Master Thesis   *Adaptive Case Management*
Information Science   **A new way of supporting knowledge work**

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Date:	**4/7/2011**
Version:	**Public Version 1.0**

Abstract / Management Summary

This study looks into a new form of Case Management, known as Adaptive Case Management (ACM). The concept ACM has arisen to support the more loose, unpredictable and knowledge intensive processes. The objectives of this study are to determine a vision, and advice a direction on ACM. By selecting relevant trends, possible new functions for ACM have been derived. Trough testing the user value for these possible functions (questionnaire) and testing the current realization-state of software in comparison to the ACM vision as a whole (benchmark), an advice is created to further develop and improve ACM software.

Preface

This thesis and underling research is the "final-piece" for my school-career. Starting from a lower-educational background, and studies at medium and higher vocational level in ICT, I have climbed up to a master level in information science. I have seen and done a lot, in the some-times bumpy road to this level. Performing academic research and writing a thesis within the company Océ, has been a very useful experience that has not only broadened my skills, but also the way of coping with uncertainty.

First of all I would like to thank Theo for all his support. His guidance and advice has helped me a lot during this end-project. Also I would like to thank Jakob, fellow intern Santiago, and all direct colleagues at Océ R&D Venlo, for their sharp and constructive feedback. The way that they involved me in various meetings and all kinds of aspects, is something what I have never experienced before in an internship. Interns are taken serious within Océ; that is something I really appreciate.
So I can say that graduating at Océ has really been an irreplaceable experience for me.

I hope that you enjoy reading this thesis,

Venlo, June 2011

Koen Strijbosch

Contents

1   Introduction

The technological advances and trends like globalization in this modern society are quickly changing the way we work. Since the internet is growing to fulfill social needs and collaboration across borders, a new kind of flexible working has arisen. People will work more at home and use the internet to communicate with their colleagues. The digital workplace is becoming more common.

For organizations, the pressure on delivering good services and products is growing each day. Also products and services change in a few months, rather than years. As a consumer we demand direct insight and performance, and will not accept slow and bureaucratic procedures anymore.

To achieve this, the work that can be automated, will be automated eventually. What remains, is the hard to grasp work; Knowledge work [DAV05]. This work leads to a new kind of worker, who has to deal with a lot of information; the knowledge worker. The knowledge worker is more autonomous, and deals with uncertain and unpredictable things, which is hard for a computer. This worker has to make decisions where a computer cannot.

Conventional solutions (like BPM and WFM) focus on processes, are complex and make implementation and change a difficult process which takes a lot of time[1]. The business wants to be more in control. This demands solutions that are easier to use and adapt, without needing an army of consultants and developers. If processes change, due to new services or products, the system must be able to handle this.

So companies have to deal with these developments, and need a way to manage this knowledge work and the new kinds of collaboration that are clearly increasing[2]. But where is it going? To overcome the limitations of conventional solutions, "Adaptive Case Management" has emerged. ACM responds to the need to manage the work and information, which has a more unpredictable nature. For example, when no process can be defined in advance or many exceptions occur. ACM gives the freedom to handle this, but also gives some kind of structure to work from.

1.1   Main research question & Goal

This leads to the main research question:

> *Describe, given the light of current developments and trends, a vision on Adaptive Case Management, and the way it supports knowledge work.*

The main goal for this research is to create a vision about ACM, and test what has been realized of this vision. Creating a vision will help to decide how to support these new kind of working with ACM. How could ACM evolve and which trends could be interesting? How and what should be further developed? These are important questions for developers of Adaptive Case Management software, which constantly need to improve their product and vision.

To be able to choose a path, some kind of prediction and vision is necessary. Otherwise blind decisions are made. Is Adaptive Case Management really the thing we are looking for? Or should we shift towards another approach?

Being ahead of the competition is crucial. A good overview combined with innovation can mean the difference in survival or not. My research provides a piece of the puzzle to achieve this.

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[1] http://www.kennisportal.com/main.asp?ChapterID=4495
[2] http://www.computable.nl/artikel/ict_topics/ecm/3770865/1277020/atos-origin-stopt-met-emailen.html

1.2   Sub questions

I will start my research by studying the literature around case management and the new Adaptive Case Management. I will describe and position the current developments that have influence, and will place Adaptive Case Management in the line of those developments. I will use the current line of trends to build a vision concerning the support of knowledge work by ACM. This vision will be used to derive functionality (in the form of base and trend functionality).

After this step, I can validate what users think about the trend-functionality (Questionnaire). Also software products will be tested to the ACM vision fit, by testing derived base-functions (Benchmark). There will be described which things lack, or are already taken care of. Finally an advice can be given.

The following sub-questions are answered:

1. *What is Adaptive Case Management, and which current developments and trends are relevant?*

   This question is one of the most important to build a vision. It helps to place Adaptive Case Management in a broader perspective, and look beyond this solution only. The base characteristics and functionality of ACM will be researched. Trends will be positioned in a trend framework, and other developments will be described too. I have used the available literature as the main source.

2. *Who work with ACM and what do they think about certain new functionality?*

   It is important to think about the users of ACM systems and their needs. I've studied the literature about knowledge work and organizations in which these are present. A workshop about personas and various expert interviews have helped to create the personas. Base- and mainly trend-functionality will then be derived using UML-uses cases as a thinking base. The trend-functionality is tested with a questionnaire for user-value. For this questionnaire the created personas will be linked.

3. *Describe where ACM is going, and give a comparison of current developments.*

   Besides the literature study and questionnaire, I reflect the current developments in software-products to the ACM vision. How do these software-products fit in the created vision? What is lacking and what is already in it? This will lead to a benchmark for testing the base- and trend-functionality, and eventually a final score for each software product.

