Master Thesis

Lean principles in Case Management
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1. Introduction

This chapter provides an introduction to the subject and the executed research.

This research is performed as part of the master thesis for the Radboud University Nijmegen and is combined with an internship at Cordys. The topic of this research is to find ways for improving the effectiveness and efficiency of business performances. To work in an effective and efficient way, business processes should create value and should only be performed when necessary.

One way of addressing the effectiveness and efficiency is the method called Lean. Lean is a proven method out of the manufacturing sector that eliminates waste and maximizes flow. The application of Lean in an office environment is called Lean Office. Another way of addressing the effectiveness and efficiency is by making business processes visible with the support of Business Process Management (BPM). The modern approach of BPM is used to design, enact, control and analyze of today's dynamic business processes. In situation where processes show characteristics of a case flow (see chapter 4), the application of BPM is defined as BPM Case Management.

This master thesis investigates in which way the successes of Lean Office and the modern solution of BPM Case Management can strengthen each other. The research question is:

How could BPM Case Management principles be applied to support knowledge workers in the Lean Office, and how can BPM Case Management solution be improved by leveraging Lean principles? [1]

To answer this research question, a basic framework will be constructed to make a good comparison between Lean Office and BPM Case Management. After investigating how Lean Office and BPM Case Management fit this model individually, the synergy between both of them will be researched. The added value of the synergy between Lean and BPM will be validated in order to answer the research question.

The next chapter starts by describing the problem statement in more detail (chapter 2). The significance of this research will be outlined in Chapter 3. Chapter 4 describes the research topic in his theoretical context. In which way the research results are achieved can be found in chapter 5. The basic framework (chapter 6) describes how Lean Office and BPM Case Management will be meeting each other. How Lean Office fits this model and what the philosophy and principles are, can be found in chapter 7. Chapter 8 has the same structure where the BPM Case Management will be placed into the basic framework. The outcome of chapter 7 and chapter 8 leads to the synergy clusters, that can be found in chapter 9. One of the synergetic clusters will be described in detail what can be find in chapter 10. Chapter 11 contain a case study where the answers will be found on the research question. This research ends with a conclusion that can be found in chapter 12.

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[1] Lean Office and BPM Case Management will be explained in chapter 4.

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2. Problem statement

This chapter describes the problem that forms the basis for this research.

Today's businesses are changing very fast and are under constant pressure. Enterprise competitiveness and cost pressures are creating the need to rapidly adapt and streamline business processes to generate new business value efficiency [Bloomberg, 2003].

Because of the current global financial crisis it is much more important to reduce costs. In order to support the fast-changing business climate, in combination with the cost reduction need, this research is about improving the effectiveness and efficiency of business performance. As already described in the introduction (chapter 1) this research is about combining the methods *Lean* and *Business Process Management (BPM)*. For Lean and BPM we use the following definitions:

Definition

Lean: A systematic approach to identifying and eliminating waste through continuous improvement by flowing the product (or service) at the demand of the customer. [Womack & Jones, 1996]

Definition

BPM: Supporting business processes using methods, techniques, and software to design, enact, control and analyze operational processes involving humans, organizations, applications, documents and other sources of information. [Aalst, 2004]

BPM improves business processes by making them visible and manageable. With today's increasing need for efficiency and cost reduction, there should be more attention being paid to process improvement. This is where Lean came in mind. Lean is a proven method, out of the manufacturing sector, that eliminates waste and maximizes flow. This research will learn from the best practices of Lean and investigates in which way it can be strengthen the offered BPM solution.

In more detail, this research is about the relationship between Lean Office and BPM Case Management. The subdivision Lean Office and BPM Case Management will be explained further in chapter 4: theoretical context. For now on, only the research question is provided. The research question is:

How could BPM Case Management principles be applied to support knowledge workers in the Lean Office, and how can BPM Case Management solution be improved by leveraging Lean principles?

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3. Relevance

These chapters express why this research is significant.

The global financial crisis of today has a long-term duration [Torbat, 2008]. Due to the financial crisis, less money is available because businesses and consumers are postponing investments. To make money, you have to save money.

When a company has the ability to optimize their business processes, money can be saved because the operational work will be more efficient, effective and agile [Rudden, 2007]. A proven production practice that meets these three successes is Lean manufacturing. Based on Lean manufacturing there has been lots of research, even outside the manufacturing sector (see chapter 4). This research will investigate in which way the successes of Lean can also be used to improve dynamic information processing companies.

Another way to optimize business processes is to make processes visible and manageable with the support of modern technology. BPM supports fast changes in business operations and reduces the time to market. BPM consists of a set of management activities for the design, modeling, execution, monitoring and optimization of business processes.

BPM pays more attention to the way business processes are supported, where Lean pays more attention to value creation and waste elimination. There has been numerous of research into BPM and Lean in particular. This research is about the business benefits provided by a combination of both of them.

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4. Theoretical context

This chapter explains the knowledge area of the research in more detail.

The Lean philosophy originated from the manufacturing world at the Toyota Motor company. As described in [Womack et al, 1990], Lean has been established according to the evolution of the manufacturing sector: craft production, mass production, Lean production. The philosophy of Lean is to make a business process 'Lean' by the elimination of waste and optimize flow.

Lean principles have become useful in other sectors as well. This research focuses on the service sector, in particular the *knowledge worker* at the *Lean Office*.

Definition

Knowledge worker: A person that creates value from a mental ability to think. [Niblick, 2007]

Definition

Lean Office: 'The administrative area working systematically to identify and eliminate all waste' [Tapping & Dunn, 2006] trough continuous improvement by flowing the service at the demand of the customer.

BPM is a set of methods, tools, and technologies used to design, enact, analyze, and control operational business processes. The basic operational value proposition of BPM is the ability to process more with less effort and higher quality [Rudden, 2007]. According to [De Man, 2009a] we can define two kinds of business processes: sequential workflow and *Case Management* [2].

Definition

BPM Case Management: The management of long-lived collaborative processes that coordinate knowledge, content, correspondence and resources to progress a case to achieve a particular goal; where the path of execution cannot be predetermined in advance of execution; where human judgment is required to determine how the end goal can be achieved; and where the state of a case can be altered by external out-of-band events. [White, 2009]

This research focuses on Case Management, but in some cases sequential workflow will be used as well, to obtain a better understanding of the relationship between BPM and Lean.

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[2] For more information, see chapter 7 Business Process Management.

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5. Methods

This chapter describes the method that is used to achieve the research results.

To allow scientific research to the combination of Lean and BPM a method is required. This chapter starts with the main research question (paragraph 5.1). Paragraph 5.2 describes how this question is divided into several sub questions. This chapter ends with paragraph 5.3 where the plan of approach will be explained.

5.1 Main research question

As mentioned in the problem statement, this research is about the relationship between the Lean philosophy and BPM. The main research question is formulated as:

How could Case Management principles be applied to support knowledge workers in the Lean Office, and how can BPM Case Management solution be improved by leveraging Lean principles?

5.2 Sub questions

To find a good answer, the main research question has been split into four sub questions. The sub questions are formulated as:

A. What is Lean and, in particular, what are the principles for the Lean Office?

B. What is BPM and, in particular, what are the principles for BPM Case Management?

C. How can knowledge workers in the Lean Office be supported by leveraging the synergy between Lean Office and BPM Case Management solution?

D. How can the Cordys BPM Case Management solution be improved by leveraging the synergy between Lean Office and BPM Case Management?

5.3 Plan of approach

Figure 1 gives a schematic view of the plan of approach with the sub questions included:
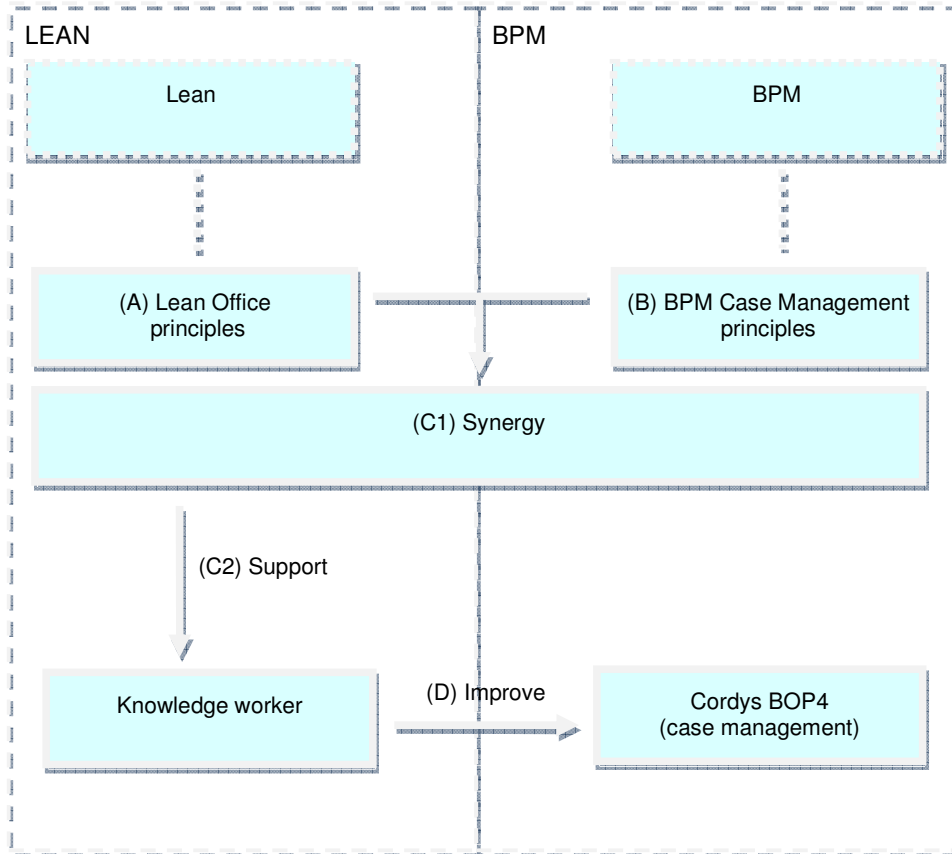
Figure 1: Schematic overview of the plan of approach

In the phases of the approach, the following actions will be taken:

A.   What is Lean and, in particular, what are the principles for the Lean Office?
Figure 1, (A) Lean Office principles.
Collection of data:
Data will be collected based on a literature study. A framework will be described in agreement with the principles for the Lean Office.
Reporting of data:
A good framework for the Lean Office will be adopted or constructed.

B. What is BPM and, in particular, what are the principles for Case Management? Figure 1, (B) BPM Case Management principles:
    <u>Collection of data</u>:
    Data will be collected based on a literature study. A framework will be described in agreement with the principles for BPM Case Management.
    <u>Reporting of data</u>:
    A good framework for BPM Case Management will be adopted or constructed.

C. How to support the knowledge workers in the Lean Office by leveraging the synergy between Lean Office and BPM Case Management solution? Figure 1, (C1) Synergy and (C2) Support.
    <u>Collection of data</u>:
    The synergy between the outcome of sub question (A) and (B) will be established and validated during a case study with the aid of the Cordys BPM Case Management solution.
    <u>Reporting of data</u>:
    After the best practices are set, the covered best practices will be described in detail.

D. How to improve the Cordys BPM Case Management solution by leveraging the synergy between Lean Office and BPM Case Management? Figure 1, (D) Improve.
    <u>Collection of data</u>:
    Improvements will be proposed for the best practices that are not covered by the Cordys BPM Case Management solution as found by the outcome of sub question (C2).
    <u>Reporting of data</u>:
    The improvements will be described in detail and related to the uncovered best practices of sub question (C2).

By identify the Lean Office (A) and BPM Case Management (B) principles, the synergy will become visible (C1). After investigating the synergy in detail a solution will be found in which way the knowledge worker can be supported (C2) and in which way BPM Case Management can be improved (D). The results of sub question (C2) and sub question (D) will lead to an answer to the research question.

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6. Basic framework

This chapter describes the basic framework that is used to bring Lean Office and BPM Case Management together.

Lean Office and BPM Case Management have their own origin. To make a good comparison in which way Lean Office and BMP Case Management strengthen each other, a basic framework is needed.

Paragraph 6.1 contains a first outline of the comparison. The steps toward the basic framework will be outlined in paragraph 6.2. The final framework, which has a more process focus, will be depicted in paragraph 6.3.

6.1 Key aspects

According to [Van Vliet, 2008] there are three key aspects to keep in mind during a software development project. Figure 2 shows these aspects as a first high level positioning in which way Lean and BPM complements each other. Lean is used to optimize where BPM is used to register and validate.
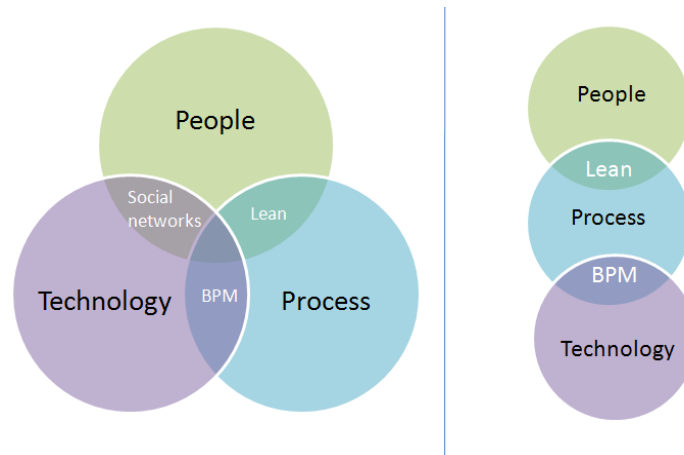
Figure 2: Key aspects of basic framework combined with Lean and BPM

As shown in figure 2, there is actually an overlap at the process aspect. Lean mainly revolves about the relation between people and process, while BPM is focused more on the relationship between process and technology. These relationships will be explained in more detail in chapter 6 Lean and chapter 7 BPM.

6.2 Steps towards the framework

Seligmann et al defined a framework (Figure 3) to compare different methodologies of system development methods [Seligmann et al., 1989]. This framework is used as a basis to compare Lean with BPM.
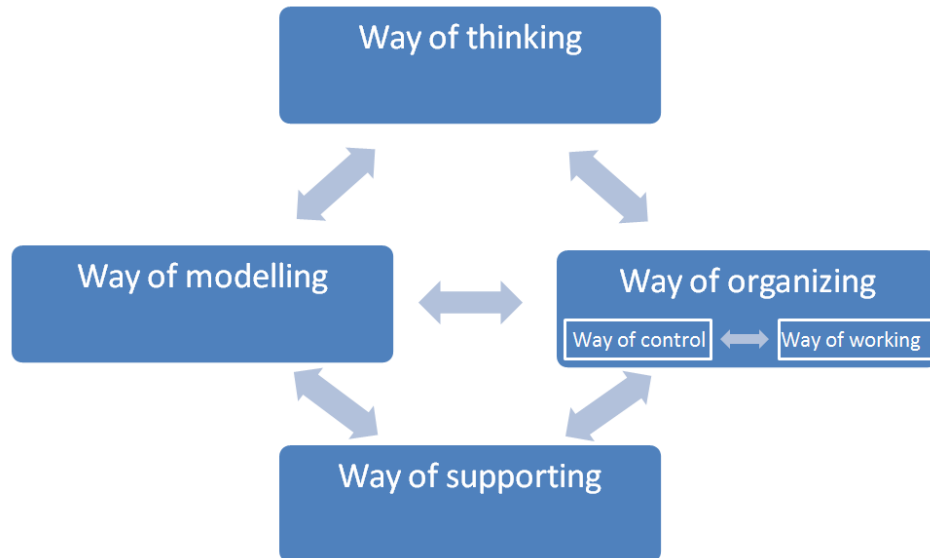
Figure 3: Framework of Seligmann

 The descriptions of the aspects, according to [Seligmann et al. 1989], are:

- Way of thinking: The description of the major visions of a methodology.

