often overlap exists between definitions. Even more often it are only different symbiotic perspectives on the same topic.

Many promises, already made too often by preceding IT concepts, are made again and said to come true this time; SO/SOA will facilitate integration of IT and enable reuse of software components. A major claim is that SO/SOA will enable organizations to become agile.

In the business world a range of every day challenges is often addressed with a cry for "flexibility" and "agility". IT could help in this by addressing various scenarios and facilitating alternative actions. However, in the cooperation between business and IT something frequently goes awry. This shows in various symptoms and bottlenecks; insufficient and (too) late actions, difficult adaptations, etc. . Can SO/SOA address these bottle necks?

Assuming there is truth in the claim among various sources, that SO/SOA is an enabler of agility the question then presents itself; if SO is an enabler of agility, what kind of agility is then enabled? Where can SO/SOA come to help?

1.2 Thesis; Focus and Context

This thesis is an attempt to provide a piece in the bigger jigsaw and find an answer on how SO/SOA makes agility possible.

Therefore this thesis will focus on the concepts of agility and SO/SOA, these concepts will first be elaborated from a theoretical point of view. This will be attempted by constructing a framework with agility on one axis and SO on the opposite axis.

Due to limitations in time for a thesis only one sector will be researched, namely the financial[8] sector in the Netherlands. The following parties have an interest in this research;

Cordys

Cordys is an IT company providing solutions for the SOA BPM market. It is founded in 2001 by Jan Baan, Cordys targets organizations worldwide. Currently Cordys has about 600 employees across the globe, it focuses on markets in western Europe, USA, India and China.

Cordys offers the possibility to conduct a research with their backup and support. The company of Cordys showed interest in the research proposal and might use (parts of) the results for their implementation methodology Cordys@Work, which is integrated in the Cordys Developers Network (CDN).

University

The University of Twente is a technical university in the east of the Netherlands. Besides various studies, the university also hosts research on a number of areas. The University of Twente co operates

[8] *See paragraph 2.3 for the specific reasons for focusing on the financial sector.*

with two other Dutch technical universities in the 3TU group.

The University of Twente requires this research as the final thesis for rounding off a Master degree "Industrial Technology Management", with a specialization "IT and Management".

1.3 Thesis; Structure

The current paragraph only provides a short enumeration of the components of this paper. This thesis is divided into five distinct parts, which can be read separately, but belong together.

These parts are sub divided in chapters and paragraphs. The detailed structure of the paper is elaborated in conjunction with the research methods in the next chapter, see paragraph 2.4

The parts of this thesis are;

- **Part I – Setting up a research;** This is the part you are currently reading. It contains the introduction to this thesis and a brief and rewritten version of the research design for this thesis.
- **Part II – Theory;** The theory elaborates relevant constructs and concepts required to answer the questions stated in the research design. This comes down to agility/agility gaps, Service Orientation/Service Oriented Architecture and Organizations. Also the construction of a research instrument in the form of questionnaire is elaborated.
- **Part III – Refinement:** The resulting theory and questionnaire from part II are discussed with subject matter experts. Their feedback is analyzed and where necessary incorporated. This will result in a new (final) questionnaire.
- **Part IV – Research;** The final questionnaire is applied to a number of cases to arrive at an answer on the stated research questions.
- **Part V – Wrap up;** This part contains the discussion of research results and insights from theory. It will be topped off by the conclusion and recommendations.
- **Part V – Appendices;** This is a separate part of the thesis. This is the overflow of supporting material, too detailed to be included in the main body of the thesis. Although these are essential for the completeness of the research and as a reference.

2. Research Design

This chapter contains a rewritten version of the original Research Design. It details the research questions and how these questions were approached.

2.1 Research Questions

A number of questions arise, when considering the topic of SO/SOA and agility. This is tackled by formulating a main research question which is split up into sub research questions.

Main research question

The main research question, to be answered in this thesis is formulated as;

> *"How can organizations achieve (business) agility, when using Service Orientation /Service Oriented Architecture?"*[1]

Sub research questions

The sub research questions are each contributing towards answering the main research question. These are;

1. *What issues currently hinder (business) agility of large financial organizations?*
2. *What is Service Orientation (SO) and what is Service Oriented Architecture (SOA)?*
3. *Which agility gaps can be bridged if using SO/SOA in organizations?*
4. *What are the implications for an organization when using SO/SOA to address agility gaps?.*

2.2 Research Concepts and Constructs

Elaborating the main and sub research questions we arrive at the following concept and constructs for this thesis;

- **Agility / Agility gaps;** these concepts needs to be defined and made specific. Also the difference between flexibility and agility needs to be distinguished.
- **Service Orientation / Service Oriented Architecture;** the abundant perspectives and terms on SO/SOA need to be identified and placed in a context. Although no attempt will be made to go into great technical detail.
- **Organizations;** The concept of organizations will only be viewed from a point of view for agility and SO/SOA. No intention exists to redefine organizational literature, but the impact or requirements of agility and SO/SOA are considered in the light of application in organizations.

[1] *These research questions are derived from the research design v0.3. p10 11. The current formulation is less formal, and the narrowing down to financial organizations is made explicit in paragraph 2.3*

2.3 Research Scope

The scope of this research will be the financial sector. Reasons for this are the specifics of the financial sector regarding bottlenecks and the options available for research. This is elaborated in the relevance of the research and the reasoning for focusing on the financial sector alone.

Relevance of Research

Service Orientation and SOA are important to consider scientifically; despite the hype surrounding the concept, only about 8% of organizations participating in a survey of the Butler group had already deployed SOA in a live environment. Other organizations are still in the trial (17%) or evaluation phase[10]. SO/SOA claims to facilitate and enable agility in organizations. However, except only superficially, this claim is generally not specified much further. How and what kind of agility is enabled through SO/SOA in practice is therefore still unclear.

Agility is a broad concept and can be specific to one branch. The financial sector is one with quite different circumstances compared to other sectors. Adding to this is the growing interest in the financial sector for SO/SOA[11].

The concepts are still evolving and knowledge needs to be build up. Therefore research into how SO/SOA can address agility can provide valuable insights. These insights can be used to use a SO/SOA solution at its fortes. Also unrealistic expectations can be tempered, preventing further misunderstandings between business and IT.

Reasons for the Financial Sector

The financial sector is an important pillar of the Dutch economy, for 2005 the financial sector alone was already responsible for 7,4% of the added value for the total Dutch economy[12].

Research of Oosterhout and Hillegersberg resulted in overviews of issues hindering agility for four sectors; finance, (mobile) telecom, logistics and utility. In their research these bottlenecks are labeled agility gaps. It is important to note that the top 15 of agility gaps for the financial sector is quite different from the overview containing agility gaps for all four sectors; of the agility gaps present in the general overview only four are also present in the top 15 for the financial sector. The financial sector seems to be one with specific characteristics. For finance all top 15 agility gaps are mentioned by ≥50% of the respondents, while in the survey overview for the top 15 of all four sectors only 5 out of 15 agility gaps score ≥50%. Because of this it can be assumed the agility gaps in the financial sector are (perceived as) more serious[13]. For an overview of agility gaps see

[10] *According to a survey carried out by the Butler group [Blowers, p13]*
[11] *See research of Oosterhout comparing the sectors of Finance, mobile telecom, logistics and utility [Oosterhout, p139].*
[12] *According to numbers provided by the CBS (Centraal Bureau voor de Statistiek), comparable to the Central Statistical Office, in the Netherlands [CBS, p48 49]*
[13] *If comparing the top 15 results from Oosterhout on agility in the sectors of Finance, mobile telecom, logistics and utility [Oosterhout, p139] with the top 15 agility gaps of van Hillegersberg specific for Finance [Hillegersberg, p6], only four of the general overview also apply for the financial sector. Migration from ERP oriented architecture to SOA ranks on 11 in*

paragraph 3.6.

Options available for research

The company of Cordys can assist in providing initial access to a number of experts and organizations related to or in the financial sector. Adding to this is the presence of a large number of financial institutions in the Netherlands. Many of them involved at implementations of SO/SOA, or addressing their agility issues in other ways. This provides an interesting opportunity for research.

Due to the importance of the financial sector to the Dutch economy, the specific agility gaps applicable to the financial sector and the access available to subject matter experts and research cases, this research will focus on the financial sector alone.

2.4 Research Approach and Methods

This paragraph will explain how the research is approached and which methods are applied. Also the detailed Structure of the research is explained.

Research Approach

The research questions lie at the basis of the research approach, resulting in a certain research logic. Within the research logic depicted in figure 1 the following research steps are present;

1. **Theory on Agility – Discussion on Theory, Intermediate Questionnaire;** Theory on agility is gathered and incorporated into an intermediate questionnaire.
2. **Theory on Service Orientation / Service Oriented Architecture Discussion on Theory, Intermediate Questionnaire;** Theory on SO/SOA is gathered and incorporated into an intermediate questionnaire.
3. **Theory on Organization Discussion on Theory, Intermediate Questionnaire;** Theory on organizations is gathered and incorporated into an intermediate questionnaire.
4. **Discussion Theory, Intermediate Questionnaire Interviews Subject matter Experts;** The concepts of theory found are compared with the experiences and ideas of subject matter experts in the field of SO/SOA and/or Business IT alignment. Also is feedback asked on the intermediate version of the questionnaire. The theoretical model will, besice the framework/questionnaire, also provide the case protocols[14]. The literature used has been selected during the construction of the research design.
5. **Interviews Subject matter Experts Framework / Questionnaire;** Input and feedback from the subject matter experts on theory and intermediate versions of the questionnaire is incorporated. This helps to improve the final questionnaire into an effective research tool. The final

the top 15 agility gaps for the financial sector.
[14] *According to Yin case protocols are questionnaire extended with a set of directions and rules for application [Yin, p67 69]*

questionnaire is used in the next steps.

6. **Definitive Questionnaire – Case Studies from literature;** The final questionnaire is used to analyze a number of SO/SOA cases described in literature. This serves the goal of testing and validating the questionnaire.
7. **Definitive Questionnaire – Case Studies from practice;** The definitive questionnaire is put to use to analyze a number of real life SO/SOA cases. Ideally multiple persons involved with the case are approached for filling in the questionnaire. This should lead to insight into the extent to which SO/SOA enables agility.
8. **Cases – Discussion;** The output of the questionnaires is analyzed and provides a start for a discussion of the results of the cases. This can be combined with insights stemming from the discussion on theory and the feedback obtained of the interviews.
9. **Discussion – Conclusion;** The discussion should lead to some insights, which can be presented as viable conclusions. Preferably in the format short sharp shocking.
10. **Conclusion – Recommendations;** The conclusion can state the obvious in general, but also a number of concrete actions possible. The latter will be incorporated in the recommendations.

Research Rationale

The rationale of the research elaborates the objectives aimed for with working out the research as described in the research approach. Agility is perceived as a topic that can be addressed by SO/SOA. But how this can be quantified is not clearly specified. The rationale of this research is twofold:

1. **Elaborate on agility in relation to SO/SOA:** What is Agility and what is SO/SOA? What notions and concepts exist and how do these relate to each other? Can such a one on one claim between SO/SOA as a facilitator of agility been made? Are there any distinctions to be made?
2. **Find instruments and processes:** which instruments can be used to manage (required) improvements in agility using SO/SOA? Which processes need to be set up to manage (required) improvements in agility using SO/SOA? What is the impact on the organization?

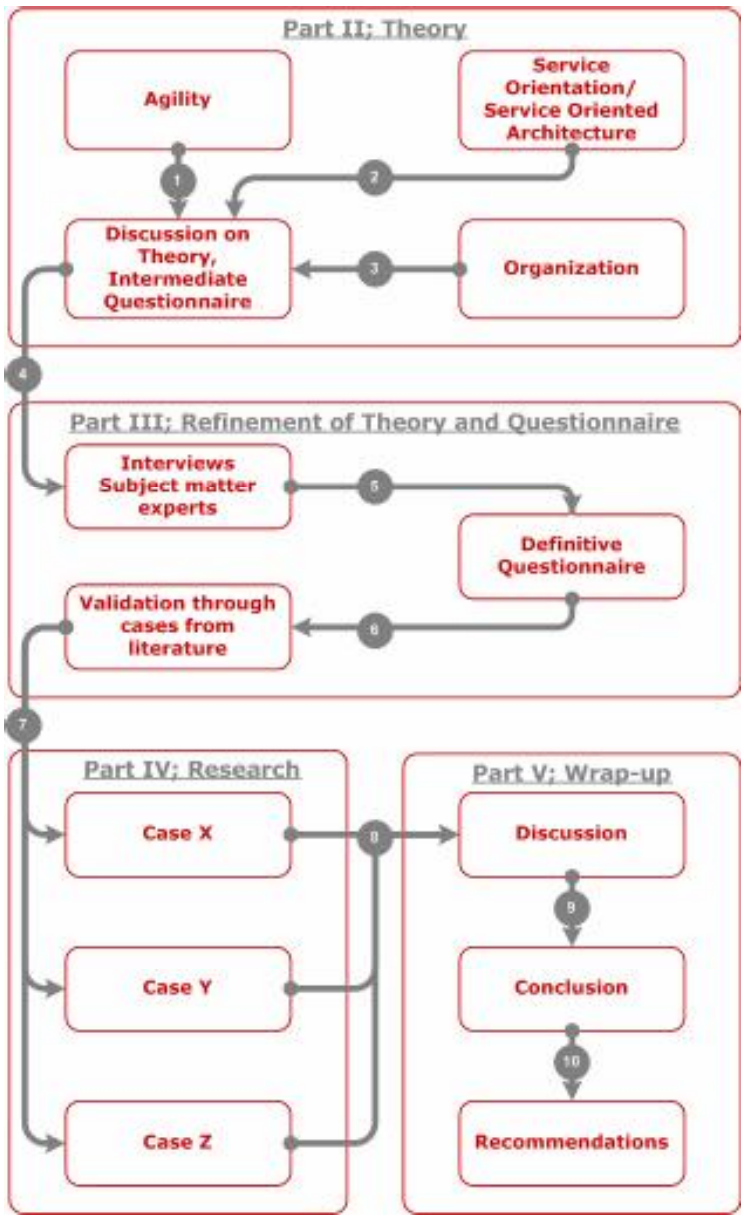
The way how the various parts contribute to the rationale of this research, is stated on the title page of each research part. This should help a reader to follow the logic of the research.

Research Methods

This research is set up as a case study research, combining a number of methods. Basically three research methods are used for this research:

- **Desk research – Theory;** Theory on Service Orientation, Service Oriented Architecture and Agility was consulted. The theory was searched through the databases Ingenta, ACM and

Scopus. Also were the websites of Gartner, CBDI and W3C examined for useful insights[1].



(Figure 1; The research logic and order of research steps for this thesis)

[1]: *In an Article of Schwartz and Russo, Ingenta and ACM ranked as the best two databases for the IS field (Schwartz, 998-110). The Scopus database was selected on advice of the supervising professor of this research; Jos van Hillegersberg. For more information on the considerations see appendix 5 of the Research Design Paper v0.3.*

- **Interviews – Subject matter experts;** The interviews were of an exploratory unstructured type. Subject matter experts of the largest Business IT consultancy firms in the Netherlands have been approached. The theory found was verified, and the initial versions of a research tool for the case studies, in the form of a questionnaire, have been tested. For more details on the research approach for the interviews see paragraph 6.1.
- **Cases – From literature and practice;** From theory encountered a number of described cases were encountered, one of these has been analyzed with the developed research tool. Real life cases were approached through contacts within Cordys, or contacts from interviewees or through other direct approaches. For this relevant people involved were asked to fill in the questionnaire.

Detailed Structure Thesis

Having detailed the steps required according to the research logic the structure of the thesis needs to be explained. In chapter 1 it was already explained that the thesis is divided in six parts, each subdivided into separate chapters (appendices not included).

The chapters describe parts of the answers to the (sub-) research questions. For this it is important to realize which research method is used for answering the (sub-)research questions. An overview of used research methods and relevant chapters per (sub-)research question is provided in figure 2. Each chapter will be finished of with a paragraph detailing a sub conclusion. This will summarize the discussed topic briefly as well as expressing some personal consideration on the topic.

	Methods			Chapters									
	Theory	Interviews	Cases	3. Agility	4. SO/SOA	5. Organizations	6. Discussion on Theory	7. Interviews	8. Framework	9. Testing cases	10. Agility Types	11. Practical Cases	12. Discussion & Conclusion
1 *What issues currently hinder (business) agility at large financial organizations?*	X			X			X			X	X	X	X
2 *What is Service Orientation (SO) and what is Service Oriented Architecture (SOA)?*	X	X			X		X	X					X
3 *Which agility gaps can be bridged if using SO/SOA in organizations?*	X	X	X				X	X	X	X	X	X	X
4 *What are the implications for an organization when using SO/SOA to address agility gaps?.*	X	X	X			X	X	X		X		X	X

(Figure 2; The research questions, with the research methods used to find an answer and the chapters where answers are formulated. Service Orientation, Service Oriented Architecture, agility gaps and implications for organizations were the main themes for the interviews.)

Also included in figure 2 is the conclusion, which will draw on research

results generated by all research methods. Here the discussion will be finished off and answers will be formulated as far as possible resulting in recommendations.

2.5 Research Analysis Strategy

The analysis strategy will discuss the data types and analysis approach of this research, attention will be given to the type of data required and the methods necessary to obtain these data types. Following on this reliability[16] and validity[17] of the research are discussed.

Data types

Four data types with specific measurement characteristics[18] exist; nominal, ordinal, interval and ratio.

However, the division between qualitative and quantitative data and analysis is also often made. The latter is about exact numbers, while qualitative is more about notions and perceptions.

Determining the data type is relevant for selecting the operations which can be applied to the collected data. Also it determines the conclusions which can be drawn. This is important to determine the amount of generalization possible in the final analysis.

Because it is an explorative research the data will be of a more qualitative nature, it will be therefore difficult to obtain exact data. For this tools are required, but often these tools will rely on other humans' opinions too. The focus will be more on relations than on values.

Quantitative data is in general not reliable because of the small sample of an unknown total population. If quantitative data is used it will be tried to target specific individuals and get as much response of these people as possible.

Analysis Approach

As figure 2 already briefly stated, the research questions will be (partly) addressed by the theory. This will be drawn from literature and a number of selective interviews, resulting in a framework/questionnaire.

The analysis approach describes how the concepts, data and results of the research are analyzed. These can be obtained from literature, interviews and questionnaires. This sub paragraph briefly details how each of these sources is approached from an analysis point of view:

- **Literature;** the analyses of the literature is carried out on concepts relevant to Agility, Service Orientation and Service

[16] *Reliability is perceived as the extent to which a measurement supplies consistent results [Cooper, p236]*
[17] *Validity is the extent to which a test measures what we wish to measure [Cooper, p231]. However, many perceptions on validity exist.*
[18] *Nominal data; classification but no order, distance or origin. Ordinal data; classification and order, but no distance or unique origin, Interval data; classification, order and distance, but no unique origin and finally ratio data; classification, order and distance and a unique origin [Cooper, p223]*

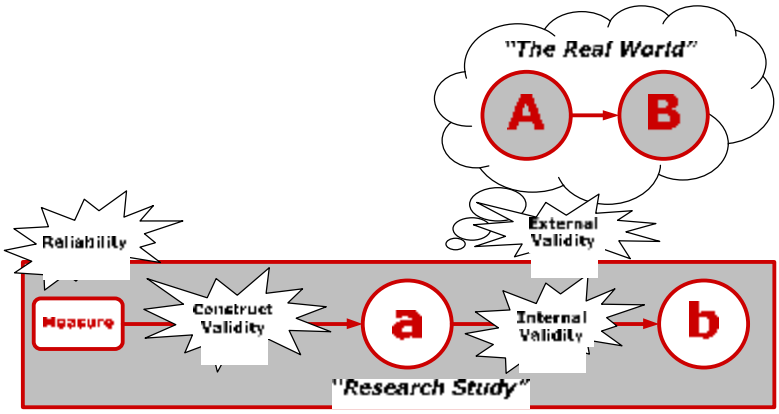
Oriented Architecture. The analysis of the literature is based on combining and reflecting on the various insights.

- **Interviews;** The interviews are used to validate the findings from literature. The interviews will be performed with operational questions drawn from the described theories, asked in an unstructured way. Data will be in the form of transcripts from the interviews, which will be provided separately. These will be coded and analyzed by means of a database[18], with the terms of analyses being the notions and concepts as described in literature.
- **Questionnaires;** The questionnaire results in on line data stored in excel files. For this research checkboxes, resulting in nominal data, for inclusion or exclusion can be used. Another source can be Likert scales, resulting in ordinal or interval data. These are only useful when it is sure an opinion is possible[20] on a question.

  The questionnaire will result in general data and data specific to one organization; these have to be dealt with separately. General data will be analyzed together, using graphs. Analyses of quantitative case specific data will be done through charts comparing the results within a single case and across cases.

Reliability and Validity

The relation between reliability and the various types of validity is depicted in 3.



(Figure 3; The relation between reliability and various forms of validity)

If a measure repeatedly produces the same outcome, within a certain range, regardless of the measurer, it is deemed reliable. The various forms of validity[21] are; construct, internal and external validity. Ultimately a research should account for it's reliability and validity.

[18] *The Access database "Interview streamliner" of the University of Erasmus, Rotterdam.*
[20] *See Cooper for an overview of rating scales and the associated resulting data types [Cooper, p252 268]*
[21] *Construct validity is about "the ability of measures to accurately reflect the underlying components. Internal validity regards alternative explanations for the results, while external validity is about the ability to generalize the results to other situations" [Moody, slide 31].*

Below the concepts of validity and reliability are listed and how these are applied in this research. Also an indication is given of the effect on the research by denoting a "+" or " ", although these have no value against each other. A positive result on one issue does not cross out a negative result on another issue, and vice versa.

This thesis addresses reliability, construct, internal and external validity in the following ways;

Reliability	+	By basing the framework on existing measurements and concepts the reliability of the study increases.
Construct Validity	+	Through deducting constructs from existing theory construct validity should be increased.
	+	Using multiple repetitions (multiple theoretical cases, multiple interviews and multiple dedicated case studies) should improve construct validity.
Internal Validity	+	Increased by discussing the theory found and composed framework with subject matters experts in interviews.
External Validity	+	Use of multiple sources; combining the use of various theoretical cases with dedicated case studies should increase external validity.
		The total population of subject matter experts is not known up front, probably not afterwards too. The opinion of the experts therefore does not need to reflect the opinion of the total population.
	+	Verifying theoretical results, from the application of the framework to theoretical cases, by comparing these with results of dedicated case studies improves external validity.
		The use of existing theoretical cases presents the problem that the original goal for which these cases were written, as well as the conditions applying, may differ of this research, it are secondary data.
		Existing theoretical cases can be biased, depending on their source. This can be an argument see prior point too

Part II – Theory

"Believe those who are seeking the truth; doubt those who find it."[22]

- **Andre Gide** –

Research Rationale Part II

This part will contribute to the research by;

- Stating the difference between agility and flexibility
- Explain various types and examples of agility.
- Expand on Service Orientation and Service Oriented Architecture and related concepts.
- Discussing how organizations deal with Agility, Service Orientation and Service Oriented Architecture
- Constructing an (intermediary) framework/questionnaire for use at business cases.

[22] *According to wisdomquotes.com*

3. Agility

This chapter explains the concept of agility; a definition is formed, and the major aspects of agility are stressed. Also a look is taken at how agility might be measured. Adding to this change factors requiring agility in large financial organizations are discussed, these are called agility gaps and are used further in this research.

3.1 Agility versus Flexibility

Agility is nowadays a buzzword applied in many different contexts. The difference between agility and flexibility is not always clear. Basically agility is only about being able to move quickly and easily. Flexibility is about being able to change or being changed and the responding capability to different circumstances[23]. Flexibility and agility are often stated as desired capabilities of business (processes).

Too often these terms are intermingled, leading to confusion. Agility, among others, has been described in the context of warfare, (software) development methods and organizations. Flexibility is applied to the same concepts and also, among others, to business at large, processes and in the manufacturing context. One way or another; overlap exists.

For example, Cherbakov states that on demand businesses, a pseudonym often used by IBM for agile businesses is "equivalent to total business flexibility"[24]. But in his article flexibility is not specified further. D'Souza identified in a manufacturing context seven dimensions of flexibility[25].

For the scope of this research it is sufficient to take note of the specification of flexibility into more precise dimensions focusing on processes. Does agility also consist of various axis? This will be addressed in the next paragraph.

Oosterhout et al. perceive various levels of flexibility and regard agility as anything beyond normal flexibility required in processes[26]. In this perception agility is some degree of flexibility, with the latter being about normal fluctuations in processes and organizations. Agility is then about the above normal changes, which in general can not be facilitated by standard means but require adaptations of the existing structures and means.

3.2 Arriving at a definition of agility

In the scientific and business community a debate is still going on, on how to define agility and bring it into practice. In CIO magazine the buzz around agility was brought back to some major questions;

"Today's lust for agility is symptomatic of the deeper issue: Who is really responsible for responsiveness? The people who "lead" or the

[23] *According to the Oxford English Dictionary, on "agile" and "flexible" [Oxford]*
[24] *An example of the tight connection/confusion between agility and flexibility [Cherbakov, p654]*
[25] *The flexibility dimensions according to D'Souza are volume , materials , mix , modification , changeover and rerouting flexibility and on top of it flexibility responsiveness [D'Souza, p578 579]*
[26] *See Oosterhout et al. [Oosterhout, p134], also see the next paragraph on a definition on (business) agility*

people who do the real work of the enterprise? Is agility a euphemism for recentralization or is it an honest bid to give more people more power to adapt their software and systems to reality?[27]

Finding answers probably depends more on identifying points of view taken towards agility, instead of finding a single simple truth. How many truths are out there?

Types of Agility

Adding to the various perspectives is that, in line with the various types of flexibility, various types of agility can be perceived. Sambamurthy already used a rough typology of agility, resulting in customer, partnering and operational agility[28]. However, their definitions of agility types focus only on "exploration of innovation opportunities". Agility is about more than that.

CIO.com stated three questions relating to types of agility[29]:

- Where on the value net do I want to be agile? On the supply or demand side, or internally?
- In what types of exchange do I want to be agile? B2B or B2C?
- Do I want to be agile with products or markets?

Between these is some overlap, but these could be translated into four possible classifications of agility: Product, Market, Process and Network (Partners and Customers). However, more forms of agility could be defined.

- **Product Agility;** The ability to easily change between various products to address changing needs.
- **Process Agility;** The ability to easily adapt the internal processes to adress changing circumstances
- **Market Agility;** The ability to easily enter and change markets.
- **Network Agility;** The ability to easily coordinate and cooperate with various partners, ranging from suppliers to customers.

Perspectives on Agility

From the military perspective the various networks are stressed as an enabler of agility, more specifically the (flexible) interactions between the command and control structures of these networks[30]. The larger

[27] *Although the conclusion of the article "the struggle to define agility", by Michael Schrage, is already from some time ago, it still poses some relevant questions to be answered in the debate on agility [Schrage]*
[28] *Customer agility is about the ability to "co opt customers in exploration of innovation", partnering agility is the ability "to leverage assets and competencies of suppliers, distributors, contract manufacturers and logistic providers in the exploration of innovation opportunities, while operational agility is "the ability to accomplish speed and cost economy in the exploration of innovation opportunities [Sambamurthy, p246]*
[29] *On the IT infrastructure for an agile enterprise [CIO.com]*
[30] *People are members of different networks, sometimes functioning within formal organizations with clear command and control. The interaction between these networks and the command and control influence an organization's agility [Atkinson, p12, p153-156]*

the variety of actions to a control system, the more agile such a system becomes.

Other sources[31] define agility on two issues, first the ability to sense (environmental) changes and second the ability to react to these changes. Gartner later added productivity and flexibility to these two[32], so an agile organization is perceived by Gartner as one that leverages both internal as well as external sourced resources. (The latter is an interesting perspective in the light of the outsourcing).

Similar but slightly differently worded definitions exist, like the one of Allen who defines agility as "the ability to act quickly and with economy of effort in accurate response to change and also initiate change for business advantage"[33].

Oosterhout regards agility as a form of flexibility, with flexibility existing in three levels; operational, structural and strategic flexibility[34]. This is incorporated in their definition; *"Business agility is being able to swiftly change businesses and business processes beyond the normal (operational) level of flexibility to effectively manage unpredictable external and internal changes".*

Definition of Agility

The definition of Oosterhout is more precise on the type of flexibility required and encompasses the sensing and reacting capabilities too. It also takes internal as well as external changes into consideration. The explicit link made between flexibility and agility makes the definition of Oosterhout et al. more eligible than it's rivals.

Only two notions are missing. One is that change of "business and business processes" can encompass the use of external resources too, beside internal ones. The second is the sensing capability, besides the reacting capability (which is well described by Oosterhout). Many sources agree on that agility in some sense is about the ability to react[35].

This needs to be added, leading to the following definition;

"Business agility is the ability to sense internal and external changes, as well as being able to swiftly adapting, in reaction to sensed changes, businesses and business processes beyond the normal (operational) level of flexibility, effectively using internal and external resources, to effectively manage unpredictable external and internal changes".

---

[31] *Among others Gartner, for example Ambrose [Ambrose, p3 4], and Overby [Overby, p121].*
[32] *Agility enablers according to Gartner [Plummer, 9 10]*
[33] *Allen defining agility, it is perceived as "one of the main aspects of Service Orientation" [Allen, p157].*
[34] *Operational (reactive routines on familiar changes, possible within existing structures and goals of an organization), structural (the capacity of management to adapt and communicate it's decision, as well as the speed of this, within the given structure) and strategic flexibility (capacity of management to react to unstructured non routine unfamiliar changes which have far reaching consequences and need quick response). These levels are taken from Volverda [Oosterhout, p134]*
[35] *See again among others Gartner, for example Ambrose [Ambrose, p3-4], and Overby [Overby, p121].*

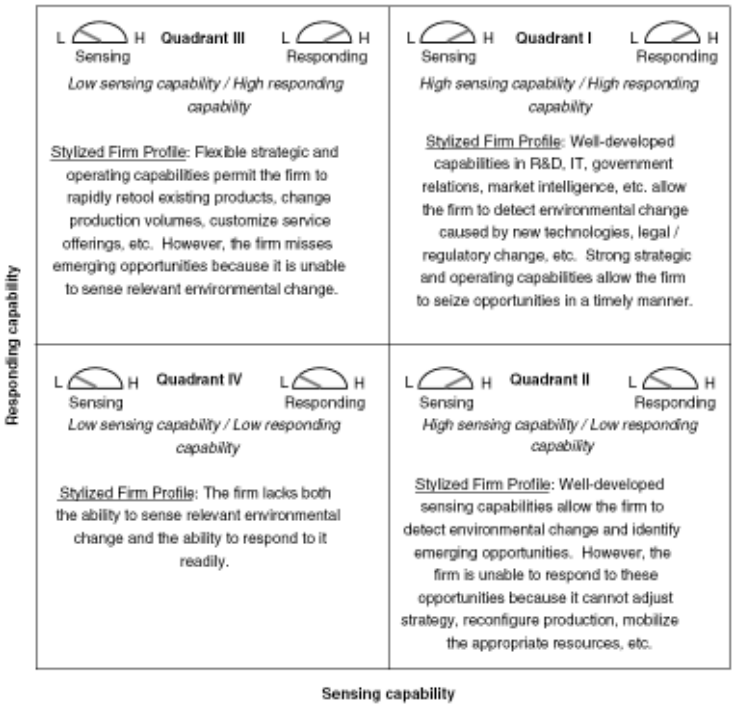
3.3 How to Measure Agility

Measuring agility is difficult and depends on what is regarded as agility. However, to concretize on the abstract notions of agility is often regarded as difficult and the notions of agility and flexibility are used together.

Overby's Framework

Overby attempted to specify agility, by creating a framework based on the possible combinations of an organization's sensing and responding capability. This framework identifies four quadrants, with combinations between high and low capabilities of sensing and responding, see figure 4.

When both on the sensing as well as on the responding aspects high scores are achieved (calculated using two formula's) an organization is regarded agile, according to Overby. This is grouped as quarter 1 in Overby's framework[36].