4. *Form an advice to deal with these developments and the future regarding ACM.*

   By using the results of literature study, vision, questionnaire and benchmark, an advice to deal with these developments in the context of ACM, can be given. Also an advice regarding possible new functionality or additional components to incorporate in ACM software products will be described.

Note that the structure and use of methods can be found in chapter 5.2.

1.3   Structure of this thesis

Chapters

-Chapter 1   Introductions of the research-topic and its relevance. Main and sub-questions will be given. Also the main research goal is set.

-Chapter 2   Introduction of the concept of Adaptive Case Management (ACM), and some important definitions to understand this concept.

-Chapter 3   Who work with ACM and introduce the "personas" and "clientas" technique.

-Chapter 4   Discusses the trends that are relevant for ACM. These trends are then placed into the trend-pyramid structure.

-Chapter 5   Builds the vision on the previous chapters. Where ACM is going to? Also the structure and deriving of functionality which will be tested for user-value (questionnaire) and completeness to the ACM vision (benchmark) is described to give overview.

-Chapter 6   Shows the questionnaire and approach that has been used to measure user-value for new trend related functions (features). The results will be further analyzed and discussed.

-Chapter 7   Describes what is realized of the ACM vision and functionality in software at this moment, by benchmarking current software products. I will show how the benchmark is set-up, and scoring is applied. The results of the benchmark will be further analyzed and discussed.

-Chapter 8   I will wrap up by giving a conclusion regarding the gained insights during this research. After final conclusions, recommendations for possible improvements and direction for ACM systems will be given. Finally some possible relevant future work will be described.

Appendices

-Appendix A   Describes the used Personas & Clientas for this research

-Appendix B   Shows the UML use case diagrams which are used to think about new functionality

-Appendix C   Listing the derived functionality made for the questionnaire and benchmark.

-Appendix D   Contains a "paper-copy" of the digital questionnaire. *Note that this is in Dutch only!*

-Appendix E   Contains the results & analysis of the questionnaire *(Confidential)*

-Appendix F   The long-list for the benchmark (short-list can be found in thesis)

-Appendix G   Contains the used test-documents

-Appendix H   Contains the results & analysis of the benchmark *(Confidential)*

-Appendix I   Possible Improvements for ACM software are described here *(Confidential)*

-Appendix J   Conclusions about the benchmark & questionnaire *(Confidential)*

2   What is Adaptive Case Management?

2.1   How can ACM be defined?

To support organizations that have a lot of knowledge workers, and thus have processes that can't be fully automated a new concept has emerged. This concept combines process and document management is also known as "Case Management" [LEC09, DEK09, AAL05, WHI10, RIC03, SIL09, REI03].

This new case management concept shares some other names: "Dynamic Case Management" [LEC09, LEC11], "Adaptive Case Management" [SWE10], "Case-Handling" [AAL01, AAL05, REI03] and (names by manufacturers like) "Advanced Case Management", which address essentially the same concept, but not all in the same way.

This new Adaptive Case Management is a way of looking at supporting processes, when comparing to the BPM method. Instead of having the process central, the data is put in the middle [SWE10]
In this sense the data is leading in the actions and activities that need to take place, and not the other way around. This leads to a product-driven work, in the form of a case. Van der Aalst & Berens [AAL01] already wrote about this product-driven case handling (PDCH) in 2001.

Although the initial concept of a "case" and the management of these cases is not new, it has been given a much broader description and purpose in the light of today's business process challenges [LEC09]. The dynamic and flexible nature of this new case management transforms it into a new way of approaching support of work; Adaptive Case Management (ACM).

To define Adaptive Case Management I will use a definition of a similar name, but with the same meaning. Dynamic case management has been defined by Forrester [LEC09] as follows:

Intensional:
"A highly structured, but also collaborative, dynamic, and information-intensive process that is driven by outside events and requires incremental and progressive responses from the business domain handling the case."

Extensional:
"Examples of case folders include a patient record, a lawsuit, an insurance claim, or a contract, and the case folder would include all the documents, data, collaboration artifacts, policies, rules, analytics, and other information needed to process and manage the case."

Van der Aalst [AAL05] state uses this new definition and understanding:

"Case-handling is a new paradigm for supporting flexible and knowledge intensive processes."

Differences between the handling of cases and workflow approaches have been studied many times in the recent history [WAR07, MUT08, AAL05, SHA10, KEL08, REI03]. The aim of those studies is mainly to fit a less defined process in a current WFM system.

The essence of "Adaptive Case Management" is supporting work that is loosely or partly pre-defined. For example a municipality needs to deal with a lot of requests, also increasingly in a digital manner. Such a request or application is referred to as one single "case" in this context. Sure, some cases can be handled the same way, but in real-practice many exceptions occur. Every case has its own specific details that can influence the way a case is being handled, no case is completely identical. That is exactly where adaption by the supporting system is necessary to solve the case.

The employees who need to process these "cases" are mostly knowledge workers, which do not always follow the same "work-path", but make autonomous decisions when necessary. For instance if they deal with an unknown or not previously encountered case (exception), the path has to be determined. So it is hard to pre-define this kind of work.

Therefore there is the need to support, the process and information (data) that the knowledge worker uses to deal with these cases. This information contains all necessary documents, scans, emails and other sources around a specific case. Ideally this would create a flexible and supporting digital work-environment for the "hard to grasp" tasks of a knowledge worker. I will continue on defining this knowledge work and worker in chapter 3.