- Way of modelling: The description of models used during the development process.

- Way of Organizing: Offers the concept of life cycle, which consists of various tasks and steps. The way of organizing can be subdivided into:

  • Way of working: A description of how the work is structured.

  • Way of control: A description of the management of time, cost and quality of the information system development process and its products.

- Way of supporting: A description of the support for techniques able to represent the models in the way of modeling.

During the evolution, this framework is used in many other disciplines. For example to evaluate methods to design flexible business processes [Daoudi & Nurcan, 2005].

6.3 Extended Seligmann framework

The basic framework, depicted in figure 4, shows the extended Seligman framework. Trough the evolution, the 'way of controlling' and 'way of working' are leveled up. Into the origin Seligmann framework they were a part of 'way of organizing'. There is also a new aspect introduced, called: way of learning.
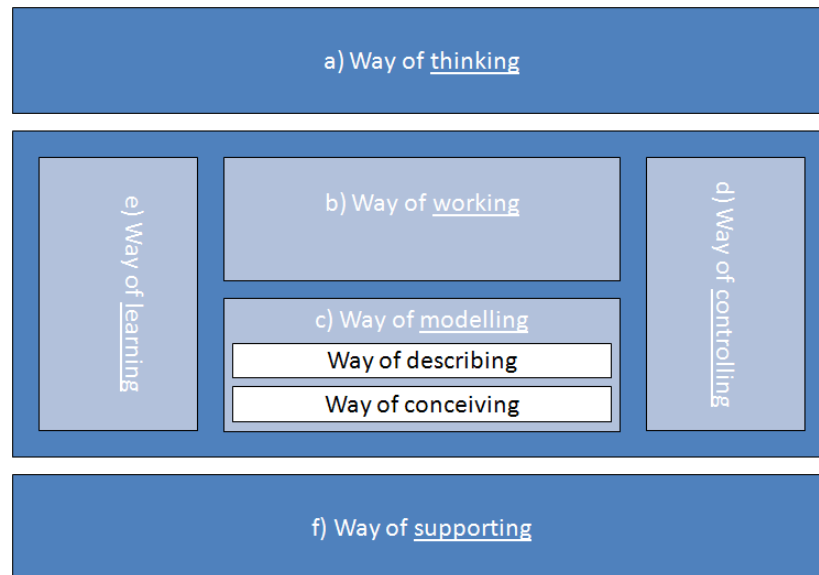
Figure 4: The basic framework

The descriptions of the basic framework:

a) Way of thinking: Assumptions people make on the b) way of working, c) way of modeling, d) way of controlling and e) way of learning.

b) Way of working: The aspects for structuring the ongoing process.

c) Way of modelling: The aspects used to conceive and describe the process:

- Way of describing: The medium and notation to represent the concepts as identified in a way of conceiving.

- Way of conceiving: A set of modeling concepts by which viewers are to observe the process domain.

d) Way of controlling: The aspects used to manage the ongoing process.

e) Way of learning: The aspects used to enable continuous improvement of the process.

f) Way of supporting: Solutions offered by the technology to support the b) way of working, c) way of modeling, d) way of controlling and e) way of learning.

The extended Seligmann framework is more process oriented and will be used as the basic framework during this research. Next chapters will relate Lean Office and BPM Case Management to this framework in order to find the synergy between both of them.

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7. Lean

This chapter describes the philosophy and principles of Lean in general, and in particular the Lean Office.

After defining the basic framework in paragraph 6.3 it is now time to find out how Lean fits into this model. The first paragraph describes the philosophy of Lean (paragraph 7.1). After an outline of the general meaning of Lean, the principles of Lean will be discussed in paragraph 7.2. The rest of this chapter focuses on the Lean Office (paragraph 7.3) and the Lean framework used (paragraph 7.4). This chapter ends with paragraph 7.5, in which the Lean framework will be related to the basic framework.

7.1 Philosophy

The Lean philosophy has its background in the studies of logistics. As described in [Womack et al., 1990], Lean has been established in the manufacturing sector: craft production, mass production (Popularized in 1920 by Henry Ford's Ford Motor Company), Lean production (Popularized in 1950 by Toyota Production System).

Craft production (also called: traditional):
-   A workforce that is highly skilled, each employee works on their own product from beginning to end.
-   An organization that is extremely decentralized.
-   The product has an extremely high quality.
-   A very low, flexible production volume, every product is unique.
-   High input of effort and high cost.

Mass production (also called: transitional):
-   A workforce that is low skilled, to repeat one simple task.
-   An organization that is centralized, to work in a sequential production flow.
-   High quality of production if no problems occur. In case of a problem, only waste is produced and rework occurs.
-   A very high, inflexible production volume, all the products are standardized and look the same.
-   Low input of effort and low cost.

Lean production (also called: Lean or flexible mass production):
-   A workforce that is highly skilled, to work in self-supported teams.
-   An organization that is extremely centralized, labor workers operate in teams.
-   The product has an extremely high quality.
-   A manageable, flexible production volume.
-   Low input of effort and low cost by producing smaller quantities of a product without increasing the cost. Using techniques like kanban (paragraph 7.4, 4. Optimized Flow & Pull Systems), just-in-time delivery system and stockless production.

Once the three production methods have been compared, the philosophy of Lean can be established. 'Lean production combines the advantages of the craft and mass production, while avoiding the high cost of the former and the rigidity of the latter. Lean production is 'Lean' because it uses less of everything' [Poppendieck, 2002]. Lean production is characterized by a minimum of labor and space and a maximum of production capacity and variety. Important for this type of production is that the production development should be fast and have a high quality. To establish a Lean production, a company needs compliance with several principles. What these principles are about has been outlined in paragraph 7.2.

7.2 Principles

According to [Womack & Jones, 1996], Lean can be established by archiving five principles:

1. Identify value: Specifying value from the viewpoint of the end customer by product family.

2. Map the value stream: Identifying all the steps in the value stream for each product family, eliminating every step and every action and every practice that does not create value.

3. Create flow: Making the remaining value-creating steps occur in a tight and integrated sequence so the product will flow smoothly toward the customer.

4. Establish pull: As flow is introduced, letting customers pull value from the next upstream activity.

5. Seek perfection: As value is specified, value streams are identified, wasted steps are removed, and flow and pull are introduced, then the process starts a new and continues (figure 6) until a state of perfection is reached, in which perfect value is created with no waste.
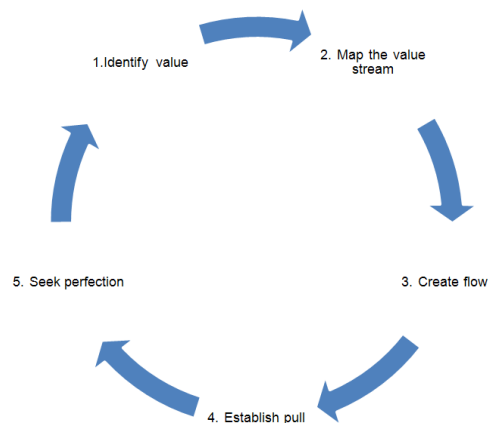
Figure 6: Continuous process

The continuous process, outlined in Figure 6, covered all the aspects at the improvement level itself. Even important is that Lean is established at all the levels of the enterprise. For example: who notes that the correct state of perfection is reached? Who is managing this kind of hamster wheel? According to [Womack & Shook, 2006] it is evenly important to pay attention to how Lean leaders lead the process.

7.3 Lean Office

The two previous paragraphs have given a general explanation of Lean production. This paragraph starts with Lean Office. Although Lean Office is a derivation of Lean manufacturing, there are two big differences.

1. <u>Work can be done simultaneously.</u>

    The focus of Lean Office is on service processes instead of linear manufacturing processes. In manufacturing, different employees or teams cannot work on the same material simultaneously, as material cannot reside in multiple locations at the same time. In Lean Office environments, people work on data, whereby multiple knowledge workers or teams can work on the same case simultaneously. In this regard the data flow is often non-linear and multi-directional.

2. <u>Activity times are relatively variable and complex to manage.</u>

    In a Lean manufacturing environment there is a sequential flow where one task is performed after another. Because each task has a static duration time, there is little or no fluctuation in the development of a product. In a Lean Office environment, knowledge workers have to deal with services that have multiple routes, even beyond the business scope. Unlike the development of a product, a task to perform a service has a dynamic duration time (for example: alternative transport arrangements). For this reason knowledge work is much more difficult to manage instead of manufacturing. Another difficulty pertaining to manufacturing is the ability to store work on stock. Knowledge work differs per case, and is mostly time bounded. In this way it is not feasible to work with safety stocks.

7.4 Lean Office framework

There are different frameworks that describe Lean. Most of these frameworks have the shape of a house, also known as the Toyota production system [Liker, 2004]. These frameworks do not seem useful, because they have a strong manufacturing focus instead of a focus on the office. BeLean, an approach by Capgemini [Patton & Donnellan, 2008] is the only framework that differs from the traditional approach and has a strong service oriented focus.

Note: BeLean varies from the basic concept as described in figure 2 because the framework consists of the key aspects people, process, <u>organization</u> instead of people, process, <u>technology</u>. With this comparison, it seems that the BeLean framework pays less attention to the technology aspect.

The BeLean framework recognizes maturity growth of organizations, on their way toward Lean. BeLean follows an upwards direction. First the opportunities will be discussed for accelerating the 'Generation I' quick wins, and after that 'Generation II', will explain how to embed the Lean culture into the business.

7.4.1 Capgemini's approach to Lean thinking (known as BeLean)
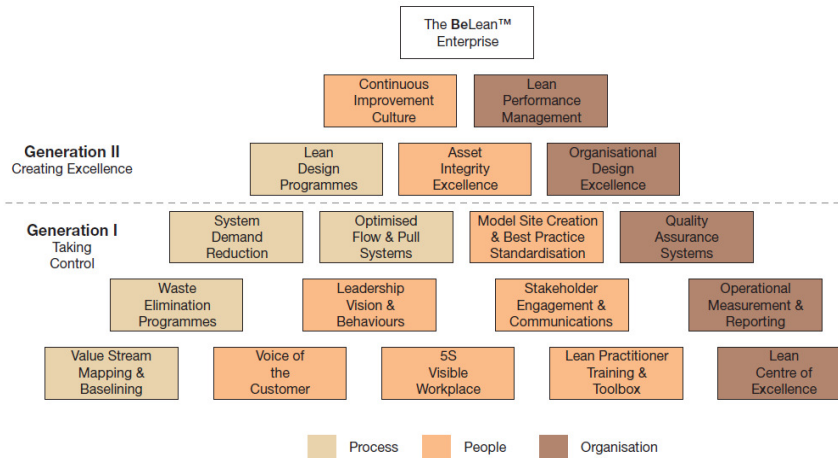
Figure 5: Two levels of BeLean deployment

Generation I: Taking control (process)

1. <u>Value Stream Mapping & Base-lining</u>

[Rother & Shook, 2003] describes value stream mapping from a traditional point of view.

> *A value stream is all the actions (both value added and non-value added) currently required to bring a product through the main flows essential to every product: (1) the production flow from raw material into the hands of the customer, and (2) the design flow from concept to launch. In case of value stream, mapping and base-lining is a way to see, understand and improve the flow of material and information as a product makes its way through the value stream.*

As mentioned in paragraph 7.3, the traditional 'Lean manufacturing' way differs from the 'Lean Office' view.

[Tapping & Dunn, 2006] describe the goal of value stream mapping in a Lean Office environment. Value stream mapping is meant to obtain a high-level, visual representation (read *Way of describing*) of a specific set of processes. When a value stream map is created there is a common view for everyone (read *Way of thinking)* to see areas of waste (read *Way of working*). For value stream mapping there are two common types.

- Current state map, visual road-map of the information and workflow that is occurring at the present time.

- Future state map, visual road-map of the information and workflow displaying how to eliminate the waste identified in the current state map.

2. <u>Waste Eliminations Programs</u>

A waste elimination program is about eliminating waste (in Lean: 'Muda') and preventing waste (in Lean: 'Poka Yoke'). [Womack, 2008] describes waste as any activity that consumes resources but creates no value for the customer. In a Lean environment there are seven categories of waste (read *Way of thinking, Way of working*). Especially for Lean Office, an additional category of waste is identified as under-utilized creativity. The categories of waste can be clarified as:

I. Defects (poor quality, causing rework) e.g.

- o defective information
- o wrong or misspelled values
- o wrong documents
- o missed data

II. Transportation (information or people) e.g.

- o unnecessary movements

III. Waiting (information or people) e.g.

- o loss or too much information push

IV. Overproduction e.g.

- o too much information
- o unnecessary information
- o providing information too early
- o providing information to too many persons

V. Inventory e.g.

- o work requests sitting in queues

VI. Motion, in Lean Office this kind of waste is similar to the waste of transportation (see II. Transportation).

VII. Extra processing (redundant or non-value added activities) e.g.

- o excessive reviews
- o too much information on task forms

VIII. Under-utilized creativity (people) e.g.

- o Insufficient possibility for knowledge worker to decide on how to do work.

3. <u>System Demand Reduction</u>

System demand reduction is about analyzing (read *Way of thinking*) value demand versus failure demand, and reducing the latter.

4. <u>Optimized Flow & Pull Systems</u>

In a Lean Office environment there should be a continuous flow of information (e.g. case file) in combination with a pull system. Pull (in Lean: 'Kanban') is a system in which nothing is produced by the upstream (supplier process) until the downstream (customer process) signals the need for it. This enables work (read *Way of working*) to flow without detailed schedules (read *Way of thinking*).

Generation I: Taking control (people)

5. <u>Voice of the customer</u>

According to [De Man, 2009b] voice of the customer is about capturing the view and requirements of the customer (read *Way of thinking).*

6. 5S Visible Workplace

   The five 'S-es' are a Lean Office improvement process for creating (read *Way of thinking*) an organized (electronic) workplace (read *Way of working*). 5S stands for:

   - Sorting

   - Straighten (or: Set in Order)

   - Sweeping (or: Shining)

   - Standardizing

   - Sustaining

7. Lean Practitioner Training & Toolbox

   Practitioners have to be educated and trained on using Lean principles on the job (read *Way of working*). Training should be provided in planar sessions as well as on individual (on-demand) basis.

8. Leadership Vision & Behaviors

   Lean leaders are partly dependent on their own personal attitudes. They have to be respectful (read *Way of controlling*) to their people, and they have to be good teachers. In general, Lean leaders need to provide vision (read *Way of thinking*).

9. Stakeholder Engagement & Communications

   In a Lean Office environment, success depends on the engagement of the people (read *Way of thinking*) as empowered workers in empowered work teams (read *Way of working*).