(Figure 4 Overby's framework of combinations of sensing and responding capabilities[37]).

Considerations on Overby's Framework

However the calculation of Overby is arbitrary because the score is

[36] *Overby on his enterprise agility framework [Overby, p126-129].*
[37] *This figure shows a number of characteristics of organizations in each quadrant [Overby, p123]*

influenced by the alignment of abilities. Classifying the alignment wrongly will affect the agility score seriously. Thereby the calculations of Overby are not based on rock solid numbers, but estimates of "experts".

The framework of Overby provides some understanding of how to measure agility. The framework of Overby is probably theoretically sound (encompassing the sensing and reacting capabilities), but difficult (if not impossible) to apply in practice. But it is unclear or it encompasses the whole truth because it works with scores. These scores are subjective and it is not clear or these should be based on currency, time, volume or other aspects. Most likely all aspects can be applicable depending on the specific focus on an issue of agility.

Implications for the formed definition

Essentially agility comes down to having the means and capabilities at hand to react on the information available, no more, no less. In the words of Overby "Non aligned firms may sense a breadth of opportunities that they cannot respond to or have responding capabilities that do not apply to the opportunities they sense".

The definition formed in paragraph 3.2 is regarded more complete, because it explains the difference between agility and flexibility as well as that it also incorporates the sensing and reacting capabilities described by Overby. However, the same drawbacks apply for the definition of this thesis; measuring capabilities remains subjective.

3.4 How to Implement Agility

Implementing agility requires real time assessment of a company's processes, because one needs to know where, when and what kind of change is required. Constant measurement, and consecutive actions, is often regarded too as part of Business Process Management (BPM)[38].

Gartner research, on how to achieve agility, proposes an agility cycle consisting of five phases[39];

- **Sense;** Organizations must become aware of changes in the business environment, which might require changes in the organization's strategy.
- **Strategize;** If charges are detected, responsive courses of action need to be identified, formulated in the form of scenarios. These scenarios should keep an organization's abilities in mind, and address the required courses of action.
- **Decide;** Once scenarios have been developed an organization needs to commit to scenarios chosen.
- **Communicate;** If (a set of) scenario(s are) is chosen, it needs to be communicated to all involved parties. Especially the (expected) role of the involved parties in the agility cycle.

[38] *"Business Process Management (BPM) is a field of knowledge at the intersection between Management and Information technology, encompassing methods, techniques and tools to design, enact, control, and analyze operational business processes involving humans, organizations, applications, documents and other sources of information" [Aalst].*
[39] *The steps of the agility cycle are described in the article "Achieving agility, the view through a conceptual framework" [Plummer, p5-6]*

- **Act;** This phase is all about the responding capabilities of an organization. The plan, set up and communicated with all involved parts of the organization, needs to be brought into action. Gartner advices a cyclic approach addressing specific projects, instead of large (waterfall like) projects.

Gartner situated these phases in a cycle to keep an organization focused on the ultimate goal; achieving agility in a continuous process. By maintaining an agility cycle it is prevented an organization starts focusing on too specific details, while losing sight of the grand plan.

According to Gartner, organizations can have different capabilities in each part of the agility cycle depending on the size, type and means of an organization.

However, or this cycle is really new is doubtable. Deming was already one of the first ones to propose an iterative cycle, focused at improving the quality; the well known plan do check act cycle, a.k.a. Deming's cycle[40]. Gartner's model seems to be a derivation of this classic.

Especially the iterative aspect of the proposed assessment is valuable, regardless of the exact stages used. Combining the agility cycle proposed by Gartner (or any other derivation of Deming's cycle) with the measuring framework of Overby, may provide a conceptualization of a process of how Agility can be achieved within an organization.

3.5 Agility Priorities

Various forces are driving the need for agility. According to Gartner these forces can be divided into economic, business, organizational, IT and work forces[41].

According to a research, conducted by "the Economist" and "Cap Gemini" among executives worldwide, the focus within IT has to shift. Within the coming years agility related issues are regarded as a high priority among executives.

Another conclusion of this research is the growing expectation about the role of IT to be played in the (near) future. While the traditional expectations remain (providing automation against low costs), the (to be) expected support of IT for revenue generating activities increases[42]. These conclusions are agreed on by another study of Kruidhof[43].

See figure 5 for an overview of the responses of executives on their priorities when allocating their IT budget within the near future. This research however, provides no indication of what issues currently hinder agility within organizations.

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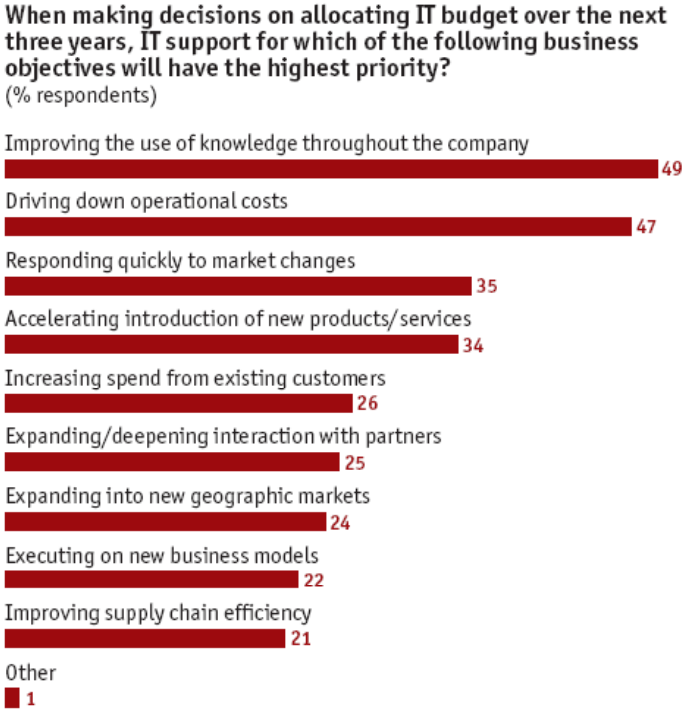
[40] *It originated in the 1920s with the eminent statistics expert Mr. Walter A. Shewhart, who introduced the concept of PLAN, DO and SEE. This was later elaborated by Deming into the PLAN DO CHECK ACT cycle, this has formed the basis for many variations [Wikipedia]*

[41] *Forces driving organizational agility, according to Gartner [Ambrose, p4]*

[42] *"...while C level respondents stress the importance of IT's revenue generation role, driving down operational costs remain at or near the top of their list when it comes to budgeting priorities" [Borzo, p5].*

[43] *See the presentation of Kruidhof for Cordys, based on the European CIO survey of Cap Gemini [Kruidhof, slide 5 6].*



(Figure 5; Quicker responses to market changes, an important aspect of agility, is regarded the 3rd most important priority for executives worldwide, when allocating IT budget[44])

3.6 Agility Gaps

Agility gaps are defined by Oosterhout et al. as the difference between the required and the current business agility. These gaps occur due to change factors requiring agility (the need for swift change), combined with the inability to address these needs within time[45].

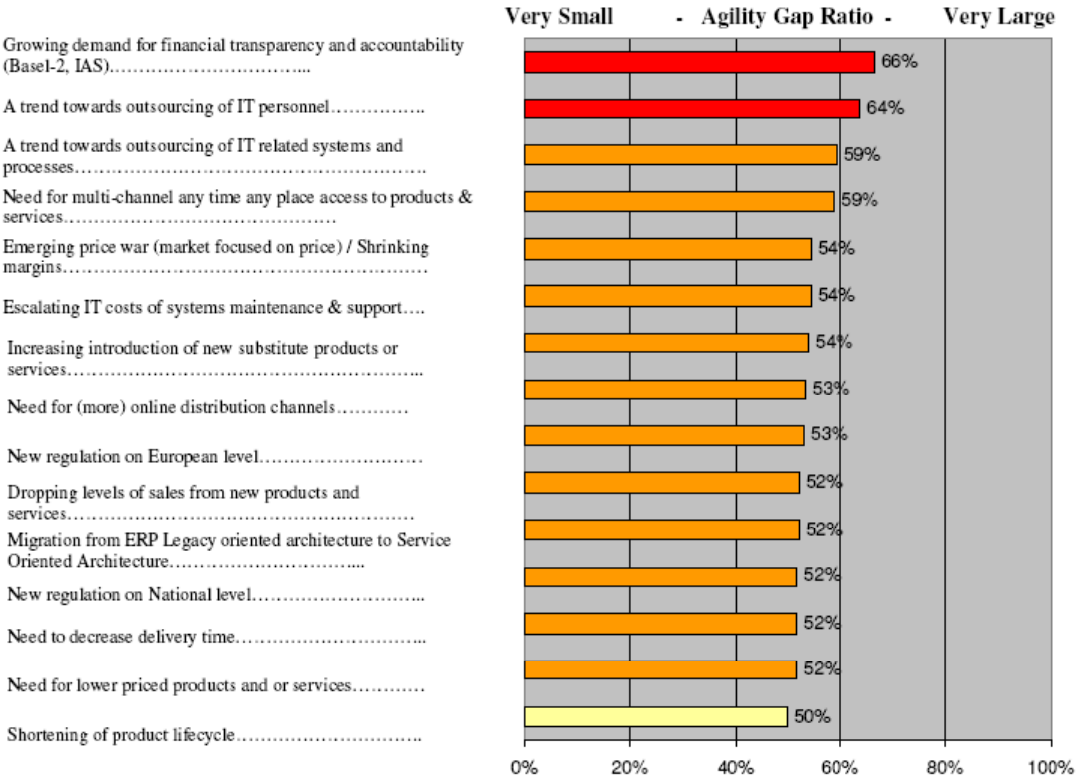
Figure 6 provides an overview of the top 15 agility gaps in the Dutch financial sector, resulting from a research conducted by Hillegersberg. The research of Oosterhout resulted in an overview of agility gaps across four sectors, namely: Finance, Mobile telecom, Logistics and Utilities. Hillegersberg focused on the financial sector alone.

The gaps have very different origins, some gaps deal with agility regarding suppliers, others regarding customers or internal agility. Also variations exist between market and product agility. All viewpoints are represented in the agility gaps.

Important to realize is that these gaps can change continuously. This means that measurement should take place regularly. Based on the analysis actions need to be started continuously, if the need to address a new agility gap arises. This is the essence of Business Process

[44] *The figure is taken from a report of the Economist, researching the changing role of IT in the business [Borzo, p4 and p13]*
[45] *Agility gaps arise due to unexpected internal and external changes, requiring fundamental adaptations [Oosterhout, p135]*

Management. The agility cycle proposed by Gartner, combined with the framework of Overby might provide instruments for this.



(Figure 6: the top 15 agility gaps for the financial sector, according to the research of van Hillegersberg [Hillegersberg]. In the research of Oosterhout a combined top 15 of agility gaps for the (mobile) telecom, logistic, utility and financial sector is presented)

3.7 Propositions on Agility types

The agility gaps can be sorted on the type of agility required for solving these gaps. The use of this is to arrive at insight what type of agility can actually be adressed by SO/SOA, instead of stating common places like "SOA helps your organization become agile".

Recalling the types of agility these can be used to assess which ones are enablers for addressing agility gaps. The definitions can be summarized for product agility as being about easily changing between products and services to changing needs, while process agility is about easily adapting the (internal) process to changing circumstances, network agility is about facilitating coordination and cooperation with partners and market agility about easily entering and changing markets.

It will be asked to people involved in business cases, to indicate which types of agility are enablers for addressing each agility gap. This will be assessed using a questionnaire; the expected results are stated as a form of propositions.

The following table indicates which types of agility are expected to be required for addressing the agility gaps mentioned in the prior paragraph.

		Product Agility	Process Agility	Market Agility	Network Agility
1	Growing Demand for Financial Transparancy and Accountability (Basel-2, IAS)		X		
2	A trend towards outsourcing of IT personnel		X		X
3	A trend towards outsourcing of IT related systems and processes		X		X
4	Need for multi-channel any time any place access to products & services		X		X
5	Emerging price war (market focused on price) / Shrinking margins	X		X	
6	Escalating IT costs of systems maintenance & support		X		X
7	Increasing introduction of new substitute products or services	X			
8	Need for more (online) distribution channels			X	X
9	New regulation on European level		X		
10	Dropping levels of sales from new products and services	X		X	
11	Migration from ERP legacy-oriented architecture to SOA		X		
12	New regulation on national level		X		
13	Need to decrease delivery time		X	X	
14	Need for lower priced products and or services	X			X
15	Shortening of product lifecycle	X			

The propositions above can be compared with the actual outcomes of the final questionnaire.

3.8 Summary and Sub Conclusion on Agility

This chapter elaborated the difference between flexibility and agility. Flexibility is being defined as the ability to deal with normal fluctuations, within existing structures. While agility is being defined as extreme flexibility, requiring structural changes which can implicate changes of strategy too.

From a theoretical stance agility is regarded as having two axis; ability to sense and ability to react. Overby created a framework on this principle. However correct, measuring agility is difficult and quickly becomes arbitrary. However, due to the lack of any better option for measuring agility the notion of sensing and reacting capabilities is useful. This has been incorporated in the following definition of (business) agility;

"Business agility is the ability to sense internal and external changes, as well as being able to swiftly adapting, in reaction to sensed changes, businesses and business processes beyond the normal (operational) level of flexibility, effectively using internal and external resources, to effectively manage unpredictable external and internal changes".

However, there is more detail to agility then sensing and reacting

capabilities alone. Attempts to classify agility can be helpful, only are such classifications not necessarily mutually exclusive. Possible forms of such classifications of agility might be process, product, process and network.

Variations of Deming's cycle are proposed to arrive at a continuous assessment of issues requiring agility and defining appropriate options. Gartner devised a five stage circle to analyze and achieve agility in a continuous process. The stages are; sensing, strategizing, deciding, communicating and acting. However, this is only one possible interpretation of Deming's circle.

Especially the iterative aspect of the analysis is useful, due to the continuously changing order of agility issues and priorities between these issues. Combining cyclic assessments with the notion of agility being dependent on sensing and reacting capabilities, can result in a first concept to address the need for agility. A classification of agility might be useful to arrive at more precise specifications of required actions.

Current research on agility in an IT context shows various lists. The need for improved sensing and reacting capabilities, put in various wordings, is expressed again and again.

4. Service Orientation and Service Oriented Architecture

This chapter describes the various concepts about and related to Service Orientation and Service Oriented Architecture. Instead of defining one single truth it is attempted to explain the relation between concepts and theories around.

For this some theoretical concepts about SO and SOA are discussed. Also related concepts as architecture, Business Process Management, Granularity, Maturity and Governance are discussed in various grade of detail.

4.1 Service Orientation versus Service Oriented Architecture

A tower of Babel occurs when different languages are spoken, or the same word is perceived with multiple meanings. When dealing with Service Orientation and Service Oriented Architecture, we encounter the very same situation as in the days of Babel.

SO and SOA are two intertwined concepts. Often the term SOA is overloaded with varying interpretations. Service Oriented Architecture has become a term which has steadily been allocated with ever more 'meaning'.

From a set of (technical) architectural principles[46], it has been deemed a design approach[47], a product according to various vendors[48], a strategy[49], a business IT alignment approach[50] or even a paradigm[51].

Service Orientation is proposed as a coordinating paradigm. Strikingly enough no explicit definition of Service Orientation as a paradigm has been encountered in the literature. Often Service Orientation and SOA are mixed up. One of the reasons is the growing hype around this term and the many commercial interests trying to join in with their interpretation of the hype[52].

In the view of Erl and Allen SOA is clearly distinct from Service Orientation, in the sense it is more about technology. Service Orientation is regarded by them as a paradigm, focused at obtaining and creating a better alignment between IS and the business processes and structure of an enterprise[53].

Due to the confusion and overlap between SO and SOA this thesis is

[46] *Among others, according to Foster [Foster, p30] and Erl [Erl, p54], sometimes treated as equal to Enterprise Architecture [Bloomberg, p2 5].*
[47] *According to Gartner Research of Natis [Natis, p2]*
[48] *HP, Oracle, IBM, etc.*
[49] *According to Infosys viewpoint march 2006 [Jayashetty, p3]*
[50] *According to Allen [Allen, p3]*
[51] *According to Bieberstein [Bieberstein, p691] or the OASIS SOA Reference Model [Wikipedia, OASIS]. See also the Zap think article as an example to see how the terms SOA and Service Orientation got mixed up [Bloomberg, p4] or the report on SOA of the Butler group [Butler p11]*
[52] *Erl on popular misconceptions around SOA [Erl, p54], Gartner research of Genovese on the benefits of SOA [Genovese, p2]*
[53] *According to Erl, in an interview with searchwebservices.com, published on techtarget [Techtarget]*

not going to define the ultimate truth on what Service Orientation is and what Service Oriented Architecture is. Instead it is attempted to shed some light on a number of concepts and theories around and there relations.

4.2 Service Orientation

Cherbakov perceives Service Orientation as one aspect of achieving an on demand business, the other important enabler mentioned is componentization[54]. Unclear from this list is if these enablers are comprehensive according to Cherbakov. Also does Cherbakov not explicitly define Service Orientation. It is only one example of using Service Orientation as a loose term. Therefore crafting a definition might be helpful.

Allen is one author who uses the notion of Service Orientation, applying it is a paradigm. Interesting is that he is one of the few who becomes more outspoken when talking about Service Orientation. Two issues are worthwhile mentioning here; Viewpoints and components of Service Orientation.

Definitions Service Orientation

As already stated in the first paragraph of this chapter no explicit definition of Service Orientation as a paradigm is provided in literature.

When attempting to construct some definition, one could arrive on something similar as: *"Service Orientation is an architectural design paradigm focused on the (re-)construction, facilitation and management of federated processes[55], which are constructed of loosely coupled services offering reusable functionalities"*. The functionalities mentioned can be obtained from internal and external sources.

On one hand the goal is on driving costs of IT down, on the other hand the goal is on offering IT as a flexible instrument for (re-) creating (agile) Business Processes in line with the organizational strategy. This should result in functionalities required to address the customer at low process[56].

Viewpoints

Service Orientation touches to many aspects, therefore it can be useful to use a number of lenses, translated by Allen into seven Service Oriented Viewpoints (SOV7). The SOV7 are focused on the Service Oriented analysis at a process level[57]. For an overview of all seven viewpoints and a description of each, see the table below.

However, the division/relation between these viewpoints and the underlying principles is not always clear. The viewpoints do have

[54] *With "on demand" being an acronym for agile [Cherbakov, p654]*
[55] *According to Allen federated processes allow largely independent parts to act with the unity of a whole, toward a common purpose, such that the whole is more than the sum of it's parts [Allen, p6]*
[56] *The goals of Service Orientation are derived from the book written by Es et al. [Es, p26-27].*
[57] *In the light of a shift from a manufacturing to a service perspective, the SOV7 are a starting point to ask questions which help analyze a business process according to a Service Orientation paradigm [Allen, p54-55, p91-92].*

overlap and the reasoning why seven viewpoints are selected is not explained. Due to the lack of anything better yet, it is worthwhile discussing it superficially.

Viewpoint	Description
Transparence:	Smoothness of the customer's experience in using the service, includes consistency of information.
Customer fit:	Using core competencies to provide customers with excellent products and experiences, Tailoring offerings to customers needs.
Partner connectivity:	Using third parties to perform commodity services. Offering service(s) to different partners to streamline a business process, improve business relationships or to generate revenue.
Adaptation:	Gracefully adapt the process to changes in the marketplace
Multi channel capability:	Supporting the customer end to end through the process, using different channels to achieve continuity Ability to offer the same service through different channels
Optimization:	Offering services in real time at high performance levels
One stop experience:	Catering to different needs of the customer through one set of services, typically offered through one channel at one time, often via portals.

Components

Within Service Orientation Allen defines three building blocks. These components are[58];

Business Architecture (BA): the business architecture component focuses on defining and analyzing the business processes. For this various models are used, from domain models, to service information models and Business Process Models. But Allen does not concretize the BA too much and makes references to Harmon for more details.

Service Oriented Architecture (SOA): Allen describes SOA

[58] *See the building blocks of Service Orientation, according to Paul Allen [Allen, p18], the explanation on Business Architecture [Allen, p52, 60-82], explanation of SOA [Allen, p18, p43-44] and the explanation of SOM [Allen p33-37]*

most of the times as an enabling infrastructure or a collection of technologies. But he stresses there is more to SOA than technology alone, therefore he switches to the paradigm of Service Orientation.

Software Oriented Management (SOM): is a term introduced by Allen combining issues of Service Execution Management (SEM) and Service Level Management (SLM). Service Level Agreements (SLA's) play an important role.

4.3 Service Oriented Architecture

SOA evolved from many best practices and lessons learned in the IT. It is still strongly associated with technology, although many publications stress the opposite[65].

Definitions Service Oriented Architecture

The myriad of perceptions of SOA result in a very diverse set of possible definitions. One's preference for a certain definition is probably more telling about one's perspective/background than that it helps finding a definition of SOA.

Service Oriented Architecture, regarding it is a paradigm, is about "organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations"[66].

Service Oriented Architecture, from an architectural point of view, is about designing an organization so that functionalities of various applications can be offered as reusable service components, to facilitate composition of (federated) processes[67].

Service Oriented Architecture, from an infrastructural point of view, is about the facilitating technical software and hardware, necessary to create and exchange reusable services based on independent (legacy) applications

All of the above options can be valid definitions, like dozens of different definitions. Arriving at a single definition will not provide added value for this thesis. Therefore it is sufficient to take notice of the various possible points of view.

Technology

SOA is often perceived only as a technical issue. Initially this was also the part receiving most attention. The prior sub paragraph already showed there is more to SOA than technology alone.

No attempt will be undertaken to provide a comprehensive overview of all SOA related technologies. If looking for books describing all the nuts and bolts of SOA, the books of Erl are well known in the "SO/SOA scene". But a myriad of articles and blogs exists on the technical side

[65] *See the statement of Krafzig et al. [Krafzig, p8], or the statement in the Butler report on SOA being "a concept rather than a product or technology [Butler, p11, p19]*
[66] *According to the OASIS definition of SOA, see wikipedia for the OASIS SOA Reference Model [Wikipedia]*
[67] *According to Allen [Allen, p6-7]*

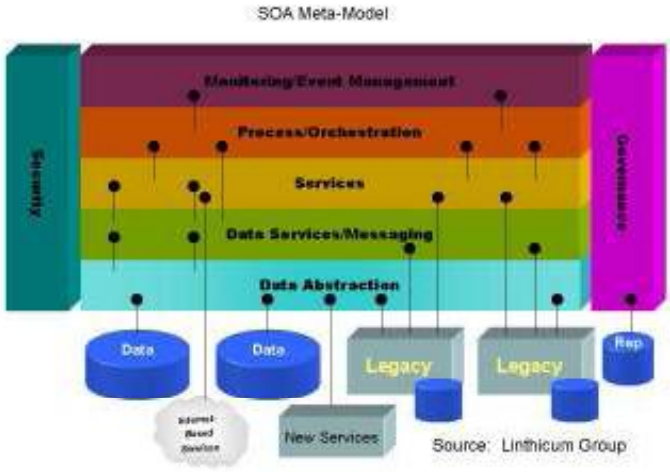
of SOA, this is out of the scope of this research.

However, when discussing SOA some notions of the technology have to be explained briefly (this is not a comprehensive overview!!):

- **Webservices:** this can be perceived as services offered over the web to human users. In the context of SOA it refers to application(module)s offered over the internet through XML protocols. "Webservices do not imply automatically a SOA, nor is a SOA only possible with webservices. But it is difficult to discuss one without the other"[62].
- **Modelling and Programming languages;** many are used but some of the most well known are Business Process Execution Language (BPEL), Business Process Modeling Notation (BPMN), Extensible Markup Language (XML) and Common Object Request Broker Architecture (CORBA). When discussing SOA from a technical point of view one will almost certainly encounter one of these.
- **Enterprise Service Bus (ESB);** An Enterprise Service Bus is generally regarded as an important component, which acts as a connecting middleware between other components of a system. Often the ESB uses XML, connectors can be made between XML and any other (application)language. This makes an ESB an important integration tool present in every SOA.
- **SOAP:** Simple Object Access Protocol or Service Oriented Architecture Protocol abrieved to SOAP[63]. This refers to the messaging protocols used within SOA.

Meta Model

- A meta model is a collection of concepts within a certain domain. A handsome meta model of a SOA is provided by the Linthicum group, see figure 7.



(Figure 7; A SOA Meta model as defined by the Linthicum group)

[62] *This explanation is taken from Krafzig (Krafzig, p13) and a report on SOA (Butler p12)*
[63] *See the wiki on SOAP for more details [Wikipedia]*

The model of the Linthcum group defines a number of aspects related to SOA[54];

- A number of abstraction levels which can be used to discern a number of granularity levels
- It identifies the necessity for Governance across all levels of a SOA
- It shows the notion of various services, at various levels of granularity. Also in the form of composite services.
- It identifies the need for security when turning to SOA.

The incorporation of legacy or internet based systems in the SOA is depicted. The strength of a meta model is also it's weakness; the abstraction. However the metamodel does provide a nice depiction of a number of notions of SOA.

Principles

The principles of SO or SOA are often mentioned, although too often not specified further. The question arises; "What are these common known principles then?" Truth is there is not one commonly agreed on and accepted list of principles available[55].

An attempt to define a set of principles on Service Orientation comes from Erl, although these principles are regarded as architectural principles[56]. Erl discerns an enterprise logic, which can be split in two; a business and an application logic The first one is focused at business processes and the latter on various technologies offering an (automated) solution to be part of the business logic. The concept of Service Orientation results in a third layer between the business and the application logic, the service logic[57]. The principles defined by Erl apply to all layers, but most on the service layer.

Erl also states that no official set of principles exists, but according to him the following list is commonly associated with principles on Service Orientation;

1. **Service reusability:** Logic is divided into services with the intention of promoting reuse.
2. **Service contract:** Services adhere to a communications agreement, as defined collectively by one or more service description documents.
3. **Service loose coupling:** Services maintain a relationship that minimizes dependencies and only requires that they maintain an awareness of each other.
4. **Service abstraction:** Beyond what is described in the service contract, services hide logic from the outside world.

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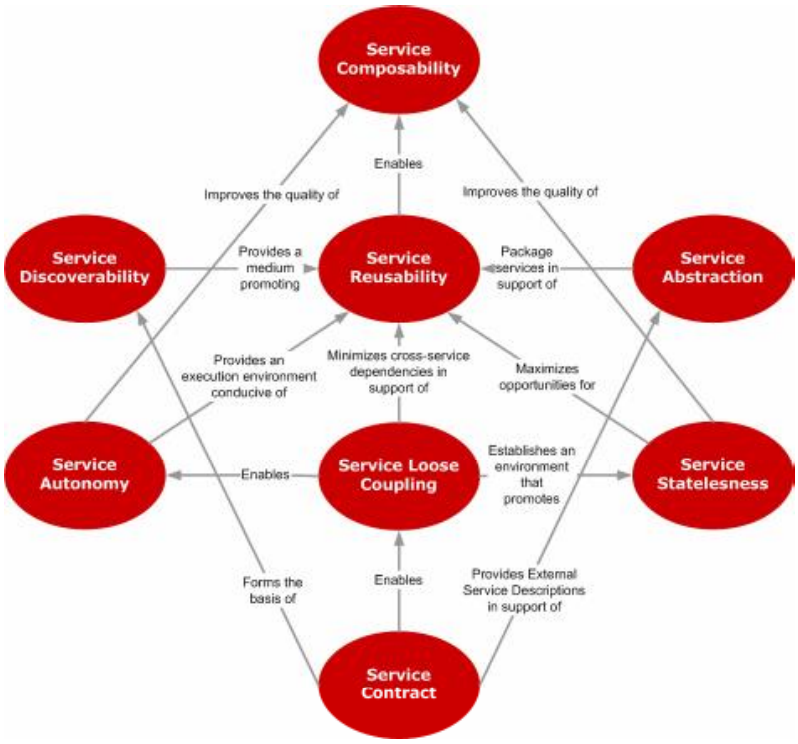
[54] *The meta model of SOA is published on wikipedia [Wikipedia]*
[55] *For example, in the report on SOA of the Butler group references are made to a set of "SOA principles, but this is not specified any further [Blowers, p133, p147]. This is confirmed by Erl "No official set of principles on service orientation exists" [Erl, p291]*
[56] *See for example the wiki on SOA, [Wikipedia]. Other sources also often refer to SOA as an architectural style [Butler, p11]*
[57] *On the different layers of logic in an organization [Erl, p280-290] and Service Orientation Principles [Erl, p37] and on the website on service orientation* http://www.serviceorientation.org/p0.asp

5. **Service composability:** Collections of services can be coordinated and assembled to form composite services.
6. **Service autonomy:** Services have control over the logic they encapsulate.
7. **Service statelessness:** Services minimize retaining information specific to an activity.
8. **Service discoverability:** Services are designed to be outwardly descriptive so that they can be found and assessed via available discovery mechanisms.

It is important to note that Erl here also mixes up the notions of Service Orientation and Service Oriented Architecture. His principles clearly apply to architecture, but are labeled principles of Service Orientation.

The principles describe by Erl contain a clear logic in how they interrelate, as depicted in figure 8.



(Figure 8; figure above is composed by Harold Kvisli, based on the Service Orientation principles stated by Erl [68])

Concepts of SOA

SOA is not a brand new concept within IT, but has evolved over the years. These concepts evolved in the ages before SO/SOA, but are nowadays often presented as being SOA principles[69].

[68] See the website os service orientation http://www.serviceorientation.org/p0.asp
[69] On a number of evolved concepts of SOA [Berg, p41-53]

1. **Componentize:** componentization in independent services along business logic facilitates maintenance and loose coupling.
2. **Agree on how to do things:** this touches to standardization and governance. Agreements on common understanding and application are required when integrating IT.
3. **Use what you already have:** this focuses on decreasing redundancy and increasing reuse. This touches again to loose coupling of services.
4. **From "made to order" to "infrastructure":** with the evolving IT industry it has become more and more possible to obtain functionality on the market place instead of building it yourself. With SOA the following order is advised "buy before reuse before build". Reason for this is to cut on maintenance and reduce the Total Cost of Ownership (TCO).
5. **Facilitate change, continually improve:** These are two sides of a medal, facilitating change requires agility, while optimization requires standardization. This is regarded nowadays as the very essence of SOA
6. **Do it for a (business) reason:** by providing componentization and reuse change and optimization becomes easier. This helps addressing needs of business, thereby aligning business and IT.
7. **React to the environment:** According to this principle IT needs to shift from batch driven architecture to event driven architecture. Once this succeeds, IT becomes more agile towards the needs of business.

Again, none of the concepts mentioned above is new. All have been around before in best practices, but have now been integrated and labeled SO/SOA.

4.4 Business Process Management

According to Aalst BPM is "a field of knowledge at the intersection between Management and information technology, encompassing methods, techniques and tools to design, enact, control, and analyze operational business processes involving humans, organizations, applications, documents and other sources of information"[6].

Strictly speaking Business Process Management is out of the scope of this research. However, in the ever changing market of SO/SOA, BPM is more and more linked to SOA. SOA forms then the basis for enabling BPM. Also some reason the other way around, without BPM the potential of SOA cannot be fully released.

In this context SOA is often regarded as taking care of the IT orchestration, while BPM takes care of the Business orchestration. However, the claim that SOA (whether or not in combination with BPM) is enhancing flexibility not always confirmed. In some aspects it does, in some it doesn't[7].

[6] *According to Aalst*
[7] *In the thesis on SOA and BPM, among others in the introduction [Veen, p10], in the conclusion on the capabilities of architectures based on SOA and BPM to enhance flexibility*

One way or another; it is important to take notice of the perceived link between BPM and SOA.

4.5 Architecture

Transforming to a Service Oriented organization involves greater organizational challenges than only implementing the (technical) SOA infrastructure. According to Cherbakov componentization is required, which is about allowing "an enterprise to deconstruct, analyze, and then reconstruct into value nets, in which partnerships with customers and suppliers operate in a network supported by real time information flows and integrated IT systems."[72]. This requires various architectures.