2.2   Characteristics of processes that can be supported by ACM

One of the authors of the book "mastering the unpredictable" [SWE10]; Dermot McCauley gives some key characteristics of processes where Adaptive Case Management is applicable:

"-Goal driven
-Knowledge intensive
-Highly variable processes
-Long Running
-Information Complexity
-Highly collaborative
-Multiple participants and fluid roles
-Inter-related cases
-Juggling fixed and flexible timescales
-Sensitivity to external events
-Cross-organizational visibility
-History
-Demanding Security requirements
-Isolated pockets of automation"

2.3   Characteristics a ACM system should have

Although there are not much scientific papers written, there are many whitepapers and publications which give a description of the characteristics of a case-handling system. I will now discuss some key characteristics for Adaptive Case Management as seen in the literature.

White [WHI10] has formed a set of challenges which a case-handling system should deal with:

"-Striking a balance between Practice and Procedure
-Capturing implicit rules and tacit knowledge
-Formalizing Experience - supporting learning
-Supporting ad hoc change
-Involving participant in the design of knowledge processes
-Supporting collaboration
-Supporting decisions
-Effectively coordinating participants
-Managing complexity
-Managing Artifacts
-Integrating disparate systems "

To continue, Reijers Et al. [REI03] also give a number of characteristics of case-handling:

> *"-System focus is on the case*
> *-Process is data driven*
> *-Parts of the process model are implicit"*

Van der Aalst Et al. [AAL05] states four core features of case-handling, related from his work on contemporary workflow management systems, and previous insights of alumni [REI03]:

> *"-Avoid context tunneling by providing all information available (i.e., present the case as a whole*
> *rather than showing just bits and pieces),*
> *-Decide which activities are enabled on the basis of the information available rather than the*
> *activities already executed,*
> *-Separate work distribution from authorization and allow for additional types of roles, not just*
> *the execute role,*
> *-Allow workers to view and add/modify data before or after the corresponding activities have*
> *been executed (e.g., information can be registered the moment it becomes available)."*

Bruce Silver [SIL09] gives a few functional requirements for case management.

> *"-Case information managed as documents*
> *-Case activities added at runtime*
> *-Case advancement trough events*
> *-Case context trough shared case folder"*

Also interesting to see are the three guidelines Swenson gives [SWE10]. He suggests a completely different approach from BPM.

> *"-It is not based on the principles of scientific management[3]*
> *-It does not require that a process diagram be discovered and formalized beforehand*
> *-It does not expect a large up-front cost to be recouped through a large number of repeated processes."*

Also where Swenson suggests a completely different approach, others like Silver suggest a sort of expanded BPMS. This makes clear that the exact realization and implementation is not uniform a there are more visions and possibilities.

So the different authors give some good viewpoints, but at the same time also impose a lot of questions. The number of different "tasks" an Adaptive Case Management system should cover is hard to realize. Is it possible to do all of this in one system? Looking at the start areas of different software-products and its specific orientations there will be some, which are better at certain parts in this list. This will be described later on.

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[3] Scientific management is the school of management by Taylor, which aimed at improving the physical efficiency of an individual worker, by recording precisely what must be done for a particular task, and then training workers to replicate that. [SWE10]

2.3.1   Key Categories

From these viewpoints, I have combined and grouped the key characteristics into three global sets of "key categories" for ACM systems. With other words what are the key areas an ACMS should be involved with:

Collaboration & Decisions	Process & Activities	Information & Presentation
-Supporting collaboration	-Case activities added at runtime	-Case context trough shared case folder
-Supporting decisions	-Separate work distribution from authorization and allow for additional types of roles, not just the execute role	-Avoid context tunneling by providing all information available (i.e., present the case as a whole rather than showing just bits and pieces
-Capturing implicit rules and tacit knowledge	-Supporting ad hoc change	-Managing Artifacts
-Effectively coordinating participants	-Involving participant in the design of knowledge processes -Striking a balance between Practice and Procedure -Case advancement trough events	-Case information managed as documents -Managing complexity -Integrating disparate systems
	-Formalizing Experience - supporting learning	-Allow workers to view and add/modify data before or after the corresponding activities have been executed (e.g., information can be registered the moment it becomes available)
	-Decide which activities are enabled on the basis of the information available rather than the activities already executed -No formalized process diagram is necessary.	

So this leads to three key categories which case handling has to deal with. This gives a clear image of the areas where Adaptive Case Management should focus on. I will briefly explain the three sets.

-Collaboration & Decisions

> The need for collaboration and the support of the decision-making process by being aware of the state of the case is vital. Also the control on the case should be in the hands of the people who need to solve it, so not too much forced system decisions but better suggestions. Of course there are some situations of less free processes, in which more guidance is needed.

- Process & Activities

> There should be support for a flexible process and activities. In other words if there is an ad-hoc change, the system needs to deal with it. A worker should have the possibility to create new activities or deviations from the standard process, also re-executing activities and skipping should be incorporated.

> The state of the case-handling process should be based on events or rules, so the system can track the state of different cases. A request is for example an event that triggers the initial state of a case.

Also learning from previous activities and followed process path's is essential. This learned path can then be applied to new instances of the same kind, by proposing activities to handle that case. The concept: learning from other cases is also referred to as "Case Based Reasoning" (CBR). Essentially this means solving new problems with the information, knowledge and solutions used in the past.

-Information & presentation

The presentation of information in a case handling system (also including interface) should be kept simple and aim at a central case-folder where all information of a single case is available and managed. Information in this sense can be virtually every digital document or "artifact". Although all information for a single case should be complete and could give too much complexity, context tunneling should be avoided.