10. Model Site Creation & Best Practice Standardization

    Best practice standardization is a major precondition to Lean. Because knowledge workers require much flexibility to deploy their creativity, this seems controversial. Best practice here means finding the right balance between flexibility (read *Way of thinking*) and standardization (read *Way of working*) in the Lean Office.

Generation I: Taking control (organization)

11. Lean Centre of Excellence

    The Lean centre of excellence is the home-base of stakeholders that need to participate in Lean transformation efforts (read *Way of thinking, Way of working, Way of learning*).

12. Operational Measurement & Reporting

    Operational measurement and reporting is about analyzing and controlling (e.g. monitoring) (read *Way of controlling*) business data that is created by business processes.

13. Quality assurance systems

    Quality assurance systems are a solution for standardizing work and making sure everything is done consistently (read *Way of controlling*). In Lean this refers to recognizing and resolving (read *Way of learning*) abnormal conditions in the process.

Generation II: Creating excellence (process)

14. Lean Design Programs

    Lean design programs are defined to analyze the as-is situation and design new processes for the to-be situation based on Lean principles (read *Way of learning*).

Generation II: Creating excellence (people)

15. Asset Integrity Excellence

    Assets integrity excellence is the discipline that is more easily applicable in the Lean manufacturing environment, where assets revolve around equipment (machinery). In Lean Office environments this focus on equipment plays a minor role. More important in the service sector are human assets (read *Way of thinking*, *Way of working*). Working from this idea, asset integrity excellence is meant to represent the human asset integrity.

16. Continuous Improvement Culture

    According to [De Man, 2009b] employees of a Lean Office should be able to not only execute their operational work, but to also contribute to continuous processes to improve their work (read *Way of learning, Way of controlling*).

Generation II: Creating excellence (organization)

17. Organizational Design Excellence

    Organizational design excellence is about the excellence (maturity) of organizations as a result of implementing Lean (read *Way of thinking, Way of controlling*).

18. Lean Performance Management
    Lean performance management is about embedding Lean behavior in the human resource management system. (read *Way of working*, *Way of learning*, *Way of controlling*).

7.5 Lean Office framework related to the basic framework

The previous paragraph (paragraph 6.4 Lean Office framework) contains all the aspects of the BeLean framework, tagged according to the aspects of the basic framework (figure 4). The results are shown in table 1: BeLean framework related to the basic framework. Figure 6 is a visual representation of this correlation.

Table 1: BeLean framework related to the basic framework

|		Thinking	Describing	Conceiving	Working	Controlling	Learning	Supporting
1	Value Stream Mapping & Base-lining	1	1		1			
2	Waste Eliminations Programmes	1			1			
3	System Demand Reduction	1						
4	Optimized Flow & Pull Systems	1			1			
5	Voice of the customer	1						
6	5S Visible Workplace	1			1			
7	Lean Practitioner Training & Toolbox				1			
8	Leadership Vision & Behaviours	1				1		
9	Stakeholder Engagement & Communications	1			1			
10	Model Site Creation & Best Practice Standardization	1			1			
11	Lean Centre of Excellence	1			1		1	
12	Operational Measurement & Reporting					1		
13	Quality assurance systems					1	1	
14	Lean Design Programmes						1	
15	Asset Integrity Excellence	1			1			
16	Continuous Improvement Culture					1	1	
17	Organizational Design Excellence	1				1		
18	Lean Performance Management					1	1	1
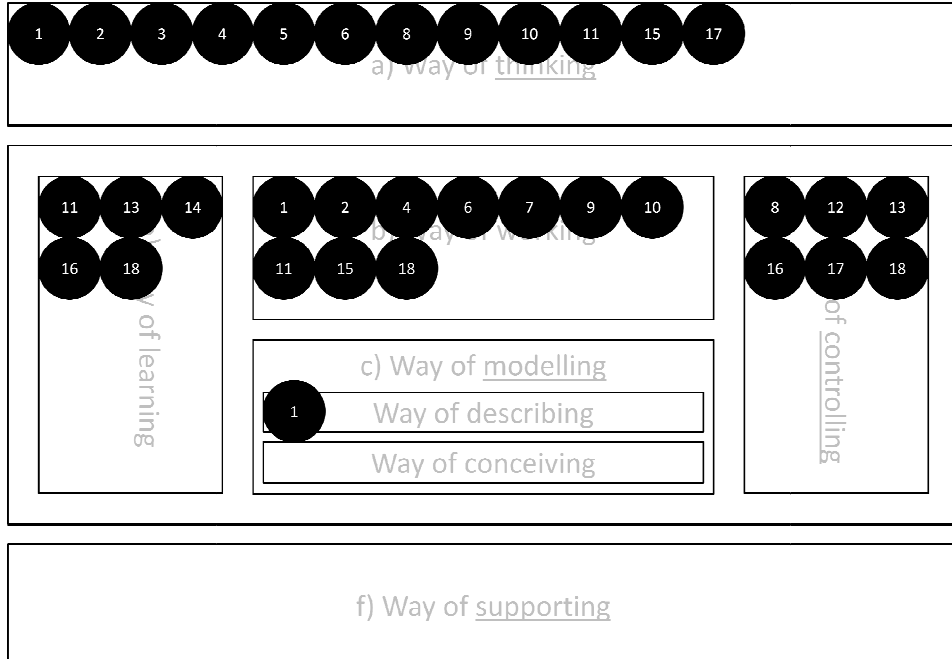
Figure 6: Visual representation BeLean/Basic framwework

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8. Business Process Management

This chapter describes the philosophy and principles of BPM in general and Case Management in particular.

After an explanation of the Lean Office in Chapter 7, it is now time to find out how BPM fits the basic framework. This chapter has the same structure as before, starting with the philosophy of BPM (paragraph 8.1). Paragraph 8.2 discusses the principles on which BPM is based. The rest of the chapter gives an outline of BPM Case Management (paragraph 8.3) and the framework that is composed (paragraph 8.4). This chapter ends with paragraph 8.5, in which the BPM Case Management framework will be related to the basic framework.

8.1 Philosophy

The roots of BPM can be found in *Total Quality Management (TQM)* and *Business Process Re-engineering (BPR)*. Both TQM and BPR are process and customer oriented: thinking from the customer viewpoint, improving customer satisfaction. Even though they have something in common, their target, focus and responsibility differ[3].

Definition

TQM: An approach to doing business that attempts to maximize the competitiveness of an organization through the continual improvement of the quality of its products, services, people, processes and environment [Goetsch & Davi, 1995].

TQM is an organizational change intervention that is concerned with quality.

- Target: streamline improvements based on the existing system.
- Focus**:** on the processes in the entire organization.
- Responsibility: all employees in the organization are responsible.

Definition

BPR: A radical scrutiny, questioning, redefinition and redesign of business processes with the aim of eliminating all activities not central to the process goals … and automating all activities not requiring human judgmental input, or facilitating that judgment at reduced cost [Thomas, 1994].

BPR is about re-engineering redesigning organizational processes.

- Target: dramatic improvements of badly designed process, also called redesign or re-engineering.
- Focus: on a specific area or process of the organization
- Responsibility: the project team is responsible.

Due to dramatic acceleration of today's businesses, BPR fails because it sees process improvement as one finite event. The use of TQM also fails, because it is not flexible enough to make changes in a short time period to meet swiftly changing business requirements. This is why they have been replaced by BPM as a solution for the continuity and flexibility of today's business processes.

---

[3] Wong W, Compare TQM and BPR

According to [Cantara, 2008] BPM has the necessary characteristics for:

- Making the business process visible (and thus explicit) to business and IT constituents through business modeling.
- Empowering business users and business analysts to manipulate a business process model to directly affect modifications in downstream implementations.
- Enabling rapid iteration of processes and underlying systems for continuous process improvement and process optimizations.

A graphic representation of the three characteristics can be found in figure 7: The Cordys Business Operations Platform. To establish BPM, a company needs compliance with several principles. What these principles are about has been outlined in paragraph 8.2.
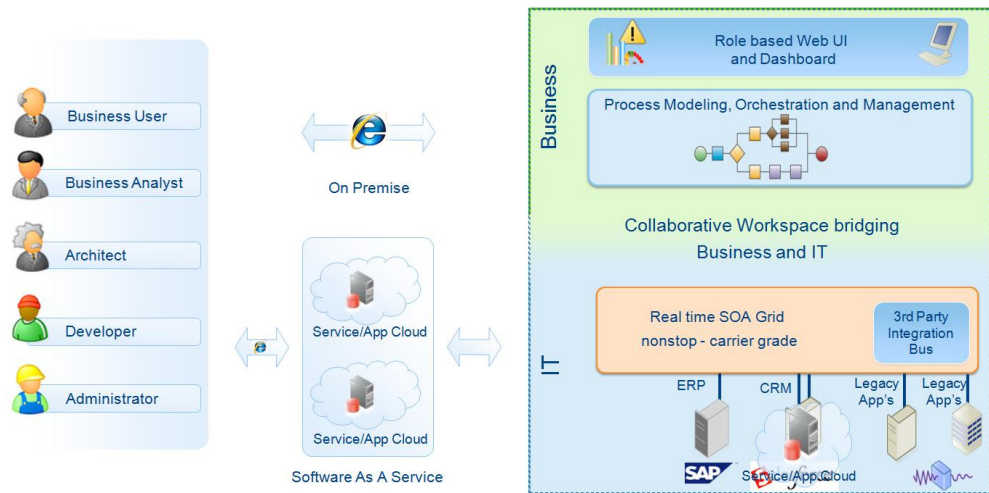
Figure 7: Cordys Business Operations Platform [4]

8.2 Principles

The Principles of BPM can be established through a real time round trip engineering process. Most of the BPM vendors use a way of working that is based on the circle of Deming (Plan, Do, Act, Check) or based on DMAIC[5] (Define, Measure, Analyze, Improve, Control). In this master thesis, the focus is on the Cordys closed-loop[6]:

- Qualify & Analyze the organization, select a process, determine goals and scope, analyze the as-is process and its gaps
- Design & Model an optimized to-be process, its sub processes, case activities and rules.
- Develop & Deploy services, integrations, transformations and user interactions.
- Run & Monitor business processes by collecting process performance information, such as efficiency and effectiveness, for analysis and optimization.

A graphical representation of the Cordys closed-loop can be found in figure 8.
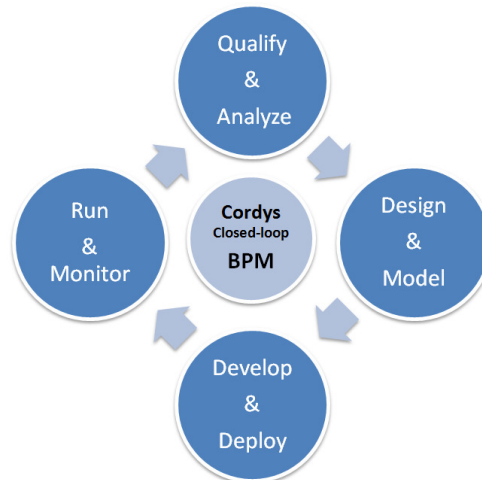
Figure 8: Cordys closed-loop

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[5] IBM Technical white paper: IBM BPM – The foundation tool for public sector Lean six sigma

[6] Cordys closed loop: http://community.cordys.com/

8.3 BPM Case Management

The two previous paragraphs have given a general explanation of BPM. This paragraph starts with BPM Case Management. The essence of Case Management was summarized by [Davenport & Nohria, 1994]. Davenport predicted that Case Management had the potential to become the future of all business organizations. This quotation seems still valid today. According to [White, 2009]:

Case-based BPM enables organizations to strike the appropriate balance between creating procedures for repetitive and mundane aspects of knowledge work while providing scope for the creative and discretionary elements. BPM-based Case Management can combine knowledge and process effectively, support the ad hoc and unpredictable nature of cases, and coordinate a range of other technologies to appropriately support knowledge intensive processes.

From this description, there are three fundamental differences in comparison with BPM straight through processing. BPM Case Management is:

- Unpredictable (8.3.1 Unpredictable path)
- Knowledge intensive (8.3.2. Knowledge intensive)
- Collaborative (8.3.3. Collaborative)

8.3.1 Unpredictable path

According to [Rooze, 2007] and [De Man 2009b] three different types of cases can be distinguished:

- **Mass cases**: These cases can be almost completely automated and managed by straight through processing BPM.
- **Regular cases**: The human worker is in control of how the process evolves, but the degree of freedom of the worker can be constrained by a number of elements:
    - Business rules
    - Evaluation of the case data
    - Case states
- **Special cases**: In these cases, the user has plenty of freedom to handle them and is supported in his or her decision making.

Most of the cases of BPM Case Management are structured as regular or special cases. According to [De Man, 2009a] such cases are coordinative and goal-oriented. Typical for a goal-oriented case is that the goal is clearer than the path to follow, and the path is mostly not predetermined.

8.3.2 Knowledge intensive

The biggest difference between BPM straight through processing and BPM Case Management is that Case Management is knowledge intensive (figure 9). According to [Niblick, 2007] a knowledge worker can be defined as a person that creates value from a mental ability to think. So a case worker is typically a knowledge worker whose skills allow him or her the freedom to make decisions. Important in this is that a knowledge worker has an overview of the entire case, what is actually the same as goal oriented as described in paragraph 8.3.1 unpredictable path.
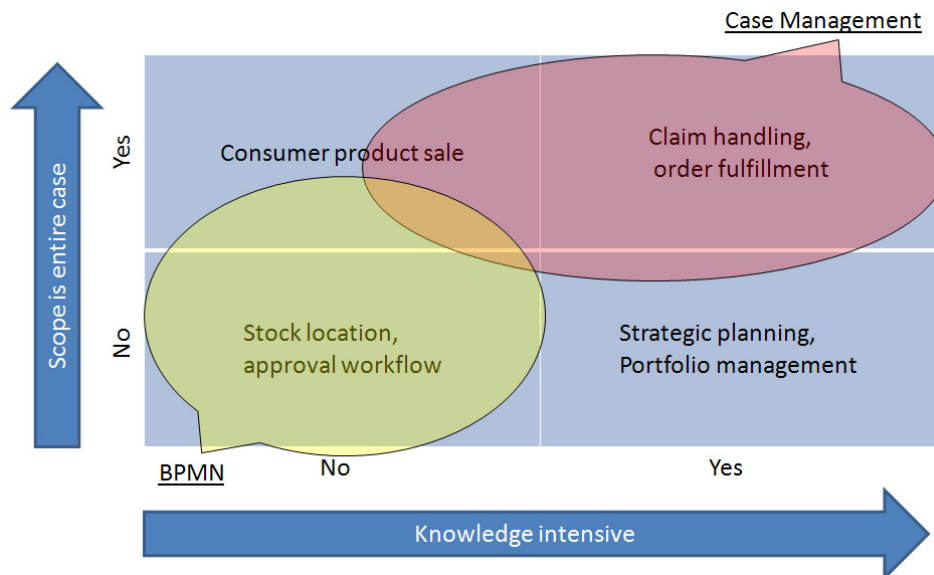
Figure 9: Position of Case Management

8.3.3 Collaborative

To handle a case on time and in a productive way, knowledge workers should work together. To work on a case in teams was firstly associated by Davenport. Davenport defined Case Management as end-to-end processing by individuals or small teams, to deliver a service to a customer, whereby the customer can be both external and internal to the organization [Davenport, 1994]. Davenport also covers Case Management as the vehicle to facilitate the shift from division of labor to combination or integration of labor.