Architecture is filled in, abeled and applied differently by various authors. In the context of SO/SOA the notions of Business Architecture (BA) and Enterprise architecture (EA) are used. But terms like process information and application architecture are also found in literature, although can be seen as detailed views of EA.

Business Architecture (BA)

BA contributes to shed light on the complexity within an organization and between organizations, by focusing on responsibilities related to activities. The BA is used as a starting point to arrange responsibilities across business domains. These domains can incorporate (a part of) an organization, or multiple organizations.

According to Versteeg the term BA is used in numerous publications, but not always according to the same definitions. Although Versteeg draws a clear distinction between BA and EA; "enterprise architectures is any "architecture at the enterprise level", where "enterprise" is used to indicate the scope of the architecture being enterprise wide. BA is different, it is defined as;

"Business Architecture is meant to structure responsibility over economic activities by multiple organizations (supply chain level), by one organization (enterprise level) or by part of an organization (business unit level). This happens from a business needs point of view, prior to further decomposition into subsequent functional, process, information and application architectures"[73].

The term B.A. often overlaps with Enterprise Architecture (EA), but has a clearly different focus. The latter has a focus within the borders of an organization, BA not. Although others, like for example the Archimate project, do not draw such a clear line[74]. Versteeg

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[Veen, p71].

[72] Cherbakov signals organizational and business hordes, to be expected when applying the Service Oriented Paradigm. Cherbakov's description of the need for componentization; 'Businesses need to focus on their core business competencies that differentiate them from their competitors. A strategic analysis could then reveal which capabilities are best done within and which can be outsourced to a partner to the advantage of both parties. Thus, businesses should view themselves as a federation of capabilities that collaborate with other enterprises within a business "ecosystem."' [Cherbakov, p654-655]

[73] See Versteeg; Business Architecture, a new paradigm to relate strategy to ICT [Versteeg, p91-92]

[74] Archimate describes itself as an Enterprise Architecture modeling tool, but does not limit itself to the boundaries of one organization [Archimate].

decomposes the BA into process , application and information architectures.

The goal of aligning various organizations in a value chain is also strived for by other initiatives, like for example the smart business network (SBN).

The SBN acts as a 'business operating system', segregating business logic from the execution of processes, facilitating quick connections and disconnections[75]. Actually a concept as BA is required for facilitating SBN's. The requirement of SBN's to limit itself to meta processes (instead of addressing each detail of each sub process across all involved organizations) calls for a clear distinction between a BA (with a focus across organizations) and EA (with a focus on one specific organization). Within a BA an EA can detail the incividual processes to which an organization is contributing at a higher level.

Enterprise Architecture (EA)

The exact components of EA will differ per organization due to different terms and definitions. An EA is generally conceived as the coordinating architecture in an organization that comprises detailed architectures.

Within the field of EA Zachman wrote two authoritive articles[76], describing basic elements in an EA. The various stakeholders involved are identified, as well as various detailed architectures. These can focus on for example (Business) Processes, Infrastructure, Information or Applications.

However, other stances are taken too by groups defining their own approach to EA. Currently attempts are undertaken to come to a unified modeling tool for Enterprise/Business Architecture (the difference between these too is not always consistent among various publications). One example is the Archimate project of the Telematica Institute.

Although other examples also exist, this study will not attempt to obtain a complete overview of all modeling tools for the field of Enterprise/Business Architecture. Ultimately the quest for the Holy Grail of process modeling is the construction models resulting in executable code. However, this is still far from reaching operational status yet.

4.6 Maturity Models

The realization is growing that mastering a broad concept requires experience and a lot of hard learning. Just as people grow more mature, so do other things For software such an idea is expressed in the Capability Maturity Model (CMM) or the improved version of it (CMMI).

Continuing on the levels from CMM/CMMI this would result in the

[75] *Smart Business Networks as a 'business operating system' analogous to for example a computer operating system [Vervest, p5], the ability to quickly plug in or out should enable application of products in a wider field and at a faster pace [Vervest, p23-29].*
[76] *Describing a comparision between the building discipline and the information architecture discipline [Zachman I], [Zachman II]*

following levels[17];

1. Initial
2. Repeatable
3. Defined
4. Managed
5. Optimized

With the same line of reasoning several SOA Maturity Models are produced by businesses. Some of these Maturity Models follow the same division as the CMM/CMMI, others take various different approaches in grading the level of maturity.

This paragraph does not attempt to provide an overview of all Maturity Models around for SOA (many are still classified/internal only), but it discusses some different approaches encountered in literature so far.

Sonic Maturity Model

A consortium[18] led by Sonic created a SOA maturity model, which uses the same division as the CMM/CMMI model. A depiction is provided in Figure 9. Continuing on this model a Quick Reference has been made with some other contributors (Systinet, Amberpoint and Bearing Point).

(Figure 9: CMM/CMMI Levels translated to a SOA Maturity Model and the Key Benefits per level [Sonic, p21])

An important notion of this model is that the higher the level achieved with this model, the more the focus shifts from enabling technology to the Business aspects of SOA.

[17] *Taken from the kunalmittal website, which discusses SOA related issues [Kunnalmittal]*
[18] *See the paper "A new Service Oriented Architecture (SOA) Maturity Model" written by Sonic software, Actional, Datadirect Technologies and Progress Software [Sonic].*

Krafzig et al, SOA Maturity Model

Krafzig et al. take a different stance. They do not use the CMM(I), instead they define three maturity levels for SOA, namely: Fundamental SOA, Networked SOA and Process enabled SOA's. They combine this with four layers of SOA. These layers enable the construction of SOA's with gradually increasing complexity and expansion within an organization. According to Krafzig et al. maturity levels and the associated layers are[79]:

- **Fundamental SOA's;** consist only of basic and enterprise layers. An application is divided into meaningful (loose) components, according to the SOA principle. At the level enterprise layer "portals" with distinct functionality can be offered to the public.
- **Networked SOA's;** these incorporate an intermediary layer which can include "façades, technology gateways, adapters and functionality adding services". This is a first step in shielding complexity from basic services, by grouping these into composite services. Krafzig calls this intermediary services; services combining related actions. These can be offered to various users. For example booking and order and billing a customer.
- **Process enabled SOA's;** according to Krafzig a process layer is added whether or not combined with an intermediary layer. The process layer contains services capable of dealing with a process. These can be hooked up to an all encompassing portal. Both services at in a process and intermediary layer can be offered to multiple users.

Sogeti/IBM Maturity Model

The maturity model composed by Sogeti and IBM is composed of key areas that need to be addressed and the varying levels of maturity that can be reached in these key areas. The key areas are grouped into three categories; people, processes and technology. An overview of all the key areas defined is provided in the following table:

Category	Key Area
Process	1. Commitment and Motivation 2. Relationships with Projects 3. Roles and Responsibility 4. Development of Architecture 5. Use of Architecture 6. Architectural Tools (Methodology and Software)

[79] *The maturity levels for SOA are Fundamental SOA, Networked SOA's and Process enabled SOA's [Krafzig, p87-102]. This is matched with four layers (Basic, intermediary, process and enterprise layers) of SOA's which can be gradually introduced, depending on the complexity of a SOA [Krafzig, p80-84]. An interesting observation is that higher maturity levels correlate to more business process integration efforts [Krafzig, p90].*

	7. Quality Management
	8. Service Portfolio Management
	9. Vision of Architecture
	10. Alignment IS with Business
	11. Budgeting and Planning
Technology	12. Technology and Standards
	13. Componentization and reuse
	14. Business Process Implementation in IS
	15. IS (Infrastructure and Applications) flexibility
	16. Security
People	17. SOA Skills IT
	18. SOA Skills Business
	19. SOA mindset and knowledge among IT people
	20. SOA mindset and knowledge among Business People

For each of the categories a score can be achieved ranging from A (lowest) to at maximum D (highest). These scores are detailed in their book. Stages can be defined, ranging from an early pilot project up to continuous business improvement. In total a scale, with 13 grades of stages, is described. The rankings (A-D) are located as benchmarks on these scales. For each benchmark a set of questions and checkpoints are defined. Priority should be given to the key areas scoring lowest in that stage, this implies also that not everything has to happen at once[80]. See for this also the Roadmaps in the paragraph on governance.

The advantage of the maturity model of IBM and Sogeti is that it is on one hand detailed enough, while on the other hand still workable.

4.7 Granularity

Services can be defined at various levels, depending on the level of detail incorporated; often the grading is made on a scale ranging from technical to business services. The level of a service is also named granularity, and this depends on the intended scope and range of a service. *"Vagueness results from too high a level of service granularity. At the same time, too low a level of service granularity and it is difficult to see the wood for the trees"*[81].

A related notion is the use of various (smaller) services, combining these into a higher level service. This is often referred to as composite services. However, it is a rather crude and imprecise classification. The notion of a composite service alone does not make clear what the scope of such a service is.

[80] *In the book SOA for profit form Sogeti and IBM, see chapter 8 and 13 [Berg, p140-158]*
[81] *Allen on the granularity of services [Allen, p71]*

Various sources use various levels or layers of SOA to define the granularity. Some examples:

- The Buttler group identified two extremes on a spectrum from coarse grained to fine grained services[82].
- Erl uses three layers; business application , service interface and application layer. The service interface layer is further decomposed into an orchestration layer, a business service layer and an application service layer[83].
- Krafzig is incorporating an enterprise level (which represents portals which are more telling to a business community). The other layers are labeled by Krafzig basic, intermediary and process layers[84].
- The Linthicum group discerns five layers of SOA. The data messaging and service layer can be regarded as similar to the intermediary layer as defined by Krafzig.

The conclusion is that no overall accepted universal classification for defining levels of granularity is in use yet.

4.8 Governance

During the last decade the management of IT received ever more attention, from theories on (strategic) alignment between business and IT, to governance of IT or SOA's[85].

The bottom line is having means (people, IT, and/or infrastructure) available alone, won't do the job. Some sort of process, together with a set of procedures, is needed to utilize the possibilities and put these to use.

SOA Governance cannot be separated from the field of IT governance. If organizations are applying SOA there should be already some sense about governing IT, therefore some basics of IT governance are discussed first. Following on this the concept of SOA governance is elaborated.

IT Governance

If organizations are striving for achieving Agility, centralized IT governance is regarded as an important enabler. This requires a good relation between business and IT too[86].

Weil and Ross are well known authors in the field of IT governance. They defined IT governance as *"Specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT"*[87]. According to Weill and Ross IT Governance includes the following

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[82] *In a report on SOA of the Butler group [Blowers, p173].*
[83] *See Erl on Service layers [Erl, p337-352].*
[84] *Krafzig sees this level of detail too but defines it just as more possible interpretations of services at the intermediary level.*
[85] *For example the article of Henderson & Venkatraman (strategic alignment), the book of Weill and Ross (IT governance) or various publications on SOA governace, see Gartner Research of Malinverno [Malinverno].*
[86] *According to 93% (on relation between IT and business) and 77% (on IT Governance)of the respondents in the CIO survey of Cap Gemini [Cap, p14-16]*
[87] *IT governace as defined by Weil and Ross. In their view IT governance is not about specific*

disciplines[88]:

- **IT Principles;** What is the relation of IT with Business?
- **IT Architecture;** What are the core business processes, can these be supported through standardization or specialization?
- **IT Infrastructure Strategies;** What infrastructure needs to be offered under what conditions?
- **Business Application Needs;** How can businesses be supported through IT?
- **IT Investment and Prioritization;** Which priorities need to be set at strategic or tactical level?

These disciplines can be addressed in various ways. Basically these are addressed through one or more of the following archetypes of IT governance[89]:

1. **Business Monarchies:** A Cxx[90] makes all the IT related decisions for the complete enterprise.
2. **IT Monarchies:** One or more IT executives make the IT related decisions for the whole enterprise.
3. **Federal:** Cxx's and business representatives of all organizational units collaborate with the IT department
4. **IT Duopoly:** a selective group of executives and business units make decisions
5. **Feudal:** decisions are made at isolated departments or organizational units, without a view on the bigger picture.
6. **Anarchy:** Every man for himself...

IT governance can be arranged in various ways in an organization; from centralized approaches to decentralized approaches. The extent of (de-)centralization will result in different archetypes of IT governance to be applied. Each archetype being suitable for different goals and requiring a different approach, see figure 10.

decisions, but encompasses the overview of who is contributing to each decision [Weill I, p2, p8-10]

[88] In their article a far more extensive list of examples is provided for each IT governance discipline [Weill II, p30]

[89] The archetypes are described in an article [Weill II, p26] or in their book [Weill I, p59-64].

[90] Cxx is a common notation among larger enterprises for various degrees of Chief officers in an organization; CEO, CIO CXO or CFO etc. .

	PERFORMANCE		
	PROFIT	ASSET UTILIZATION	GROWTH
Strategic Driver	Profitability via enterprisewide integration and focus on core competencies	Efficient operation by encouraging sharing and reuse	Encourage business unit innovation with few mandated processes
Key Metrics	ROI/ROE and business process costs	ROA and unit IT cost	Revenue growth
Key IT Governance Mechanisms	■ Enterprisewide management mechanisms (e.g., executive committee) ■ Architecture process ■ Capital approval ■ Tracking of business value of IT	■ Business/IT relationship manager ■ Process teams with IT members ■ SLA and chargeback ■ IT leadership decision-making body	■ Budget approval and risk management ■ Local accountability ■ Portals or other information/services sources
IT Infrastructure	Layers of centrally mandated shared services	Shared services centrally coordinated	Local customized capability with few required shared services
Key IT Principles	Low business costs through standardized business processes	Low IT unit costs; reuse of standard models or services	Local innovation with communities of practice; optional shared services
Governance	More centralized E.g., Monarchies and Federal	Blended E.g., Federal and Duopoly	More decentralized E.g., Feudal arrangements; risk management emphasis

(Figure 10: IT governance can be focused on various types of performance. Different types of focuses require different archetypes of IT governance[91].)

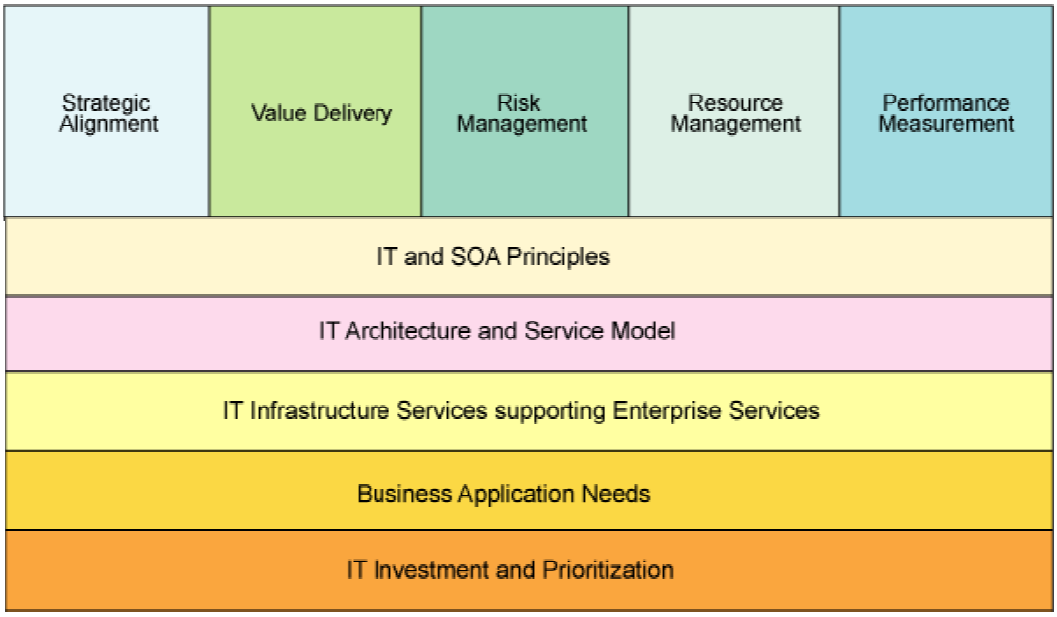
SOA Governance

SO/SOA is not necessarily all new to the IT field, a lot of practices are already around for some time. Therefore existing governance mechanisms can be adapted to suit the SO/SOA. Although SO/SOA requires some additional points of attention; the notion of federated processes implicates that the contributors to decisions have to be located across various Lines of Businesses (LOB's), business domains and sometimes even across organizational borders[92]. This complicates governance mechanisms.

SOA governance is included in running SOA. Gartner defines the relation between IT and SOA governance as follows; *"Within the IT governance framework, SOA governance identifies decision making authority for defining or modifying the business processes that will be supported with SOA techniques, the service levels required, the service performance requirements, the access rights and so on. In addition, SOA governance addresses the way reusable services are defined, designed, accessed, executed and maintained. SOA governance is also an important mechanism for determining service ownership and cost allocation in a shared service organization".*

Another statement in the same report is *"SOA governance is not an option, it is an imperative. The bigger the SOA is, the more it needs governance, and the governance roles and mechanisms need to be more comprehensive."*[93]

[91] *Figure copied from the article of Weill and Ross [Weill II, p32]*
[92] *According to IBM IT and SOA governance are intertwined and cannot easily be separated, but SOA governance has some specific requirements [Mitra]*
[93] *SOA governance definition and need provided by Malinverno [Malinverno, p2]*



(Figure 11; The activities of SOA Governance (Top) and the disciplines of IT governance. The figure is taken from the article "A case for SOA governance of IBM")

In line with IT governance, if dealing with services, a number of decisions need to be taken. Priorities need to be set and if concerning a new request, need to be compared to the existing services. Also issues as responsibility and ownership should be addressed[94]. Five activities of SOA governance can be combined with the disciplines defined by Weill and Ross[95], see figure 11 too;

1. **Strategic alignment:** focuses on the imperative to align the IT efforts with the business vision, goals and needs.
2. **Value delivery:** focuses on how the value of IT can be proved through results like profitability, expense reduction, error reduction, improved company image, branding, and so on.
3. **Risk management:** focuses on business continuity and measures to be taken to protect the IT assets.
4. **Resource management:** focuses on optimizing infrastructure services, or other environments supporting the application services.
5. **Performance management:** focuses mainly on monitoring the services.

Acapting the definition of IT governance towards SO/SOA leads to the following one; *"Governance in a SO/SOA context is about specifying the priorities, decision rights and accountability framework to encourage desirable behavior in the use and creation of services at the*

[94] *According to Malinverno; 1) Which services to do (first)?, 2) Is it really a new service?, 3) Who will pay for the development and maintenance of the service? And 4) Who owns this service?*
[95] *This figure was composed by IBM [Mitra]*

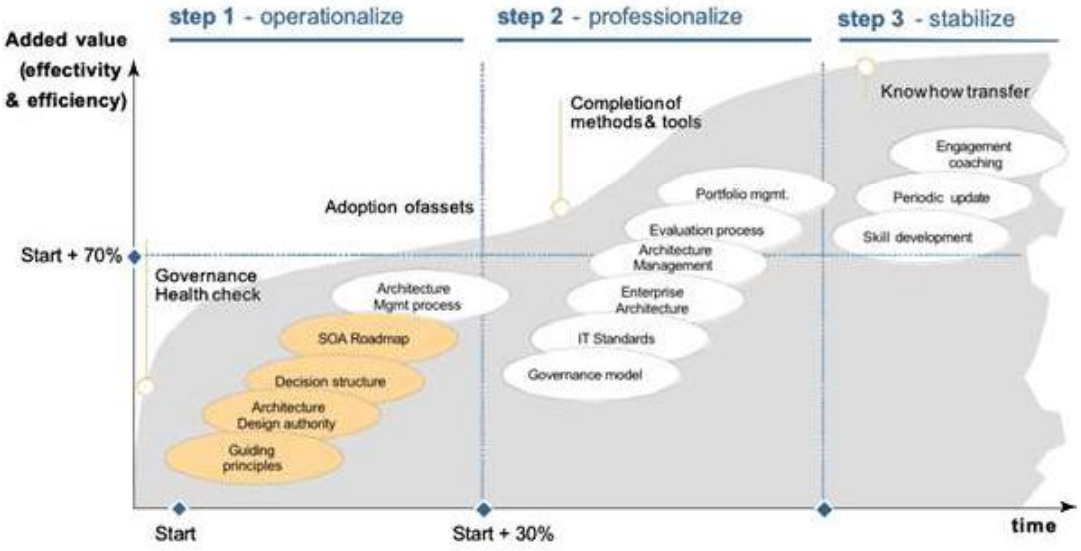
appropriate levels[96]"

For effective SOA governance a good understanding of the notions of granularity of services and composite services is required. The type and granularity of services are closely connected with the maturity of the SO/SOA environment in an organization.

For example Krafzig et al. define three levels of maturity for a SOA. Each level of maturity describes a specific build up and management of the services for a SOA[97]. The trouble is only that there still are no commonly agreed on definitions of granularity and maturity.

Roadmap and Roles

Concepts like granularity and maturity can be incorporated in a SOA roadmap, which provides a step by step blueprint for the implementation of a SOA. An example is depicted in figure 12[98].



(Figure 12: A visualization of a roadmap for implementing a governance model for a SOA in three steps)

Figure 12 depicts a roadmap for the implementation of a SOA governance model. This figure could be made up in conjunction with a SOA maturity model. When an assessment with a maturity model has been made, the roadmap can be filled in specifically for an organization, addressing various aspects which need to be filled in.

When engaging on a SOA governance project, a number of roles have to be defined. According to Blazer the following roles are required[99];

---

[96] *Definition based on the definition of Weil and Ross of IT governance [Weill I, p8], accentuated towards Service Orientation/Service Oriented Architecture.*
[97] *The maturity levels of SOA are fundamental, networked and process enabled SOA's. Fundamental SOA's only consist of two layers (Basis and enterprise layers), Networked comprise an intermediary layer too, while process enabled SOA's also incorporate a process level [Krafzig, p87-102].*
[98] *This governance model is described in an article of IBM [Balzer].*
[99] *As described in an article of IBM on how to improve SOA Plans [Balzer].*

- **Domain Owner:** A domain comprises a collection of one or more services required for a number of business functionalities. The domain owner should stress the business perspective. Works with LOB's, specialists and analysts to define a sound business case.
- **Domain Service Oriented Business Analyst:** Focuses on the required service functionality. For this candidates in the business processes for well abstracted and normalized (business) services are identified and specified.
- **Line of Business Representative:** Helps identifying and analyzing business services for the domains.
- **Domain Developer and Maintainer:** Builds and maintains services consistent with the service oriented development life cycle. For this (internal) frameworks and standards are required.
- **Service Tester:** Certifies that the composite (business) service conforms to the business case defined.

Governance and location in an organization

Many organizations involved with SO/SOA, among others Gartner and IBM, acknowledge Governance can best be located within existing structures.

Often these are called CC/ICC ((Integration) Competence Center) or CoE (Center of Excellence). These have to be provided with a blueprint for dealing with Governance in a Service Oriented environment. Logically this blueprint should deal with the same categories as EA; people, processes, technology and services[165]. See for more on this the sub paragraph on Competence Centers in the next chapter.

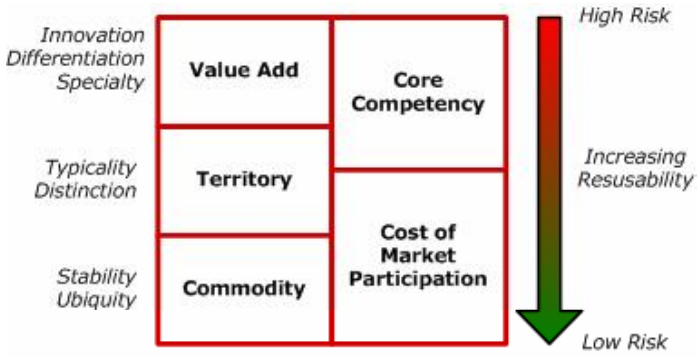
Sourcing

The Service Orientation paradigm implies an organization focuses on core competences. In the light of services this means organizations need to identify the properties of the required services.

If services are quite common they can easily and safely be obtained from the marketplace. If services are more specific and determine the success of a business' core operations, they need to be maintained in house. See also figure 13.

This consideration is similar to the consideration for an organization whether to integrate horizontally or vertically. But also overlap between the classification of services and the decision on whether to outsource or not, can be perceived.

[165] In the article on "ICC and SOA Governance" from Gartner [Malinverno, p3 4]. In the article "A case for SOA governce" from IBM the CoE organizational entity is mentioned, with a focus on people, processes, technology and services [Mitra]. However, not all publications mention the 4th topic services, for example van de Berg [Berg, p140]



(Figure 13 Different classifications for processes and Services in Types, their focus, characteristics and the associated risk[101])

Within this consideration the advise "buy before reuse before build" becomes relevant too. Once a service is externally available it is probably more ubiquitous and should be bought from outside. Reuse of existing services is more difficult, let alone building a new one[102]. However, this consideration is based on TCO of a service, this does not take importance of a service into account. These considerations touch with all activities of SOA governance, this shows again the overlap between sourcing and governance issues.

4.9 Summary and Sub Conclusion on Service Orientation and Service Oriented Architecture

SO and SOA are subject to many, often overlapping, perceptions. SOA as a concept has strong roots in the underlying technologies, while SO as a concept is generally perceived as having more focus on the organization. However, other opinions also exist, and many are valid too, but stress only one perspective.

Most important to note is that SO and SOA are two sides of the same medal. Also it is interesting to note that SO/SOA are not new but a collection of best practices and lessons learned in the application of IT so far. Issues incorporated in SO/SOA, but applied long before, are among others; componentization, reuse, standardization, governance and collaboration between business and IT.

Due to the various interpretation of SO/SOA no commonly agreed on definition can be settled on. Personally I do not believe this is valuable either, because another definition only becomes one of the voices in the cacophony. I have come to believe it makes more sense to attempt to see the wood for the trees and show how the various perspectives interrelate.

In line with the lack of a single definition for SO/SOA, no single set of principles exists, although Erl and Allen both did an attempt. The principles of Erl are quite comprehensive and referred to by other sources too. But these are also commonly regarded as only applicable in an architectural context. Allen defined a set of viewpoints that has a broader focus, but it is unclear of it is comprehensive and complete.

[101] *This overview is taken from the book of Allen on Service Orientation [Allen, p73]*
[102] *The reasoning is that buying external services lowers the cost of maintenance and TCO and is therefore preferable [Berg, p49]*

When organizing an organization, architecture plays an important role. Commonly this is all perceived under the flag of Enterprise Architecture. The concept of Business Architecture is currently evolving, within time this will be integrated in the EA framework.

In the context of architecture issues as maturity and granularity are important. With enough insight roadmaps can be made up, detailing which issues can be addressed best and how, given the current state and capabilities in an organization. This could all be incorporated under governance, whether it is IT or SOA Governance. Especially because it goes much broader and touches to sourcing decisions in which financial gains have to be weighted against competitive interests regarding control and reliability.

5. Organizations

The fourth sub research question focuses on the effect of agility and SO/SOA on an organization. This thesis will only address organizations in this context. The notion of organizations, and their sub themes, can assist in answering (a part of the (sub)research question). This can provide input for the discussion and conclusion of this thesis.

The chapter first discusses some basic notions on organizations, after which a number of concepts regarding organizations (in the light of SO/SOA and agility) are elaborated.

5.1 Organization, Basic Notions

This thesis does not attempt to comment on all existing theory on organizations. Nor does it want to address the professional field of organizations as a whole, with all related details.

The focus in this chapter is on theory on agile and service oriented organizations, albeit not always directly related to the technical aspects of SO/SOA.

However, two aspects might be helpful when discussing an organization; a definition and the basic notion of an organization.

Organization Definition

Various definitions of organizations exist[163]. All of them run along the same line as the following one; *"Organizations are social entities that are goal directed, deliberately structured activity systems linked to the external environment"*[164].

Organization Structure

When discussing organizations, the theory of Mintzberg becomes relevant for classifying the various parts of an organization. Mintzberg proposed a view with five basic parts of an organization; the strategic apex, the middle line, the operating core, the support staff and the technostructure. See figure 14.

(Figure 14: The five basic parts of an organization, according to Mintzberg. Some depictions also include a "halo" of ideology around the organization.)

[163] *For example, Wikipedia on organizations [Wikipedia]*
[164] *Definition of organizations according to Daft [Daft, p609]*

The structure of Mintzberg is helpful to conceptualize centralization and decentralization in an organization. This basic structure is worked out into a number of organization types, with varying size and importance of respective parts. The organization types identified by Mintzberg are; Machine bureaucracy, professional bureaucracy, the division structure, the adhocracy and the entrepreneurial startup[165].

Within an organization structure various ways of functioning can be discerned; formal chain of commands, regulated activities, (informal) communication lines, groupings and (ad hoc) processes[166], see appendix A2 for depictions. These ways of functioning interact and influence each other continuously.

5.2 Agile Organizations

Agility is a hot topic in both business as well as military organizations, with the major question being how to achieve an agile organization. In warfare agility has always been a dire need to 'outperform' the opponent. Therefore the military profession might provide interesting 'leads' on agility, because it is of old more focused on agility if compared to business.

This paragraph discusses a number of topics related to the quest for agility in organizations.

Smart Business Networks Initiative

The Smart Business Network Initiative (SBNI) sees the rise of smart business networks (SBN's) as a product of an environment demanding increasing agility[167]. These networks consist of (parts of) individual organizations which participate/contribute on a 'plug and play' basis, called by the authors the quick connect and disconnect ability.

As described in the prior chapter, this requires a domain/organization spanning architecture. Ideally such an architecture is supported by an "easy" (de-)composition of processes. Nowadays this is perceived as Business Process Management, and supporting tools are being developed.

Command & Control and Agility

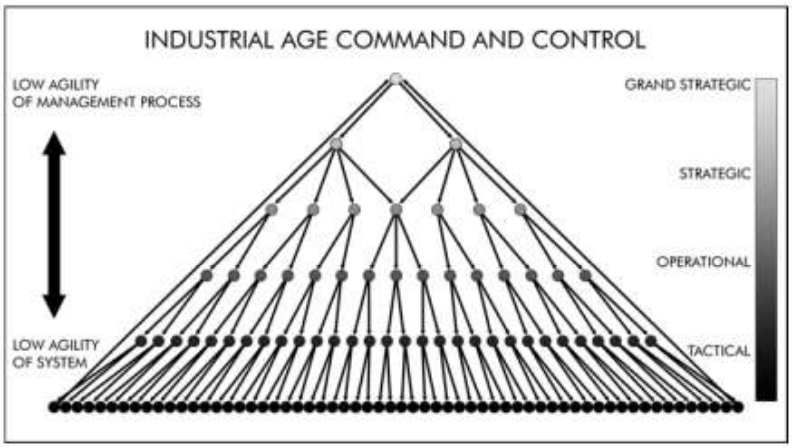
Achieving agility in the military branch is nowadays envisioned with terms like netcentric operations/warfare. This focuses on enabling and using information sharing and ease of collaboration[168], with a strong focus on improving/facilitating the decision making process.

Atkinson and Moffat focus on the command and control in an organization. Their research in the military field is interesting because of the analogy between the theory of SBN's and net centric military operations. Both aim to facilitate a quick connect and disconnect

[165] *See Mintzberg on the organization types [Mintzberg, p166-294]*
[166] *Mintzberg on the basic principles of an organization [Mintzberg, p20-25]*
[167] *An joint academic business initiative aiming to develop knowledge on business networks required to address modern challenges [Vervest, p92]*
[168] *"Widespread information sharing and ease of collaboration are the hallmarks of net centric operations as envisioned by the Department of Defense (DoD) planners. Net centric operations are an enabler of both speed and precision in decision making and in military operations" [Bass, p3].*

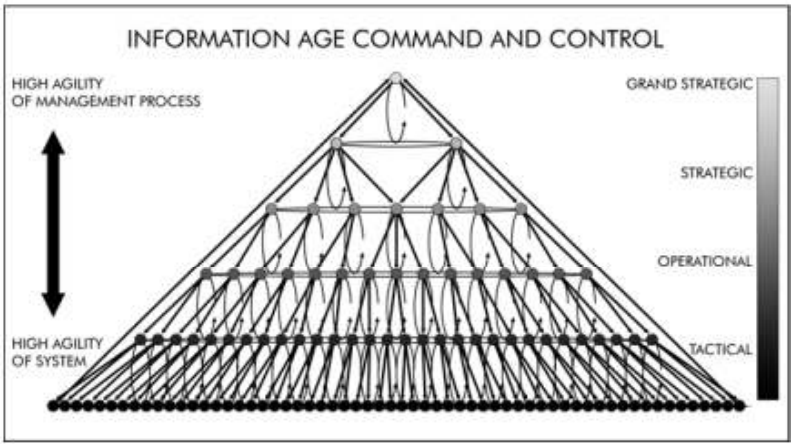
capability to deal with changes.