All the characteristics of these three categories share a close relation to each other with some overlap. This leads to the "Adaptive Case Management - Core".
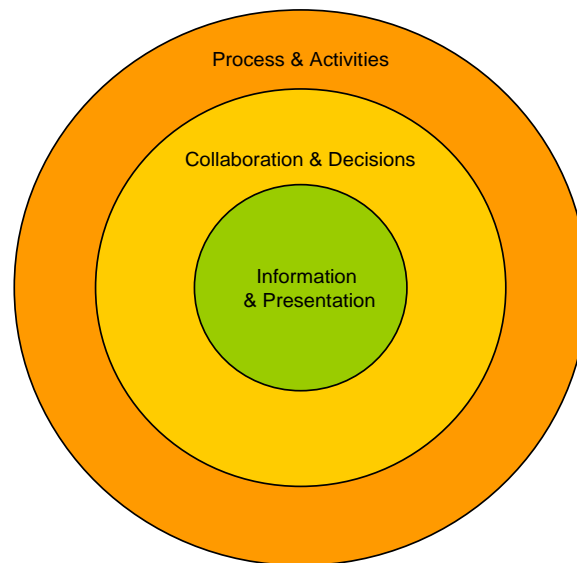

Figure 1: The Adaptive Case Management core

This figure gives an abstract view on the key categories where ACM should be concerned with. It gives a way to think about ACM and the vision behind it.

2.4   Problems with current approaches

Adaptive Case Management has emerged because it has potential to solve problems that current approaches such as ECM and BPM suites have. The most important problems with current approaches are listed:
Note that some definitions on BPM can be found in chapter 2.6.

Problems with BPM [SWE10]
-        Processes have to be defined and described in detail before enactment can start.
-        Often needs a long pre-implementation and implementation trajectory.
-        Many consultants and technicians are needed to update the running processes and system. (There have been attempts to let the business control their processes themselves but these do not succeed.
-        BPM suites are complex and need expert knowledge that companies do not have.
-        BPM incorporates process and workflow technology but has many of the same problems that WFM has.
-        The designer and executer of the processes are different persons. So one person designs what the other should do, for example there can be misunderstandings which result in designing processes that are not suited enough (unpractical) for the real work.

Problems with WFM [AAL05]
-        Processes need to be specified in advance, including exception pads. Processes that cannot be predicted are hard to support, because exceptions paths are not clear.
-        Users are restricted in possible actions, resulting in bypassing the system. Flow control is leading, not the data and information around the case. This is also known as context tunneling, as Van der Aalst et al. describe
-        The work what needs to be done is straight jacketed into activities, but the work itself is more fine-grained
-        Routing of work by the WFM is focused on what should be done, instead of what can be done. This results in rigid inflexible workflows.
-        The routing is used for both work distribution and authorization, resulting in crude mechanisms to align workflow and organization. This gives problems with coincide of distribution and authorization.
-        Needs process analysts to make and update the flow of processes, due to complexity. Again attempts to let the business do it themselves have failed in most cases.

        Van der Aalst et al. [AAL05] also states that recent flexible workflow management approaches are still based on routing as the only mechanism for process support. These have the same problems as contemporary WFM.

Problems with ECM/DMS
-        Mainly focused at the storage of content. This includes the whole lifecycle of content, such as records management, data retention and other specific content related applications.
-        Supplies workflow for the content lifecycle, but not for other processes.
-        Connections with the process & activities of the work are often not or badly realized, resulting in a separate system.
-        You do not need a document or dossier to start a case; it could be a call or meeting.
-        In DMS systems, content is often created outside the system, and afterwards "registered" in the DMS application. This could result in a system that is only used for dumping documents and not really working with it.

Problems with CRM
-        Too much aimed at the customer side, connections with back office and other parts in the processes are often not made, resulting in separate systems. Often CRM systems are badly integrated and run besides the other applications organizations already have.

- Although in a certain context also aimed at cases, the system often has not the flexibility a case management has. It is limited to CRM like cases (strict forms, limited actions, and no other content can be added), other cases cannot be handled. [WHI10]

2.5 Main advantages & disadvantages of ACM

ACM combines the best of process-, content- and customer-centric approaches. This results in a versatile tool with less restriction. It will enable doing work with a system, that truly gives the handles and support to do the processes that have not been supported before. Data can be found at one place for all colleagues, giving room for collaboration. Also advantages of BPM and WFM can be used to have some simple workflow, but with a much less strict approach.

So what are the main advantages and disadvantages of Adaptive Case Management? Looking at the literature the following are given.

2.5.1 Advantages

Most of the disadvantages by other approaches, named in the previous paragraph are to be solved by the use of case management. The advantages are mainly created by the freedom a case management system offers against the strictness by conventional systems and approaches. Not everything can be grasped in a process or workflow model.

The main advantages, concluding from relevant literature [AAL01, AAL05, LEC09, REI03, SIL09, WHI10, SWE10] are:

-Aimed at data/products instead of processes, all case information is available not just parts
-Has no context tunneling, because focus is on the case (all available data on the case is presented)
-No full process description or workflow is needed in advance, so quick implementation
-Support for change (that also can be made by the business, without needing to consult an expert)
-Learn from previous cases (CBR, case based reasoning)
-Flexibility, to be used widely in situations where some kinds of "cases" emerge.
-Usable in high innovative, knowledge & collaboration- rich environments
-Leads to reduced costs, cycle time and increased value.

2.5.2 Disadvantages

The main disadvantages, coming from the freedom that Adaptive Case Management offers, in perspective to BPM/WFM are [REI03]:

-Needs more coordination effort from the users
-Less efficiency (for simple, repeatable processes)
-Harder to ensure quality, because processes can be handled differently
-Harder to maintain in the sense that logistics and content of work are integrated
-Sometimes more structure is needed than given by a CHS.

So the ability to deal with loose processes in a flexible way, goes at the expense of tight and efficient process control that BPM/WFM approaches deliver. This can be a big disadvantage in environments where the majority of processes can be straight through processed (STP) or should be handled very strict. For example a financial administrative process should be handled strict. This makes ACM less suitable and applicable for strict processes, where a lot of control is required.