8.4 BPM Case Management framework

According to [Hill et al., 2006] BPM can be defined as an IT-enabled management discipline consisting of:

- BPM as a management discipline: discipline that treats business processes as assets to be valued, designed and exploited in their own right. The BPM discipline has implications for four aspects of business: The strategy, governance, organization and culture aspects.
- BPM-enabling technology: tools that business managers can use to control and modify their processes. BPM-enabling technologies are available as separate specialty tools, as integrated BPMS, and are being added to some major application packages. Gartner [Cantara, 2008] defined a model with 10 areas of capabilities required in a BPMS (Figure 10).
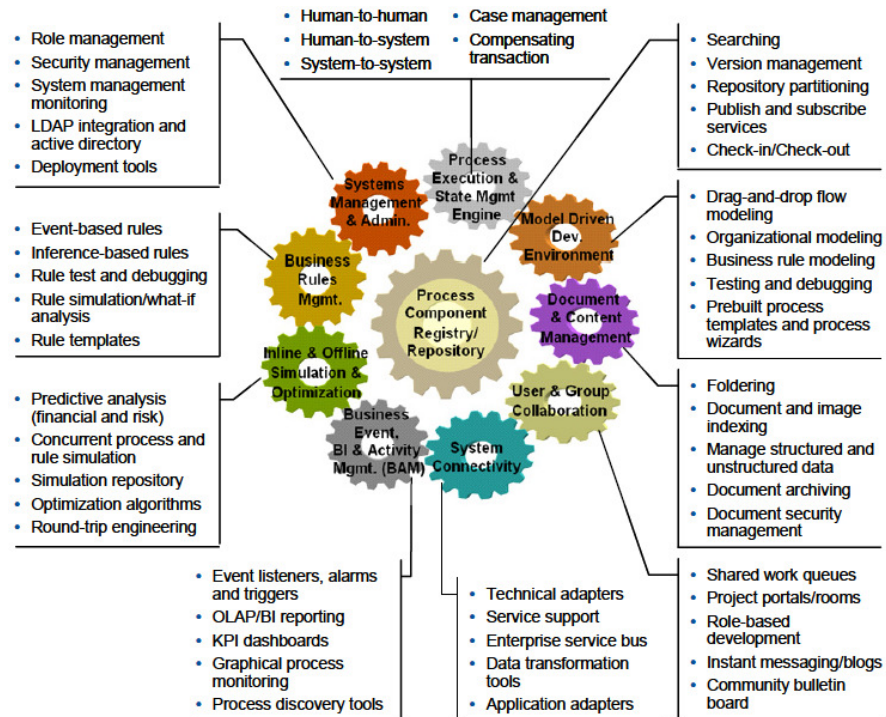
Figure 10: Aspects of a Business Process Management Suite (BPMS)

Figure 10 is focused on the Business Process Management Suite (BPMS) aspects. The four business management disciplines are not included. In the aspect of 'Process execution & state mgmt engine,' figure 10 devotes too little attention to case handling. For BPM Case Management, much more attention is needed for decision making. Figure 11 construct a framework that expands figure 10 with business management and Case Management aspects.
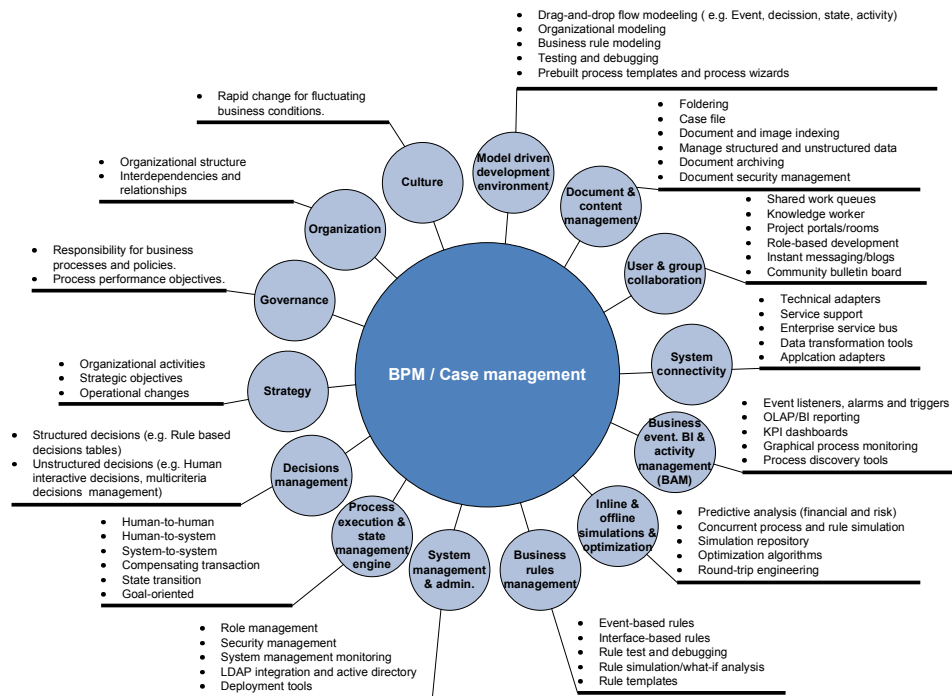
Figure nodes and labels:

- Drag-and-drop flow modeeling (e.g. Event, decission, state, activity)
- Organizational modeling
- Business rule modeling
- Testing and debugging
- Prebuilt process templates and process wizards

Culture
- Rapid change for fluctuating business conditions.

Organization
- Organizational structure
- Interdependencies and relationships

Governance
- Responsibility for business processes and policies.
- Process performance objectives.

Model driven development environment

Document & content management
- Foldering
- Case file
- Document and image indexing
- Manage structured and unstructured data
- Document archiving
- Document security management

User & group collaboration
- Shared work queues
- Knowledge worker
- Project portals/rooms
- Role-based development
- Instant messaging/blogs
- Community bulletin board

System connectivity
- Technical adapters
- Service support
- Enterprise service bus
- Data transformation tools
- Applcation adapters

Strategy
- Organizational activities
- Strategic objectives
- Operational changes

BPM / Case management

Business event. BI & activity management (BAM)
- Event listeners, alarms and triggers
- OLAP/BI reporting
- KPI dashboards
- Graphical process monitoring
- Process discovery tools

Decisions management
- Structured decisions (e.g. Rule based decisions tables)
- Unstructured decisions (e.g. Human interactive decisions, multicriteria decisions management)

Inline & offline simulations & optimization
- Predictive analysis (financial and risk)
- Concurrent process and rule simulation
- Simulation repository
- Optimization algorithms
- Round-trip engineering

Process execution & state management engine
- Human-to-human
- Human-to-system
- System-to-system
- Compensating transaction
- State transition
- Goal-oriented

System management & admin.
- Role management
- Security management
- System management monitoring
- LDAP integration and active directory
- Deployment tools

Business rules management
- Event-based rules
- Interface-based rules
- Rule test and debugging
- Rule simulation/what-if analysis
- Rule templates

Figure 11: BPM Case Management framework

BPM-enabling technology

A. Model driven development environment

As described in figure 11, the model driven development environment supports (read *Way of supporting*) the business analyst with the (re)design (read *Way of describing*) of the case model. According to the characteristics depicted in paragraph 8.2 the 'design time' modifications should affect the business environment directly, in real time.

B. Document & content management

BPM Case Management has to deal with content that is submitted from many directions. To give knowledge workers access to all the relevant information, all information should be stored in one central location. According to [De Man, 2009a] the case data or case file serves as the central and shared context across all activities. BPM Case Management has to support (read *Way of supporting*) this way of information processing.

C. User & group collaboration

As described in figure 11, Case Management is collaborative. BPM Case Management has to support (read *Way of supporting*) the knowledge worker to handle a case simultaneously within and between multifunctional teams.

D. System connectivity

BPM Case Management should have a correlation with the real time *Service Oriented Architecture (SOA)* grid. This way (read *Way of supporting*) other systems can easily connect to each other with the help of an Enterprise Service Bus (ESB).

> Definition
>
> SOA: A paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains [Oasis, 2006].
>
> Definition
>
> ESB: Software architecture constructs which provides fundamental services for complex architectures via an event-driven and standards-based messaging-engine[7].

E. Business event. BI & activity management (BAM)

The goal of Business Activity Monitoring (BAM) tools is to use data logged by the information system to diagnose (read *Way of controlling, Way of learning*)**,** the operational processes [Aals, 2004]. By monitoring (read *Way of supporting*) business activity in real time, the business can automatically trace exceptions based on event listeners, alarms or triggers.

F. Inline & offline simulations & optimization

With the support (read *Way of supporting*) of a simulation option, predictable information can be collected (read *Way of learning*). Based on the gathered information (read *Way of thinking*) the business analyst can adjust (read *Way of describing*, *Way of conceiving*) the process (read Way of working, Way of controlling) to meet the business objectives.

G. Business rules management

The do's and don'ts in a case model or case file should be regulated by rules. With the support (read *Way of supporting*) of business rules, the business analyst can define statements (read *Way of controlling*) that restrict behavior according to the business objectives.

H. System management & admin.

To prevent unauthorized users accessing system management, (read *Way of supporting*) is of crucial importance. The administrator of the BPM Case Management system should regulate access (read *Way of controlling*) based on roles, tailored to specific modules. Users should have access only to the modules they need to work with.

I. Process execution & state management engine

BPM Case Management supports (read *Way of supporting*) the transactions of an instance between all participants that are needed to handle a case. A participant can be a human as well as a system. With the use of a state, where the instance is phased in, knowledge workers have the ability to track and trace (read *Way of working*) the instance trough the process.

---

[7] http://en.wikipedia.org/wiki/Enterprise_service_bus

J. Decisions management

This aspect is especially added to give more attention to Case Management. With the support of (read *Way of supporting*) decision tables, case files can automatically follow a path (read *Way of working*) based on specified rules (read *Way of controlling*). For the more knowledge intensive (read *Way of thinking*) decisions, where the path to follow is not predetermined, the knowledge worker should be supported by the decision options that are the most likely to yield results.

BPM as a management discipline

K. Strategy

For every individual organization, the strategy of Case Management can be different. Depending on the kind of business, BPM Case Management can support (read *Way of supporting*) the strategy by making the progress visible, tangible and manageable (read *Way of controlling)*.

L. Governance

Every organization is unique, and the same goes for the governance of Case Management. Depending on the kind of business, BPM Case Management can support (read *Way of supporting*) governance by supplying business rules (read *Way of controlling*) (see G. Business rules management) and manageable decisions (see J. Decision management).

M. Organization

BPM Case Management can support (read *Way of supporting*) the organization (read *Way of controlling*) by mapping the organization chart with (read *Way of working*) the defined knowledge worker/knowledge teams (C. user & group collaboration).

N. Culture

As described in figure 11, the knowledge worker has a central role in Case Management. With the rapid changes of today's businesses the BPM Case Management technology supports this kind of work (read *Way of working*). Equally important is creating a culture where the knowledge worker has the ambition to continuously discover new approaches (read *Way of learning*).

8.5 BPM Case Management framework related to the basic framework

The previous paragraph (paragraph 7.4 BPM Case Management framework) contains all the aspects of BPM Case Management framework, tagged according to the aspects of the basic framework (figure 4). The results are shown in table 2: BeLean framework related to the basic framework. Figure 12 is a visual representation of this correlation.

Table 2: BPM Case Management framework related to the basic framework

		Thinking	Describing	Conceiving	Working	Controlling	Learning	Supporting
A	Model driven development environment		1					1
B	Document & content management							1
C	User & group collaboration							1
D	System connectivity							1
E	Business event. BI & activity management (BAM)					1	1	1
F	Inline & offline simulations & optimization	1	1	1	1	1	1	1
G	Business rules management					1		1
H	System management & admin.					1		1
I	Process execution & state management engine				1			1
J	Decisions management	1			1	1		1
K	Strategy					1		1
L	Governance					1		1
M	Organization					1	1	1
N	Culture					1	1	
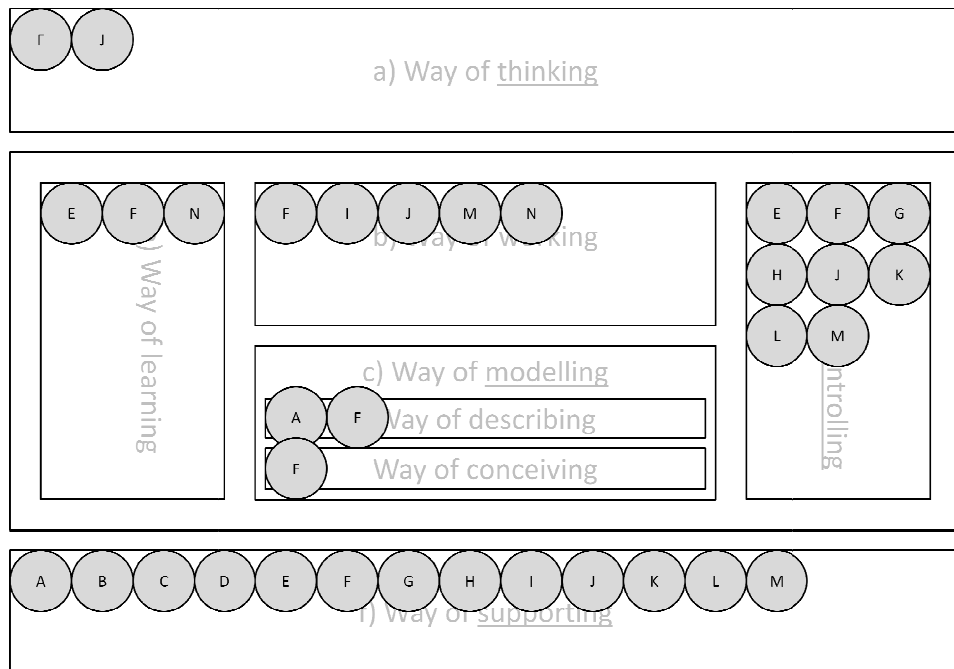
a) Way of thinking

d) Way of learning

b) Way of working

c) Way of modelling

Way of describing

Way of conceiving

e) Way of controlling

f) Way of supporting

Figure 12: Visual representation BPM Case Management/Basic framework

CORDYS

Lean principles in Case Management

9. Combine Lean with BPM

This chapter describes the combination Lean with BPM.

The previous chapters described how Lean Office (chapter 7) and BPM Case Management (chapter 8) are related to the basic framework. This chapter combines these results and shows in which way they complement each other (paragraph 9.1). Paragraph 9.2 describes the synergy clusters, by mapping Lean Office directly to BPM Case Management. In paragraph 9.3, the cluster with the highest level of synergy is chosen to be detailed.