Atkinson and Mofat perceive a difference between organizations structured along industrial age principles and the principles of the information age. The main line of reasoning is that the difference lies in the capabilities of these networks.



(Figure 15; the agility of a system and the command and control structure in the industrial age, according to Atkinson and Mofat)

In the industrial age organizations had a low agility due to the limitations of the management process[109], see figure 15. This leads to specializations within the structure of an organization. With an eye on the development of IT, this led to specific stand alone applications with a narrow focus.



(Figure 16; the agility of a system and the command and control structure in the information age, according to Atkinson and Mofat)

In the information age IT provides the opportunity for various networks crossing the traditional "stove pipes", horizontal information linkages, thus increasing the agility of a system and it's command and control, see figure 16. The result can be a more hybrid flattened hierarchy within a(n) (group of) organizations.

[109] *Atkinson bases this conclusion on the application of Ashby's law [Atkinson, p127]*

A turbulent environment requires a loosely coupled management style within an organization. This requires networks to reorganize quickly, to be able to adapt to changes in the environment. These networks do not need to follow the command and control structure, but needs its "blessing"[110]. Yet abstract, their line of reasoning is interesting because it points attention to the impact on command and control of information sharing. The quest for agility will require adaptations of a command and control structure in an organization.

This could be explained as a plea against centralization and for the spread of information and empowerment. This can impact the way an organization is structured as well as the infrastructure required by such an organization.

5.3 Service Oriented Organizations

According to Erl, organizations standardizing on SOA are "working towards an ideal known as the Service Oriented Enterprise (SOE)". The by Erl proposed SOE model comprises a number of building blocks, among which the "primitive business activity, the primitive business service and the primitive business process" are fundamental[111].

However, the concept of SOE is not very detailed and often described only quite superficially. An exception is an article written by Bieberstain, on behalf of IBM. He describes a possible organizational arrangement for a SOE, labeled a Human Service Bus.

Human Service Bus

If IBM's on demand concept is perceived as dealing with agility, Bieberstein describes an organizational concept dealing with agility too. The described on demand operating environment provides a "flexible virtualized IT infrastructure" to deal with rapid responses to changes as these arise[112].

The HSB can be regarded as "a SOA reference architecture filled by humans instead of programmed services"[113]. The concept of the Human Service Bus is a new structure in addition to already existing organizational structures like functional organizations, geographical structures, divisional organizations and matrix organizations[114], see Figure 16.

The HSB is focused on delivering services, defined by Bieberstein as

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[110] *Atkinson and Moffat, on who decides what in case of increasing complexity instead of coordinating it all [Atkinson, p92 94]*

[111] *Erl describes this as an organization where all business processes are composed of and exist as services [Erl, p52]. "Primitive business activities represent the smallest piece of definable and business logic within a service oriented environment [Erl, p427] process activities are "...a term used to represent an executable business process logic workflow" [Erl, p428]. Primitive business services encompass functionality limited to that specific simple task or function [Erl, p 429]*

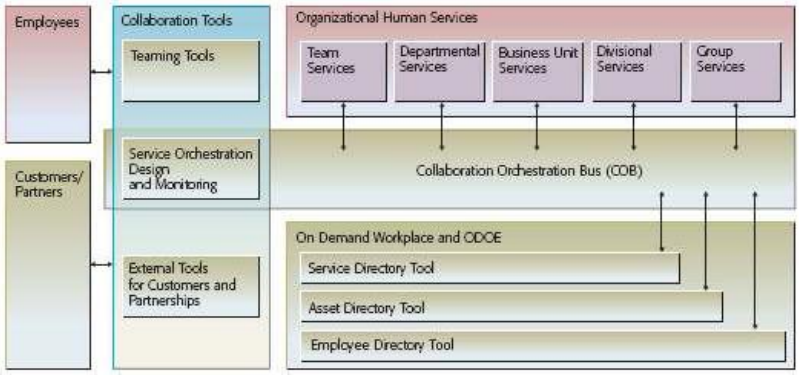
[112] *Bieberstein, describing a concept for the on demand operating environment [Bieberstein, p605] and the Human Service Bus [Bieberstein, p608].*

[113] *On the HSB as a communication an collaboration framework [Berg, p118 119].*

[114] *The concept of HSB is set up to address the "on demand business environment", the HSB extends the SOA analogy and combines it with existing organizational structures [Bieberstein, p696 700]. The HSB concept is based on empirical results coming forth from IBM business activities [Bieberstein, p707].*

anything which fulfils a specific task. The interesting issue is that Bieberstein perceives various 'granularities' of services; team , departmental , business unit , divisional and group services [115]. These services can be dispersed geographically.

The concept of an on demand operating environment links up with the organizational structure as described by Atkinson for what they call the "information age"; the organizational structure of an agile organization should facilitate the plug and play, also called a quick connect disconnect ability. This is a plea against formalization in the form of quantative agility, by specifying all possible scenario's up front into plan and then adhere to this pre specified plans [116].



(Figure 17: a depiction of the Human Service Bus concept of Bieberstein)

The HSB is based on experiences of IBM and provides some interesting insights. However, it is difficult to value due to the non disclosure of the cases used by IBM.

Competence Centers

When dealing with the theory around IT and SOA Governance it was already stated that (Integration) Competence Centers are frequently regarded as the driving organizational entity.

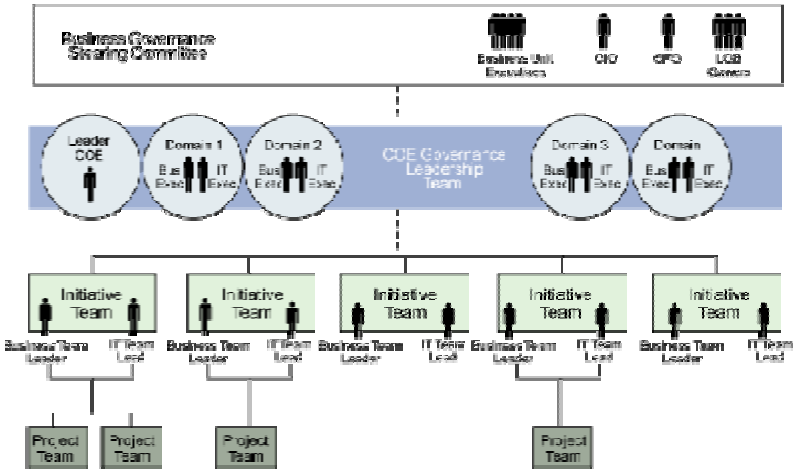
According to the opinion of Gartner integration efforts can best be undertaken by established organizational entities, in this case labeled Integration Competence Centers (ICC). The prediction of Gartner is that within 3 4 years the majority of larger organizations will have some form of an ICC[117].

For processes Bieberstein notes it is essential to allocate executive responsibility, where the executive needs to make sure the process is

[115] *See the book "SOA for profit" [Berg, p120 122] and Bieberstein [Bieberstein, p696 697].*
[116] *Quantative agility is used by Atkinson and Moffat to refer to the practice in the military headquarters to plan for all scenario's, if the situation arises the right scenario has to be chosen. This is associated with industrial age command & control by Atkinson's, his description of Information age command and control is a plea against this form of (up front) centralization and formalization of plans [Atkinson p176 178]*
[117] *SOA governance is a logical extension of IT governance and can best be dealt with by the same organizational entity[Malinverno p2-3]. "By 2010 more than 60 percent of the large enterprises will have one or more ICC's" [Malinverno, p4]*

in line with organizational goals[118]. Research of Teo into Critical Success Factors regarding the alignment of IT and business confirm this[119]. This is a strong call for (involvement with) governance at a high level, accordingly the executing organizational entity (the ICC) should have plenty of executive backup.

Mitra sketched a meta model for a structure for the organization of governance. It stresses the involvement of various executives, as well as the involvement of LOB owners, see figure 17.



(Figure 18: This is an example of a meta organizational structure for a governance organization according to IBM-[120]. In this figure IBM uses the notion of COE, instead of the notion of (I)CC used in other publications)

Given the need for (knowledge about) various architectures, when aligning business and IT, it might be wise to incorporate a number of architecture specialists in a(n) (I)CC. Both the concepts of BA and EA can assist in the alignment of strategy with business functions, domains and processes[121].

The meta organizational structure for a governance organization could be perceived as an alternative view on (ad hoc) processes, within the description of Mintzberg, see also appendix A2.

Shared Service Centers

In the light of SO/SOA and ICC/CC's theory of Shared Service Centers becomes relevant. The business community has already quite some years of experience with the SSC concept.

A link is perceived between SSC's and Service Orientation within an

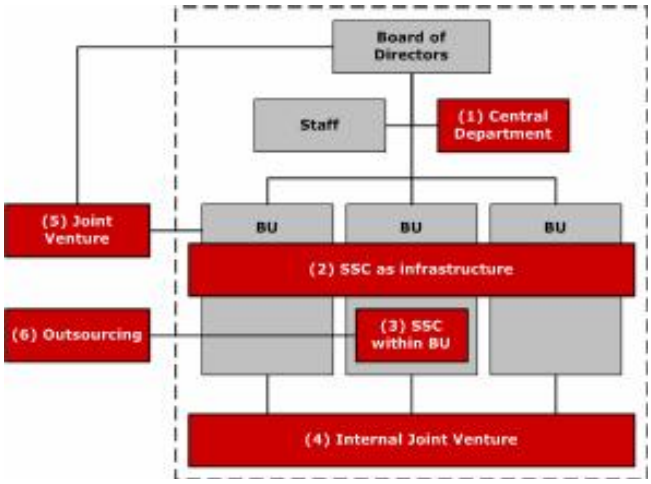
[118] *"... it is critical to specify an executive as the owner for each specified set of services...", this requires involvement in the enterprise governance too [Bieberstein, p.693]*
[119] *Teo conducted a research of the critical success factors in the alignment of IS plans with business plans, this research found a list of 18 CSF, which came forward from theory, and were deemed important by organizations in the business community of Singapore [Teo, p176, p178]*
[120] *In the article "a case for SOA governance" [Mitra]*
[121] *According to Versteeg, on the concept of business architecture [Versteeg, p92-93] and the conclusion in their article [Versteeg, p100-101].*

organization. The reasoning is that SSC's are a first step in a Service Orientation paradigm, with defining front- and back offices in an organization. These are a step away from thinking only in organizational silo's or business processes. In this context a service oriented organization is perceived as a network organization, and SSC's can be a way to define a number of business services[122].

So SO/SOA touches to the concept of SSC because it may, in some instances, extend or facilitate the application of SSC's in the form of composite (business) services. These services are than at the intermediary or process level of a SOA, as defined by Krafzig.

Another link with SSC comes forward due to the governance required by SO/SOA. This governance is generally located in the form of an organizational entity labeled an ICC. This ICC can be set up as a SSC, offering it's knowledge, templates and experience organization wide.

The use of SSC's is about deciding on centralization versus decentralization within an organization. However, various types of SSC's exist. A classification of archetypes of SSC's is provided by Jansen, based on Strikwerda[123]. See also figure 19.



(Figure 19: The SSC archetypes, conceptualizing the location and scope in an organization)

This could be perceived as another view on the ways of functioning of an organization focused on SSC's, as described by Mintzberg, see appendix A2. The SSC archetypes can be an additional way of looking at an organization in various constellations across the basic parts of an organization defined by Mintzberg.

The archetypes of SSC's offer another possibility. When combined with

[122] *On organizational measures required in the transformation towards a Service Oriented Enterprise (Es, p31-35).*

[123] *According to Jansen on centralized or decentralized organizations [Jansen, p2] the SSC archetypes Jansen adapted from Strikwerda. A SSC with a scope of an ICC can be at a central department (1) or at an internal joint venture (4). Services at the intermediary or process layer of SOA will deal more with the SSC as infrastructure (2), within a Business Unit (BU) (3), (partially) outsourced (5) or in a joint venture (6)).*

the sourcing classification of Allen, described in paragraph 4.8, the impact of sourcing services becomes visible.

Services that are classified as core competency can better be allocated in house (location 2, 3 and 4 in figure 19) Services that are a cost of market participation on the other hand, may be obtained from one internal supplier (location 3 and 4 in figure 18) or externally (location 5 and 6 in figure 19).

Another application might be using the SSC archetypes to make the organizational entities, involved in a service, visible. Following this reasoning ICC/CC's are more likely to be an central department (type 1) or an internal Joint Venture (type 4). Business level services are more likely to be of a SSC type across or within a Business Unit (BU) (type 2 or 3) or located externally (type 5 or 6).

5.4 Summary and Sub Conclusion on Organizations

This chapter elaborated some basic concepts on organizations. Mintzberg could be used to link the constructs discussed in the light of agility and SO/SOA together.

The construct of Smart Business Networks provides a view on what is (theoretically) possible when various organizations in an environment can team up and rearrange 'easily'. This goes beyond the scope of the model of Mintzberg in the sense it crosses organizational borders. Unclear is how this will affect the various parts of an organization.

Agility and Command and Control (Hierarchy) affect each other in a military context, as Atkinson and Mofat et explained. In line with their reasoning it could be stated that if an organization pursues agility, it should allow for multi dimensional decision making, instead of top down alone. Their argumentation points to the need for facilitating IT structures for this. Other authors in the military field, when discussing net centric warfare, look for this enabling IT structure in the form of SOA's.

Ideally this results in a Command and Control structure in agile organizations that can 'easily' hook up with various parts within the own organization, or even from other organizations.

The HSB concept is the only description encountered in theory so far on how a Service Oriented Enterprise might be organized. However, it is not immediately clear how this affects the ways of functioning in an organization as described by Mintzberg. It might affect all aspects ranging from communication, to hierarchy, to processes, to culture, etc.

(Integration) Competence Centers and Shared Service Centers can be in line with each other. Meta organizational concepts for CC's are described in literature and bring together aspects of the functioning of an organization according to constellations of work and hierarchies. Also it offers a starting point to set up a communication function for an (I)CC.

Theory on SSC's can be used for classifying an (I)CC in an organization. However, according to some sources it could also be a starting point for an organization that wants to move to Service Orientation. From this point of view the archetypes of SSC's can be used to fill in the arrangement between various parts of an organization as described by Mintzberg, either organizational or through the use of services.

6. Discussion on Theory

This chapter continues on the theoretical insights of the prior chapters, these attempted to stick to the theories itself. This chapter will, where possible, attempt to merge and link the concepts and theories together. This is done through personal reasoning.

For this the concepts of agility, SO/SOA and organizations are discussed separately and together. Also it is shown how these result in the first intermediate questionnaire, which will be used as a discussion piece in the explorative interviews.

6.1 Discussion on Agility

When discussing agility it is important to go beyond the mere fashionable phrases. Too often agility and is used as a roaring cover up for vagueness. The link or difference between agility and flexibility is not always made clear. Agility goes beyond flexibility, requiring structural and strategic responses, while flexibility should be addressable with existing processes.

However, it is difficult to become concrete on agility because current theoretical literature is also not able come up with rock solid measurement frameworks, nor a commonly agreed on classification of agility. Therefore conceptualizations in aspects (sensing and reacting capabilities) and types of agility, however abstract, can be useful. These classifications can serve the goal of incorporating various more concrete examples of agility.

Especially if these classifications are being combined with an iterative approach, for regular/continuous assessments. If this is being done consistently, various continuously changing rankings of agility priorities and gaps can be found. This can serve as a starting point for directing required actions to address the agility gaps found.

However, in my opinion, this is only the case if agility is made clear. This implicates a clear division or relation between flexibility and agility, because the latter might require more radical responses. The currently described classification of agility types can be helpful too. Although this could be a topic for further research, which might result in a more suitable classification.

6.2 Discussion on SO/SOA

The various interpretations on SO/SOA lead to many possible definitions. As stated before I don't believe it is useful to come up with a definition of my own, another definition only becomes one more of voice in the cacophony. While muddling through the theoretical concepts I came to see the links and relations between various concepts of Service Orientation and Service Oriented Architecture. Therefore I believe it is better is to take them together into SO/SOA.

In a certain way SO/SOA is a move back to the early tailor made Information Systems, only now with an attempt to mass customize it. SO/SOA is mistreated if it is regarded as an all new approach. It stems from prior experiences, and has to be applied in the existing contexts.

Attempts to define a common set of principles or viewpoints can be a step towards a better understanding of the various aspects of SO/SOA. However, as long as the differences in perception on SO and SOA remain, it is unlikely that a commonly agreed on set of principles will

emerge soon. The principles of Erl are useful for a (theoretical) architectural approach, Allen defined some viewpoints, but these seem to incorporate various axis without being complete. Therefore these have a limited applicability or need adaptations due to a lack of comprehensiveness.

While working through the theory I became more and more aware of the fact that SO/SOA is not going to land in a greenfield situation, but has to cope with current systems and architectures. A SO/SOA approach has to reflect this. It basically is, in my opinion, an improved way of working with existing concepts as EA and governance. Especially the latter is important, however not in the way of the SOA governance hype. Governance has to cope with SO/SOA in the existing situation. Architecture, roles, maturity models and roadmaps are only a few examples of what is required in a governance setting.

Afterthought[124]

In this context the phenomenon of maturity models is especially promising. Maturity models could, if they are composed of the right aspects, provide a good indication of where an organization stands and what are the (critical) conditions to improve. A maturity model can be a first start in assessing the current state regarding various aspects of SO/SOA. If the aspects requiring action are identified, these can be incorporated in a roadmap, detailing which issues to tackle first. This roadmap can be part of a SOA project but is more likely to be maintained in a competence center or an EA group.

To assess where an organization stands on a scale of maturity, the model of Sonic is appealing due to it's similarity with the CCM(I) model. However, from a point of view of applicability I personally prefer the maturity model described by van de Berg et. al. . Another reason is that it might be possible to obtain historic data on this maturity model.

Given the evolving nature of the field of knowledge of SO/SOA I expect that the maturity models on SO/SOA will qualify for further enhancements too. Especially the people and process aspects might require more attention, due to the evolving knowledge on these aspects of SO/SOA

6.3 Discussion on Organizations

Discussing notions like agility and SO/SOA is prone to become a theoretical exercise if not placed in the context it has to be applied in; organizations.

Boldly speaking I believe it is more interesting to make concepts and technologies come true in the organization itself, instead of dealing with each separately. Again in my opinion; technology alone will not be sufficient when striving for agility through SO/SOA. The latter approach is not likely to succeed in the end.

Notions like Service Oriented Enterprises (SOE's) and Service Oriented Organizations (SOO's) are not necessarily new. But more a way of coping as best as possible with continuing challenges. Flexible and

[124] *This part is added as an afterthought, after considering the opinions in the interviews on the initial questionnaire, the last paragraph of this chapter therefore seems to make an odd choice.*

adaptable structures and processes can be facilitated by SO/SOA, but will also require a matching attitude and culture. With military organizations as examples of agility of old, it's not crystal clear how this translates to business organization.

Numerous aspects are involved, ranging from architectures and structures to agreements and procedures, the challenge is to address all these aspects in a coherent way applicable to one's own circumstances. Within the context of SO/SOA and organizations, governance is frequently labeled as the "organizational" concept, which has to face the various aspects of SO/SOA.

If discussing governance, we are quickly moving to a comprehensive discussion.

6.4 Comprehensive Discussion

Any organization should answer the question if it should strive for the full agility, organization wide. Or should it be strived for only selectively? This requires an assessment of the challenges faced, compared to the goals of the business(unit).

To make sure considerations run along the same line, a centralized body of expertise in the form of a (I)CC or COE is frequently advised. Here a group of specialists and generalists, each with specific roles, can assist the organization.

Such an entity should offer tooling and procedures for assessing it's current position in the fields of agility and SO/SOA. An organization should regularly assess what agility is required and what issues are hindering the required agility. Iterative approaches are available for this, although often these still seem arbitrary in their assessment. However, even an arbitrary assessment can be preferable over no assessment at all.

The agility gaps are useful because these discuss concrete examples of (the lack of) agility. However, other/later researches may find other rankings of issues regarding (a lack of) agility. To prevent a research from addressing only a very small number of concrete issues, without making broader generalizations possible, agility types can be useful. Matching concrete agility gaps on agility types can help by incorporating other/later rankings of agility issues. In this way it can become possible to state in more generalized terms what agility can be enabled by SO/SOA.

Continuing on this new research could attempt to identify alternative responses to agility types, not addressed by solutions offered by SO/SOA. This would be valuable because governance is not necessarily always able to tackle all its challenges with solutions offered by SO/SOA. (Although the other way around is different; SO/SOA without governance is likely to fail, governance needs to be incorporated into any SO/SOA based solution).

This could also use a number of concepts and tools discussed in the prior chapter, for example; meta models, roadmaps and maturity models, but also mechanisms to settle on a granularity for a service.

When addressing all these various aspects, whether in an active and planned approach or a more reactive organic way, a powerful agent of change can be released in an organization.

6.5 Intermediate Questionnaire

The theory so far was comprehended in a first, intermediate framework. This framework addressed the main issues from theory and attempts to link SO/SOA with agility gaps.

Build up of intermediate questionnaire

The intermediate questionnaire attempts to arrive at an answer to the main research question in two stages: first a classification of the agility gaps on agility types is attempted. Second for each agility gap it is attempted to assess the impact of principles of SO/SOA. These high level principles are intended to be refined in specific guidelines by means of accompanying note boxes at the questionnaire and interviews on the questionnaire.

The principles used for the intermediate questionnaire are adapted from the viewpoints defined by Allen. Because the viewpoints of Allen have a broader scope than the principles defined by Erl[1/3], these are deemed more usable. However, as noted before, the viewpoints of Allen seem sometimes arbitrary or stating the obvious.

Therefore the viewpoints of Allen have been adapted, according to insights encountered in literature. Especially the need for Governance was deemed important. The line of reasoning towards a more comprehensive set of SO/SOA viewpoints is elaborated in appendix A6.1. Parts of the intermediate questionnaire are incorporated in the (sub) appendices A6.2.

Application of intermediate questionnaire

The intermediate questionnaire was tested against the opinion of various subject matter experts. They will be asked to provide feedback on relevance and applicability of the intermediate questionnaire.

Initially the intermediate questionnaire was intended to be applied in three ways;

1. **General application by subject matter experts;** these would be asked to fill the questionnaire in for the agility gaps in general. The goal was to obtain a general reference base for the types of agility associated with the various agility gaps (a) and the ability of SO/SOA principles to address agility gaps (b).
2. **Application to selected cases from literature;** A number of cases have been encountered in literature, regarding the application of SO/SOA at financial institutions. Filling in the intermediate questionnaire for these cases could provide an additional reference base for the ability of SO/SOA to address agility gaps.
3. **Application to dedicated cases from practice;** With applying the intermediate questionnaire to a number of selected real life cases in the financial sector, initial insight can be gained in the extent to which SO/SOA addresses the current top 15 of agility gaps for the financial sector.

[1/3] *Erl's Service Orientation principles are regarded as having more focus on architectural application.*

Part III – Refinement of theory and questionnaire

"It is better to know some of the questions, than all of the answers"[126].

James Thurber

1864 – 1961

Research Rationale Part III

This part will contribute to the research by;

- Discussing how interviewees regard concepts discussed in the theory of the prior part.
- Introducing different/new concepts on Agility, Service Orientation and Service Oriented Architecture
- Constructing a revised framework and questionnaire on Agility, Service Orientation and Service Oriented Architecture

[126] *According to quotationspage.com*

7. Interviews

This chapter describes how the interviews for this research were conducted. The interviews aimed for obtaining feedback on the theory and testing of the intermediate questionnaire. First it is explained how the interviewees were selected and approached. The results of these interviews were analyzed qualitatively. Following on this it is explained what the results of the interviews were, this is split up in feedback on the theory and feedback on the questionnaire. If required, additional (theoretical) concepts are elaborated.

7.1 Interviewees

Interviews were conducted to gather feedback on the initial questionnaire and to verify the collected theory. These interviews were conducted with subject matter experts from various Business IT consultancy firms in the Netherlands.

Method of selection

The interviewees were approached in two steps;

1. **Survey of organizations;** it was sorted out which large Business IT consultancy firms operated in the Netherlands. This was done through internet research, consulting sales and consultancy staff at Cordys and attending professional congresses[137].
2. **Approaching Organizations;** The organizations found were approached in various ways using contacts from sales and consultancy staff at Cordys, or through contacts via the internet or from congresses. Sometimes these contacts were directly with people specialized in Business IT integration, Service Orienatation/SOA and or the financial sector. Otherwise it was asked if these people were willing to cooperate with an interview.

Approach of Interviews

All interviews were semi unstructured. A brief outline was made in advance with a mindmap of topics to be ticked off during an interview. For this outline see Apperdix 5.

Whenever possible interviews were recorded on .wav format, these audio files were typed out afterwards. If it was not possible to record an interview, the notes were typed out. These typed out notes were offered to interviewees, to be reviewed.

Following on this check, texts were structured using concepts and constructs from theory. This was put into an access database[138] for qualitative analysis.

Feedback on the initial questionnaire was used to modify and improve the questionnaire. This approach implies that the questionnaire went through a number of iterations.

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[137] *The congresses attended were the "Cordial" Congress in Putten on September 13th and 14th 2006 and the "Carriere beurs" in Amsterdam on the 9th and 10th of March 2007.*

[138] *The empty database is provided on the website of the faculty of social sciences of the Erasmus university, see (http://www.eur.nl/fsw/staff/homepages/pruijt/software/interview/).*

Feedback from the interviews was addressed in two ways. If an important missing link in theory was encountered it was incorporated in the theory. However not all input from theory was deemed suitable for the theoretical model, if not it is being elaborated on in this chapter. See paragraph 6.2 for more details.

Names/Organizations of Interviewees

The following people have been interviewed for this research:

1. **Eric Kruidhof**

   Cap Gemini, Consultant

2. **Jeroen van Dullemen**

   Atos Origin, Principal Consultant

3. **Sjoerd Talsma**

   Getronics, Senior Consultant

4. **Martin van de Berg**

   Sogeti, Service Line Manager Architecture

5. **Art Ligthart**

   Ordina, Principal Solution Architect

6. **Andries van Dijk**

   Deloitte, Senior Manager IT Strategy and Architecture

7. **Ronald Verschoor**

   Accenture, Senior Manager Solution Design

8. **Edwin van Dis**

   LogicaCMG, Consultant on Architecture and SOA

7.2 Analysis of Interviews

The analysis of the explorative interviews was carried out using the access database Interview Streamliner. All worked out texts of the interviews were imported after being sorted out on topics.

These topics are equal to the topics discussed in the Theoretical model, see part II of this thesis. Also look at Appendix A5.2 for an overview of the terms of analysis used.

Additional refining of the topics was done to prevent overlap and combine related topics.

Because the explorative interviews were conducted in Dutch, this database also consists of notes in Dutch. If required, translation is done during the analysis.

A consideration was made on the results of interviews had impact on the theory, or that it should be dealt with separately form the existing body of theory.

This consideration was made by the theoretical underpinnings offered in an interview, when the theory aspect addressed a gap in the existing theory or when the statement was supported by the majority of the interviewees. If this was not the case, but the statements were worthwhile to incorporate, this was done in this chapter

7.3 Feedback on Theory on Agility

This paragraph discusses the feedback on agility received during the interviews. If required, concepts are elaborated further with their (theoretical) underpinnings.

Agility

Agility is seen as the capacity to anticipate changes, although the difference between agility and flexibility is not always perceived as very sharp. Sometimes the concepts are even not defined. Although, the need for (partial) agility is regarded as a requirement for success of organizations, for example organizations in a stable market with commodity products or which have to exclude risks as much as possible, will have far less need for agility[129].

Standardization can be an approach to achieve agility at large, but it can limit the capability to provide true 'tailor made' service[130]. Agility should be striven for selectively, not all (parts of) organizations need to be agile, this is perceived as a serious flaw in the current claims on agility[131].

Another issue regarding agility is the difficulty in measuring agility, theoretical concepts as sensing and reacting capabilities are right. But how to measure this objectively in practice is regarded as difficult, the same applies to rankings of agility gaps and priorities[132].

During the interviews master thesis's were encountered on the combination of SOA and BPM[133]. The combination of SOA and BPM is chosen to address (business) agility/flexibility issues. However, both researches could not clearly confirm that the combination of SOA and BPM alone would be sufficient for achieving agility/flexibility[134].

Research of Cap Gemini confirms this to the extent that SOA can be enabling for achieving agility, by providing agility to IT itself. But new cultures and business models are required too. SOA at it's own will not be doing the job, but can be a prerequisite[135]. SOA can especially help achieving agility in complex environments, often this are larger (multinational) organizations. Although smaller and younger organizations could apply SOA too to maintain their agility[136]

Agility Types

Although not commonly known, the division of agility in various types

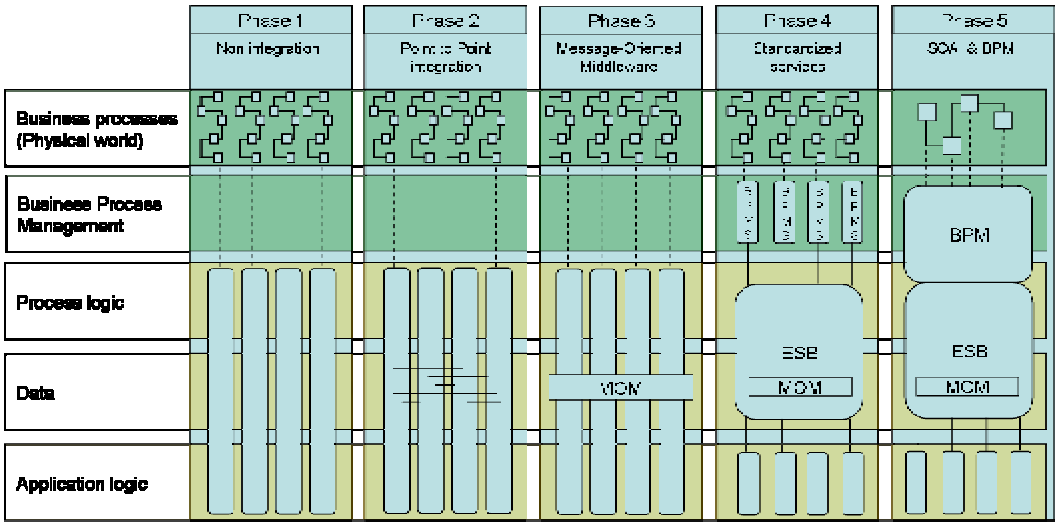
[129] *On agility and flexibility [Lighthart] and the need for agility [Kruidhof] as researched in the CIO survey of Cap Gemini [Cap], confirmed by Ronald Verschoor [Verschoor] and Jeroen van Dullemen [Dullemen]. Andries van Dijk perceives a lack of clarity on what is meant by Agility [Dijk].*
[130] *According to Jeroen van Dullemen [Dullemen]*
[131] *According to various interviewees [Ligthart], [Verschoor]*
[132] *According to Andries van Dijk [Dijk]*
[133] *See the interview with Art Ligthart [Ligthart] and Jeroen van Dullemen [Dullemen].*
[134] *Business agility is hampered by lagging IT, while the changing environment stresses the need for more agility [Woltshoorn, p56 59] Besides improving flexibility by addressing complexity, flexibility might also be hampered by SOA/BPM [Veen, p71]. An IT driven approach alone is not sufficient [Woltshoorn, p66].*
[135] *According to the CIO survey of Cap Gemini [Cap, p23 24]*
[136] *According to Eric Kruidhof [Kruidhof].*

makes sense to the interviewees; however after the types agility are perceived jointly under the concept of (business) agility. Some want to add a legal dimension to the already formulated agility types[137].