Comparing to CRM and ECM approaches, ACM seems to take the best of these. The data-driven character represents the ECM approach, and the cases are directly connected to customers, just like in CRM. So ACM offers more structure, but with keeping the flexibility.

2.6   Concepts around ACM

Because there is a close relation to ECM/DMS and BPM/WFM systems, I will explain a few important concepts for ACM.

2.6.1   Digital Dossier

A digital dossier (or case-folder) is emerged out of the need to bundle documents that have a relation with each other in one folder. Just like a physical dossier-folder which contains all related information in a certain context. The concept of a "dossier" is very old and determines the context or relationship of a set of documents[4]. Dossiers create structure in large parts of information. This is closely related to the science of archiving, which has his roots in Germany (note that archiving itself is obviously much older; libraries and archives exist for thousands of years). Jacob von Rammingen (1510-1582), wrote the first registry and archival management manuals, which where printed in 1571 [RUM01].

Later on much of the archival discipline gained a boost in the twentieth centuries, by the coming of new technologies like computers [RUM01]. From the beginning of electronic archiving of dossiers in the 1980s a lot has been done in this area [TIM01]. The oxford pocket dictionary of current English, defines a dossier as:

> *"A collection of documents about a particular person, event, or subject"[5]*

So converted to the digital variant; a digital dossier is a collection of digital documents, possible in different media-forms, which have a particular relation or coherence, in a specific context. For example: the relation or coherence in a specific context can be seen as "the dossier of a student". This dossier holds the progress, grades, comments, but also a picture of the student and other information.

The management of dossiers and content falls under the Enterprise Content Management "umbrella". Managing digital dossier content holds many challenges, especially when storing files with files in them (for example a document with video enclosed. Also the line between digital and conventional sources, through augmented reality and other new representation techniques is a development that is taking place.

2.6.2   Business Process Management

BPM is concerned with the management of business processes in a broad sense. A business process is not static and should be updated and innovated [HAM90, KO09, DAV93]. The process of designing, configuring systems, process enactment and diagnosis is all part of the so-called BPM life-cycle, which is iterative. [KO09, AAL95, AAL03] This term is commonly used as an "umbrella"-term, when talking about process related techniques. But there is a lot of confusion around this term [HIL08].

Van der Aalst et al. [AAL03] defines BPM as:

> *"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."*

BPM lifecycle
Because BPM is a continue process there are a number of steps to be defined within. This is called the BPM lifecycle which is iterative. The BPM life cycle consists of the following steps [KO09, AAL95, AAL03]

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[4] http://www.archiefwiki.org/wiki/Dossier
[5] The Oxford Pocket Dictionary of Current English. 2009. http://www.encyclopedia.com

1. Process Design, from paper or other sources processes are electronically modeled in a BPM system.
2. System Configuration, The BPMS and underlying infrastructure is configured.
3. Process Enactment, the electronically modeled business processes are now deployed in the BPMS.
4. Diagnosis, through monitoring and analysis, bottlenecks are identified and improved where needed.
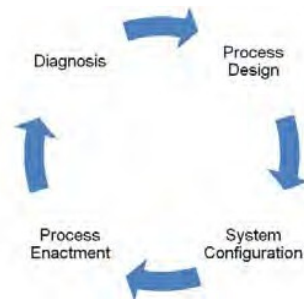

Figure 2: BPM Lifecycle Van der Aalst et al. [AAL03]

Confusion
There are many abbreviations that look like BPM or are related to this subject, but not mean the same. So BPM is often confused with BPR. Business process redesign is concerned with radical rearranging or improving of existing business processes. BPM is much more practically aimed at the step-by-step (iterative) improvement of processes. Ko explains [KO09]:

> *"However, BPM and BPR are not the same. Whereas BPR calls for a radical obliteration of existing business processes, BPM is more practical, iterative, and incremental in fine tuning business processes."*

2.6.3   Workflow management

WFM is a discipline which aims at the control and execution of processes. In essence, a workflow is a sequence of small steps. These resemble the order of work that needs to be done, to complete a certain task. The workflow follows the process it is based on, but is primarily aimed at execution level. Optimization of execution and control is one of the aims of WFM. That makes WFM very suitable for pre-defined or predictable processes. For knowledge intensive tasks it is hard to force a strict workflow. [ELS03, LEC09, AAL05]
Although workflow management was a separate work of field; it nowadays is more considered a part under the BPM-umbrella. This is because there has been a shift in content of these terms over the years [AAL95, AAL03, KO09]. Workflow management systems make the practical implementation of parts from the BPM-cycle possible.

To understand workflow management the following underlying concepts also need to be viewed.

2.6.3.1   Process
A process can be seen as the recipe to achieve a certain end-goal. A process combines a set of activities in a specific order to get a specific end-result. So a process has a clear goal or purpose, but also the input and output are defined. A process is not concerned with the real technical implementation and execution; this is handled by a workflow, which I will describe below.

2.6.3.1   Activity
An Activity is a single logical unit of work, which can be separately executed. So basically these are little pieces of work that one person can deal with. Many activities together form a process. Also activities can be further fine-grained in steps. Mostly, these steps within activities are up to the worker to decide.

2.6.3.1   Workflow
The line between a process and a workflow can be a bit vague, but they are different concepts. A workflow can be seen as a certain sequence of small steps that resemble the order of work that needs to be done, and follows the process on which the workflow is based. A workflow specifically concerned with the organization

of work and is much more into the details than a process. So how should a certain activity, be executed in detail. Things like: who needs to do the next step, assigning tasks, tracking of the process and the technical implementation are all managed with a workflow management system.