9.1 Lean Office framework combined with BPM Case Management framework

To understand how Lean Office and BPM Case Management complement each other, a combined basic framework is provided. Figure 13 combines figure 6: 'Visual representation BeLean/Basic framwework' with figure 12: 'Visual representation BPM Case Management/Basic framework'.
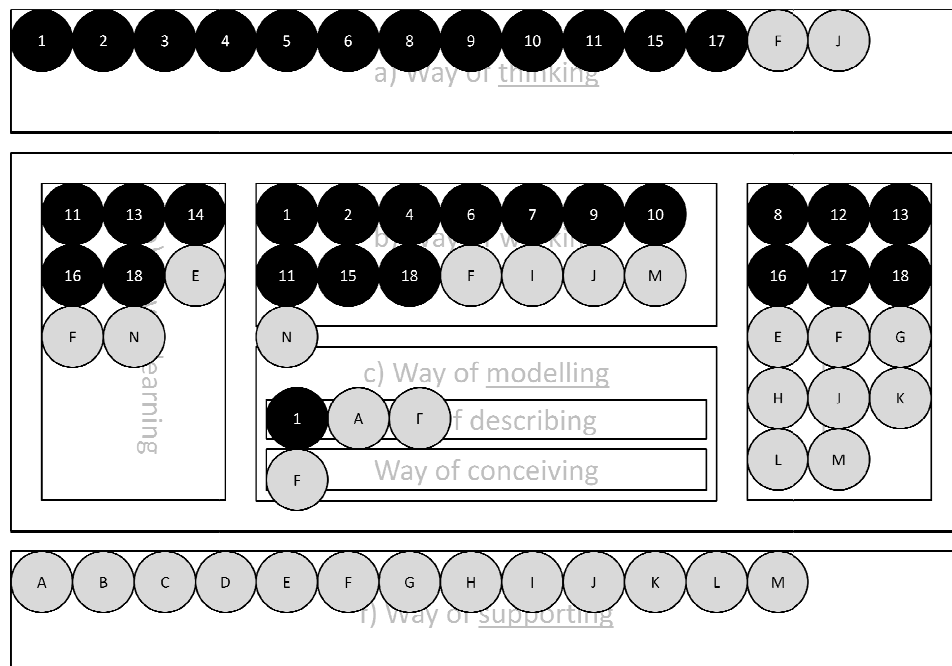
Figure 13: Lean Office combined with BPM Case Management

Figure 13 shows a good balance between Lean Office and BPM Case Management, related to the basic framework. They have lots in common but there are some remarkable differences. Lean Office (1-18) is more represented into the way of thinking / way of working, where BPM Case Management is more represented into the way of supporting. Figure 14 shows this synergistic relationship into a radar and column diagram.
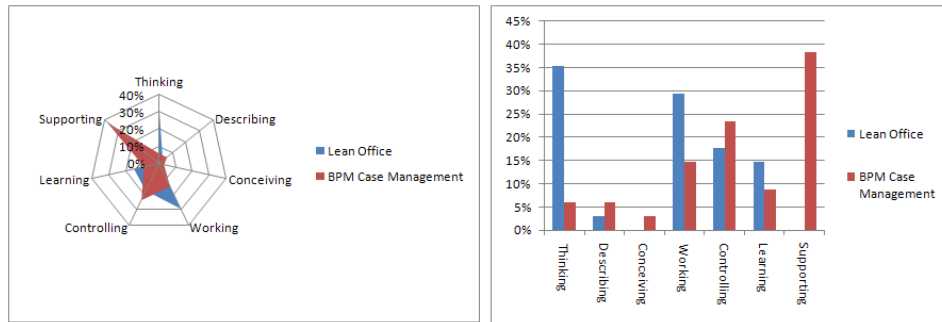

Figure 14: Percentage of total amount related to the basic framework

The diagrams are based on the arithmetic mean of the total of checkmarks provided by table 1 and table 2. The percentages are shown in table 3.

Table 3: Average of total amounts

	Thinking	Describing	Conceiving	Working	Controlling	Learning	Supporting
Lean Office	35%	3%	0%	29%	18%	15%	0%
BPM Case Management	6%	6%	3%	15%	24%	9%	38%
Average	21%	4%	1%	22%	21%	12%	19%

9.2 Synergy clusters

The previous paragraph (paragraph 9.1) explained that Lean Office and BPM Case Management complement each other. The check marks in table 4 identify the aspects that have a direct relationship.

There are two types of check marks that describe a relationship between Lean Office (1-18) and BPM Case Management (A-N):

- Regular check marks describe a less obvious relationship.

- Double check marks describe a clear relationship.

Table 4: Synergy clusters: Lean Office & BPM Case Management

Column headers:
- A. Model driven development environment
- B. Document & content management
- C. User & group collaboration
- D. System connectivity
- E. Business event. BI & activity management (BAM)
- F. Inline & offline simulations & optimization
- G. Business rules management
- H. System management & admin.
- I. Process execution & state management
- J. Decisions management
- K. Strategy
- L. Governance
- M. Organization
- N. Culture

Lean Office aspect	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1. Value Stream Mapping & Base-lining	√√			√	√√	√√	√					√√	√√	√√
2. Waste Eliminations Programmes	√√				√	√	√		√√					
3. System Demand Reduction	√				√√				√					
4. Optimized Flow & Pull Systems	√	√	√		√√	√√			√√	√√			√	
5. Voice of the customer			√		√									
6. 5S Visible Workplace		√√	√		√				√√					√
7. Lean Practitioner Training & Toolbox		√	√											
8. Leadership Vision & Behaviours											√	√√	√	√
9. Stakeholder Engagement & Communications			√							√			√	
10. Model Site Creation & Best Practice Standardization	√√	√								√√				
11. Lean Centre of Excellence	√		√										√	√
12. Operational Measurement & Reporting	√			√	√√				√				√	
13. Quality assurance systems					√		√		√					
14. Lean Design Programmes	√				√								√	
15. Asset Integrity Excellence								√					√	√
16. Continuous Improvement Culture	√√				√√	√	√		√			√	√	
17. Organizational Design Excellence				√√	√							√		√
18. Lean Performance Management			√		√				√			√	√	

The obvious outcome of table 4 is that all the aspects strengthen each other. From the BPM Case Management point of view, the aspects that most strengthen each other are the Lean aspects related to E. 'Business event. BI & activity management (BAM)'. Aspect H. 'System management & admin', has the least amount of synergy with the Lean Office aspects.

From a Lean Office point of view, aspects 1 'Value Stream Mapping & Base-lining' and 4 'Optimized Flow & Pull Systems' creates the most synergy, since they both have the most BPM Case Management related aspects. The least synergy with the BPM Case Management is created by aspect 5 'Voice of the customer'.

9.3 Synergy clusters selection

The previous paragraph (paragraph 9.2) shows that Lean Office and BPM Case Management complement each other in many ways. To ensure the quality and the limited time, this research focused on the most synergistic cluster. Because the starting point of a way of thinking is much more logically than the way of supporting, the strongest clusters from a Lean Office point of view are considered (see paragraph 9.2):

- Synergy cluster I: Value Stream Mapping & Base-lining.
- Synergy cluster IV: Optimized Flow & Pull Systems.

After consultation with the supervisors (paragraph 13.4) and the external advisors (paragraph 13.5) the focus will be on cluster IV (see paragraph 9.2). Cluster IV has been selected based on the following considerations:

- Sufficiently complex

- The rich source of synergy.

- Result representative of other clusters with restrictions.

- The outcome could be directly adopted by Cordys.

Because the other clusters provide a rich synergy as well and are not described in detail, they should be left for further research.

Lean principles in Case Management

10. Analysis of the combination: Pull & Flow with BPM

This chapter describes the business benefits of synergy cluster IV and what is needed to reach them by defining best practices.

In the previous chapter, chapter 9.3, synergy cluster IV was chosen to be worked out in more detail. The main purpose of synergy cluster IV is to reduce the lead time and increase the capacity, which can be reached by workload balancing and waste elimination.

This chapter starts with paragraph 10.1, which gives an outline of the business benefits. How to reach these benefits can be found in paragraph 10.2, in which the 13 best practices will be addressed.

10.1 Business benefits

✓ **Reduced lead-time**

✓ **Increased capacity**

Can be established by:

✓ **Workload balancing:**

- Produce faster by reducing work in progress time.

- Producing more with the same workforce.

- Producing the same and free up resource capacity to let knowledge workers participate in other processes, such as continuous improvement projects.

✓ **Waste elimination:**

- Eliminating problems (bottlenecks) faster by making them visible.

10.2 Best practices

A. Model driven development environment

BP1.   Case work balancing should be defined for a family of case models.

According to [De Man, 2009c] a family matrix is associated with a group of case types that have a high degree of commonality. The commonality between case types can be used to design efficient flows.

B. Document & content management

BP2.   <u>All the case information should be stored into the case itself.</u>

All the related case information (for example: case data, procedures, attachments) should be stored into the case itself. By centralizing the case information, work can be pulled in a more efficient way between knowledge workers; self supported teams; or even third parties.

C. User & group collaboration

BP3.   <u>Production should be triggered by downstream.</u>

To work on a Lean Office way, nothing should produced by the upstream (supplier process) until the customer signals the need for it (customer-demand pull). Case Management implies this because the customer order (case file) drives the process.

BP4.   <u>Within a self supported team, case workers should pull work only at the moment they need it.</u>

To work in a collaborative way, a team of case workers should be equipped with a shared work queue. In this way, work can be assigned to teams instead of named workers. A case worker should also be prevented from pulling too much work simultaneously.

BP5.   <u>A case could be *pipelined* to eliminate bottlenecks in order to optimize throughput according to customer demand.</u>

Splitting up casework, of cases within a case family (see BP1), in multiple units of work and assigning these too different teams such that required and available capacity are in balance within each team and whereby each team can complete its contribution within *takt time* (see BP 7).

> <u>Definition</u>
>
> Pipelining: A key implementation technique used to build fast processors. It allows the execution of multiple instructions to overlap in time.
>
> <u>Definition</u>
>
> Takt time: The pace of customer demand. Takt time determines how fast a process must run to meet customer demand. [Tapping & Dunn, 2006]

E. Business event. BI & activity management (BAM)

BP6.   <u>The case flow should be continuously monitored.</u>

To enable a certain cadence in flow of cases, the flow has to be managed based on progress data. The data has to be gathered by continuously monitoring the progress and other performance aspects, such as service level, quality parameters, norm times, and queuing time. Productive monitoring requires automation.

F. Inline & offline simulations & optimization

> BP7. Lean designer should be supported by an online interactive simulation capability.
>
> With the support of historical data and the experience of the forecaster, a cumulative forecast should be created for each case family. Based on forecast and calendar of available working time, a takt time is calculated. The Lean designer will define work teams and case work assignments to the teams iteratively whereby cycle times are harmonized with takt time and capacity utilization is optimized. The Lean designer might design multiple scenarios for work balancing which can be reused under different circumstances.
>
> BP8. The feasibility of a balanced flow should be tested by running a simulation.
>
> With the creation of instance within a simulation, the tact time can be calculated. Based on the statistical data the balanced flow should be further optimized.

I. Process execution & state management engine

> BP9. To enable a *one-piece flow* solution, a priority strategy should be set on each queue and state family.
>
> With the support of a priority strategy, a queue can be managed to establish a flow in sequence of customer demand pull. For example: First Due First Serve (FDFS), First In First OUT (FIFO) or Last In Last Out (LIFO).
>
> | Definition |
> | --- |
> | One-piece flow: Cases are handled, and flow through the system, one-by-one (instead of being batched), in a way that best preserves customer demand pull sequence from beginning to end. [De Man, 2009c] |
>
> BP10. An engine should be available to automatically run the process.
>
> The engine should be able to respond to external events and to prompt to the case workers in order to make decisions or to perform tasks.

J. Decisions management

> BP11. The customer demand should be leveled to protect a balanced flow.
>
> According to de Man [De Man, 2009c] customer demand might be very irregular. Lean systems work best for regular demand patterns. By leveling case demand, irregular demand patterns are transformed into regular ones.
>
> BP12. Case workers should have the ability to add a task to a case when they see a need.
>
> Follow up decisions (to add more case work) are typically triggered by events and often made by case workers. Note that case workers should be empowered to define their own work.

Lean principles in Case Management

11. Case study

This chapter describes whether cluster IV is feasible with a organization as a starting point.

To validate the best practices (chapter 10.2), a case study has been examined, with the help of a well known company. Since this case study contains critical business information, the name of the company has been changed into: 'Calamity'.

11.1 Case study description

The emergency centre 'Calamity' is typically a case management based organization. Operational characteristics of calamity are:

- Permanent staff: 200 employees.

- Summer months busy due to holidays, extra staff through temporary agency (may only handle simple cases).

- 22 different customers (insurance agencies) that employ the emergency calls center for handling calls.

- World-wide coverage.

- Assistance and service around the clock 24/7.

A case is triggered by a call of the customer, and is handled in order of the insurance company. Figure 15 shows an example of a case handled by Calamity.
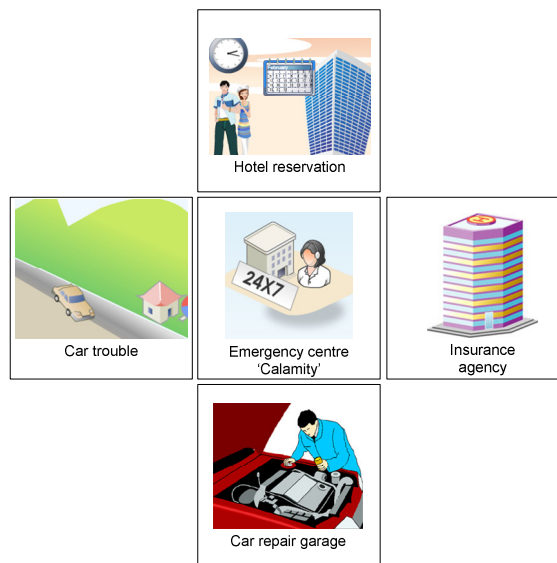
Figure 15: Example of a case handled by calamity

11.2 Best practices covered by Calamity
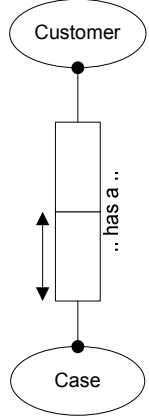
This paragraph starts by giving an overview of the best practices that are covered by Calamity (11.2.1 Best practices). Paragraph 11.2.2 explains the covered best practices in more detail.

11.2.1 Best practices

BP2.	All the case information should be stored in the case itself.
BP3.	Production should be triggered by downstream.
BP4.	Within a self supported team, case workers should pull work only at the moment they need it.
BP10.	An engine should be available to automatically run the process.
BP12.	Case workers should have the ability to add a task to a case when they see a need.