Some interviewees regard SOA as a mean to address "process" agility; parts of the internal system and structure are composed in services and tied together. However, this does not imply that other agility types are not affected by SOA, but "process" agility is the most obvious one[138]. Others wonder which part of agility can be addressed by which part of SO/SOA. Are these only the concepts, or only technology, or both?[139]

Agility Maturity Model

One of these thesis's created an agility maturity model, from an IT point of view. It incorporates five phases in achieving ultimate agility, SOA and BPM are in this model seen as the ultimate enabler of agility[140]. See figure 20.



(Figure 20; This figure is created by Wolthoorn, as an illustration of the various phases in achieving agility maturity)

According to a research by Cap Gemini, people are the most important enabling factor for agility although this cannot help achieving agility alone; "Agility is based on a well balanced triangle of people, processes and technology. If one of those areas fails, agility does not work[141]. This points at a serious drawback in the agility maturity model because the perspective is on IT alone. Other issues also require

[137] *According to Eric Kruidhof [Kruidhof] and Kruidhof and Ligthart on Agility types [Kruidhof], [Ligthart]. The four already defined agility types are process, product, network and market.*
[138] *According to Martin van de Berg [Berg] and Ronald Verschoor [Verschoor]*
[139] *According to Andries van Dijk [Dijk]*
[140] *[Wolthoorn, p27 37]. It is useful for a quick glance, however it does not take political, cultural nor psychological causes are not incorporated [Wolthoorn, p15 16].*
[141] *People are regarded as most important (49%), compared to Systems (23,8%) and Processes (26,7%), according to the CIO survey research of Cap Gemini [Cap, p16]*

attention. This is not addressed in the Agility Maturity Model.

7.4 Feedback on Theory on SO/SOA

This paragraph discusses the feedback on SO/SOA received during the interviews. If required, concepts are elaborated further with their (theoretical) underpinnings.

Service Orientation / Service Oriented Architecture

The difference between SO and SOA is perceived differently among the interviewees. SOA is a term coined longer ago and with more of a name around, therefore it is preferred by some people. Although all interviewees agreed that the notion of SOA got overloaded with a range of interpretation from technology to organizations, and everything in between. Therefore other interviewees preferred to discuss SO as an encompassing paradigm with an organizational focus, and SOA merely as a set of technologies[142].

One way or another, the different opinions do not rule each other out, most agree that the notion of SOA is sailing under false colours; much more than only architecture is meant.

And yes, it is known what SOA also means in Dutch. Certainly IT has by now become bored to death about that rather stupid joke[143].

The notion of SOA is already around since 2000 2001 or so, but only since about 2004 the buzz is getting around. Especially standards and technologies for administration of SOA contribute to the growing interest and application. 2006 is commonly perceived as the year in which SO/SOA came forward into the main light[144]. Standards are more applicable on the IT/technical aspects of SO/SOA, business services will be more specific to each organization itself[145].

SO/SOA is regarded as an important collection of best practices and new technologies. But some interviewees have their doubts if it is always in every case the one and only solution. The casting in services requires a certain amount of standardization that can enhance flexibility, but also limit it. Organizations with more standardized large scale processes might be more fit to commence with the SO/SOA endeavor, than specialized organizations[146].

The application of SO/SOA results in a myriad of notions and abbreviations in the sense of "Service Oriented ..." etc. Although frequently pointing at interesting views, the value of another abbreviation is doubted. Better would be to cast it into existing concepts[147].

Agility in an organization should be striven for selectively, not all (parts of) organizations need to be agile. Continuing on the perceived link between agility and SO/SOA, not all parts of an organization might

[142] *See various interviewees with a preference for Service Oriented Architecture [Berg], [Verschoor], while others prefer Service Orientation [Ligthart]*
[143] *According to Martin van de Berg on SOA [Berg] Note for the non Dutch reader; the abbreviation SOA means in Dutch 'Sexually Transmittable Diseases' (STD's).*
[144] *According to Martin van de Berg and Eric Kruidhof on SOA [Berg], [Kruidhof].*
[145] *According to Edwin van Dis on standardization and Agility [Dis]*
[146] *According to various interviewees [Dullemen], [Verschoor].*
[147] *According to various interviewees [Dullemen], [Ligthart], [Berg], [Verschoor].*

need SO/SOA equally[148]. Another consideration can be the required reliability of a (part of a) system, if a high degree of reliability is required SO/SOA will not always be the best candidate[149].

However, with SO/SOA being a collection of best practices and experiences gathered throughout the years, it is being applied more and more. Even organizations not working on SO/SOA themselves, might get in touch with SO/SOA when buying new applications with SO/SOA incorporated[150].

SO/SOA is suited well to bring a number of advantages, ranging from flexibility to cost reduction in some instances. But only striving for cost reductions is not deemed a viable approach[151]

SO/SOA Principles and Viewpoints

At first principles and viewpoints on SO/SOA are appealing, but often lacks in completeness or varying perspectives are found. Adding to this is that these principles and viewpoints remain very high level and therefore vague, or a very narrow (technical) scope is taken. Too often the obvious is stated again[152].

The most important overriding principle should become that the business interest is guarded. Principles might be nice from a theoretical point of view, but in practice a more pragmatic approach is preferred. One is not constantly switching back to principles when defining a service[153].

Business Process Management

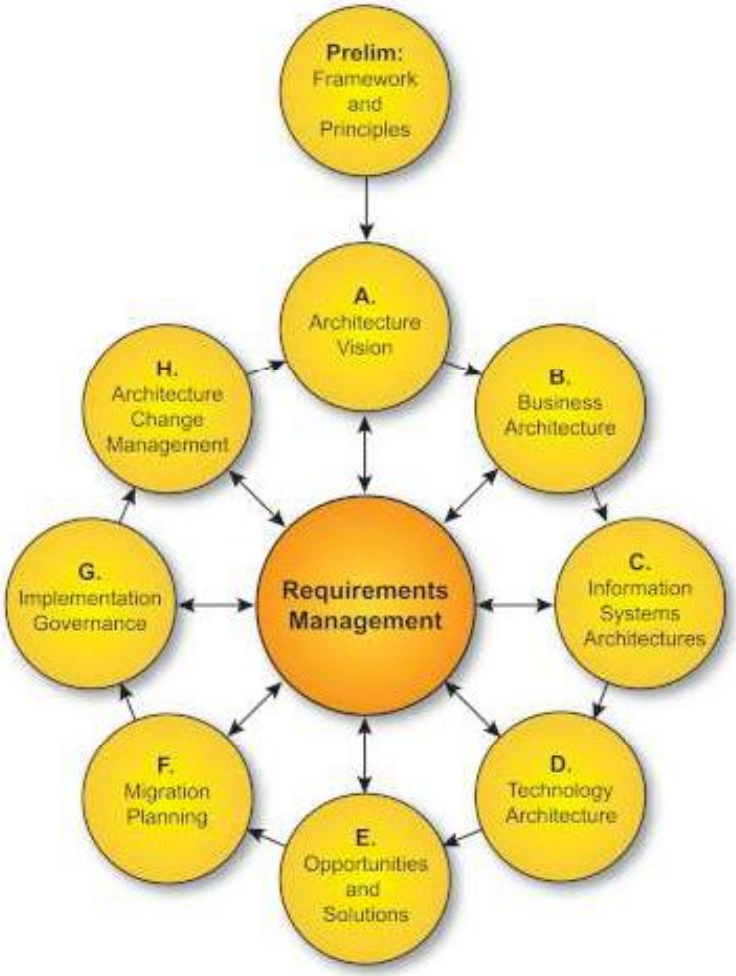
The combination between SO/SOA and BPM is recognized, but the specific filling in of the combination is not always crystal clear. The combination is made because defining services on the IT side alone, will not reap all the advantages offered. Some overlap is perceived between the SO/SOA BPM combination and Governance focused on processes[154]. But especially the BPM issue is new to people and therefore often not well understood yet,[155].

Architecture

The notions of (enterprise) architecture are becoming better demarcated. Simply speaking it is the collection of all the models used within an organization, this should regard more than technology alone. In this context some work on standardization is carried out. For example The Open Group Architecture of Framework (TOGAF) composes a framework of various relevant views on architecture. Within the Netherlands the Archimate project aims for this, as well as

[148] *According to various interviewees [Ligthart], [Verschoor], [Dullemen] and [Dis]*
[149] *According to Jeroen van Dullemen on reliability and SO/SOA [Dullemen]. Contingency as more focused on having the appropriate backup of data, while Continuity is more about having the means to get (parts of) business up and running elsewhere if required.*
[150] *According to Martin van de Berg and Jeroen van Dullemen [Berg], [Dullemen]*
[151] *According to Erwin van Dis on Competence Centers in the light of SO/SOA [Dis]*
[152] *According to various interviewees [Dullemen] [Ligthart], [Berg], [Kruidhof], [Dijk].*
[153] *According to various interviewees on Principles [Berg], [Martin], [Ligthart].*
[154] *According to various interviewees on SO/SOA and BPM [Kruidhof], [Berg], [Ligthart], [Kruidhof] and [Dis]*
[155] *According to Jeroen van Dullemen on BPM [Dullemen]*

consultancy firms like Sogeti with their DYA approach[156]. Often this is approached through various viewpoints, TOGAF defines eight phases of architecture, which can be viewed in a continuous architecture development cycle, see figure 21[157]:



(Figure 21; a depiction of the architecture development cycle as described by TOGAF)

In this context SOA is regarded as an architectural style that can be a solution to specific needs. It affects all aspects of architecture. Enterprise Architecture exists anyhow, and if SO/SOA is a solution it can be applied to the EA. However, often SOA is chosen first while the problem to be solved is not always clear. Logically this approach is not advisable[158].

It is regarded better to discuss SOA in the light of the current structure

[156] *According to various interviewees on architecture and related notions [Dijk], [Ligthart], [Berg], [Dullemen]*
[157] *As described on the website of TOGAF [TOGAF]*
[158] *According to various interviewees on SOA and architecture [Berg], [Ligtnart], [Dijk], [Dullemen] and [Dis].*

and situation. For example Ordina tries to introduce new issues as least as possible, when commencing on SOA. Their SOCRATES approach tries to find the required adaptation for SOA, instead of defining from scratch an completely new situation. Enterprise Architecture is relevant in the context of SO/SOA to plan further ahead than the immediate future; where do the business and IT need to be within three to seven years?[159].

In this context the remarks was made that organizations should strive for their own course of action regarding (enterprise) architecture, regardless of the involved partners and suppliers. The reason is to obtain a stable long term course of action instead of a "wobbly waggle" based on opinions of passers by[160].

Roadmap and Maturity Models

Various maturity models exist for SO/SOA and agility, and many consultancy organizations choose a best of breed approach in constructing one of their own[161].

For example Sogeti described a maturity model in coordination with IBM. See the theory for a more extensive description.

Another example is Accenture, which created a Capability Matturety Model (Improved) (CMMI) like maturity model with four phases; Awareness, Initial Deployment, ESB based SOA and Industrialized Lifecycle. The first two phases take at least 18 months, while the consecutive phases can take 18 up to 30 months each. Implementing SO/SOA is a task taking years[162].

Maturity models can be combined with roadmaps that show possible courses of actions in the implementation of SO/SOA. Here also a spectrum of actions is available from bottom up to top down approaches. Bottom up usually starts with the IT, while top down often comes with the moment that management starts realizing the business value of SO/SOA[163]. Best of course would be a combination.

An example of roadmaps are the "high performance models" of Accenture, which detail for various industries the main processes in organizations, from process flows to definitions of standard webservices. This focuses on three issues; differentiation on the outside, simplification on the inside and an execution repository[164]. However, ideally each organization comes up with it's own roadmap, specific to it's own situation and circumstances[165].

Interesting in this context is the attempt of Logica CMG to arrive at a commonly accepted maturity model. The value of such a standard would be that it can be applied across different organizations and systems, and provides comparable results. However, this attempt is still in the early stages[166].

[159] *According to Art Ligthart on Architecture and SOCRATES [Ligthart]*
[160] *According to Edwin van Dis on Enterprise Architecture and Competence Centers [Dis].*
[161] *According to various interviewees [Ligthart], [Berg, Verschoor]*
[162] *According to Ronald Verschoor on Maturity Models [Verschoor]*
[163] *According to Ronald Verschoor en Martin van de Berg [Verschoor], [Berg].*
[164] *According to Ronald Verschoor of Accenture [Verschoor].*
[165] *According to Edwin van Dis on Agility and roadmaps [Dis]*
[166] *According to Edwin van Dis on Maturity Models [Dis]*

Granularity

Some interviewees perceive granularity on a spectrum from fine (IT level services) to coarse grained (Business process level services), in which the ideal granularity depends on many unique factors. Although it is not always true that small services are technical and coarse service are business focused. Therefore it is by some interviewees not deemed likely to use a strict classification of levels of granularity, as encountered sometimes in theory. Although enterprise and department–levels can in general easily be discerned[167].

In practice the start of SO/SOA is often a bottom up process starting at the IT level; re use is easiest here. Once organizations have a certain amount of services defined, they often realize that the defined services have a strong IT scope[168].

Adding to this is that many organizations approach the definition of services and their granularity not yet in a methodical way[169]. Master Data Management is regarded as an important issue for controlling data, which can be translated to matching services. But many more methods exist[170].

The various levels of granularity, combined in composite services, can easily lead to the chaos of the future without good governance mechanisms[171].

Governance

SOA governance is not perceived as completely different from prior (IT)governance issues, basically it comes down to adapting existing structures and practices to the SO/SOA way of working. But many organizations (in the Netherlands) are not yet coping professionally with (IT)governance, let alone SOA governance. Therefore the notion of SOA governance can seem a very complex and difficult issue, better is to focus on IT governance and adapt this where necessary to SO/SOA[172]. Sometimes even external organizations are hauled in to do the governance of an organization[173].

Some regard SOA governance as the more organizational part of SOA. Ownership of services should be located at the business side of organizations[174]. Issues as cost, quality and risk control should be addressed, this continues with the fields of Business Contingency Management and Business Continuity Management. Others regard ownership and granularity of services as issues to be addressed by Governance[175].

One way or another, governance is regarded by most interviewees as a very important aspect of SO/SOA, without governance it is deemed

[167] *According to various interviewees on Granularity [Verschoor], [Ligthart], [Berg] and [Dijk].*
[168] *According to Martin van de Berg [Berg].*
[169] *According to various interviewees on granularity [Ligthart] , [Berg], [Dijk].*
[170] *According to Art Ligthart on Granularity [Ligthart]*
[171] *According to various interviewees [Ligthart], Verschoor], [Dijk]*
[172] *According to Art Ligthart on Governance [Ligthart]*
[173] *According to Sjoerd Talsma on Governance [Talsma]*
[174] *According to Martin van de Berg on SOA and Governance [Berg]*
[175] *According to Jeroen van Dullemen on Governance [Dullemen] and Ronald Verschoor on Governance [Verschoor]*

unlikely to obtain a successful SO/SOA project[176].

An interesting dimension to Governance shows when dealing with geographically dispersed organizations. This leads to splits between centralization, coordination and local presence. The setup of governance across all locations requires a clear vision and approach[177].

Within the practice of Governance strong attention to Change Management is required. This can focus on technical changes but more important is the human/organizational aspect. In the words of one interviewee "Systems do not resist change, it are the organizations and people around systems that resist change"[178]. This points to the importance of Change Management.

Another issue required within the practice of governance are Service Level Agreements (SLA's). However, depending on the span of control require the SLA's can be made up at the level of composite services. These represent logical (interdependent) groupings of services, which could also be obtained (partly) from external parties. The latter require more formal SLA's to get clear what is expected from a transaction[179]. It is regarded unlikely that services will be decomposed into the smallest level possible, accompanied by SLA's. Also the principle of loose coupling of services is deemed unfeasible. This is both contrary to some theories on SO/SOA[180].

When composing services various approaches can be taken. One approach described incorporated three angles of approach; enterprise process decomposition, enterprise data modeling and an interaction between the prior two[181].

Governance at least needs to provide mechanisms to find an appropriate granularity for a service. But approaches and classifications differ, most prefer a pragmatic approach[182].

The stance on reusability of services is shifting from wanting to reuse any service, to reuse of (business)processes created with (technical) services. This has impact for the scope of governance[183].

If composing a (composite) service the expected lifespan needs to be incorporated in the design. The extent to which a "service" should be set up to fit in a SO/SOA environment depends on the required integration with legacy and the expected time of usage. If a service is expected to be required for only a short period, less rigid requirements might be recuired[184].

7.5 Feedback on Theory on Organizations

This paragraph discusses the feedback on organizations received during the interviews. If required, concepts are elaborated further with their (theoretical) underpinnings.

[176] *According to most interviewees on Governance [Talsma], Verschoor], [Berg], [Kruidhof], [Cullemen] and [Dijk].*
[177] *According to various interviewees on Governance and locations [Kruidhof], [Berg]*
[178] *According to Edwin van Dis on Organizations [Dis].*
[179] *According to Eric Kruidhof on Outsourcing [Kruidhof]*
[180] *According to Art Ligthart on Sourcing, SLA and Governance [Ligthart]*
[181] *According to Art Ligthart on Granularity of services and Governance [Ligthart]*
[182] *According to various interviewees on Granularity and Governance [Verschoor], [Berg].*
[183] *According to Edwin van Dis on Governance and Granularity [Dis]*
[184] *According to Eric Kruidhof on Governance and life span of services [Kruidhof]*

Organizations

When combining notions as agility and SO/SOA some interviewees find this too abstract, they rather prefer to discuss concrete application of concepts and technologies instead of referring to notions as agile organizations or Service Oriented Enterprises/Organizations[185].

A possible implication of SO/SOA at the level of an organization is the division between front end and back end and a modularization of the overall organization[186].

Competence Centers/Shared Service Centers

Gartner introduced the term of (Integration) Competence Centers, and envisioned this as a permanent entity in an organization. The (I)CC is foreseen as a permanent entity because of the scarcity of the capabilities and knowledge of the people involved.

However, according to some interviewees, (I)CC's are often set up as temporary project teams and grow organically. This has impact on issues like (influencing) culture, (political) power and continuity. In an ideal situation these project teams become therefore embedded in existing organization structures. The approach taken by some organizations working with SO/SOA is to create a small core unit starting with a project, which might later evolve further.[187].

Others question the need for centralizing CC's, because in larger geographically dispersed organizations experts are spread around too. The striving for centralization of Governance in a single CC is contrary to the philosophy of decentralization enabled by SO/SOA. Centralization is not always the best solution, maybe for some specific specialties. But a clear need for good collaboration tools is also perceived[188].

But the need for a coordinating body, that sets standards and minds the architectural and governance issues on the long term, is recognized by many interviewees.[189]. This especially shows if an organization uses SO/SOA in an effort to outsource certain services. Preferably ownership of a service is then located at the business side[190]. Within this constellation Architects play a pivotal role, but it is remarked that it is important that Architects adopt a facilitating role. Final decisions need to be taken by management involved as LOB owners and Program boards. With LogicaCMG this is perceived as a triangular constellation between enterprise architecture, enterprise programs and enterprise strategy and planning[191].

A problem is perceived in the amount of knowledge existing at applying parties. Consultancy and Independent Software Vendors (ISV's) already have accumulated a lot of knowledge and best

[185] *According to various interviewees on SO/SOA, agility and Organizations [Kruidhof], [Talsma].*
[186] *According to Jeroen van Dullemen on impact of SO/SOA on organizations [Dullemen] and Sjoerd Talsma on issues addressed in organization by SO/SOA [Talsma].*
[187] *According to Art Ligthart on Competence Centers [Ligthart], Jeroen van Dullemen and Andries van Dijk [Dullemen], [Dijk].*
[188] *According to Eric Kruidhof on Competence Centers [Kruidhof]*
[189] *Most interviewees agreed on this [Dijk], [Kruidhof], [Ligthart], [Berg]*
[190] *According to Martin van de Berg and Art Ligthart [Berg], [Ligthart]*
[191] *According to Edwin van Dis on Governance and Organizations [Dis].*

practices. But the customers, which have to apply the knowledge on CC's, rely heavily on consultancy and ISV partners. Sometimes this results in regularly changing policies, due to changes in partners. However, especially the customers need to set a clear line of approach to which future projects have to apply, to obtain a consistent and steady policy[192]. This implies a clear and committed policy and involvement of (top) management

7.6 Feedback on Questionnaire

The questionnaires initially matched viewpoints and principles of SO/SOA on agility gaps. Each gap was matched on a separate page, with principles of SO/SOA.

However, the viewpoints/principles are too often regarded too abstract and high level. Also is the scope on principles too narrow (Erl principles focus more on an architectural approach alone), or do the viewpoints seem to be random and incomplete[193].

Also it was frequently stated that it is difficult to draw a clear and distinct link between a viewpoint or principle and an issue to be addressed. Multiple explanations and interpretation can be provided[194].

Regarding the types of agility, the concept was deemed interesting but a legal entity was missed. The agility gaps needed more explanation on their meaning. Clustering of agility gaps was suggested[195].

Overall the intermediate questionnaires were sometimes deemed too dense with information, more selection and more explanation was asked for. Legends, questions and delineations should be visible in a single overview. Also interviewees wondered or they were supposed to fill the questionnaire in based on a specific case, or from their experience at random. The latter was deemed as difficult due to a lack of a clear example[196].

7.7 Conclusion on Interviews

This paragraph summarizes the broad outlines described in this chapter. This is split in consideration stemming from the interviews conducted, and a personal view on the results of the interviews.

Summary on Interviews

Agility is deemed important for organizations in the current changing world. However, agility alone is rather vague. Specifying it more through agility types or gaps can be useful.

The interviews clearly showed the range of different opinions on SO/SOA. Various interpretations were given, but overall the interpretation did not exclude each other. SOA is sometimes preferred

[192] *According to Edwin van Dis on Competence Centers [Dis].*
[193] *According to various interviewees on an intermediate version of the questionnaire [Talsma], [Berg], [Dullemen], [Kruidhof]*
[194] *According to various interviewees on an intermediate version of the questionnaire [Berg], [Dullemen]*
[195] *According to various interviewees on an intermediate version of the questionnaire [Ligthart], [Dijk]*
[196] *According to various interviewees on an intermediate version of the questionnaire [Talsma], [Berg], [Dijk], [Dullemen].*

because the term is used and known worldwide. However, that SOA is about more than only architecture and technology is also recognized. Service Orientation is not always recognized, while others deliberately stress the broader scope of SO, compared to SOA.

SO/SOA has impact on a range of topics in the organization. Especially architecture is affected, but also issues like governance. Ideally SO/SOA is not started from scratch but implemented in the existing (organization) structures and entities.

All interviewees agreed on the importance of governance, without governance SO/SOA is not deemed likely to succeed. Some practices for governance were discussed; most important is the involvement of business in this process.

Issues to be addressed by Governance are ownership, (terms of) use, granularity and standards. For this, tooling and frameworks are available. Maturity models are especially important because SO/SOA is a long term project which requires learning and a dedicated build up of capabilities.

Organizations can commence with SO/SOA, but will have to adapt in some ways. Frequently a center of knowledge and a coordinating body are created in a(n) (Integration) Competence Center. Other parts of the organization might be affected by modularization and thinking in front and back end departments.

The overview of the initial questionnaire was deemed poor and the total questionnaire was found to be long and tedious.

Personal view on Interviews

The explorative interviews were enormously helpful in sharpening ideas and concepts. Sometimes first drafts and ideas were floored, but more often confirmations or leads were provided.

A personal view on the interviews, together with the theory of the prior chapters, will be incorporated in the discussion.

I became more and more aware of the possibilities offered by SO/SOA. However, at the same time, I became more and more convinced SO/SOA is not entirely new and certainly not always the solution required. Also it struck me how models are often overly simplistic, for example the Agility maturity model assumes that once an organization has SOA and BPM this can be regarded as a agile organization. Such simplification ignores many other aspects which were discussed by interviewees.

Especially the need for addressing resistance and proper change management came forward during the interviews. This should address attitude, culture and political stakes.

8. Framework; Service Orientation vs. Agility

The theory and the explorative interviews provide a solid ground for the construction of a framework that can be used as a research tool. Because of the application on research cases it will be labeled questionnaire.

First some considerations on the concepts to be addressed will be provided. These considerations stem from the theory and the explorative interviews. Secondly the questionnaire will be elaborated; including scales expected format of answers, as well as the application of the questionnaire.

8.1 Considerations

The goal of the framework/questionnaire is to obtain information required for answering the main and sub research questions. For this a number of considerations are made regarding the concepts and constructs of the research questions.

Ultimately a comparison between agility on one axis, and SO/SOA on the other axis, is made.

Agility

Agility has been defined in the theory as extra ordinary flexibility requiring structural and strategic responses. In the interviews this definition was not challenged, but as was noted in theory too, the separation between agility and flexibility is not always made that sharp.

The types of agility are not a construct encountered in scientific literature[197], but based on an article on the website CIO.com. Nor were the types of agility always discerned by all interviewees, some referred to business agility in general. However, in the context of SO/SOA elaborating the agility types might be useful. Reason for this is that the claim is often made that SO/SOA makes organization agile, but this claim is too often not specified any further.

When elaborating the notion of agility it was encountered that measuring agility concretely is difficult, or at least prone to arbitrary choices[198].

To avoid this 'problem' existing lists of agility issues can be used. Various lists can be found, and the exact order of these rankings will change frequently. A sound candidate is the list of agility gaps created by Oosterhout and Hillegersberg. Reason for choosing their list of agility gaps is that this research also relies heavily on their articles for the definition of agility[199]. But other rankings of agility issues could be

[197] *The notion of various types of agility was adapted from an article published on the website CIO.com. This article stated a number of questions for CIO's, from these questions initially four types of agility were deducted; product, process, network and market.*
[198] *See Overby's framework, which asked for an indication on sensing and responding capabilities. But this indication, although based on some formulas, basically relies on an expert's opinion/estimation.*
[199] *To be truly honest; the articles of Hillegersberg and Oosterhout were used from the early start of this research, other rankings of agility issues were only encountered later, long after the initiation of the research. Matching these agility gaps on agility types can provide an easy start for incorporating later rankings too.*

chosen too.

Due to the time dependent nature of agility issues, agility should be addressed in an iterative process of analyzing planning and actions. For this various cycles are possible, but it is interesting or this also happens in a structural way at organizations.

Service Orientation / Service Oriented Architecture

Theory and explorative interviews pointed to a not so clear distinction between "Service Orientation" and "Service Oriented Architecture". Therefore this thesis frequently uses the composite abbreviation SO/SOA.

The explorative interviews also showed that, although attractive at first, principles and viewpoints of SO/SOA are or too one dimensional and detailed or incomplete[266]. Therefore a simple framework with principles on one axis and agility gaps on the other axis will provide incomplete or trivial outcomes. Attempts to construct an improved set of principles/viewpoints are likely to turn into a theoretical exercise which will remain too high level and abstract to be truly useful for a questionnaire.

When discussing SO/SOA, while taking the technical "nuts & bolts" for granted, a maturity model may address all related topics (like governance, roadmaps, granularity and architecture). Ideally a suitable maturity model is used for collecting data, my personal preference would be to use the version of Sogeti/IBM. Reason for this is the application at the cases of "de Amersfoortse" and the worked out instructions.

Organizations

From a military perspective agile organizations will need a flexible command and control structure; a hierarchy that not only facilitates vertical communication, but also horizontal and diagonal, according to the needs of a situation. This will require flat(ter) organizations, where certain resources can easily be obtained.

Ideally this is orchestrated by a Competence Center entity incorporating a flexible architecture team combined with specialists on standards.

SO/SOA starts with more than only a set of integration technologies, this came clearly forward from both theory and explorative interviews. A number of concepts can already be discerned in an organization, when moving into the direction of SO/SOA;

- Thinking in backend and frontend organizational units.
- Using SSC's to provide a uniform set of processes to other entities in or outside the organization.
- The existence of an organizational entity with a coordinating role in the integration efforts; a CC.

From interviews the question came forward if agility should always be

[266] *Erl's SO principles are focused on an architectural application and are so detailed it is difficult to attribute a single principle to a specific occurrence. Allen's viewpoints are a nice start, but seem to be incomplete. A striking weakness is a lack of foundations of arguments why he arrived at SOV7.*

striven for. In certain occasions less agile organizations might be more suitable; for example in case of strict procedures.

Intermediate versions of the Questionnaire

Intermediate versions of the questionnaire were suffering from a poor overview and were deemed to be too dense with information. Especially repetition of questions added to this density. Besides this it was stated that the level of detail between agility and SO/SOA was different, leading to uneven comparisons.

Also it was asked to provide more explanation of build up and meaning of terms. Especially the agility gaps were open to multiple explanations. Adding all these remarks together pointed to the need for a smart way of combining agility with SO/SOA.

Possible Comparisons between Agility and SO/SOA

As the title of this research suggests, an attempt is made to find out if and how agility can be facilitated by SO/SOA.

From the theory and the explorative interviews it came forward that SO/SOA touches to much more than technology alone. Initial attempts to find a 'simple' list of principles for SO/SOA were in vain.

Theory showed that the various aspects of SO/SOA have different importance, depending on the maturity of the SO/SOA project. Theory and interviews also showed that SO/SOA is not necessarily completely new, therefore matching agility gaps specifically to SO/SOA aspects might become a trivial exercise if not taking maturity into account. Actually, it is the other way around; a MM takes all aspects of SO/SOA into account to assess an organizations maturity.

For assessing maturity various maturity models are available. The MM set up by Sogeti/IBM is the most practical one encountered. Therefore this will be used.

To be able to answer the main research question a comparison has to be made between agility and SO/SOA. However, from a point of view of interviewee friendliness, it is not preferable to ask for every single agility gap separately for all SO/SOA issues[26]. This also applies to the Maturity Model of Sogeti and IBM for which more than 1200 gradings are possible[27].

Besides that it is unlikely that interviewees are willing to fill in such a questionnaire, it is about comparing apples and oranges. The agility gaps describe a number of topics at a more abstract high level. Trying to compare this to specific details of SO/SOA does not make sense. Especially because SO/SOA and agility are not isolated topics, but have to be regarded in the context of current organizations.

Therefore a comparison between agility gaps and the main

[26] *For example; the initial versions of the questionnaire asked for each agility gap separately a ranking on all SO/SOA principles. This resulted in 15 pages with similar questions asking for how SO/SOA helps addressing the agility gaps. However SO/SOA alone is not going to address that gap alone. A questionnaire set up along those lines gives rise to more questions then it answers.*

[27] *The MM of Sogeti/IBM has twenty categories, each with 3 to 4 possible gradings If this is required for 15 agility gaps interviewees would be required for minding 900 options (20x3x15).. .. ... :S*

components of SO/SOA is proposed. To be able to match these results with the outcomes of the MM assessment the following high level aspects will be used for SO/SOA; people, process and technology.

8.2 Questionnaire

This paragraph details the actual questionnaire. The final questionnaire is provided in appendix A6.3. Below are the approach and considerations provided.

Application

The questionnaire detailed in this chapter will be applied in two instances; theoretical cases and practical cases.

If applying the questionnaire to real life/theoretical cases, not all agility gaps will always be at stake. Therefore a simple check box should be incorporated, to indicate whether a gap is applicable in this specific case or not. The same reasoning could be followed for identifying the type of agility involved, this could also be done through a check box. This results in nominal data.

Buildup

The actual questionnaire will be published on a survey website, with the results being incorporated in an excel file. The detailed buildup will be worked out in Appendix 6.3. Below a short description of the buildup of the questionnaire is provided;

- **Introduction:** The introduction of the questionnaire should provide a short explanation on the goal of this research, mention it is part of a master thesis and clearly explain the buildup of the questionnaire, including a clarification of terminology.
- **Agility gaps – types:** This part of the questionnaire will only be filled in by respondents. It will not be used for the 'theoretical cases'.

  Various rankings of agility are possible, and research on this is being published regularly. Therefore a classification independent of a ranking list is preferable. If a ranking can be split into types of agility, it becomes possible to incorporate the results of other/later rankings too.