3 Who work with ACM?

3.1 Knowledge work

3.1.1 Knowledge

To understand the concept of knowledge work and workers, first knowledge needs to be defined.
I will use the definition of Davenport & Prusak [DAV98] of knowledge:

> *"Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms."*

So knowledge is something hard to grasp and stays mainly in the minds of knowers. A part of this knowledge can be available in documents or other repositories. But when does some kind of information get to be knowledge? This transformation is crucial.

> *"If information is to become knowledge, humans must do virtually all the work. This transformation happens through such C words as:*
> *Comparison: How does information about this situation compare to other situations we have known?*
> *Consequences: What implications does the information have for decisions and actions?*
> *Connections: How does this bit of knowledge relate to others?*
> *Conversation: What do other people think about this information?"* [DAV98]

They further make the connection between knowledge and the source, through learning and interaction.

> *"Clearly, these knowledge-creating activities take place within and between humans. While we find data in records or transactions, and information in messages, we obtain knowledge from individuals or groups of knowers, or sometimes in organizational routines. It is delivered through structured media such as books and documents, and person-to-person contacts ranging from conversations to apprentice-ships."* [DAV98]

It becomes clear that interaction between humans, learning in groups and discussions, which is essentially collaboration, is important for knowledge. This makes clear that knowledge and collaboration in a sense are closely related.

There are a few important aspects of knowledge, seen by Davenport & Prusak [DAV98]. These are:

-Experience
Knowledge develops over time through experience that is absorbed and processed in the knowledge that was initially there. Knowledge grows trough formal and informal learning. What we have done in the past shapes the knowledge, by experiencing it.

-Ground truth
This is a concept which describes the rich truths of real situations experienced close up: on the ground, rather than from the heights of theory or generalization. Ground truth means knowing what really works and what does not. Reflection is important. What were the initial goals, what did happen, and what were the differences? Learning from these differences is important to actually know something.

-Complexity
Knowledge can deal with complexity in a complex way. Knowing more, usually leads to better decisions than knowing less. This makes knowledge complex. Being certain and wrong is a common occurrence.
-Judgment
An important aspect of knowledge in comparison with information is that knowledge contains judgment. The ability to judge if certain information is correct or applicable, is one of the main abilities that come with knowledge.

-Rules of thumb and intuition
We learn from things in the past and develop shortcuts to earlier seen problems, or approaches. These are Rules of thumb. With knowledge an answer you do has to be build up from scratch. You can use knowledge and experience of the past. With many routes and possibilities intuition is also important.

-Values and belief
People who gather knowledge are never completely objective and neutral. As a person we are shaped and these values and belief have powerful impact on the organizations we work at. Our thoughts and actions are strongly influenced by our values and belief.

These qualities make knowledge workers important assets in organizations.

3.1.2   Knowledge worker

A case-handling system mainly aims at supporting knowledge workers in completing their work. Now knowledge is defined, how can this so-called knowledge worker be defined?

The term "knowledge worker" first appeared in the 1950s, introduced by Taylor (known for the scientific management school), but in that time the focus was set on physical efficiency of individual workers in factories. Later on Peter Drucker[6] gave the concept true meaning, by research around this concept. His first reference made to "knowledge work" was in 1959. After him many others have described this kind of "work", "workers", and the importance of these in the nearby future. There are more definitions around, but I will use the following by Davenport's "Thinking for a living" [DAV05]:

> *"Knowledge workers have high degrees of expertise, education, or experience, and the primary purpose of their jobs involves the creation, distribution, or application of knowledge.*
> *Knowledge workers think for a living."*

So which workers belong to this "category"? According to Davenport [DAV05], these knowledge workers are not only the "easy to see ones" like: physicists, scientists and airplane pilots. Also the managers of any company, engineers, researchers, marketers and planners fall under this category. Davenport explicit says all jobs involve knowledge to some degree, but knowledge workers are those whose jobs are particularly knowledge oriented. So this means that there is no job that is completely routine, or completely unpredictable. But a knowledge worker is more found in solving the less predictable work.

So the line between being a knowledge worker or not, is not fixed. At one side of the spectrum, you have work that is totally pre-defined by procedures. At the other side you have discretionary practices that are very loosely defined. There is a lot in the middle, which shares a mix of both sides of the spectrum.

[6] http://www.cgu.edu/pages/292.asp

White [WHI10] states that:

> *"Knowledge workers are the most important and fastest growing section of the workforce, but the processes that they use in their work are not well supported by technology; and generally they haven't been the focus of systematic process improvement initiatives."* [WHI10]

He builds this argument by relating it to process improvement that mostly has been aimed at transactional workers, manufacturing workers and people in call centers. This is typically work that has big parts that can be automated. The remaining work tends to need more human, often requiring creativity and innovation that especially knowledge workers provide.

Le Clair & Moore from Forrester [LEC09], state that there is a shift to people doing the activities that cannot be straight-trough processed by the automated system. As a result the so-called "information worker", which is some degree a knowledge worker, has to deal with:

> *"-An increased variety of tasks to handle*
> *-Ad hoc and less-scripted process flows*
> *-Collaboration and social media tools added to their structured work processes."* [LEC09]

The impact of technology on collaboration, like the internet, social media and others, has a big influence on the next generation of knowledge workers, and workers in general.

Given these statements, I can state that the number of workers falling under the category knowledge worker is growing. As later on described in the trends, knowledge work is growing. In some sectors (healthcare and eduction) they account for 75% of the workforce in 2011 in the U.S.A., according to recent research of McKinsey[7].

The work that can be automated will eventually be automated, so the hard to grasp work will remain. This tends that the work will be more knowledge and information intensive. The number of knowledge workers will grow due to this. The remaining work is something that cannot be (fully) automated, so this work has to be supported in another way. That is exactly where ACM is needed.