11.2.2 Explanation of covered best practices in detail

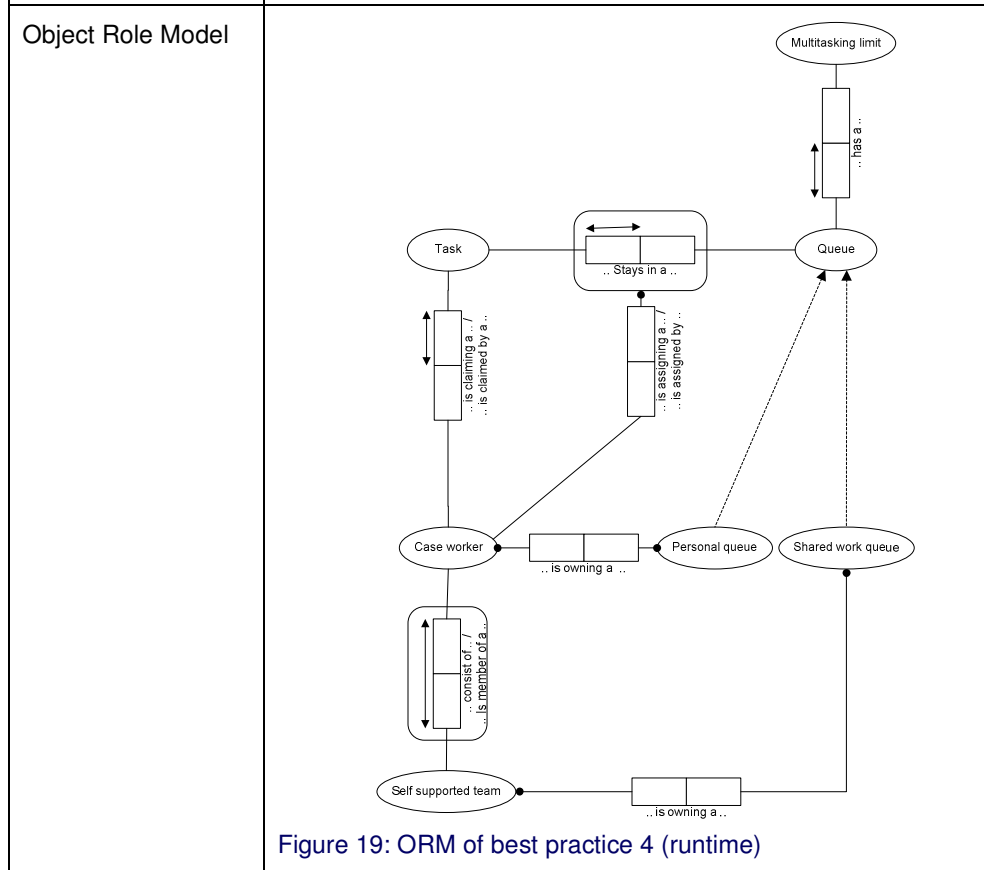| BP2.	All the case information should be stored in the case itself.
Description	Best practice 2 is completely covered by Calamity. The data as well as the documents (procedures or attachments) are part of the case itself. All the case related information is maintained centrally. Appendix B (paragraph 16.2.1) shows a working example where the data is entered into the input fields of a case. Figure 16 shows best practice 2 in the form of an Object Role Model (ORM). How this ORM relates to the total ORM of Calamity, can be found in appendix A (paragraph 16.1.2).
Object Role Model	 Figure 16: ORM of best practice 2 (runtime)

BP3.	Production should be triggered by downstream.
Description	Calamity only performs work based on customer demand pull. This means that a case is only be initialized when the client is triggering the process. For example a car trouble (figure 15). Figure 17 shows best practice 3 in the form of ORM. How this ORM relates to the total ORM of Calamity, can be found in appendix A (paragraph 16.1.2).
Object Role Model	 Figure 17: ORM of best practice 3 (runtime)
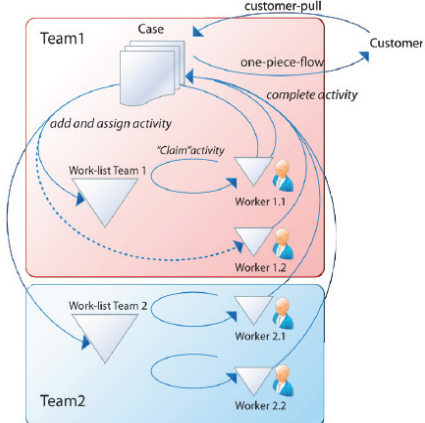
BP4.	Within a self supported team, case workers should pull work only at the moment they need it.

Description	Appendix A (paragraph 16.2.2) shows how a case worker is claiming a task. Calamity covers this best practice by providing the ability to:
	    - Pull/claim work from the shared work queue to the personal queue
	    - Defining work and assigning it to workers or teams.
	
	The various aspects of pull are best described by [De Man, 2009c]. Figure 18 shows a graphical representation.
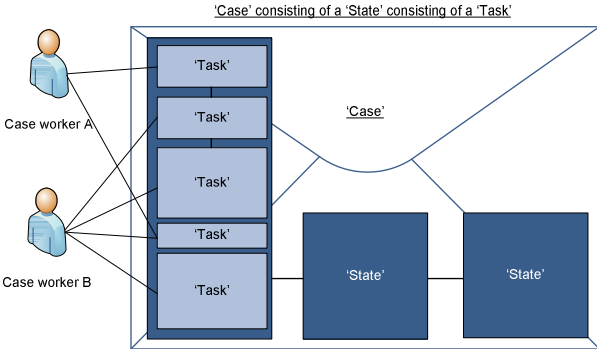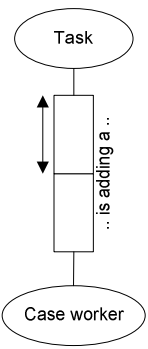
	Figure 18: Pulling knowledge work [De Man, 2009c] Within a self supported team, case workers pulling tasks when their previous one has been completed. In this way Calamity creates an optimal balance where overflowed or empty queues are avoided. The ORM of best practice 4 is depicted in Figure 19. How this ORM relates to the total ORM of Calamity, can be found in appendix A (paragraph 16.1.2 and paragraph 16.1.1).
Object Role Model	 Figure 19: ORM of best practice 4 (runtime)

BP10.	An engine should be available to automatically run the process.
Description	Calamity covers best practice 10 in many ways. Appendix A (paragraph 16.2.3) shows an example of the design environment. In this example a case is constructed including the states 'Open', 'Cancelled' and 'Closed'. Within the state 'Open' the tasks are connected with an A (Automatically) or an M (Manually). In this way the engine knows how to respond when a task is initialized. There are also some free tasks, which can be performed (into the state open) when the case worker see a need.
Object Role Model	N/A

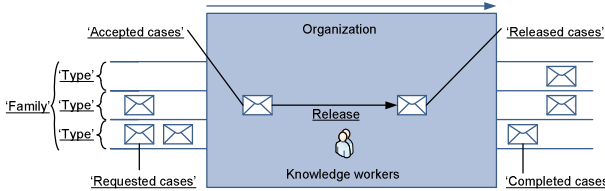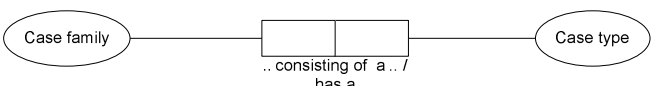| BP12.	Case workers should have the ability to add a task to a case when they see a need.
Description	As already described in best practice 10, states can have free tasks. Tasks can also be added in follow-up to case events. A free task should be started when the case worker feels the need for it. After adding a task, the task can be performed by the case worker itself or assigned to others (figure 20). For more information about this collaborative aspect see best practice 4. Figure 20: Adding a task to a case Calamity covers this best practice very well by adding and assigning a task, as shown in appendix A (paragraph 16.2.4). The ORM of best practice 12 is depicted in Figure 21. How this ORM relates to the total ORM of Calamity, can be found in appendix A (paragraph 16.1.2).
Object Role Model	 Figure 21: ORM of best practice 12 (runtime)
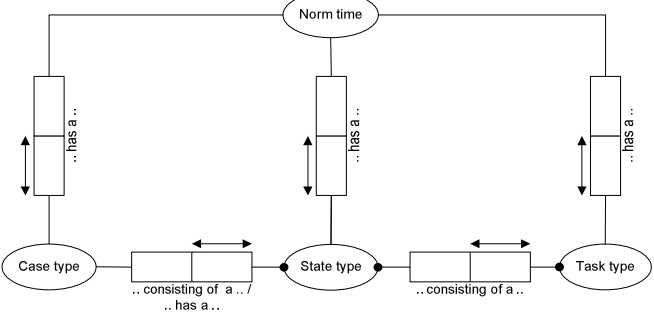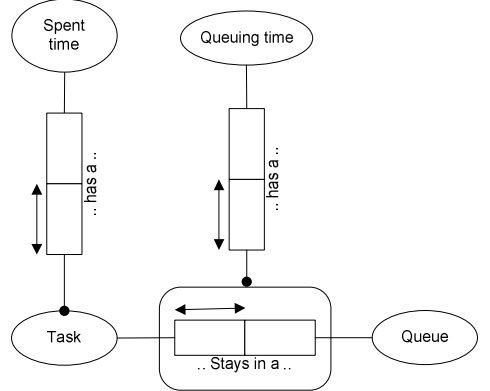
11.3 Best practices that can be covered by the current Cordys solution.

This paragraph starts with an overview of the best practices (Paragraph 11.3.1) that are covered by the current Cordys solution, but not yet implemented by Calamity. Paragraph 11.3.2 explains the best practices in more detail.

11.3.1 Best practices

BP6.	The case flow should be continuously monitored.

11.3.2 Explanation of the supported best practices in detail

BP6.	The case flow should be continuously monitored.
Description	The Cordys solution already covers best practice 6. Depending on what a company wants to monitor, different Key Performance Indicators (KPI) are necessary. The case handling process of company Calamity can be improved by KPI's that help managing the flow, defined at task, state or case level. See the following example where the duration time is exceeded.
	In design time (figure 22) the norm time of a work unit can be determined. By continuously monitoring the spent time and queuing time of a task (figure 23), a violation of the norm time can be intercepted and be managed.
	To enable productive monitoring not every case exception should be reviewed individually. When durations or norm times in a case are violated structurally the system should automatically change the duration time or norm time to facilitate better case flow management.
	An example of best practice 6 is depicted in Figure 22 and figure 23. How this ORM relates to the total ORM that is covered by Cordys, can be found in appendix B (paragraph 16.3.1 and paragraph 16.3.2).
Object Role Model	Figure 22: ORM of best practice 6 (design time) Figure 23: ORM of best practice 6 (runtime)

11.4 Best practices that can be covered by improving the current Cordys solution.

This paragraph gives an overview of the best practices (Paragraph 11.4.1) that are not fully covered by the current Cordys solution. Paragraph 11.4.2 gives an explanation in which ways Cordys can improve its product to meet these best practices.
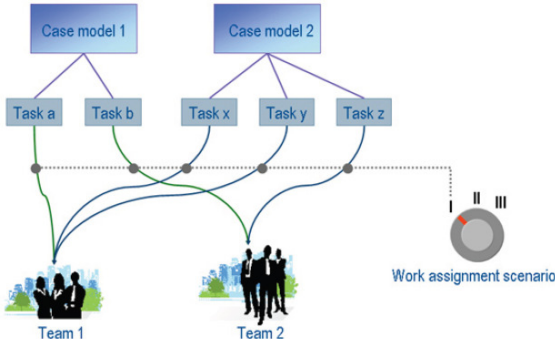
11.4.1 Best practices

BP1.	Case work balancing should be defined for a family of case models.
BP5.	A case could be pipelined to eliminate bottlenecks in order to optimize throughput according to customer demand.
BP7.	Lean designer should be supported by an online interactive simulation capability.
BP8.	The feasibility of a balanced flow should be tested by running a simulation.
BP9.	To enable '1-piece flow' solution, a priority strategy should be set on queues and state family.
BP11.	The customer demand should be leveled to protect a balanced flow.

11.4.2 Explanation of best practices to improve Cordys

BP1.	Case work balancing should be defined for a family of case models.
Description	Figure 24 shows that case families consist of case types.
	 Figure 24: Case families
	This best practice has a strong relation with best practice 7. By defining case families, workload can be better balanced. See also BP2.
	For example balancing at Calamity can potentially be improved by creating a case family for simple work, especially for the summer holidays. During the summer holidays extra staff is hired that can only perform simple work.
	The ORM of best practice 1 is depicted in Figure 25. How this ORM relates to the total ORM of improving Cordys, can be found in appendix C (paragraph 16.4.1)
Object Role Model	 Figure 25: Object Role Model of best practice 1 (design time)

BP5.	A case could be pipelined to eliminate bottlenecks in order to optimize throughput according to customer demand.
Description	Best practice 5 enables an optimal balance of the flow of cases within a case family (see best practice 1 and also 7). The idea is that case work is broken up in chunks and assigned to different workers or teams in such a way that each worker or team can complete its work just within takt time of the case flow. The ORM of best practice 5 is depicted in Figure 26. How this ORM relates to the total ORM of improving Cordys, can be found in appendix C (paragraph 16.4.1)
Object Role Model	 Figure 26: Object Role Model of best practice 5 and 7 (design time)

BP7.	Lean designer should be supported by an online interactive simulation capability.
Description	As described by [De Man, 2009c] the Cordys solution can improved with an online interactive capability. Figure 27 shows a graphical representation.

Figure 27: Predefined scenarios for case work assignment [De Man, 2009c]

The current work distribution of Calamity is static, where every case type is performed by the same team of case workers. For the companies that have always a steady customer demand this solution is fine. But for some companies more flexibility is needed. Because the case flow of Calamity is rather fluctuating (for example summer holiday peaks) balancing at Calamity can be improved with predefined scenarios.

Based on historical data and the input of the forecaster, alternative workload balance scenarios can be created by the Lean designer. These scenarios specify the teams that are required to do the work as well as the distribution of case work to these teams. This way the flow manager can toggle between multiple scenarios depending on the situation 'busy' versus 'less busy' periods. Think about the metaphor of the controller of an air conditioner or heather in the room. It is also possible that the case flow management system automatically selects a balance scenario based on planned effective date of the scenario.

For more information see the ORM that is depicted in figure 28. How this ORM relates to the total ORM of improving Cordys, can be found in appendix C (paragraph 16.4.1)

| Object Role Model | See figure 28. |

BP8.	The feasibility of a balanced flow should be tested by running a simulation.
Description	If a balanced flow is created, there should be an option to run a simulation. With the support of a simulation option, the balanced flow design can e.g. be tested on robustness against unforeseen variations in demand and available capacity.
Object Role Model	N/A

BP9.	To enable '1-piece flow' solution, a priority strategy should be set on queues and state family.
Description	A priority strategy can be used to protect customer demand pull sequence throughout the case flow. Commonly strategies are: First Due First Serve (FDFS), First In First OUT (FIFO) or Last In Last Out (LIFO). The ORM of best practice 9 is depicted in Figure 28. How this ORM relates to the total ORM of improving Cordys, can be found in appendix C (paragraph 16.4.1)
Object Role Model	 Figure 28: Object Role Model of best practice 9 (design time)

BP11	The customer demand should be leveled to protect a balanced flow.
Description	To enable regular demand patterns, accepted cases (cases which customer request has been accepted and delivery promised to the customer) should be leveled by the case flow manager. With the support of a schedule the case manager can create a leveled demand stream as input to the case flow system. The ORM of best practice 11 is depicted in Figure 29. How this ORM relates to the total ORM of improving Cordys, can be found in appendix C (paragraph 16.4.2)
Object Role Model	 Figure 29: Object Role Model of best practice 11 (runtime)

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12. Conclusion

This chapter looks back to the research in order to find an answer to the research question.

Based on the plan of approach (paragraph 5.3) there are four sub questions formulated. This chapter follows the same structure in order to find an answer to the main question. As already described in paragraph 5.1 the research question is: *How could BPM Case Management principles be applied to support knowledge workers in the Lean Office, and how can BPM Case Management solution be improved by leveraging Lean principles?*

Chapter 7 identified the Lean Office principles, derived from Lean Manufacturing. Although the method of improving the effectiveness and efficiency is the same, there are two substantial differences. The first difference is that Lean office can perform work simultaneously because information can reside in multiple locations at the same time. The other difference is that work is more complex to manage, because most of the work has a dynamic duration time.