  For this the list of agility gaps will be matched on the types of agility. With the types of agility being: product, process, network and market. It is not expected that all agility gaps fit neatly into one specific type, so multiple answers will be possible.

  The best approach for collecting the answers on this issue will be a check box.
- **Agility gaps scoping:** When applying the questionnaire to a case, not all agility gaps will be applicable to that specific case. Therefore a simple checkbox will be used to sort out which cases are affected by which agility gaps.

  It is possible that certain gaps are not present in the cases selected for this research. This should be accounted for in the conclusion.

The option for pointing to the existence of other agility gaps might be used. However, because the 15 agility gaps from Hillergersberg are already a top 15 for the financial sector, adding such an option leads to repeating oneself.

- **SO/SOA Maturity Model:** The maturity model as described by Sogeti and IBM is the only one encountered which weighs many (theoretical) aspects with a practical framework. The scale of this framework is a Likert scale with 13 stages, divided in a grading of three to four classes[263].

  No other options for answering are to be included. The reason for this is that the MM should provide for the whole spectrum from not having an SO/SOA environment to having one. Therefore other answers are deemed irrelevant for the research.

  The results of this maturity model assessment can be depicted in a spider diagram. This allows for easy comparison between various cases. This also results in nominal data.

- **Agility gaps versus Maturity Model:** The main classes of the MM of Sogeti and IBM will be matched against the agility gaps. The main classes are people, process and technology. This will result in an overview at a general level which aspects of SO/SOA can be helpful for addressing agility gaps. A 4th and 5th option has to be included too; the options of 'don't know' and 'not applicable'.

  Data for matching agility gaps on SO/SOA will also result in nominal data.

Interpretation of results

The results of the questionnaire are of a qualitative nature; respondents provide an answer, but these respondents are not necessarily representative. Therefore all answers only provide an indication.

The matching of the agility gaps of Hillegerberg will provide a coarse indication required agility types. This can be used with the outcomes of cases on applicable agility gaps, to answer which types of agility can be addressed by a SO/SOA solution.

The Maturity Model will be used to specify this relation in more detail. The results of the Maturity Model provide an indication on the progress made in an organization regarding various aspects of SO/SOA. Combining this with questions, whether the main components of the Maturity Model affect agility gaps, can provide indications which aspects of SO/SOA have an impact on agility.

[263] *Not all aspects in the maturity model of Sogeti and IBM have the same grading. Some use a scaling from A to D, others from A to E.*

9. Testing cases from literature

The final questionnaire constructed, was based on input from the interviewees. It has been presented to a number of "guinea pigs" for their first impression and to draw feedback. Adding to this two cases on Credit Suisse, described in literature, were used to fill in the questionnaire constructed.

The results of these cases have limited value for the conclusions, but serve the goal of testing the questionnaire on relevance and usability.

9.1 Selection and scope of a case from literature

For the research two cases from literature have been selected, describing Credit Suisse. These cases have been used to test the research tool constructed.

Selection of a case from literature

Various cases on the implementation of SO/SOA in financial organizations were encountered in literature; among others Ialifax bank of Scotland, ING, and Accredited home lenders.

Of these, the case of Credit Suisse was chosen for testing the questionnaire. Reason for this is that the case of Credit Suisse is well documented with 5 sources encountered describing the same case. For testing the research tool the descriptions of Allen and Krafzig were selected[204].

Scope and limitations of this case

The case from literature is used for testing the research tool. It will therefore not be used for collecting data on the relation between agility and SO/SOA. The generic part of the questionnaire (regarding the agility types and gaps) is also not included in this chapter, this was already addressed in stating propositions in chapter 3.

This chapter uses "testing" instead of "validation", because true validation is not possible. The outcomes based on cases from literature could not be compared to the outcome of a filled in questionnaire by Credit Suisse. This chapter therefore only focuses on the applicability and blind spots of the questionnaire.

9.2 Description of the Credit Suisse case

Credit Suisse is detailed in various case descriptions. The following description is taken from Allen and Krafzig. The description is brief, because it is the goal to test the research tool, not to provide data on the case of Credit Suisse.

Credit Suisse General

Credit Suisse is a worldwide operating financial services company with about 60.000 employees. Since the 70's the number of IT applications

[204] *Herman Schlaman has provided a description of his experiences at Credit Suisse [Allen, p301 325], Krafzig et al. provide a complementary case on Credit Suisse [Krafzig, p341 357].*

and systems grew steadily, reaching about 600 applications. The takeover of the Schweizer Volksbank by Credit Suisse in 1993 led to a doubling of the number of IT systems. For transaction oriented applications mainframes continue to be the preferred platform, for other applications SOA comes forward as a candidate[265].

Goals of Credit Suisse's SOA Introduction

Overall business required more flexibility of the IT of Credit Suisse. Five goals can be identified for the SOA introduction[266]:

1. Technical integration
2. Logical integration
3. Process and desktop integration
4. Integration of purchased software
5. B2B integration

Reasons for choosing SOA

In 1998 the first parts of SOA were implemented, in 2002 efforts were undertaken to reduce system complexity. Decoupling of physical systems and interfaces was deemed necessary[267].

Point to point integrations had not met the expectation of Credit Suisse, because it resulted in to much middleware. Combining this with the need to reconstruct Data Centers and the cleaning of data warehouses, due to mergers and acquisitions, led the CIO to decide for the implementation of SOA. No business plan was complied prior to introducing a SOA in Credit Suisse[268].

In general it is stated that business (management) required a more flexible support of IT to new products. In the cases a number of more specific reasons for choosing SOA are detailed[269]:

- Existing IT could no longer deal with required business functionality:
  - The demand for multi channel banking
  - On line trading
  - Consolidation of the core business application portfolio
- Minimize costs of market participation
- Focus on Core competencies

Organizational aspects of introducing SOA

From an organizational perspective the goals for a SOA introduction

[265] *According to Allen [Allen, p302]. Involving various platforms and approximately 12 millions lines of code. According to Krafzig [Krafzig, p342]*
[266] *According to Allen on the requirements of business [Allen, p303] and Hagen on the goals of the SOA integrationArchitecture [Krafzig, p343 344]*
[267] *According to Allen on strategic considerations of Credit Suisse [Allen p302].*
[268] *According to Krafzig [Krafzig, p343]*
[269] *From a business point of view according to Krafzig [Krafzig, p342 343] and according to Allen [Allen p302 303].*

were addressed by five complementary domains; customers, distribution, products, management support and data warehouses. Applications were assigned to these domains and doubled functionality was cut out and placed in services, which could be offered to various applications[210].

Credit Suisse used a central architecture unit within the IT department which set out an approach for SOA. Management support was provided to stress the need for compliance to this SOA approach[211]. This was a clear top down approach. (Potential) service users and service providers drew up together a coarse specification of a service. This specification was used to see or there already existed services, which could be partly reused. This approach was strictly bottom up with no overall planning of services[212].

The development of services was facilitated by using two repositories, one with the functionality of each service and one of the existing applications and their domain memberships. Service specifications were compared with the service database, to make sure that services were reused (the commodity services, see paragraph 4.8)[213]. Ultimately this resulted in 75 80% of services required for a new process, already being available in the repository[214].

9.3 Results of the SOA Maturity Model

The SOA Maturity Model is filled in for the Credit Suisse Case as a whole, based on the descriptions of Allen and Krafzig.

- From a process point of view Credit Suisse seems to be quite well developed on the use and application of architecture, as well as quality and service portfolio management. Adding to this is that the top management of Credit Suisse is clearly dedicated to the implementation of SO/SOA.
- From a technology point of view, especially the componentization and reuse are well developed, resulting in specific business applications build together with business people.
- From a human perspective the skill of the IT people, specifically dedicated architects, are well developed. Overall the IT department is ahead of the business. This can be explained by the technical (IT) origin of the SO/SOA effort at Credit Suisse. For a detailed reasoning per key area, go to appendix 7. Here the motivation and reasoning for each score is detailed, based on the two cases of Credit Suisse. For the score per key area see figure 22.

[210] *Krafzig on five domains [Krafzig, p343] and Allen on encapsulating legacy application and reuse of shared functionality [Allen, p315]*
[211] *Krafzig on the implementation of SOA at Credit Suisse [Krafzig, p346] and Allen [Allen, p303].*
[212] *According to Krafzig on Service Development at Credit Suisse [Krafzig, p347 348*
[213] *According to Allen on asset inventory and service reuse [Allen, p310 312]*
[214] *According to Krafzig on application development at Credit Suisse [Krafzig, p356]*

Building Block	Nr	Key Area	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Process	1	Commitment and motivation		A				B				C				
	2	Relationships with projects				A			B		C				D	
	3	Roles and responsibility					A			B			C			
	4	Development of architecture			A				B			C				
	5	Use of architecture				A							C			
	6	Architectural tools					A				B			C		
	7	Quality Management						A						C		D
	8	Service portfolio management					A			B			C			D
	9	Vision of architecture		A				C							D	
	10	Alignment Information Systems with business			A			B			C			D		
	11	Budgeting and planning				A						C			D	
Technology	12	Technology and standards		A				B					C		D	
	13	Componentization and Reuse			A				B					C		D
	14	Business processes implementation in Information systems				A					B			C		D
	15	Information systems flexibility			A		B						C			D
	16	Information Security		A			B			C			D			
People	17	SOA skills IT			A				B			C				
	18	SOA skills Business			A				B			C				
	19	SOA mindset & knowledge IT People		A							C					
	20	SOA mindset & knowledge Business People		A				B			C					

(Figure 22; The scores on the various key areas of SOA maturity. Green indicates the present state, while red indicates which immediate priorities can be recognized. See Appendix 7 for an explanation on arriving at the scores for the Maturity Model).

9.4 Results of the applicable Agility Gaps

From the analysis (see Appendix 7) of the cases on Credit Suisse the following agility gaps came forward as being applicable to the case (See figure 23 for the complete overview);

- "A trend towards outsourcing of IT related systems and processes"
- "A trend towards outsourcing of IT personnel"
- "Need for multi channel any time any place access to products and services"
- "Escalating IT costs of systems maintenance and support"
- "Need for (more) online distribution channels"
- "Need to decrease delivery time"

Of the applicable agility gaps for Credit Suisse, the impact of the key areas of the SOA Maturity Model, grouped in the Building Blocks "Processes" and "Technology" is clearly described. The impact of the topics in the key areas of the SOA Maturity Model building block "People" is much less extensively described and therefore more difficult to assess.

In the case of all the agility gaps the factors Technology and Processes, from the SOA maturity model, clearly come forward as having a positive effect on these agility gaps. The human factor is not described into great detail; therefore it is impossible to assess the impact on agility cannot be assessed, based on the available cases.

	Applicable ?			Range of effects			
	Yes	No	Unknown	Process	Technology	People	
1. "Growing demand for financial transparency and accountability"			X	Na	Na	Na	Ranking
2. "A trend towards outsourcing of IT related systems and processes"	X			++	++	??	
3. "A trend towards outsourcing of IT personnel"	X			??	++	??	
4. "Emerging price war (market focused on price) and shrinking margins"			X	Na	Na	Na	
5. "Need for multi channel any time any place access to products and services"	X			++	++	??	
6. "Escalating IT costs of systems maintenance and support"	X			++	++	??	
7. "Increasing introduction of new substitute products of services"			X	Na	Na	Na	
8. "Need for (more) online distribution channels"	X			++	++	??	
9. "New regulation on European level"			X	Na	Na	Na	
10. "Dropping levels of sales from new products and services"			X	Na	Na	Na	
11. "Migration from ERP legacy oriented architecture to SOA"			X	Na	Na	Na	
12. "New regulation on national level"			X	Na	Na	Na	
13. "Need to decrease delivery time"	X			++	++	??	
14. "Need for lower priced products and/or services"			X	Na	Na	Na	
15. "Shortening of product life cycle"			X	Na	Na	Na	

(Figure 23: An overview of the applicability of agility gaps and the effect of SOA maturity model building blocks on the applicable agility gaps.)

9.5 Conclusion on the Credit Suisse Case

The case of Credit Suisse shows the questionnaire constructed for this research covers various aspects of SO/SOA, the inclusion of a SOA maturity model is an important contributor to this.

Limitations of the Credit Suisse case

Filling in the questionnaire based only on two case descriptions from literature does not provide adequate insight; on some aspects the descriptions are superficial. The cases are not detailed enough to provide a clear difference between impact of SOA maturity classes on agility, only positive, negative or no relations can be sensed.

However, clearly excluding an agility gap based on the case descriptions is difficult. This is due to the original goal of the case descriptions being different from the use of the case descriptions in this research.

Acding to this is that the choice to limit the questions on type of SOA maturity to Processes, Technology and People has implications. Answers provide an indication of which aspects of SO/SOA are having an effect, but based on the results of the questionnaire it is not possible to point to specific key areas.

Outcomes of the Credit Suisse case

From the list of top 15 agility gaps applicable to the financial sector only one third can be concluded as being applicable to Credit Suisse based on the used case descriptions. Especially outsourcing and getting to customers and partners easier, faster and more efficient over multiple channels come forward as agility gaps applicable to the SO/SOA implementation case of Credit Suisse. Other gaps might be applicable too, but were not described as being addressed by a SO/SOA implementation.

From the to Credit Suisse applicable agility gaps a relation with SOA was found. The SOA Maturity Model building blocks "Processes" and "Technology" were found to be enablers, the building block "People" could not be concluded due to a lack of detail in the case descriptions of Credit Suisse.

Part IV – Research

"Everyone is entitled to their own opinion, but not their own facts"[71].

Daniel Patrick Moynihan

Research Rationale Part IV

This part will contribute to the research by;

- Discuss the results of the classification on types of agility for the agility gaps.
- Detailing and analyzing a real life case by means of the questionnaire constructed.

[71] *According to brainyquote.com*

10. Agility types

The agility gaps for the financial sector from Hillegersberg et al. were presented to a number of respondents, with the question to provide a classification on required agility types for each gap.

10.1 Approach & Population

The questionnaire presented to respondents consisted of two parts, a general part on agility gaps and types and a case specific part on SO/SOA Maturity and the agility gaps applicable on a case. This chapter deals with the results of the general part of the questionnaire.

The agility gaps for the financial sector from Hillegersberg et al. were presented to a number of respondents. For each type of agility a definition was provided, with the question to provide a classification on required agility types for each agility gap.

The total population which reacted on the questionnaire was nine people (N=9) from 3 different cases; "de Amersfoortse", "DAS Rechtsbijstand Verzekeringen" and the "Rabo Bank". Of these reactions one (1) was invalid[216]. These responses were taken together and analyzed as one sample.

10.2 Results of mapping Agility gaps on Agility types

Due to the nominal nature of the data collected no order between the agility types can be concluded. The only conclusion possible is that one type of agility can be mentioned by more respondents as being required for an agility gap. An important note is the requirement for nominal data of the categories to be "mutualy exclusive and collectively exhaustive"[217].

The responses point to a strong need for "Process Agility" to counter the agility gaps for the financial sector. Thirteen (13) out of fifteen (15) gaps have process agility as the most important type of agility required.

From the responses "Network Agility" comes forward as an important second type of agility required for countering the agility gaps for the financial sector with two (2) times being most important and nine (9) times being ranked as the second most important required agility type.

Compared to "Network Agility" the "Product Agility" was more regarded as the most important enabler required for addressing the top 15 agility gaps (3 times number 1, against 2 times for "Network Agility". However, "Product Agility" comes only three (3) times as the second most important enabler required for addressing agility gaps.

The detailed overall results can be found in appendix 8, in figure 24 a summary of the percentage of responses stating an agility type is required per gap. Also it is shown how the actual results match with

[216] *Due to a double answer of the same person with different responses on a number of questions, both responses were regarded as invalid for this research.*
[217] *Nominal data can be grouped in two or more categories, "the counting of members in each group is the only possible arithmetic operation". According to Cooper et al. on Nominal data [Cooper, p223]*

the hypothesizes of chapter 3 on the required agility types per gap. In short process agility is even more important to address the agility gaps, than initially hypothesized.

		Product Agility	Process Agility	Market Agility	Network Agility	Product Agility	Process Agility	Market Agility	Network Agility
1	Growing Demand for Financial Transparancy and Accountability	33%	**89%**	11%	44%		X		
2	A trend towards outsourcing of IT personnel	22%	**67%**	22%	**67%**		X		X
3	A trend towards outsourcing of IT related systems and processes	44%	**67%**	33%	**67%**		X		X
4	Need for multi-channel any time any place access to products & services	56%	44%	**78%**	22%		X		X
5	Emerging price war (market focused on price) / Shrinking margins	56%	**78%**	44%	33%	X		X	
6	Escalating IT costs of systems maintenance & support	22%	**89%**	11%	33%		X		X
7	Increasing introduction of new substitute products or services	**89%**	67%	67%	56%	X			
8	Need for more (online) distribution channels	33%	**89%**	44%	44%			X	X
9	New regulation on European level	22%	**89%**	0%	33%		X		
10	Dropping levels of sales from new products and services	**67%**	**67%**	22%	56%	X		X	
11	Migration from ERP legacy-oriented architecture to SOA	33%	**78%**	0%	33%		X		
12	New regulation on national level	33%	**89%**	11%	44%		X		
13	Need to decrease delivery time	67%	**89%**	22%	22%		X	X	
14	Need for lower priced products and or services	56%	**89%**	11%	78%	X			X
15	Shortening of product lifecycle	**78%**	**78%**	22%	44%	X			
		46%	78%	27%	42%				

(Figure 24: An overview of the responses on required agility types for various agility gaps in percentages. The results of the agility type classification on the left (the answer of the respondents) and on the right (the hypothesis stated in paragraph 3.7). Green indicates the opinion of the respondent group, orange indicates where the initial hypothesis deviates form the opinion of the respondent group. The total population was nin respondents (N = 9))

10.3 Conclusion on types of agility

Based on these results the following conclusions can be drawn on agility types; Process agility is regarded as the most required agility type for addressing the agility gaps.

Below some more details.

- **"Process Agility"** is regarded as the most important requirement for addressing most of the top 15 agility gaps for the financial sector (13 out of 15). This is confirmed by the sum of the percentages of all agility gaps, 78%.
- **"Network Agility"** is regarded as the second most important requirement for addressing most of the top 15 agility gaps for the financial sector. This is based on the combination of being regarded 2 times as the most important, and 9 times as second most important enabler. However, the sum of the percentages of the agility gaps for network agility provide a slightly different perspective; 46%. This is lower than the sum for Product agility

- **"Product Agility"** is ranked as the third most important enabler of agility gaps with 3 times being mentioned as number one and 3 times as the second most important. However, according to the sum of the percentages process agility scores 'better' than network agility.
- **"Market Agility"** is ranked as being the least required enabler for the top 15 of agility gaps. It is ranked once (1) as the most important enabler and thrice as the second most important enabler. This is also confirmed by the sum of the percentages for market agility, this is the lowest of the four; 27%.

11. Practical Cases

This chapter applies the conceived method of research on two practical cases. Each case will be described in general, as well as more specific on goals and reasons for implementing a SO/SOA. This is followed by the application of

11.1 Selection of cases from practice

Half a dozen potential cases were approached directly or indirectly. Whenever possible, introductions from within Cordys or from interviewed consultants were used.

Approach of cases

Through contacts related to the cases contact with other experts like information and enterprise architects, business and project managers was sought. Targeted respondents were asked to fill in the digital questionnaire. For this they received an instructional e-mail and, if required, repeated requests for filling in. Cordys made rewards available in the form of a book, if people filled in the questionnaire.

Selection of cases

It was aimed for to have more than 80% response from the targeted respondents. So far this has only been achieved for "de Amersfoortse". Other potential cases did not yield enough response or did not want to cooperate at all.

11.2 "de Amersfoortse" case description

This paragraph provides background information on the case of "de Amersfoortse" in general as well as more specifically related to the SO/SOA implementation. This project is baptized "Jiskefet" within "de Amersfoortse".

"De Amersfoortse" General

The Amersfoortse is a subsidiary of Fortis, which is an international provider of banking and insurance services to private, business and institutional customers. Fortis ranks among Europe's top 20 financial institutions, with a market capitalization of EUR 43 billion, a presence in over 50 countries and a workforce of 60,000. About a quarter of the company works on insurances[218].

The Amersfoortse is officially since 2001 part of the Fortis Insurance group, other brands are Ardanta, Eurobeesche, Falcon Leven and Fortis ASR. The latter consists since 2005 of AMEV, Stad Rotterdam and Woudsend. Together these insurance companies have on average 10% of the Dutch market, ranking third. The Amersfoortse focuses on pensions and income insurances (covering public health and disability insurances)[219].

[218] *This description is adapted form the corporate website of Fortis, see* http://www.fortis.com/general/brief.asp
[219] *Adapted from the website of "De Amersfoortse", see* https://www.amersfoortse.nl/

Goals of SO/SOA introduction at Amersfoortse

De Amersfoortse aims at completely renewing their information systems environment. Where the adaptation of SOA is regarded as the most important basis to reach the desired goals of being able to really measure and manage business processes and implement a supporting systems environment that is able to keep up with the pace of change of the business[220].

Within the Amersfoortse the business unit Individual Disability Insurances group (AOD) focused at Small to Medium sized Enterprises (SME)[221] provides specific insurance services for private persons. This process exists of: the applying (called a "claim"), consideration and payment sub processes. Based on a "claim" a number of consecutive actions have to be undertaken to assess the claim and finish it off, the latter can imply payment, advice or rejection. In the course of this process three disciplines are involved; the medical examiner, the work circumstances specialist and the insurance specialist.

No effective digital process did exist to support this service, data was written and stored literally on paper cards. Legislation required a clear division of insurance and medical related data. This was obtained by using different drawers, but was physically not secured. Therefore Cordys was asked to built a solution.

Cordys started in February 2006 with the automation of this process, as part of the Jiskefet project. Amersfoortse provided the functional design by themselves, and involved Cordys for the building of a solution. Cordys is currently only involved in the claim part of the process.

Reasons for choosing SO/SOA

"De Amersfoorte" choose for a SO/SOA based solution in the Jiskefet project for several reasons[222];

- **Replacing existing legacy;** the existing legacy within "de Amersfoortse" is nearing the end of it's lifecycle and has to be replaced in due time. However, a gradual replacing approach was preferred over a big bang approach. Encapsulating legacy in services offered the possibility for replacement at a later moment.
- **Integration of old and new technology;** While legacy is slowly being phased out and replaced for new technology, integration between existing and new technology is required for creating the processes required for project Jiskefet.
- **Need for loose coupling;** "De Amersfoortse" wants to counter the integration spaghetti and enable loose coupling between applications. Using services in a SO/SOA solution helps untangling the integration spaghetti and facilitates a loose coupling between services/applications.
- **Alignment with (open) market standards;** Standards like BPMN and BPEL are watched closely by "De Amersfoortse", as

[220] *According to the answer at the survey of an IS architect at the Amersfoortse.*
[221] *In Dutch "Arbeids Ongeschiktheids Dienst" (AOD), translated as disability (insurance) group*
[222] *The reasons for choosing SO/SOA at "De Amersfoortse" were discussed in an interview with Lex van de Geest, chief process manager and architect at "De Amersfoortse"..*

well as other standardization efforts at the OASIS group and the Object Modeling Group (OMG). A SO/SOA based solution should make it easier to adopt new and acapt existing standards.

- **Enable Business Agility;** Within "De Amersfoortse" several important domains exist which rely heavily on a short time to market. SO/SOA provides basic fundamentals for enabling agility on time to market aspects like easy composition, reuse and process modeling.

Organizational aspects from introducing SO/SOA

Because "de Amersfoortse" is a part of Fortis, it does not do it's IT on its own. The IT functionis centralized at the Fortis mother company. The technical/functional administrators are already trained in the use of Cordys.

A parallel development is that Fortis will start using Cordys companywide too. Fortis has therefore build a Competence Center and supply the services of this SSC to it's subsidiaries using Cordys.

In the project of Jiskefet a lot of best practices and standards are tested and generated, because within Fortis the Jiskefet project has made most progress so far. This showed in the answers of respondents; most indicated that the process of governance, setting standards and best practices was carried out in a project context. But this is being transferred to the Fortis Competence Center.

11.3 "De Amersfoortse" SOA Maturity Model Results

The results of the SOA maturity model were taken from an internal assessment at Fortis ASR/"De Amersfoortse". This assessment was supervised by the consulting company Sogeti.

Time of SOA Maturity Assessment

The results describe the starting situation of "De Amersfoortse" in early 2007. Based on the outcomes of this maturity model follow on actions were planned. The overview on the next page is taken from the report of this assessment[77].

Conclusion on SOA Maturity Models

According to this assessment "de Amersfoortse" is from a SOA maturity perspective still not mature. The capacity of 'budgeting and planning' and the skills of IT people are far ahead, compared to the other Key areas.

For the other areas the organization is still in it's 'infancy'. Especially regarding areas like "use of architecture", "roles and responsibilities" and "skills".

[77] *See the SOA workshop document [Fortis ASR]*

Building Block	Nr	Key Area	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Process	1	Commitment and motivation		A				B				C				
	2	Relationships with projects				A			B		C				D	
	3	Roles and responsibility					A			B			C			
	4	Development of architecture			A				B			C				
	5	Use of architecture				A				B			C			
	6	Architectural tools					A				B			C		
	7	Quality Management						A				B		C		D
	8	Service portfolio management					A			B			C			D
	9	Vision of architecture		A		B		C							D	
	10	Alignment Information Systems with business			A			B			C			D		
	11	Budgeting and planning				A			B			C			D	
Technology	12	Technology and standards		A				B					C		D	
	13	Componentization and Reuse			A				B					C		D
	14	Business processes implementation in Information systems				A					B			C		D
	15	Information systems flexibility			A		B						C			D
	16	Information Security		A			B			C			D			
People	17	SOA skills IT			A				B			C				
	18	SOA skills Business			A				B			C				
	19	SOA mindset & knowledge IT People		A				B			C					
	20	SOA mindset & knowledge Business People		A				B			C					

(Figure 25: The results of the SOA Maturity Model of Sogeti for "de Amersfoortse". Green indicates the progress made by "de Amersfoortse" on key areas, red indicates immediate points of attention. These scores were taken from a workshop report)

11.4 "De Amersfoortse" – Applicable Agility Gaps

	Applicable ?			Range of effects			
	% Yes	% No	% Unknown	Process	Technology	People	
1. "Growing demand for financial transparency and accountability"	80	20		++	+/++	++	Applicability Ranking 1
2. "A trend towards outsourcing of IT related systems and processes"	20	80		++	+	++	2
3. "A trend towards outsourcing of IT personnel"	20	80		++	++	++	4
4. "Emerging price war (market focused on price) and shrinking margins"		100		Na	Na	Na	
5. "Need for multi channel any time any place access to products and services"	40	60		+/++	+/++	+/++	3
6. "Escalating IT costs of systems maintenance and support"	60	40		++	++	+	2
7. "Increasing introduction of new substitute products of services"		100		Na	Na	Na	
8. "Need for (more) online distribution channels"	20	80		++	++	+	4
9. "New regulation on European level"	20	80		++	++	+	4
10. "Dropping levels of sales from new products and services"		100		Na	Na	Na	
11. "Migration from ERP legacy oriented architecture to SOA"	40	60		0/++	++	+/++	3
12. "New regulation on national level"	60	40		++	++	++	2
13. "Need to decrease delivery time"	80	20		++	++	+/++	1
14. "Need for lower priced products and/or services"	40	60		+/++	+/++	0/+	3
15. "Shortening of product life cycle"	20	60	20	++	++	+	5

(Figure 26: The outcomes of the questionnaire at "de Amersfoortse" on applicability of agility gaps, and the SOA Maturity building blocks involved with each agility gap. For almost all applicable agility gaps respondents indicate all building blocks of SOA Maturity (clearly) help addressing the agility gap. The total number of respondents was 5 (N=5))

Applicable Agility Gaps

The results at the Amersfoortse indicate that the addressing agility gaps "decreasing delivery time" and "obtaining transparency and accountability" are among the top priorities. Following on this are "regulations at national level" and "escalating IT costs". "dropping levels of sales", "emerging price war" and "introduction of substitute products and services" are not applicable to the Amersfoortse case. These outcomes were confirmed by Jex van de Geest.

Effect of SOA Maturity Building Blocks on Agility Gaps

The questionnaire did not point at negative effects of SOA maturity classes, only some respondents indicated incidentally no significant effect.

All other effects of the SOA classes are estimated positive, also of people. Overall the respondents indicated that the effect of SOA on the applicable agility gaps was strong to very strong.

No direct relation between the key areas per building block of the SOA Maturity Model could be deducted. Limiting the amount of questions in the questionnaire is responsible for this.

Part V – Wrap up

"A conclusion is the place where you get tired of thinking"

Arthur Bloch

Research Rationale Part V

This part will contribute to the research by;

- Setting out a discussion
- Clarifying considerations
- Formulating answers to research questions
- (Re-)formulate (new) questions
- Arriving at conclusions
- Formulating recommendations

12. Discussion & Conclusion

This chapter discussion and conclusion will summarize the main considerations related to the answers of the research questions. For this the discussion on theory (chapter 6) and the outcomes of the cases will be taken into consideration, to arrive at conclusions. The conclusions will be marked bold in the discussion text, also the main points will be summed up too in a separate paragraph. This all will be finished off with a paragraph recommendations, based on the outcomes and experiences of this research

12.1 Research Questions

Before starting the discussion, let's recall the research question of this research again. The main research question was formulated as: *How can organizations achieve (business) agility, when using Service Orientation /Service Oriented Architecture?*

The focus was thereby placed on financial organizations. This was specified further in the following research questions;

1. *What issues currently hinder (business) agility of large financial organizations?*
2. *What is Service Orientation (SO) and what is Service Oriented Architecture (SOA)?*
3. *Which agility gaps can be bridged if using SO/SOA in organizations?*
4. *What are the implications for an organization when using SO/SOA to address agility gaps?*

The discussion will start using the sub research questions of the research as a sub division. This will be followed by considerations on the main research question and the research tooling used.

12.2 Issues hindering (business) agility

Although the term agility is frequently used, it is often not well defined. Often the distinction between agility and flexibility is unclear and the terms are used together. Oosterhout et. al. regard agility as an above normal form of flexibility, this has been incorporated in a definition of agility[224]. **Basically agility comes down to flexibility requiring structural and strategic measures.** This is the definition used in the rest of the research.

Agility gaps

Researches of Oosterhout et. al. and Hillegersberg et. al. provide overviews of specific issues regarding agility. These issues are called agility gaps by them and regard change factors requiring agility, combined with the inability to address these needs within time. This resulted in lists of agility gaps for various industries, among others the

[224] *The definition formed in paragraph 3.2 is "Business agility is the ability to sense internal and external changes, as well as being able to swiftly adapting, in reaction to sensed changes, businesses and business processes beyond the normal (operational) level of flexibility, effectively using internal and external resources, to effectively manage unpredictable external and internal changes".*

financial industry.

The gap points to an inability to address these change factors in that specific industry. This provides a quick answer to the question which issues are hindering agility in the financial sector.

Alternative Agility Gaps

Reason for using the ranking with agility gaps in this research is that it helps defining the research scope. A finite list is easier to research than using a tool which measures agility issues.

However, **any individual organization will require such a tool to be able to measure their specific agility gaps.** One such tool is described by Overby but has not been used for this research because it would have made the research very complicated due to arriving at a list of .

12.3 Service Orientation versus SOA

The chapter on theory of Orientation and Service Oriented Architecture already pointed out that there is not really a distinct difference but that it are two sides of one medal.

Service Orientation

Service Orientation is not as well known as SOA, but often it is used to stress the more business/organizational aspects of SOA. SOA is then more about the underlying technology and architecture. One argument used is that the notion of SOA is loaded with far much more meaning than it has if one only takes the term "Service Oriented Architecture" in consideration.

In this perspective Service Orientation is a new and more encompassing paradigm. This implies thinking in services and supplying services to various customers in and outside of the organization. However, the obscurity and juvenile status of the notion of Service Orientation has some serious drawbacks.