3.1.3   Organization

3.1.3.1   CMM

So in what kind of organizations is this knowledge worker present? Because the knowledge worker deals with more ad-hoc and uncontrolled situations as previously described, we can look at the organization maturity by introducing the "capability maturity model" (CMM). This model is commonly used to measure the maturity of an organization. This model is mostly used by IT companies, but also other sectors use this model. The maturity model has five different levels, and looks at the characteristics of processes and software process in an organization.

The CMM is developed by the Software Engineering Institute and Carnegie Mellon University. Currently the CMM has been evolved to the CMMI model, which is constantly updated. The essence of the CMM is still present in the CMMI model, which is now available in three different flavors[8]. I will use the CMMI model for development version 1.3[9]. The following description of the maturity level is cited:

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[7] http://whatmatters.mckinseydigital.com/internet/using-technology-to-improve-workforce-collaboration
[8] http://www.sei.cmu.edu/cmmi/
[9] http://www.sei.cmu.edu/reports/10tr033.pdf

1. Initial *"At maturity level 1, processes are usually ad hoc and chaotic. The organization usually does not provide a stable environment to support processes. Success in these organizations depends on the competence and heroics of the people in the organization and not on the use of proven processes."*

2. Managed (Repeatable)*"At maturity level 2, the projects have ensured that processes are planned and executed in accordance with policy; the projects employ skilled people who have adequate resources to produce controlled outputs; involve relevant stakeholders; are monitored, controlled, and reviewed; and are evaluated for adherence to their process descriptions."*

3. Defined *"At maturity level 3, processes are well characterized and understood, and are described in standards, procedures, tools, and methods. The organization's set of standard processes, which is the basis for maturity level 3, is established and improved over time. These standard processes are used to establish consistency across the organization."*

4.(Quantitatively) Managed *"At maturity level 4, the organization and projects establish quantitative objectives for quality and process performance and use them as criteria in managing projects. Quantitative objectives are based on the needs of the customer, end users, organization, and process implementers. Quality and process performance is understood in statistical terms and is managed throughout the life of projects."*

5. Optimizing *"At maturity level 5, an organization continually improves its processes based on a quantitative understanding of its business objectives and performance needs. The organization uses a quantitative approach to understand the variation inherent in the process and the causes of process outcomes."*

After viewing these levels it becomes clear that the lower capability levels tend to have more processes that need knowledge workers because there is more ad-hoc and event driven. The higher the maturity level the more structured. Typically a factory will be able to get a high capability level, where a little innovative engineering company will have mostly remain at a low capability level.

3.1.3.2 Mintzberg's organizational types

Another way to look at organizations is the organizational type model by Mintzberg. I will introduce Mintzberg's organizational types briefly, beginning with the basic parts of the organization, and then naming and describing the organizational configurations/types. First I will shortly explain the basic parts of an organization and the six coordination mechanisms by Mintzberg [MIN80].

The basic parts of an organization:
   -**Operating core,** includes all employees who themselves produce the basic products and services of the organization, or directly support their production.
   -**Strategic apex,** the top general managers of the organization, and their personal staff.
   -**Middle line,** the managers who sit in a direct line of formal authority between the people of the strategic apex and the operating core.
   -**Techno structure,** consists of those analysts, out of the formal "line" structure, who apply analytic techniques to the design and maintenance of the structure and to the organization of its environment. (accountants, work schedulers, long-range planners)

-**Support staff,** includes those groups that provide indirect support to the rest of the organization (typical public relations, payroll, cafeteria, it)
-**Ideology,** this contains the traditions and beliefs of the organization, which make it unique.

The six coordination mechanisms[10]:
    1.Direct supervision (typical for entrepreneurial organizations)
    2.Standardization of work (typical for machine organizations)
    3.Standardizaton of skills (typical for professional organizations)
    4.Standardization of outputs (typical for diversified organizations)
    5.Mutual adjustment (typical for innovative organizations)
    6.Standardization of norms (typical for missionary organizations)

Congentincy factors & design parameters
Also the so-called "contingency factors" influence the structure of an organization. For example the age and size of an organization have influence. There are also a number of "design parameters" that organizations use to design their own structure. For instance the procedures that employees follow, or to centralize or decentralize. These are all part of the design parameters.

This short introduction leads to the seven pre-defined organization types or configurations:

Organizational types:
    1.Entrepreneurial organization (or Simple structure), large operating core, with little or no middle line, techno structure and support staff. All directed from a small strategic apex. Typical an entrepreneurial setting.
    2.Machine organization, large operating core, with a large middle line and large available techno structure and support staff. Typical an factory or large company setting with a lot of repetitive work. So standardization is key.
    3.Professional organization, large operating core, with present middle line, small techno structure but an large support staff. Relies on (autonomous) professionals' skill and knowledge in the operating core. Standardizing skills is essential. Typically an school, or craft manufacturing firm.
    4.Diversified organization (or Divisionalised), an structure base on more divions of an organization, can work with any kind of form of structures in the divisions. These divisions form a large operating core with an strategic apex, supported by a small techno structure and large support staff. Typical the Mac-Donald's would be an diversified organization which has to standardize its outputs.
    5.Innovative organization (adhocracy), Large operational core, mainly formed by project teams. With little or no middle line, techno structure and support staff. Typically project based organizations, Relies on mutual agreements. Works best in complex and dynamically environments. For example NASA.
    6.Missionary organization, a large operational core and imbedded strategical apex and no or little middle line, techno structure and support staff. Coordination mechanism is standardization of norms. Typical a movement like Greenpeace.
    7.Political organization, a large operational core and embedded little or no middle line, techno structure and support staff. In this organization no coordination form is dominant, because control is created by forming alliances within the organization. The lack of stability is a problem. Also there is no typical coordination mechanism. Typical an sales-organization.