The BPM Case Management principles are described in chapter 8. There are three big differences in comparison with BPM straight trough processing. BPM Case Management is unpredictable, knowledge intensive and more collaborative. The BPM Case Management framework shows that BPM Case Management is more represented into the aspects 'Way of supporting' and less represented into the 'Way of thinking'. The Lean Office framework looks like an inverse variant. Lean Office is more represented into the aspects: 'Way of thinking' and 'Way of working'. Remarkable is that no attention is paid to the aspect: 'Way of supporting'.

The synergistic relationship between Lean Office and BPM Case Management has been investigated in chapter 9. By mapping both frameworks directly to each other, the synergy clusters have been created. A synergy cluster groups the aspect of Lean Office and BPM Case Management that complement each other. One of the most synergistic clusters: Cluster IV Optimized Flow & Pull Systems have been detailed.

Optimized Flow & Pull Systems can be used to improve the effectiveness and efficiency of business performance by reducing the lead time and increasing the capacity. With the findings of cluster IV: Optimized Flow & Pull Systems, 13 best practices have been described, in which way the knowledge worker at the Lean Office can be supported (see paragraph 10.2). During the case study (chapter 11), each best practice has been validated in detail and the corresponding improvements for the BPM Case Management Solution of Cordys have been demonstrated.

This research shows that BPM Case Management and Lean Office strengthen each other very well. The success of Lean Office improves BPM Case Management by performing work more efficiently and effectively. BPM supports Lean Office by making improvements sustainable and manageable. By investigating other synergy clusters as well, much more reinforcements can be found, which will be left for further research. By mapping both frameworks directly to each other, some overlap became visible. For further research a kind of general BPLM (Business Process Lean Management) framework should be considered.

13. Research organization

This chapter describes additional information about the research organization.

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Country: The Netherlands

13.2 Company

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Lean principles in Case Management

14. Terminology

This chapter describes the terms used in this document in more detail.

Business Process Management (BPM)	Supporting business processes using methods, techniques, and software to design, enact, control and analyze operational processes involving humans, organizations, applications, documents and other sources of information. [Aals, 2004]
BPM Case Management	The management of long-lived collaborative processes that coordinate knowledge, content, correspondence and resources to progress a case to achieve a particular goal; where the path of execution cannot be predetermined in advance of execution; where human judgment is required to determine how the end goal can be achieved; and where the state of a case can be altered by external out-of-band events. [White, 2009]
Business Process Re-engineering (BPR)	A radical scrutiny, questioning, redefinition and redesign of business processes with the aim of eliminating all activities not central to the process goals … and automating all activities not requiring human judgmental input, or facilitating that judgment at reduced cost. [Thomas, 1994]
ESB	Software architecture constructs which provides fundamental services for complex architectures via an event-driven and standards-based messaging-engine.
Knowledge worker	A person that creates value from a mental ability to think. [Niblick, 2007]
Lean	A systematic approach to identifying and eliminating waste through continuous improvement by flowing the product (or service) at the demand of the customer. [Womack & Jones, 1996]
Lean Office	Lean Office: 'The administrative area working systematically to identify and eliminate all waste' [Tapping & Dunn, 2006] trough continuous improvement by flowing the service at the demand of the customer.
One-piece flow	Cases are handled, and flow through the system, one-by-one (instead of being batched), in a way that best preserves customer demand pull sequence from beginning to end. [De Man, 2009c]
Pipelining	A key implementation technique used to build fast processors. It allows the execution of multiple instructions to overlap in time.
Process	A sequence of tasks (or activities) to deliver a product or service.

SOA	A paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains [Oasis, 2006].
Takt time	The pace of customer demand. Takt time determines how fast a process must run to meet customer demand. [Tapping & Dunn, 2006]
Total Quality Management (TQM)	An approach to doing business that attempts to maximize the competitiveness of an organization through the continual improvement of the quality of its products, services, people, processes and environment [Goetsch & Davi, 1995].
Value stream	A sequence of processes connected by a common customer, product or service request.
Waste	Anything that adds cost or time without adding value. The seven most common wastes are: 1) Overproducing, 2) Waiting, 3) Transport, 4) Over processing, 5) Inventory, 6) Motion, and 7) Defects. Another fairly common waste is: 8) People Utilization.
Work load balancing	The distribution of work units across the value stream.

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16. Appendixes

This chapter shows the relevant background material.

16.1 Appendix A: Object Role Model of Calamity

16.1.1 Design time
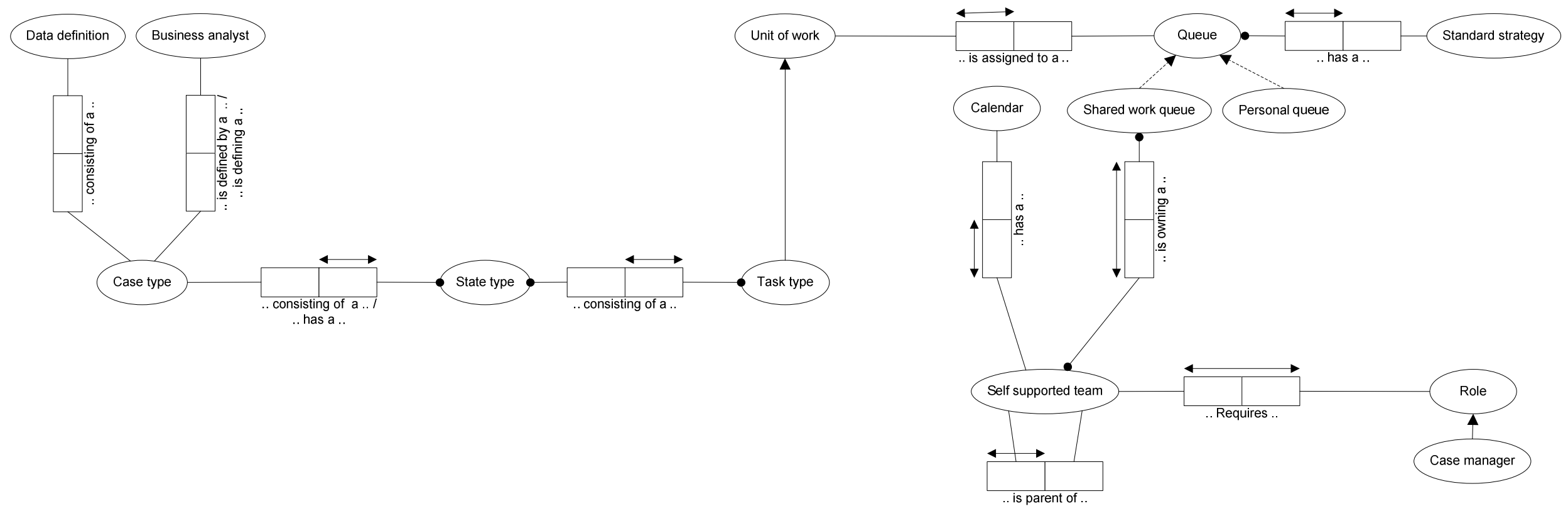
OBJECT ROLE MODEL Calamity (Cluster IV: Design time)
September 23, 2009

CORDYS

16.1.2 Runtime
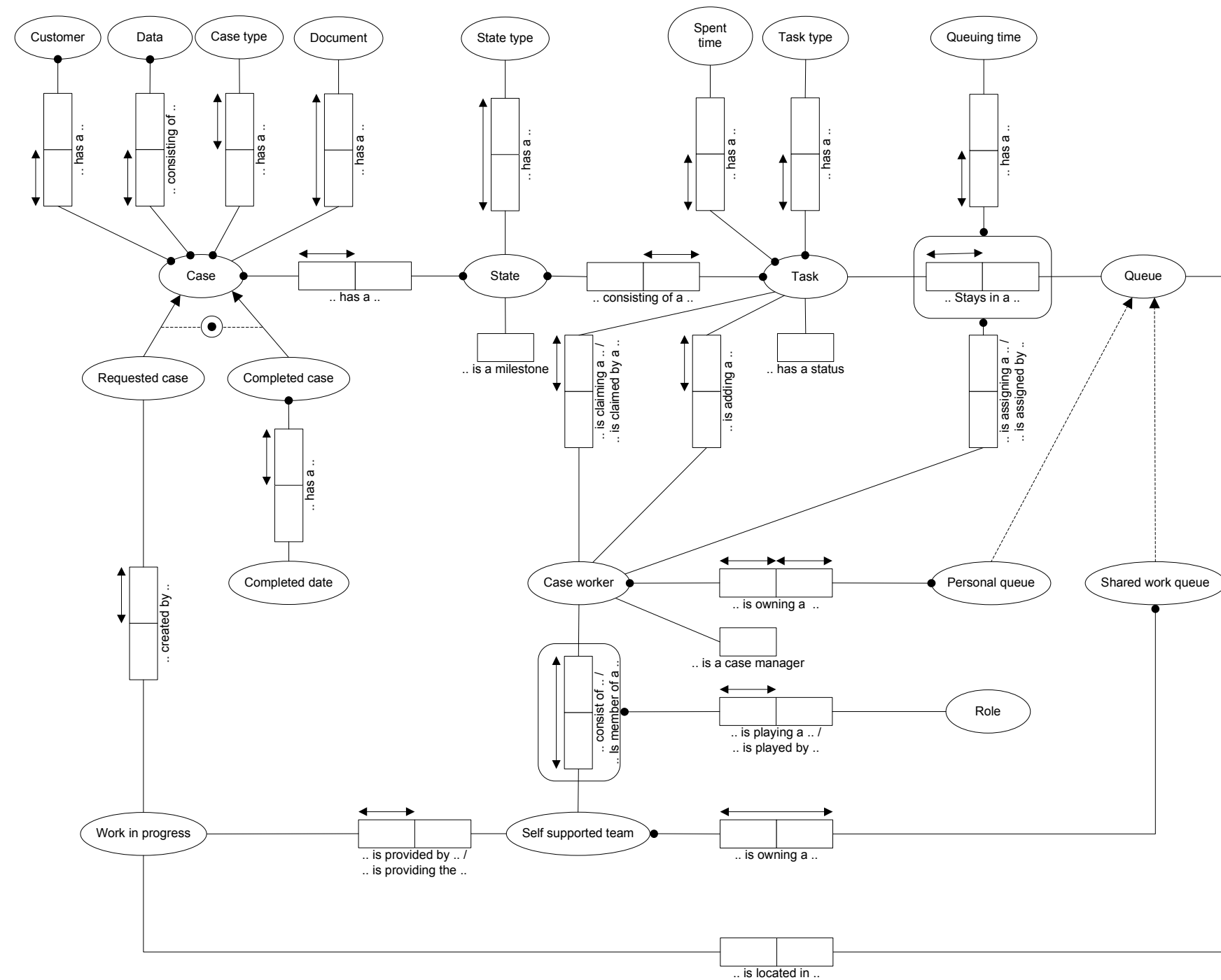
OBJECT ROLE MODEL Calamity (Cluster IV: Runtime)
September 23, 2009

16.2 Appendix B: Examples of best practices (case study)

16.2.1 Example of best practice 2

16.2.2 Example of best practice 4

CORDYS

16.2.3 Example of best practice 10
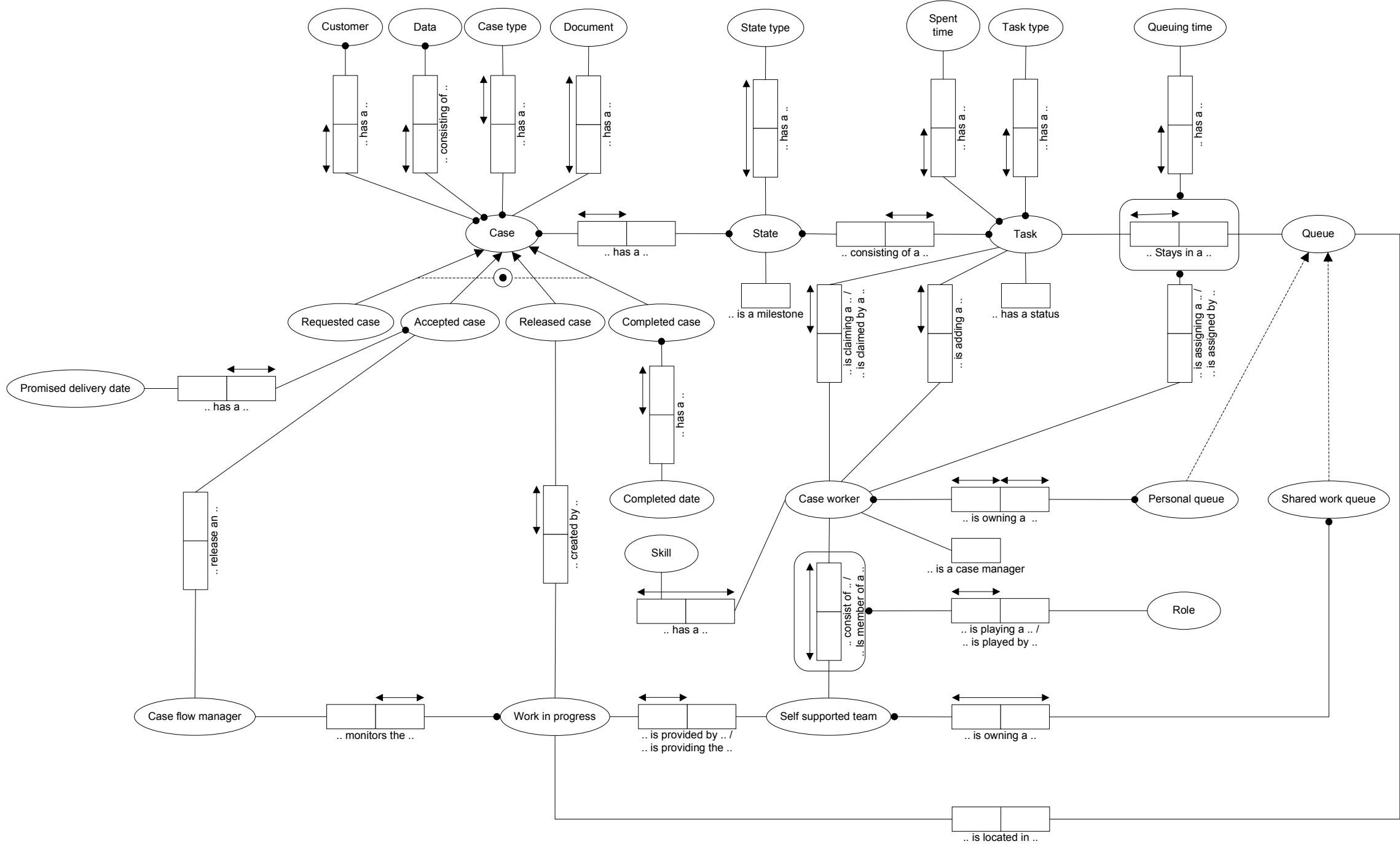
16.2.4 Example of best practice 12
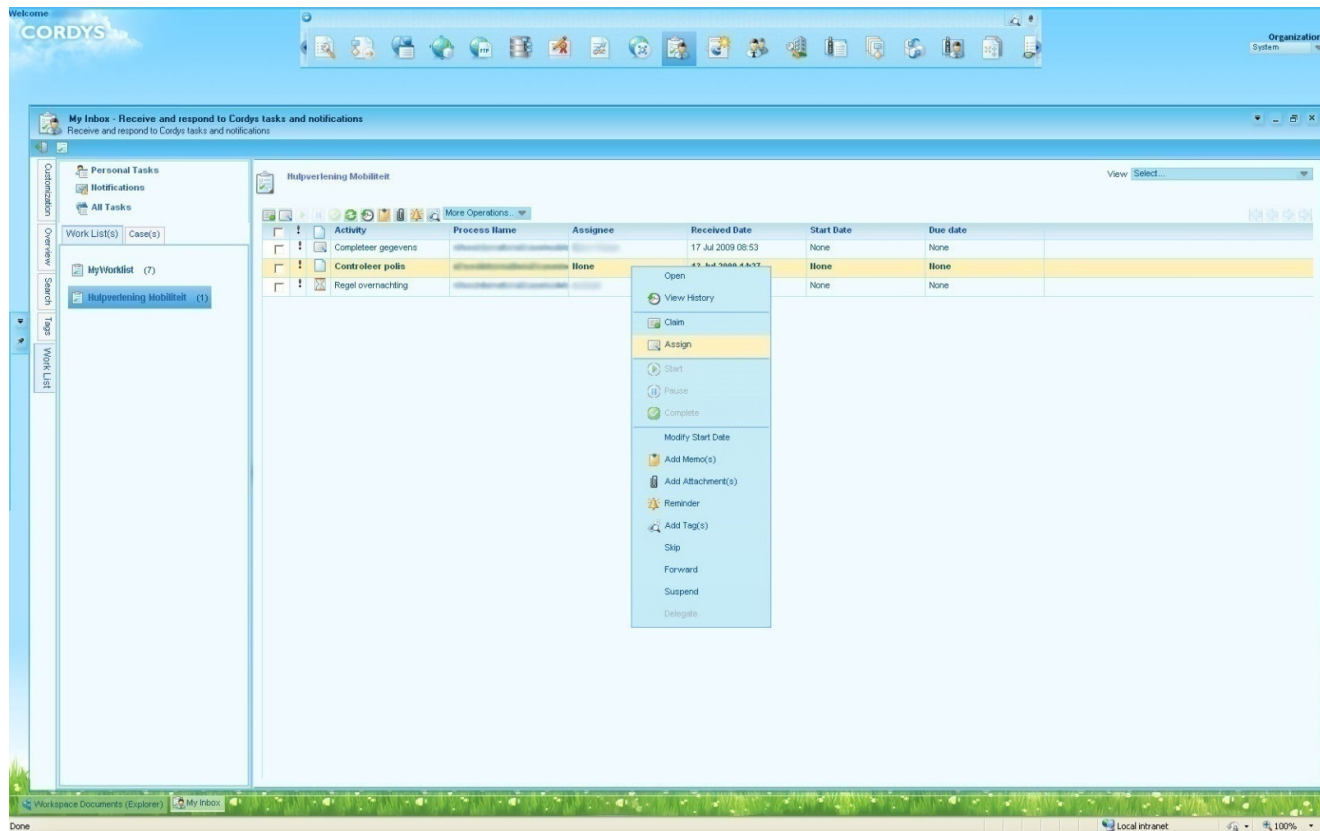
16.3 Appendix B: Object Role Model as is