Service Oriented Architecture

Interviews for this research showed that some people are aware of the inappropriate use of the term SOA, nevertheless they deliberately favour the usage of SOA because of it's established name. A concept like Service Orientation, in their opinion, only adds to more confusion.

This stance is more practical, although from a theoretical and grammar perspective not entirely correct. Confusing is that a number of topics are discussed as being specific to SOA, while these should be dealt with at a more general level, for example on governance. Dealing with this from a SOA point of view is far too limited, a broader perspective is required taking other IT, business and organization aspects into account too.

Service Orientation/Service Oriented Architecture (SO/SOA)

This research uses the notion SO/SOA, instead of making a choice for Service Orientation or Service Oriented Architecture is. Both perspectives have their merits, fact is that the notions are frequently used together or even intermingled.

Service Orientation seems more correct, but the notion ahs not been worked out in great detail. Service Oriented Arcitecture is indeed more practical because it is already quite well known, however many concepts and mearings go beyond the architectural origins of SOA. Governance and technologies.

Maybe within due time the distinction betweer Service Orientation and Service Oriented Architecture will become clearer. Until then, it is probably better to take them together.

12.4 Agility gaps to be bridged if using SO/SOA

Due to the limited number of cases for this research it is difficult to make solid statements on which agility gaps can be bridged if using SO/SOA. An answer is obtained in a two stage approach;

1. Are any agility gaps applicable to a case?
2. What relation is perceived between the agility gap and the building blocks of the SOA Maturity model?

Relation between gaps and SOA Maturity Model Building Blocks

Only if a respondent indicated that an agility gap was applicable, he could indicate the relation he perceived between the agility gaps and the SOA Maturity Building blocks.

The Credit Suisse case provided indications for a clear relation between the "technology" and "process" building blocks of the SOA Maturity Model. However, the case was very meager in it's descriptions of the human factor. Therefore no statements on the relation between the agility gaps and the SOA Maturity Model building blocks could be mace.

The results from the Amersfoortse did so too, although these results are more dispersed. Respondents filled different answers in, on which agility gaps were applicable to the case. **Striking is that on almost all agility gaps more than 95% of the responses indicate that the SOA Maturity Model building blocks (clearly) help addressing the gap.**

In case of Credit Suisse the effect of the building block People was difficult to assess due to the lack of documentation. In the case of "de Amersfoortse" only in a few instances no relation, between the agility gaps and the SOA Maturity Model building blocks, was perceived.

The results for the applicable agility gaps for each case are described below;

Applicable agility gaps for the Credit Suisse case

The Credit Suisse case in this research is based on two described cases from literature covering the effects of the implementation of SO/SOA. Therefore it is possible to conclude what agility gaps can be bridged, but excluding agility gaps is not possible. Agility gaps for which no information was available were marked as an open question in the details of this research on Credit Suisse.

The following agility gaps were found to be applicable to the Credit Suisse case, these gaps were (partly) addressed by the implementation of SO/SOA.

- "A trend towards outsourcing of IT related systems and processes"

- "A trend towards outsourcing of IT personnel"
- "Need for multi channel any time any place access to products and services"
- "Escalating IT costs of systems maintenance and support"
- "Need for (more) online distribution channels"
- "Need to decrease delivery time"

Applicable agility gaps for the "de Amersfoortse" case

The case of "de Amersfoortse" is less black and white due to the usage of a group of respondents. The responses were more dispersed; the respondents did not all agree on the applicable agility gaps. If the majority of responses (≥60%) is taken as an indication for applicability of agility gaps on a case, the following agility gaps were applicable (and addressed) in this case.

- "Growing demand for financial transparency and accountability"
- "Escalating IT costs of systems maintenance and support"
- "New regulation on national level"
- "Need to decrease delivery time"

Bridging agility gaps using SO/SOA

In summary, the cases of Credit Suisse and "de Amersfoortse" point to nine agility gaps for the financial sector, which are bridged with using SO/SOA as a (part of the) solution. Of these nine gaps the gaps "Escalating IT costs of systems maintenance and support" and "Need to decrease delivery time" were encountered and addressed by SO/SOA in both cases.

Alas, the limited amount of cases does not provide enough proof to make bold statements on which agility gaps can be bridged by SO/SOA and which ones not. **The findings so far do point at a relation between addressing agility gaps and the building blocks defined in the SOA Maturity Model.**

This outcome gives some solid ground to the claim that agility can be enabled by SO/SOA. However, addressing agility gaps will require more than only SO/SOA. One indication for this is the CIO survey 2007 research of Cap Gemini, which pointed to the human factor as being the most important enabler of agility.

12.5 Implications for an organization

Achieving agility in an organization is difficult, especially because agility is such a broad term which encompasses a range of topics. However, in this thesis a number of issues came forward (no order of importance below).

Measuring Agility in/of an organization

This research took a different approach in measuring agility; the agility gaps formulated by Oosterhout and Hillegersberg were accepted as the starting point for the research. Reason for this was to focus the results, instead of dealing with individual agility gaps per organization.

However, if an organization wants to improve it's agility it should not focus on 'average' agility gaps for the whole sector, but on agility gaps specifically applicable to the organization. This requires a process for measuring agility, see the next sub paragraph.

Regarding agility, a number of sources agree on the need of sensing and responding capabilities. To become truly agile a balance between these two has to be found. This can be perceived as a guideline for strategic decisions on priorities and investments. Investing too much on one type of capacity will not help an organization become more agile.

Process for measuring agility

To implement a process which assesses the needs and gaps on specific areas requires an iterative approach. Such an approach can start with any variation of the Deming's cycle[225], this research described a variation proposed by Gartner; Sense – Strategize – Decide – Communicate –Act.

Such a process can use a conceptual framework on agility as described by Overby. Combined with an iterative approach such a tool can help an organization assess which agility issues need to be addressed and in which order. One could also use the agility gap ratio formula defined in the Research of Oosterhout[226]. However, **both approaches rely on perceptions of respondents. Measuring agility like you measure temperature, or any other variable, is still not possible. When discussing agility this "subjective" aspect should be kept in mind when dealing with the outcomes.**

Service Orientation

Service Orientation has been encountered as a paradigm closely related to SOA. It has been argued that SO is more about the organizational aspects required for implementing SOA.

Another organizational concept, which can be implemented from a SO paradigm are Shared Service Centers. These can focus on specific services because of economics of scale or dedicated expertise. Such services can be delivered to other parts in and outside the organization.

Before an organization starts with the technical implementation of SOA related services, these are to be defined in the organization. Service Level Agreements are a logical step for defining the expectations and deliverables from suppliers and users. This is already a discipline of it's own and various models exist for this. Think for example, in the field of IT, of the ITIL framework and service management[227].

None of the concepts of SSC's and SLA's is required for implementing SOA, each of those can also exists without SOA. But both are a logical step in the evolution of an organization towards more agility and flexibility. Together with SOA, SSC's and SLA's might provide some pieces in the jig saw for agility in an organization.

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[225] *The Deming cycle is also known as Plan Do Check Act.*
[226] *See [Oosterhout, p137]*
[227] *ITIL is a best practice framework describing an integrated, process based framework for the management of ICT Infrastructure and Services*

Governance

The theory and interviews on governance indicated that there is no clear distinction between SO/SOA and IT governance. At least not in the way the governance can be organized. Both require similar roles, procedures and processes.

This is in line with the findings of the CIO survey of 2007 of Cap Gemini, here it is also stressed that good IT governance is required to obtain agility whether an organization is starting with SO/SOA or not. Good IT governance is the start of bringing flexibility in the IT systems instead of chaos.

In the CIO survey 2007 a centralized IT governance function was favored by 77% of the Cxx respondents. This matches with the practice encountered in the case of "de Amersfoortse", where Fortis is setting up a competence center focused on the SOA implementation. However, in practice this seems to be only happening after some experimenting with SOA; **first coordination efforts will be made bottom up. Later when an organization advances on the SO/SOA endeavour a more top down centralized approach can be taken at an enterprise level.**

"De Amersfoortse" case is an example of this, they first started with a bottom up project setting out some guidelines. Later this was overtaken by the Fortis mother company.

However, **a SO/SOA endeavor will stress the need for governance much more. Due to the more complicated technical infrastructure SO/SOA can imply other procedures and might require specific tooling.** An example from the Credit Suisse case, are the databases on service usage and service definitions.

For other organizations this research did not yield a complete an tested model. However, the findings of this research can be useful for defining an approach. At a high level an approach would look like:

- **Process;** Most important to realize is that each observation and resulting conclusion is made within a time frame. Over time the process of observation has to be repeated, preferably in an iterative approach measuring before and after a project. For this any variation on Deming's cycle can be used.
- **Agility (gaps);** an organization should find the specific issues which are hindering it's agility. For this Overby or Oosterhout and van Hillegersberg could be used. Important to realize is that this still is an exercise with a subjective component. Therefore objective metrics should be included where possible.
- **Maturity Model;** use one or more maturity models, this depends on the scope of the models and the disciplines involved in addressing the agility gaps. Ideally the results of the Maturity Models are combined with objective measures related to the agility gaps; turnover, failure rate, time required for implementation/change, etc. . From an SO/SOA perspective the Maturity Model of Sogeti/IBM can be used for this, for a more IT focused analysis the CMMI model might be more suitable.
- **Roadmap;** the outcomes of the analysis (with one or more maturity models) can result in a set of priorities to be addressed. Stating these priorities on a timeline, in order of addressing them, is a good reference for carrying out the required changes/implementations. However, such a roadmap

should not be cast in concrete; if a new analysis results in a different set of priorities, this should be incorporated in the roadmap.

Hierarchy in an agile organization

Regarding hierarchy, research from the military literature suggests that agile organizations in the current "networked" age should have a less stringent hierarchy. This does not imply no hierarchy, but it does imply more than only vertical "pipe lines". Also horizontal and diagonal "pipe lines" are required, to make various parts of an organization easily communicate and hook up. **Theoretically speaking SO/SOA offers the infrastructure for this. However, such an organization will require a different set of people, culture and kind of leadership too.** The latter is almost not encountered in the current discussion in literature on SO/SOA.

12.6 Achieving agility if using SO/SOA

So far the discussion dealt with the sub research. This paragraph will try to comprehend all of the previous considerations to come to an answer on what started this research; the main research question. This was formulated as: *How can organizations achieve (business) agility, when using Service Orientation /Service Oriented Architecture?*

Agility

Agility has always been an issue, being able to adapt to changes in the environment is not something that just comes of late. Maybe it becomes more of issue under the current circumstances; increasing competitive pressure and faster changing legislation due to increasing globalization and successive changes in the environment. At least it comes more in fashion. However, **the claim that agility would not be possible without SO/SOA seems too simple to me. SO/SOA can be an enabler, but it certainly is not going to "do the job alone".**

The stance of Cap Gemini seems an open door; **people are at the basis of agility. However it is an important open door. Adding to this is that organizations will require a level of skill and maturity in other areas, ranging from individual employees to processes and systems. This all will, in a certain constellation, contribute to the agility of an organization. SO/SOA can be a mean to set up the required IT infrastructure.**

This research also considered the notion of agility types, to see whether it is possible to make a more clear division on which type of agility can be enabled by SO/SOA.

From the four agility types defined (Product, Process, Market and Network) Process agility was regarded by most respondents as the most important enabler required for the list of agility gaps for the financial sector. However, based on the current data it is not possible to directly state that SO/SOA enables a specific type of agility. One could only conclude that SO/SOA should focus on enabling process agility to address most agility gaps for the financial sector.

Service Orientation/Service Oriented Architecture

The theory and interviews pointed to the fact that SO/SOA is not just brand new, but a collection of best practices which have evolved

during the prior decades. Because SO/SOA requires a certain maturity of an organization to be deployed efficiently, it can be a symptom of the readiness of an organization. Although this is a simplification.

SO/SOA can be an enabler of agility to larger organizations which are employing various (legacy) systems. The technical and architectural aspects of SO/SOA (for example thinking in (composite) services, use of a layered architecture, process driven approach) are contributing clearly to this agility. This showed in the answers of the respondents of "de Amersfoortse", who indicated that (among others) technical aspects clearly influenced the agility gaps. In this sense the research question can be answered positively.

Cultural and Organizational aspects

The cultural and organizational aspects are less clear. A number of topics this research encountered are:

- **Hierarchy:** The literature on (military) agile organizations state that more communication throughout an organization is required, according to this theory agile organizations have a less stringent hierarchy but more autonomous ad hoc (re-) grouping units.
- **Governance:** Governance is both within the SO/SOA context as the larger IT context a major issue. This requires a mature IT organization with clear procedures, roles, responsibilities and processes. When starting on a SO/SOA endeavor an organization should have it's governance even more in order. This requires an approach that offers sufficient guidance without ending in a new bureaucracy which stifles the agility and flexibility so longed for.
- **Size of an organization:** SO/SOA comes forward in organization where complicated IT environments exist. **Currently many of the larger organizations are starting with SO/SOA implementations. This could be perceived as an attempt to attain the agility of smaller organizations (with less complicated IT environments). These smaller organizations will probably not directly start with the technical implementation of SO/SOA, but will slowly introduce SO/SOA as part of other applications/functionality.**

12.7 Research tool

To provide an organization with a tool for measurement and comparison on SO/SOA offers organizations the possibility for well considered decisions. Given the complexity and magnitude of SO/SOA endeavors, a tool can be a real value adding instrument.

Early attempts

This research started with looking for a set of SO/SOA characteristics which could be used for measurement and comparison. At first SOA principles and viewpoints were used, however these were or too one sided (taking only technical/architectural aspects into account) or too high level and incomplete.

SO/SOA Maturity Models

Ultimately SO/SOA Maturity Models were encountered, in various set ups and degrees of detail. Often only the main outlines were sketched, but the actual usage of a Maturity Model remained vague.

For the research tool the SOA Maturity Model of Sogeti was used. Reason for this was the coverage of various aspects of SO/SOA (Processes, Technology and People) and the elaborate explanation on how to apply the Maturity Model. However, in practice some drawbacks of the Maturity Model of Sogeti were encountered too:

- It uses a different scaling compared to the well known CMM(I) models. This makes comparison difficult.
- The human aspect is recognized, but relatively simple; only taking 'skills' and 'mindset & knowledge' for business and IT people into account. Compared to the Agility Maturity Model encountered (see paragraph 7.3) there is more attention for the human factor. But still the human factor gets a quite meager position in the SOA Maturity Model of Sogeti. For example; taking Change Management and specific management skills into account.
- Although the technical and process areas are addressed in more detail, compared to the people aspect, one could think of extensions in these areas too. For example; has an organization already defined services? Has an organization already Shared Service Centers?

It has been remarked already a couple of times that **a Maturity Model in line with the CMMI model would be preferable.** The model described by Sonic does just that, however the work out of this model was not available. Therefore that Maturity Model could not be used for the questionnaire of this research.

The link between SOA and agility could only be observed between the main building blocks. Due to a lack of data and detail no specific conclusions could be drawn. Ideally one would have 2 or more cases without any limitations in data collection and time. Then a specific relation between the level of agility before and after a SOA implementation, and the progress on SOA maturity could be researched.

Overall one could state that the Maturity Models for SO/SOA itself are not mature yet, or not publicly available yet. In this context it is interesting to note an open standard effort for a Maturity Model in which among others Logica CMG is involved. **An open standard would be very preferable because this can result in a high quality model and contribute to the proliferation and usage of such a Maturity Model. Especially if this can be combined with prior models like CMMI.**

Other consideration regarding a research tool

One could even wonder whether SO/SOA really requires a separate maturity model. Once an organization takes on with SO/SOA it already has a certain amount of maturity regarding processes and IT. Maybe should existing models be adapted to incorporate a 'level' at which SO/SOA could be a specific solution. The same applies for BPM.

This is then in line with the Agility Maturity Model described in paragraph 7.3. . The combination of SO/SOA and BPM could point to a certain level of maturity in CMMI (like) models. Therefore

developments could also focus on developing a new "service" of questions regarding SO/SOA and BPM. The advantage of this is that the name, reputation and experience of the CMMI can be reused.

12.8 Recommendations for further research

A research has to be well defined to be able to arrive at an answer. However in the process of research one encounters many issues which are worth a new research in it's own. In this paragraph some leads are provided.

Standard repetitions

Repeating this research with more cases, abroad or in different sectors can lead to more solid conclusions and deductions. This can continue using the current tooling, or with improved versions of questionnaires.

Governance

The governance of SO/SOA solutions is a new aspect to an already longer existing discipline. Descriptive research at a number of pioneering organizations can result in more insight in required practices for SO/SOA.

The specifics of SO/SOA governance should be better integrated in the existing practices of IT governance, instead of dealing with SO/SOA as a largely independent discipline. Only this can result in a good application of SO/SOA in the long run.

BPM and SO/SOA

In this research the relation between SO/SOA and BPM has been considered only superficially. However, in practice BPM and SO/SOA are more and more coupled with SO/SOA as the supporting infrastructure and BPM on top as a process management suite. Some of the concepts currently mentioned under SO/SOA might have a strong correlation with BPM, more research is required to clarify this emerging field.

Researching this relation to provide a (theoretical) framework could provide interesting insights and help align the discussion on these topics.

Maturity Models

This research used the SOA Maturity Model of Sogeti, but pointed to a number of weaknesses in this model too. Some of this weaknesses are a lack of commonality with well known models like CMM(I) and a quite brief block on the human aspects in SO/SOA Maturity.

However, the concept of a maturity model offers advantages for comparison and analyses. Especially if combined with a classification and prioritization tool. Also mind the prior topic of integration of SO/SOA with BPM. Further development and integration into existing Maturity Models can result in more useful tooling for this area.

This might be an interesting topic of further research, in this light the standardization effort mentioned by Logica CMG might provide a good platform for this.

12.9 Recommendations for Cordys

The following recommendations are made for Cordys;

- **SO/SOA (knowledge) framework;** the concepts and aspects of SO/SOA are quite overwhelming to the uninitiated, also due to different opinions and terminology existing. Therefore an overriding framework which specifies the main outlines of various related concepts could be helpful for communication with partners and customers. This can also be useful for placing new concepts and knowledge into the Cordys perception.
- **Maturity Model;** team up with standardization efforts on Maturity Models and use these in the analysis phase of new projects.

12.10 Conclusion Summarized

In this chapter the main and sub research questions were discussed. In short one can conclude the following;

- Agility and flexibility are related concepts on dealing with changes. Agility is extreme flexibility, requiring structural and strategic measures of an organization. Flexibility is then regarded as the capability to deal with "normal" change using the existing capacity and means available.
- Agility is a form of flexibility and needs to be specified in concrete topics, this research used the list of agility gaps for the financial sector. However, any organization should research it's own obstacles for agility.
- There is not a clear distinction between Service Orientation and Service Oriented Architecture. The first is relatively new and not well known, while the second is better known but overloaded with interpretations. This part of literature has to be developed further, currently the technical aspects are dominating. Adding to this is that SO/SOA concepts are too often presented as a breed of their own, while they are more of a continuation of best practices and developments in the IT industry.
- Researching the impact of SO/SOA can best be done using a maturity model, because this can cover a range of topics and can deal with various levels of maturity. However, the current maturity models available are not mature itself, being incomplete, vague , lacking clear procedures or being overly simplistic on certain aspects. Integration/Alignment with "standard" maturity models like CMM(I) could contribute to a better usability and comparability of Maturity Models. This can also contribute to embedding SO/SOA in existing IT frameworks and practices. Also objective metrics could be included in the analysis.
- For the agility gaps deemed applicable to cases, advancements on the building blocks of the SOA Maturity Model used where found to be helpful for addressing the gap. This could be perceived as an indication that SO/SOA is one (of more) enabler of agility. However, the number of cases of this research is limited. Therefore more research is required to make more solid statements or this.
- For organizations in general, addressing agility requires an

iterative process of analysis (using (derivatives of) the Deming's cycle and maturity models). Wherever possible, the analysis should be complemented with objective measures. The set of priorities derived from the analysis can be laid down in a roadmap.

Main Research Question

Let us go back to where it started with, the main research question; *"How can organizations achieve (business) agility, when using Service Orientation /Service Oriented Architecture?"*

After all these pages of research, a simplified answer would be; *"Business Agility of an organization shows in symptoms specific for each organization. If IT is involved (technical and architectural) SOA can be a part of a solution to become more agile. However, other aspects like processes and culture in an organization need to be addressed too, these aspects could be part of what is called Service Orientation. An organization can also start with Service Oriented solutions to become more agile, without immediately clasping to technical solutions".*

Appendices

"Agility Through Service Orientation / Service Oriented Architecture"

Information regarding these appendices

These appendices are part of the research "Agility through Service Orientation/Service Oriented Architecture". This research is part of a thesis carried out for a master degree at the University of Twente. The assignment was carried out at the company Cordys.

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A1.2 Interviews

The interviews were recorded on .wav format, typed out and put in an Access database for analysis. Below you'll find an overview of the names of the .WAV files;

- Andries van Dijk.WAV
- Erik Kruidhof.WAV
- Martin van de Berg.WAV
- Sjoerd Talsma.WAV
- Jeroen van Dullemen.WAV
- Edwin van Dis.WAV
- Art Ligthart.WAV

The interview with Ronald Verschoor could not be recorded, this was worked out in a word-file and offered for review. This word-file is included on the CD.

A1.3 Quotes

Quotationspage.com, On questions:

http://www.quotationspage.com/search.php3?homesearch=questions&startsearch=Search

On research:

http://www.quotationspage.com/search.php3?homesearch=research&startsearch=Search

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Extremis.com, on conclusions
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A2. Agility and SO/SOA abbreviations

The rise of Service Orientation and Service Oriented Architecture comes with a number of associated concepts and constructs. Alas, these concepts and constructs are often abbreviated, resulting in a load of abbreviations used through each other. Let even not mention already existing abbreviations.

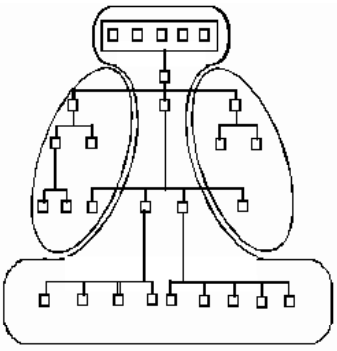
This appendix provides an overview of abbreviations used in the context of this thesis

- **BA :** Business Architecture
- **BDD:** Business Driven Development
- **BPM:** Business Process Management
- **BU:** Business Unit
- **CC:** Competence Center (See also ICC)
- **CEO:** Chief Executive Officer
- **CFO:** Chief Financial Officer
- **CIO:** Chief Information Officer
- **CMO:** Chief Managing Officer
- **CMM:** Capability Maturity Model
- **CMMI:** Capability Maturity Model Improved
- **CoE:** Center of Excellence
- **CTO:** Chief Technology Officer
- **CXO:** general abbreviation to denote Chief officers, like CEO, CIO, CFO, CMO, CTO, etc. . See also Cxx
- **Cxx:** general abbreviation to denote Chief officers, like CEO, CIO, CFO, CMO, CTO, etc. . See also CXO
- **DoD:** Department of Defense
- **EA:** Enterprise Architecture
- **EAI:** Enterprise Application Integration
- **ESB:** Enterprise Service Bus
- **HSB:** Human Service Bus
- **LOB:** Line of Business
- **ICC:** Integration Competence Center (See also CC)
- **IS:** Information Systems
- **ISV:** Independent Software Vendor
- **IT:** Information Technology
- **MoD:** Ministry of Defense
- **MM:** Maturity Model
- **MOM:** Message Oriented Middleware
- **SaaS:** Software-as-a-Service
- **SBN:** Smart Business Network
- **SBNI:** Smart Business Network initiative

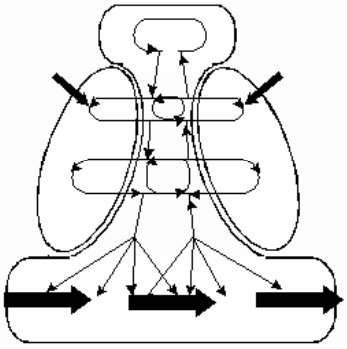
- **SLA:** Service Level Agreement
- **SOA:** Service Oriented Architecture
- **SOA-BPM:** Service Oriented Architecture - Business Process Management
- **SOAD:** Service Oriented Analysis and Design
- **SOAP:** Simple Object Access Protocol or Service Oriented Architecture Protocol
- **SOBA:** Service Oriented Business Applications
- **SOBP:** Service Oriented Business Processes
- **SOD:** Service Oriented Design
- **SODA:** Service Oriented Development of Applications
- **SOE:** Service Oriented Enterprise
- **SOEA:** Service Oriented Enterprise Architecture
- **SOI:** Service Oriented Infrastructure
- **SOMA:** Service Oriented Modelling and Architecture
- **SOO:** Service Oriented Organization
- **SOV7:** 7 Service Oriented Viewpoints
- **SO: Service Orientation**
- **SO/SOA:** Service Orientation / Service Oriented Architecture
- **SSC:** Shared Service Center
- **TOGAF:** The Open Group Architecture Framework
- **UT:** Universiteit Twente
- **XML:** eXtensible Markup Language

A3. Visions on Functioning of an Organization

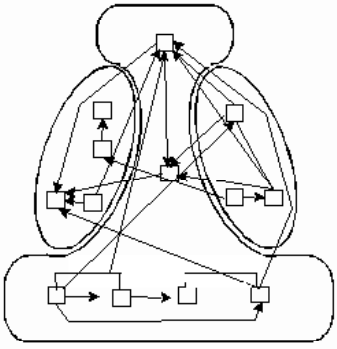
These depictions are described by Mintzberg and show five views on the functioning of an organization. These views are on the formal hierarchy (a), the flow of regulated activity (b), the flow of (informal) communication (c), the various constellations of work (d) and the flow of (adhoc) decision processes (e). According to Mintzberg the functioning of an organization is best described by all five visions together (not depicted below)[228]



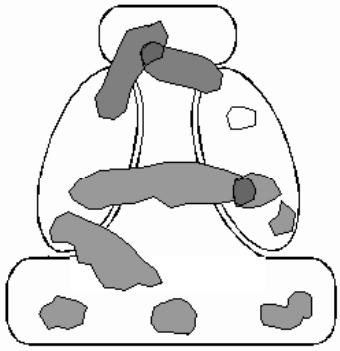
(a) Fluxo de autoridade formal



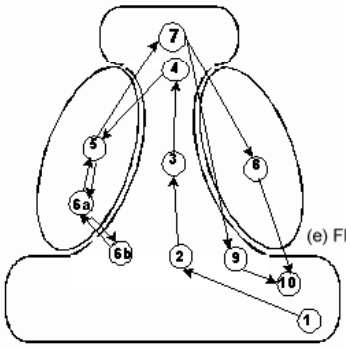
(b) Fluxo de atividades controladas



(c) Fluxo de comunicação informal



(d) Constelações de equipes de trabalho

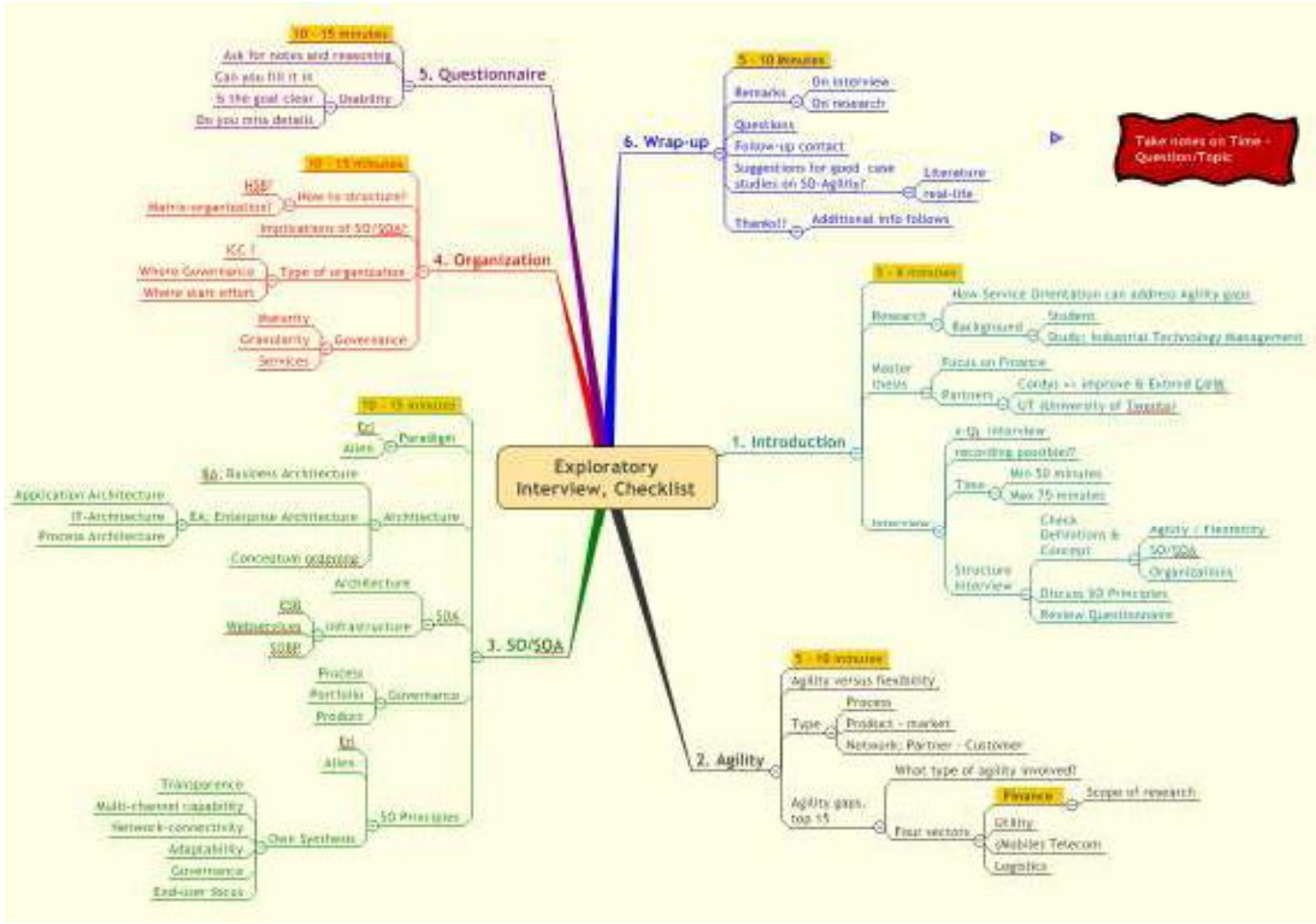


(e) Fluxograma de um processo decisório específico

[228] See Mintzberg [Mintzberg, p20-25], the figure is taken from the Brazilian website http://www.cps.ufsc.br/disserta08/seiffert/cap3.html.

A4. Checklist and Structure Explorative Interviews

This Mindmap was used during the explorative interviews as a checklist and a mean to structure the interview.



A5. Terms of Search and Analysis

This appendix contains two parts. The first part contains the search-terms used for the literature research, resulting in input for the theoretical model. The second part contains the terms used for analysis of the explorative interviews. This analysis was carried out with the access database interview streamliner, from the Erasmus University of Rotterdam.

A5.1 Search-terms Literature Research

The following terms were used as search terms for the literature research.

- SOA / Service oriented Architecture
- SO / Service Orientation
- SSC/Shared Service Centre
- SO / SOA + SSC
- SO / SOA + impact
- SO / SOA + organizational impact
- SO / SOA + literature review
- SO / SOA + organization types
- SO / SOA + consequences
- SO / SOA + IT Integration
- SO / SOA + CSF's
- SO / SOA + prerequisites
- SO / SOA + organizational prerecuisites
- SO / SOA + business and IT alignment
- SO / SOA + Granularity
- SO / SOA governance
- SO / SOA + case studies
- SO / SOA + implementation methodology
- SODA / Service Oriented Development of Applications
- SOBA / Service Oriented Business Applications
- IT and business alignment
- Organization types
- ERP + CSF's
- IT governance / Governance
- ICC/ Integration Competence Center
- Agile organizations / Agility

A5.2 Terms of Analysis for structuring interviews

The following terms (in alphabetical order) were used to label parts of interviews;

- Agility
- Agility Gaps
- Agility Types
- Architecture
- Business Architecture
- Business Process Management
- Competence Centers
- Enterprise Architecture
- Governance
- Granularity
- Interview Chatter
- Lead
- Master Data Management
- Maturity Model
- Organizations
- Questionnaire Remarks
- Roadmap
- Service Orientation
- Service Oriented Architecture
- Service Oriented Enterprise
- SOA Principles
- Sourcing

A6. Questionnaire

This appendix is about the questionnaire set up as a research-tool for the thesis "Agility through SO/SOA". It consists of two paragraphs, the first one detailing the actual questionnaire constructed. The second part contains some dummy outcomes, expected of the questionnaire.

A6.1 Intermediate Questionnaire Set-up

The SOV7 defined by Allen are chosen as a starting point for setting up a commonly applicable list of viewpoints on SO/SOA. This paragraph details the reasoning followed

NOTE; this reasoning regards the intermediate questionnaire. This is not the final questionnaire used and the line of reasoning is later rejected. Initially this research sided more to the stance of Service Orientation, although this stance was left later on.

Optimization

Allen used the principle of optimization, and stated this concerned "offering services in real-time and at high performance levels". This is rather obvious, and does not take into account that a service's performance should relate to the type of service (commodity or value add). For this thesis it is proposed performance needs to be adapted to circumstances and type of service, therefore it is incorporated in the principle of adaptation.

End-user focus

Customer-fit is deceiving because it seems to deal only with external customers. SO/SOA is broader than only focusing on external customers, internal customers are explicitly also addressed bys SO/SOA. Although Allen's wording does not exclude internal customers, for this thesis it is assumed to be clearer to speak about end-user focus.

Network-connectivity

Allen defined a principle "Partner connectivity". Again this makes a one-sided impression, are only partners implied? No customers? What is the difference between a partner and a customer? It is supposed here that it is the ability to exchange services across the network of (a) value chain(s). This can be up and down the value chain, or even to a different value-chain. Therefore this principle is reworded to focus on the complete network.

Governance

One stop experience as defined by Allen is a rather vague principle. It does only cover the customer's experience, and does not bother about the implications for the underlying services. The (composition of) underlying services need to be managed, ranging from selecting the appropriate services at the right SOA layer to choosing the appropriate channel. This all also requires choosing the right infrastructure and performance levels. Adding to the complexity is what is charged for these composed services? This all relates to how to manage those services, this is commonly labeled "Governance". Therefore this is

introduced as a new principle instead of one step experience.

Viewpoints of SO/SOA

This results in the following list of viewpoints of SO/SOA;

End-user focus;	• The experience of the end user (business/customer) of a (composite) service should be leading.
Adaptability;	• Extent to which services and processes can be adapted to changing circumstances due to requirements. The source of these requirements can be internal or coming from the environment. • Use of exchangeable external (commodity) services, to focus on high-performance core services/processes.
Transparence;	• Insight in (sub parts of) internal and external processes regarding performances. • Includes also consistency of information across various processes.
Network-connectivity;	• Abilities to link services or (parts of) processes seamlessly with those of partners and customers. • Ability to incorporate commodity services of partners, or offer services to other members of the network.
Governance;	• The presence of a (focused) coordinating organizational unit, with procedures for the analysis, selection and creation of an appropriate portfolio of services. • A process focused at maximizing the (economic) benefits of a SOA/SO program. • Products; a portfolio set of services available for use, at the appropriate granularity levels. Including mechanisms to measure performance.
Multi-channel capability;	• Services can be offered through various channels, and towards different parties.

A6.2 Intermediate Questionnaire

Aa

First page – Table of Contents

Date Interview;	
Location Interview;	
Interviewee;	
Interviewer;	
Relevant MP3-files;	•

When completed, please return this form in the attached envelop to;

Cordys,
t.a.v. Hajo van Ravenswaay Claasen
Postbus 118,
3880 AC
PUTTEN

Contents of this Questionaire

- Introduction ____ 2

Questions Part I

- Check-box on applicable Agility gaps; ____ 4

Questions Part II & III

- Agility gap 1; "Growing demand for financial transparancy and accountability" ____ 5
- Agility gap 2; "A trend towards outsourcing of IT personnel" ____ 6
- Agility gap 3; "A trend towards outsourcing of IT related systems and processes" ____ 7
- Agility gap 4; "Need for multi-channel anytime any place access to products and services" ____ 8
- Agility gap 5; "Emerging price war (market focussed on price) and shrinking margins" ____ 9
- Agility gap 6; "Escalating IT costs of system Maintenance & Support" ____ 10
- Agility gap 7; "Increasing introduction of new substitute products or services" ____ 11
- Agility gap 8; "Need for (more) online distribution channels" ____ 12
- Agility gap 9; "New regulation on european level" ____ 13
- Agility gap 10; "dropping levels of sales from new products and services" ____ 14
- Agility gap 11; "Migration from ERP legacy oriented architecture to Service Oriented Architecture" ____ 15
- Agility gap 12; "New regulation on national level" ____ 16
- Agility gap 13; "Need to decrease delivery time" ____ 17
- Agility gap 14; "Need for lower priced products and or services" ____ 18
- Agility gap 15; "Shortening of product lifecycle" ____ 19

Questions Part IV

- Requirements per Service Orientation Principle ____ 20

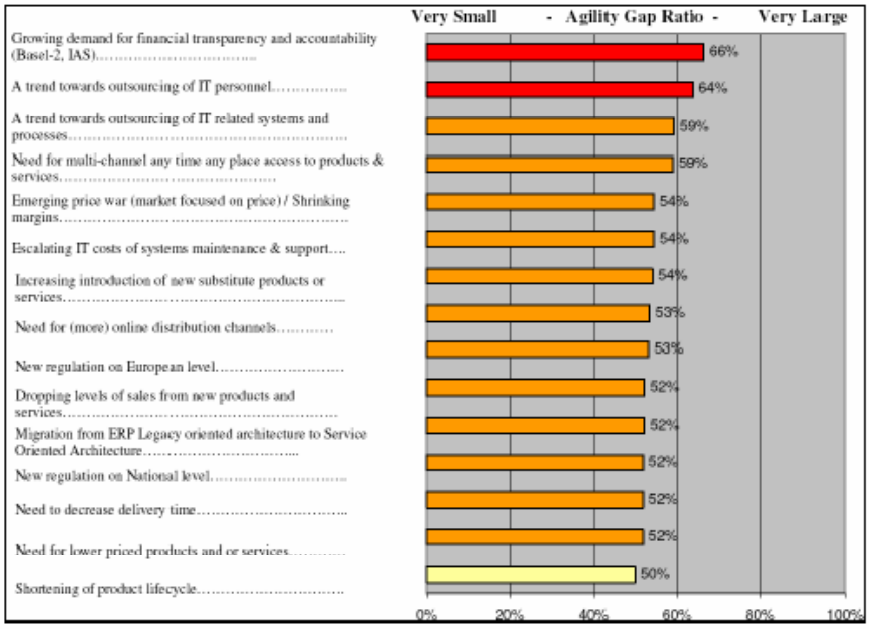
Introduction

This document is a questionnaire for exploratory interviews and case studies, as part of a research into how Service Orientation affects Agility-gaps in the financial sector. This questionnaire consists of 3 – 4 elements (3 in case of an explorative interview, 4 in case of an interview as part of a case study).

On this and the next page an explanation is provided which research steps are taken in this questionnaire, on p5-19 agility gaps are taken under consideration.

Context and scope of the Research;
The financial sector is one which is undergoing many fundamental changes, ranging from legislation, to market approach and types, sizes and location of markets. In popular business terms this has often been labeled agility, or more specifically the lack of agility.
This has implications for how financial organizations should organize themselves, their processes and their structure. Service Orientation has emerged as a possible solution to utilize existing and new IT in this new environment. In this sense the claim is often stated that Service Orientation of SOA, enables agility. But how does it address the issues labeled as agility exactly? That is what this research tries to address.

1) Top 15 Agility gaps for the financial sector; Comes from a research of Oosterhout et al, see list below.



If applying this questionnaire to (theoretical) cases the first page will contain a checkbox on which agility-gaps are applicable to the specific case. Per Agility gap, on a separate sheet, see page 5 (not applicable to explorative interviews!!)

2) Identification of type of agility involved; through checkboxes, types of agility results from an article in CIO-magazine. Please indicate what type of agility is involved by this agility gap (multiple answers possible)

- **Network agility;** the ability to quickly set up and (re-)organize connections with partners and customers.
- **Process agility;** the ability to adapt the (internal) process quickly to address rising challenges
- **Product agility;** the ability to quickly produce and (re-)design products, suited for changing demands in a marketplace.
- **Market agility;** the ability to rapidly enter a market with a specific product and/or switch between markets.

3) Service Orientation Principles; Extent to which principles affect an agility gap is measured through a 5-point Likert-scale Own principles, partly based on Allen. These definitions will be used to assess the agility gaps.;

- **End-user focus;**
  - The experience of the end-user (business/customer) of a (composite) service should be leading.
- **Adaptability;**
  - Extent to which services and processes can be adapted to changing circumstances due to requirements. The source of these requirements can be internal or coming from the environment.
  - Use of exchangeable external (commodity) services, to focus on high-performance core services/processes.
- **Transparence;**
  - Insight in (sub-parts of) internal and external processes regarding performances.
  - Includes also consistency of information across various processes.
- **Network-connectivity;**
  - abilities to link services or (parts of) processes seamlessly with those of partners and customers
- **Governance;**
  - The presence of a (focused) coordinating organizational unit, with procedures for the analysis, selection and creation of an appropriate portfolio of services.
  - A process focused at maximizing the (economic) benefits of a SOA/SO program.
  - Products; a portfolio set of services available for use, at the appropriate granularity levels. Including mechanisms to measure performance.
- **Multi-channel capability;**
  - Services can be offered through various channels, and towards different parties.

Ideally the high-level principles defined above are detailed into specific requirements per principle. Interviewees are asked to expand on (potential) requirements they identify under the topic "comments". (Theoretical) cases will be analyzed for their specific requirements applicable to high-level principles too.

If there are any questions, feel free to contact;
Hajo van Ravenswaay Claasen at hvravenswaaijclaasen@cordys.com

Checkbox on Agility-gaps

Check-box on applicable Agility gaps;

This is only applicable in case this questionnaire is provided as part of a case study at your organization. This means your organization is the topic of this questionnaire. If this is not the case, you are asked for your opinion on how each Service Orientation principle might address an agility gap. Then please skip this page.

If you used Service Orientation / SOA to address a specific business issue (stated here as agility gaps), please check the agility gaps applicable to your case. Notice that multiple answers are possible.

- ☐ Agility gap 1; "Growing demand for financial transparency and accountability"
- ☐ Agility gap 2; "A trend towards outsourcing of IT personnel"
- ☐ Agility gap 3; "A trend towards outsourcing of IT related systems and processes"
- ☐ Agility gap 4; "Need for multi-channel anytime any place access to products and services"
- ☐ Agility gap 5; "Emerging price war (market focused on price) and shrinking margins"
- ☐ Agility gap 6; "Escalating IT costs of system Maintenance & Support"
- ☐ Agility gap 7; "Increasing introduction of new substitute products or services"
- ☐ Agility gap 8; "Need for (more) online distribution channels"
- ☐ Agility gap 9; "New regulation on European level"
- ☐ Agility gap 10; "dropping levels of sales from new products and services"
- ☐ Agility gap 11; "Migration from ERP legacy oriented architecture to Service Oriented Architecture"
- ☐ Agility gap 12; "New regulation on national level"
- ☐ Agility gap 13; "Need to decrease delivery time"
- ☐ Agility gap 14; "Need for lower priced products and or services"
- ☐ Agility gap 15; "Shortening of product lifecycle"

If your specific case is not mentioned above, please state here what was the specific driver applicable to your project (multiple answers possible);

Matching SO-principles on Agility-gaps

Agility gap 1; "Growing demand for financial transparency and accountability"

Type of agility Network ☐ Process ☐ Product ☐ Market ☐

affects agility gap (almost) not	affects agility gap in some aspects	affects agility gap	affects agility gap on most aspects	affects agility gap on all aspects
1	2	3	4	5

A. End-user focus;
- The experience of the end-user (business/customer) of a (composite) service should be leading.

1	2	3	4	5

B. Adaptability;
- Extent to which services and processes can be adapted to changing circumstances due to requirements. The source of these requirements can be internal or coming from the environment.
- Use of exchangeable external (commodity) services, to focus on high-performance core services/processes.

1	2	3	4	5

C. Transparence;
- Insight in (sub-parts of) internal and external processes regarding performances.
- Includes also consistency of information across various processes.

1	2	3	4	5

D. Network-connectivity;
- abilities to link services or (parts of) processes seamlessly with those of partners and customers
- Ability to incorporate commodity services of partners, or offer services to other members of the network.

1	2	3	4	5

E. Governance;
- The presence of a (focused) coordinating organizational unit, with procedures for the analysis, selection and creation of an appropriate portfolio of services.
- A process focused at maximizing the (economic) benefits of a SOA/SO program.
- Products; a portfolio set of services available for use, at the appropriate granularity levels. Including mechanisms to measure performance.

1	2	3	4	5

F. Multi-channel capability:
- Services can be offered through various channels, and towards different parties.

1	2	3	4	5

Comments / Reasoning;

Additional requirements per principle

Requirements per Service Orientation Principle

The principles defined are high-level principles. Ideally these high-level principles are detailed into specific requirements per principle. If you come up with such requirements please state these below. If you come up with an alternative or additional high-level principle, please also state so below.

A. End-user focus; ▪ The experience of the end-user (business/customer) of a (composite) service should be leading.

B. Adaptability; ▪ Extent to which services and processes can be adapted to changing circumstances due to requirements. The source of these requirements can be internal or coming from the environment. ▪ Use of exchangeable external (commodity) services, to focus on high-performance core services/processes.

C. Transparence; ▪ Insight in (sub-parts of) internal and external processes regarding performances. ▪ Includes also consistency of information across various processes.

D. Network-connectivity; ▪ abilities to link services or (parts of) processes seamlessly with those of partners and customers. ▪ Ability to incorporate commodity services of partners, or offer services to other members of the network.

E. Governance; ▪ The presence of a (focused) coordinating organizational unit, with procedures for the analysis, selection and creation of an appropriate portfolio of services. ▪ A process focused at maximizing the (economic) benefits of a SOA/SO program. ▪ Products; a portfolio set of services available for use, at the appropriate granularity levels. Including mechanisms to measure performance.

F. Multi-channel capability; ▪ Services can be offered through various channels, and towards different parties.

--Thank you for your time and co-operation !! --

A6.3 Final Questionnaire Set-up

The questionnaire consists of five parts; an introduction, a matching of agility-gaps on agility-types, a scoping of agility-gaps, a SOA maturity model and a matching of agility gaps on main classes of the SOA maturity model

Introduction

The introduction will provide a short explanation on the build-up, scope, focus and application of the questionnaire. Also contact details in case of additional questions will be provided.

Agility-gaps versus types

The agility gaps will be matched through a multiple choice checkbox with the following agility-types; Process, Product, Network, Market and Compliance. Also the options 'can't know' and 'other, … .. (please fill in)' will be provided.

The agility-gaps are taken from the article of Hillegersberg, these agility gaps are the top 15 of agility gaps for the financial sector in the Netherlands[247].

Agility-gaps scoping

Because not all agility gaps will be applicable to a theoretical/practical case, a simple inclusion-option per agility-gap will be provided.

If an agility-gap is excluded (deemed not applicable) it will also not return in the final matching between agility-gaps and the main classes of the SOA Maturity Model

SO/SOA Maturity Model

The SOA Maturity Model used in this these is the one developed by Sogeti and IBM. It will be offered through an online website[248], but is included below.

A description of each aspect of the maturity model is copied from the book of Sogeti and IBM. The A, B, C and D's refer to the maturity levels of the model. The levels 0-13 refer to a sliding scale, A-D are locations on this scale detailed with a short description of the typical state if at that position of the scale of the maturity model[249].

Due to restrictions in width the main classes of this maturity model are not included. The main classes are processes, technology and people. Aspects 1 to 11 are about processes, 12 16 about technology and 17-20 about people.

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[247] For the article see 'Business Agility requirements in financial services; implications for IT Architectures' [Hillergersberg, p6]
[248] The website used is http://freeonlinesurveys.com/. Interviewees are provided with a log-in and a password. The website provides the research data in an excel-file.
[249] For a description of each aspect see the book "SOA for Profit", p142 146. For the description of the maturity classes and the sliding scale see p147-149 [Berg, p142-146, p147-149]

		0	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Commitment and Motivation		A				B				C				
2.	Relationships with Projects				A			B		C				D	
3.	Roles and Responsibility			A			B			C					
4.	Development of Architecture			A				B			C				
5.	Use of Architecture				A				B			C			
6.	Architectural Tools (Methodology and Software)					A				B			C		
7.	Quality Management						A				B		C		D
8.	Service Portfolio Management					A			B			C			D
9.	Vision of Architecture		A		B		C							D	
10.	Alignment IS with Business			A			B			C			D		
11.	Budgeting and Planning				A			B			C			D	
12.	Technology and Standards		A				B					C		D	
13.	Componentization and reuse			A				B					C		D
14.	Business Process Implementation in IS				A					B			C		D
15.	IS (Infrastructure and Applications) flexibility			A		B						C			D
16.	IS Security		A			B			C			D			
17.	SOA Skills IT			A				B			C				
18.	SOA Skills Business			A				B			C				
19.	SOA mindset and knowledge among IT people		A				B			C					
20.	SOA mindset and knowledge among Business People		A				B			C					

Agility-gaps versus SOA Maturity Model

For each of the 15 agility gaps it is asked whether it is applicable to the case of the respondent. If the answer is no, the question is repeated with the next agility gap.

If the answer is yes, the respondent is asked to indicate whether the effect of the SOA Maturity Model Building Blocks (Process, technology and people) is negative or positive. For this a 5-point Likert scale is used with 1 being a negative effect, 3 is neutral and 5 is a positive effect. Also is a respondent asked to provide a short example description of the agility gap. After this the questionnaire proceeds with the next question.

A7. Case Credit Suisse; reasoning

This appendix provides the reasoning that lay at the basis of filling in figure 22 of the research paper "agility through SO/SOA. The answers are discussed in separate sections, one for each aspect, 20 in total. The aspects are numbered (which corresponds with the row in the summarizing table) and the score is depicted between brackets.

A7.1 Commitment and motivation – (B)

The SOA-effort at Credit Suisse was decided on by the CIO, because the then existing infrastructure was not up to the task anymore. Through the years the support of the (complete) management has been decisive for Credit Suisse. Centralized (Architectural) coordination units were set up, which laid down sets of procedures, standards and processes. The role of the coordination units was backed by management to overcome resistance[232].

Because the SO/SOA approach is still being set up, and not integrated in the organization's processes, the maturity model score 5 (B) is given.

A7.2 Relationships with projects – (-)

Credit Suisse set up (multiple) architecture teams dedicated to creating a SOA infrastructure. These teams laid down standards and processes, but also served as an advisory board for projects and took service definitions in review[233].

From the description of the cases it is not clear to make up, but the communication seems to be one way (from architecture to projects) and seems still evolving. This results in a score of 2 (-).

A7.3 Roles and responsibility – (A)

At Credit Suisse the initiative for the architecture is clearly located in the IT department; here the central coordination units are set up. From the business side initiatives can be taken to formulate new services, supported by IT. Also a quality process with checks on proposed services is set up where the central coordination units are involved[234].

The IT department being clearly in charge of architecture results in Credit Suisse at least being ranked at level A. However, the case is meager on the collaboration between business and IT on their architectural process. Therefore a score of 5 is awarded.

A7.4 Development of architecture – (A)

The more a SOA architecture development process is integrated in the continuous process of an organization, the more mature it is regarded in this model. Credit Suisse has some coordination set up, but no prior

[232] *On the main driver and initiation of the SOA [Krafzig, p342-343], management support [Krafzig, p356] and strategic consideration [Allen, p302-303]*
[233] *On central architecture units and their role towards projects [Krafzig, p347]*
[234] *On the (central) architecture role located in IT [Krafzig, p346, Allen, p303] and on definition of services [Krafzig, p347-348].*

overall planning of the services landscape. The case of Krafzig states that SOA is a success [235], but does not expand on the specific cooperation between business and IT. Architecture is clearly beyond the project level, but it remains unclear or it is a transversal process with the business. Therefore a score of 3 (A) is filled in on the maturity model.

A7.5 Use of architecture – (A)

Architecture is used within Credit Suisse for specific goals, SOA is not the goal it itself. However no prior planning of a service landscape is made, services are chosen and selected in a bottom up process. Especially redundant functionalities in legacy applications across various domains are targeted. This helped rationalizing the technology landscape within Credit Suisse[236]

Architecture is clearly used beyond informatively usage and moving towards steering content. But the cases are not outspoken on architecture already being used to do so, it is not stated as the direction Credit Suisse is moving into. This is awarded a score of 5 (A).

A7.6 Architectural tools – (A)

Credit Suisse might have specific tools for architecture (like BPM) but this does not show from the cases. Dedicated databases for management of service definitions and applications are in place. This is coupled with a policy laid out by the (top) management and detailed by architecture teams. Education and training seems to be in place at Credit Suisse, but unclear is or this is also about company-wide architectural tools or only some SOA related databases[237]. Therefore a score of 6 (A) is awarded.

A7.7 Quality Management – (A)

Quality Management at (proposed) services is carried out in a series of checks by the architecture team. This is encapsulated in the service development process; the idea is ideas flow bottom-up, while quality assurance goes top down[238].

The quality process at Credit Suisse seems to move into the direction of an interactive assessment. However, from the case description the standardized indicators doe not stand clear. Therefore the score of 6 is awarded (A).

A7.8 Service portfolio management – (B)

The portfolio of services at Credit Suisse grows organically; according to the cases no prior planning of the service landscape is done. The need for services is facilitated bottom up in a process where service users and providers set up a coarse service definition. This definition is used for searching existing services for required functionality; the claim is that about 70-80% of required services is already existing.

[235] *On service landscape plannig [Krafzig, p348] and on the success of SOA [Krafzig, p355]*
[236] *On the various domain [Krafzig, p344] and the prior planning of the services landscape [Krafzig, p347-348, Allen p307]*
[237] *On the service development process and training [Krafzig, p347] and SOA related databses [Allen, p310-312]*
[238] *On Quality Checks on services [Krafzig, p347-348, Allen, p321-322]*

SLA's are used for defining needs from the perspective of an end-user[239]. At the cases no description is found on the funding of these services.

Services are clearly decoupled from the application delivering them, the services are managed using SLA's, which is a criterion for assigning a score of 7 (B)

A7.9 Vision of architecture – (A)

Credit Suisse uses Architecture teams for laying down guidelines and standards, which serve a short term goal. However, it is striking that no prior overall architecture of required services is made[240]. From a change management perspective this makes sense, but it is a reasons to assign a score of just 1 (A).

A7.10 Alignment IS with business – (B)

The initiation of SO/SOA is already underway for some time at Credit Suisse, the existing legacy has been rationalized into domains. The services stemming from these applications and their domains are administered, resulting in an overview of which applications and services serve which part of the business.[241]. However, the architectural process is not yet supporting the business in full; the starting point of Credit Suisse was to disentangle the "integration spaghetti". The shift of paradigm towards supporting the business seems to arise just now. Therefore the score of 5 (B) is filled in.

A7.11 Budgeting and planning – (-)

This topic is difficult to assess from the cases; in the case of Allen it is stated that yearly cost-benefit analyses are carried out. In this section it is stressed that long term benefits are preferred, even if this implies negative short-term cost-benefit ratios[242]. A score of 1 (-) has been assigned, also due to the lack of extensive information.

A7.12 Technology and standards – (A)

Technology and standards are (among others) chosen by the architecture teams, the cases especially describe processes and standards quite extensively. The technology is managed from a Technical Infrastructure Architecture (TIA) plan, this plan specifies the platforms, operating system (OS) and middleware software. The ITA was used to assess the technology required for new or changed applications[243].

The cases are not clear on IT is also proving its approach on processes and technology. Especially the standards are not discussed in detail. Therefore the score of 4 (A) is filled in.

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[239] *On the definition of services [Krafzig, p347-348], on service databases [Allen, p311-312], reuse of services [Krafzig, p356] and the use of SLA's [Allen, p318-319].*
[240] *On the position of Architecture within Credit Suisse [Krafzig, p346-348].*
[241] *On the impact on business and technology at Credit Suisse [Krafzig, p342-346]*
[242] *On the line of commoditization [Allen, p310-311]*
[243] *On processes, structures [Krafzi, p347-348, Allen p303, p321] and technology [Allen, p307-309].*

A7.13 Componentization and Reuse – (B)

The focus is on decoupling the implementation of physical systems and their interfaces. Credit Suisse uses repositories with services for reuse. Also architecture and databases are used to oversee which applications deliver what services and where these are used. However, this still only focusses on technical IT services. Business services are not clearly described in these cases[244]. Due to the lack of information on business services the score is set at 6 (B).

A7.14 Business processes implementation in IS – (A)

From the cases it does not become clear whether business processes are implemented as part of an information system. But it is explained how business-users can request for the development of new services. Also it is explained that application development has shortened due to reuse of existing services, and that business services are used across applications[245]. Indirect clues point to a flexible implementation of business processes in the existing information systems; however the direct leads are meager. Nevertheless the score of 6 (A) is awarded, because the impression of the case description is that Credit Suisse is already quite advanced on this issue.

A7.15 Information systems flexibility – (B)

Credit Suisse had to deal with existing legacy, which was set up as 'monolithic giants'. These silos doubled a lot of identical functionality, reducing this doubling was one of the first goals of Credit Suisse. Legacy was encapsulated and interfaces between applications were (re)structured, sometimes this resulted in the merging or splitting of applications. Reducing data redundancy and establishing a clear master data management process was a primary goal[246].

This description of the situation at Credit Suisse shows that actions were taken pro-actively. Integration across various infrastructures and applications has already been achieved. However, this integration does not seem to be organization-wide and completely focused on process-integration yet. Therefore a score of 4 (B) is awarded.

A7.16 Information Security – (A)

Security is not discussed in the cases on Credit Suisse, which is not rare given the confidential nature of this topic. Therefore this topic receives a score of just 1 (A). However, given the nature of a large financial institution, the actual score will be probably much higher.

A7.17 SOA skills IT – (B)

The cases of Credit Suisse show that SO/SOA skills are present among IT people in Credit Suisse. Especially the internal award-winning business school points to an present base of knowledge and skills. Given the origin of the SO/SOA effort IT-architects are at the front of

[244] *On application and service portfolios [Allen p311-312, Krafzig p348] and on the focus on decoupling [Allen p302]*
[245] *On application development [Krafzig p355-356] and the requesting process of (new) services [Krafzig p347-348].*
[246] *On legacy applications [Allen p315] and how to deal with these legacy [Allen p321]*

knowledge on SO/SOA within Credit Suisse[247]. This results in a score of 6 (B)

A7.18 SOA skills Business – (-)

The SO/SOA skills of the business of Credit Susse are not clearly described in this case. It is stated that the business can define a rough definition of a service required, but in which greater process this definition is created by the business is vague. The only clear notions are that business people also attend the internal business school[248]. Therefore a score of 1 (-) has been awarded, but this can easily change if more information is found.

A7.19 SOA mindset & knowledge IT People – (A)

See the description under 17. A lower score is awarded because the IT architects still seem to fulfill a pioneering role within the IT organization too[249]. A score of 3 (A) is awarded.

A7.20 SOA mindset & knowledge Business People – (A)

See the description under 18. A score of 1 ( ) is awarded.

[247] *On the internal business school and the role of IT architects [Allen, p323].*
[248] *On creating service definitions [Krafzig p347 348] and the internal business school [Allen p323]*
[249] *On the role of IT Architects [Allen, p303].*

A8. Agility gaps versus Agility Types

This appendix contains the results of the mapping of agility types on agility gaps by the respondents. The total response was of nine respondents, of which one was invalid. The results are given per respondent, the total number per agility type/gap and the percentage per agility type/gap.

	Edwin van Dis (DAS)				Marcel Donath (DAS)				Walter Roobeeks (DAS)				Jan Maessen (Aiverstoetse)				John Adegeest (Aiverstoetse)				Rene Heerberg (Aiverstoetse				Lex van de Geest (Aiverstoetse)				John Schut (Aiverstoetse)			
	Product Agility	Process Agility	Market Agility	Network Agility	Product Agility	Process Agility	Market Agility	Network Agility	Product Agility	Process Agility	Market Agility	Network Agility	Product Agility	Process Agility	Market Agility	Network Agility	Product Agility	Process Agility	Market Agility	Network Agility	Product Agility	Process Agility	Market Agility	Network Agility	Product Agility	Process Agility	Market Agility	Network Agility	Product Agility	Process Agility	Market Agility	Network Agility
1 Growing demand for financial transparency and accountability																																
2 A trend towards outsourcing of IT related systems and processes		1	1	1				1		1						1		1		1		1		1	1	1			1	1	1	1
3 A trend towards outsourcing of IT personnel	1	1	1	1			1	1		1						1		1		1	1	1		1	1	1			1	1	1	1
4 Emerging price war (market focused on price) and shrinking margins	1	1					1	1		1	1		1	1	1		1	1	1	1	1		1		1		1				1	
5 Need for multi-channel anytime anyplace access to products and services	1	1	1		1	1			1	1		1		1		1		1	1		1	1	1		1	1				1	1
6 Escalating IT costs of systems maintenance and support		1				1				1		1		1				1		1		1			1	1			1	1	1
7 Increasing introduction of new substitute products or services	1		1	1	1	1			1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1		1		1	
8 Need for (more) online distribution channels		1		1	1	1	1	1		1	1		1	1	1			1	1			1		1		1						1
9 New regulation on European level		1		1	1	1		1		1				1		1		1				1		1		1			1	1		
10 Dropping levels of sales from new products and services	1	1		1	1	1		1	1			1		1		1	1	1	1	1	1		1		1	1						
11 Migration from ERP legacy oriented architecture to SOA		1			1	1		1		1			1			1		1		1		1			1	1				1		
12 New regulation on national level		1		1		1		1		1	1			1			1	1	1			1		1	1	1			1	1		
13 Need to decrease delivery time	1	1			1	1	1			1	1			1			1	1			1	1	1	1	1	1			1	1		
14 Need for lower priced products and/or services	1	1		1		1	1	1	1	1	1			1		1		1		1	1	1		1	1	1			1	1		1
15 Shortening of product life cycle	1	1				1		1	1	1	1		1	1		1	1	1			1	1	1	1	1	1			1		1	

	Product Agility	Process Agility	Market Agility	Network Agility	Product Agility	Process Agility	Market Agility	Network Agility
1 Growing demand for financial transparency and accountability	3	8	1	4	33%	89%	11%	44%
2 A trend towards outsourcing of IT related systems and processes	2	6	2	6	22%	67%	22%	67%
3 A trend towards outsourcing of IT personnel	4	6	3	6	44%	67%	33%	67%
4 Emerging price war (market focused on price) and shrinking margins	5	4	7	2	56%	44%	78%	22%
5 Need for multi-channel anytime anyplace access to products and services	6	7	4	3	66%	78%	44%	33%
6 Escalating IT costs of systems maintenance and support	2	8	1	3	22%	89%	11%	33%
7 Increasing introduction of new substitute products or services	8	6	6	5	89%	67%	67%	56%
8 Need for (more) online distribution channels	3	8	4	4	33%	89%	44%	44%
9 New regulation on European level	2	8	0	3	22%	89%	0%	33%
10 Dropping levels of sales from new products and services	6	6	2	5	67%	67%	22%	56%
11 Migration from ERP legacy oriented architecture to SOA	3	7	0	3	33%	78%	0%	33%
12 New regulation on national level	3	8	1	4	33%	89%	11%	44%
13 Need to decrease delivery time	6	8	2	2	67%	89%	22%	22%
14 Need for lower priced products and/or services	6	8	1	7	66%	89%	11%	78%
15 Shortening of product life cycle	7	7	2	4	78%	78%	22%	44%