16.3.1 Design time
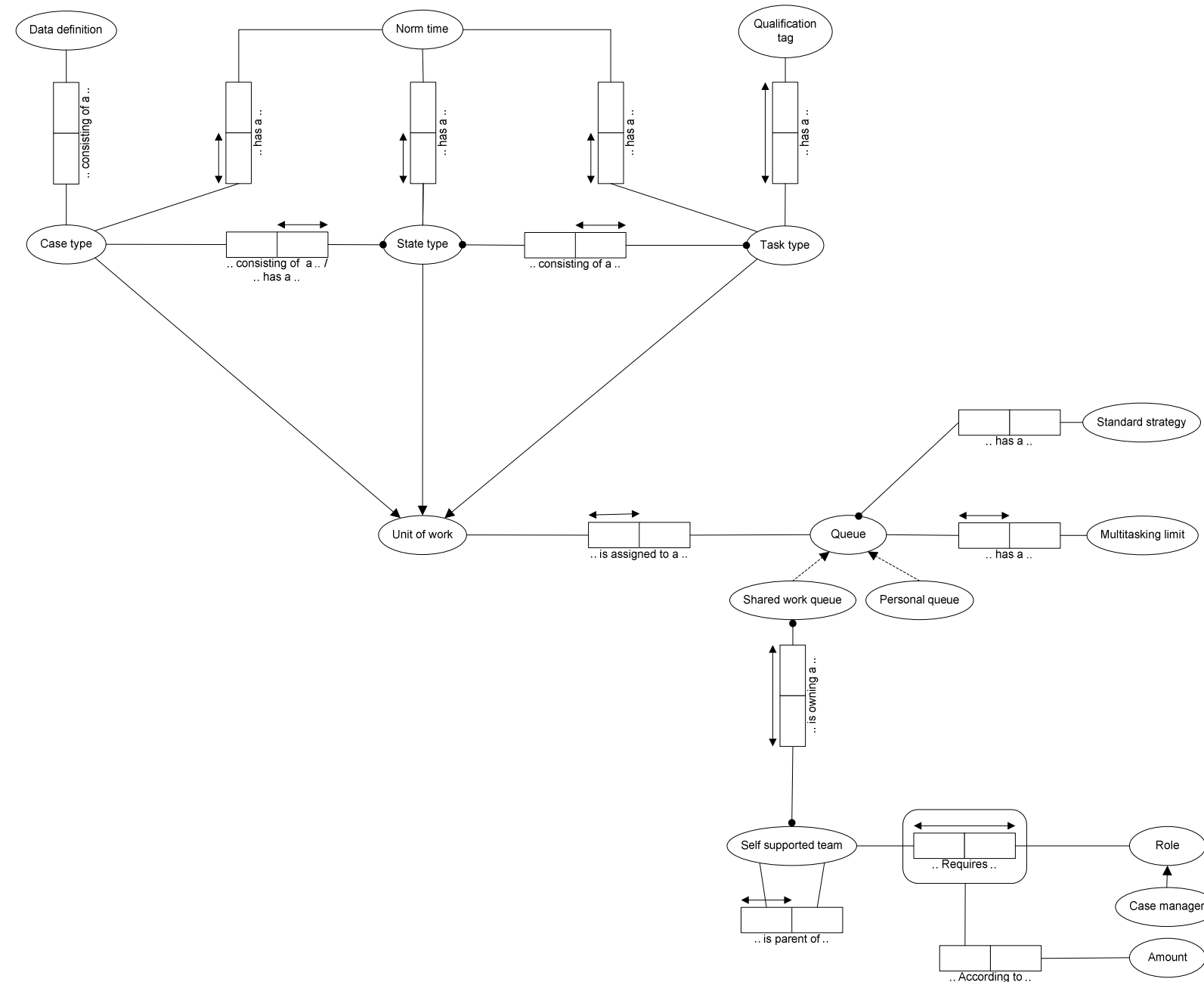
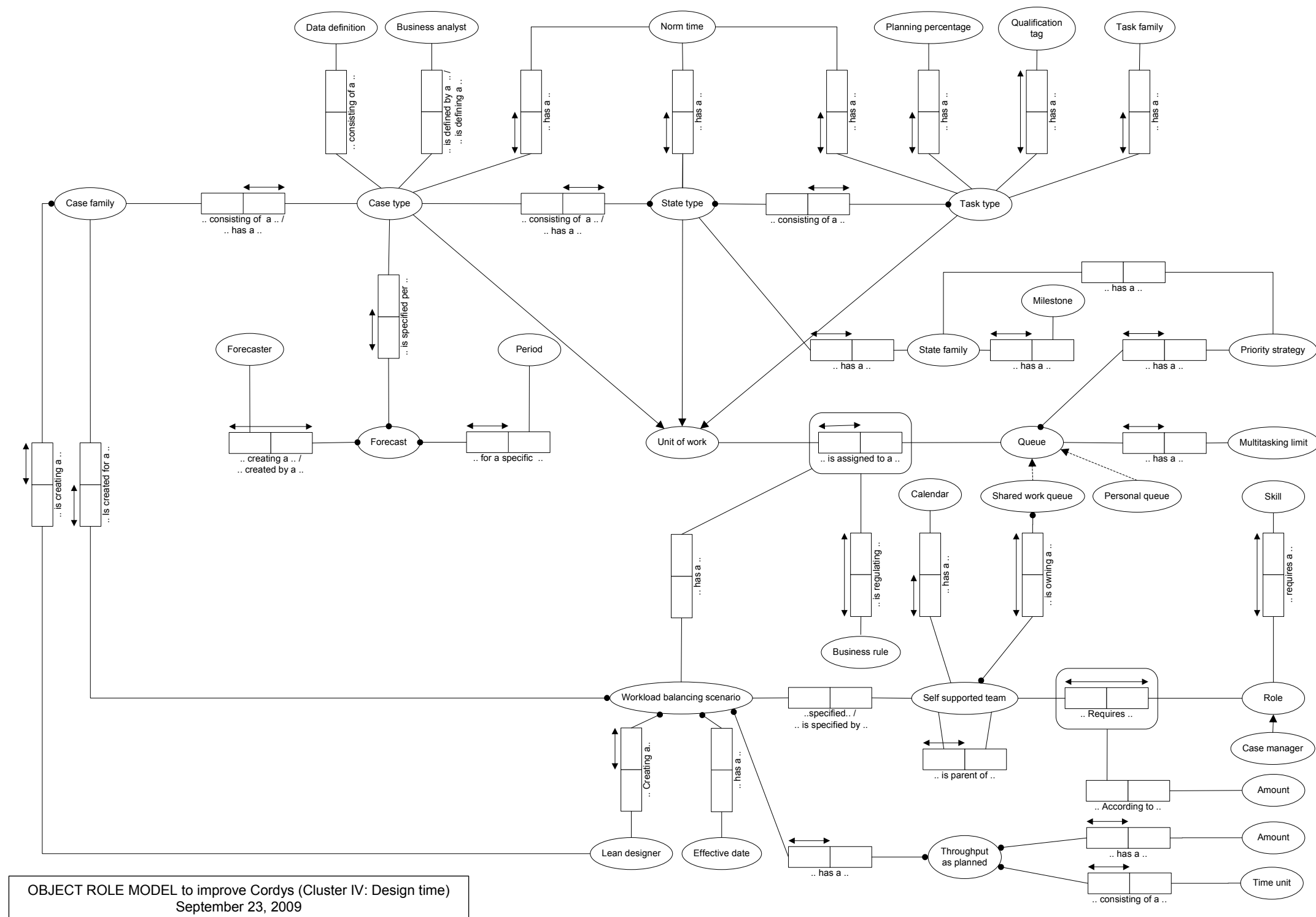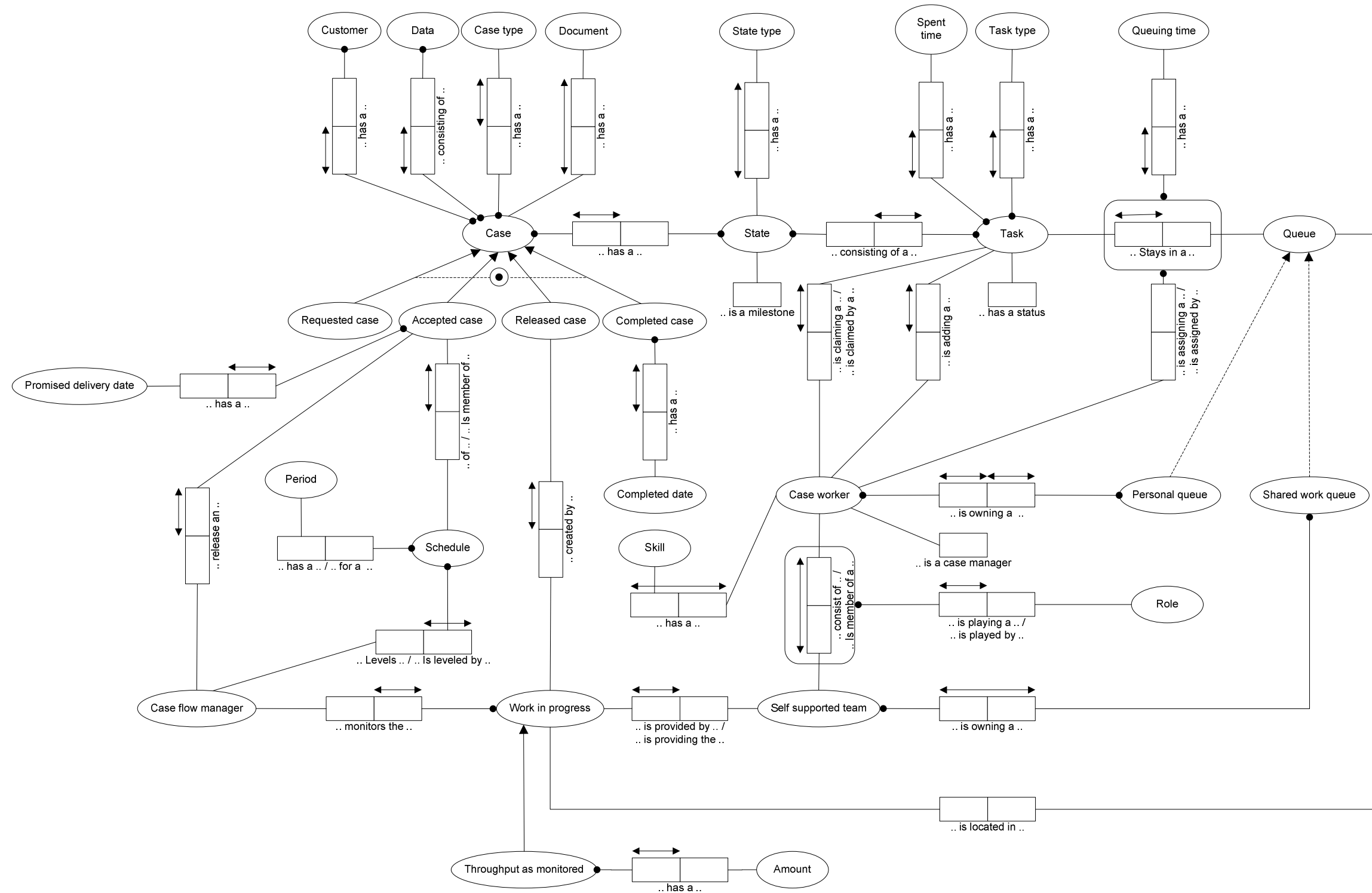OBJECT ROLE MODEL covered by Cordys (Cluster IV: Design time)
September 23, 2009

CORDYS

16.3.2 Runtime

OBJECT ROLE MODEL covered by Cordys (Cluster IV: Runtime)
September 23, 2009

16.4 Appendix C: Object Role Model to be

16.4.1 Design time

OBJECT ROLE MODEL to improve Cordys (Cluster IV: Design time)
September 23, 2009

16.4.2 Runtime

OBJECT ROLE MODEL to improve Cordys (Cluster IV: Runtime)
September 23, 2009