Initially there are five "ideal" or "pure" organizational configurations types, as defined by Mintzberg [MIN80]. During the time, there have been added two special structures like "political organization" and "missionary organization" [MIN80], leading to seven types.

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[10] Note that there is no typical coordination mechanism for political organizations.

Note here that Mintzberg is concerned with how organizations work, and thus function. He tries to prescribe effective organizational forms, from a management-theory point of view. In fact organizations are mostly a mix of these organizational configurations. There is no "wrong" organization in terms of configurations.
So there are many more mixed configurations possible and new forms of configurations can emerge. Also organizations can transition from types. In later work he also argues that all organizational types can be seen as forces that pull organizations in a certain direction, as seen below [MIN89].

1. Entrepreneurial organization, directional force
2. Machine organization, efficiency force
3. Professional organization, professionalization force
4. Divionalised organization, concentration forces
5. Innovative organization, Learning forces

If we now look at different of organizational configurations by Mintzberg and knowledge workers I can state the following: a professional organization is typical an organization which holds a lot of knowledge workers. Also an innovative organization (adhocracy) and small high-tech entrepreneurial organizations will hold knowledge workers. Missionary and political organizations may have some knowledge workers but will have more transactional or information workers. The other configurations are less suited for the presence of knowledge workers.

Note that big organizations often have departments that act like another sort of organization within the total organization. Most organizations are in essence a mix of the ideal forms as described by Mintzberg.

3.2   Collaboration

Although the definition of collaboration might be trivial; the actual process of collaboration is not. There are many influencing factors and variables. First I will define collaboration. Collaboration is the noun, of the verb "to collaborate". The oxford pocket dictionary of current English, defines "collaborate" as:

> *"Work jointly on an activity, esp. to produce or create something"[11]*

So collaboration is about the process where people work jointly on an activity, to reach a certain common goal, for example to produce or create something. Why collaborate? The biggest benefit of collaboration is being able to use and share the expertise and knowledge of other people on a problem. This combined effort makes it possible to perform better, for example give better results in a shorter time. So with collaboration you become able to create things that you would not be able to do on your own. In that sense collaboration is very important for innovation.

Because the goal for collaboration should be common, there needs to be a good understanding under the people that collaborate. For collaboration, information sharing and agreeing on how certain things should be interpreted is crucial in the overall process and the goals to be reached. Otherwise there cannot really be worked jointly, and the collaboration could have a retardant effect on reaching the set goals.

3.2.1   Influencing factors

Now I will take a closer look at the factors influencing collaboration. Factors influencing the collaboration have also much to do with the factors that influence groups. This is because collaboration often occurs in groups or in other form where more than one person is involved. Mattessich et al. [MAT01] gives the following main factors that influence collaboration:

-Goal of purpose of the collaboration
-Context or environment of collaboration
-Resources that the people collaborating have
-Process and structure that is used in collaboration
-Membership or position that people have (also in the collaborating group)
-Communication sort that is used

These factors can be further specified in sub-factors. For the purpose of this research it is not necessary to break them further down. Mattessich also explicitly underlines that successful collaboration is a process and needs attention, commitment and work [MAT01]. So the factors above are important to keep in mind, when looking at support for collaboration. For collaboration most of the above factors are also important for the digital tools available.

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[11] The Oxford Pocket Dictionary of Current English. 2009. http://www.encyclopedia.com

3.2.2   Knowledge and Collaboration

After looking at the factors described by Davenport and Prusak [DAV98] for the transfer of knowledge, there are some factors that are quite the same, or address the same problem areas. When you collaborate, you often share or receive knowledge. One of the important concepts for knowledge sharing is trust. The people who share knowledge in the organization should get credit for it. There should be something "traded" for the sharing.

Some people love to share information, but others keep it to themselves. The status of the knower counts here, people judge the information and knowledge on the person who gave it to them [DAV98, MAT01]. For instance information or knowledge of a senior manager is preferred over a junior manager, even if the information given by the senior is in essence wrong. This in a way refers to the membership and position people have in the collaborating group. This is also applicable to collaboration, where knowledge and information sharing is important, they should have trust, common grounds and a non-hierarchical approach.

So there can be concluded that knowledge and collaboration are closely related. Clearly this is a somewhat vague process, especially when you would like to support this with the use of an information system. This brings us to collaboration trough digital tools. What can be facilitated with such digital tools?

3.2.3   Collaboration trough digital tools

Since we are using computers at a daily basis for work and collaboration, the digital side of collaboration has become important. To collaborate with someone that is situated in another county gives a lot of new factors influencing the collaboration. Especially when going over borders there can be a lot of interpretation problems because of cultural differences. If also collaborating in a digital manner, the complete picture changes further. Not being able to see the person or group you work with leaves much to guess, and imposes all kinds of problems. For example in knowledge sharing, "trust" is an important factor [DAV98].

New (online) digital collaboration tools have a lot of influence on the collaboration, as Luther et al. [LUT10] describe some factors on success in "online creative collaboration", aimed at online moviemaking (newgrounds.com). So now we take a look at the current diversity of online collaboration tools (or related). A good representation and overview, although not scientific, is the list by Robin Good[12]. Looking at this list my main point is that there are many tools out there at this time. Below I have listed the categories he uses:

-Web presenting	-Event scheduling
-White boarding	-Project management
-Webinars	-Collaborative writing
-Co-browsing	-Collaborative visual reviewing
-Virtual 3d immersive collaboration	-Mind mapping/Diagramming
-Web conferencing	-Group communication
-Video conferencing	-Private social networking
-Audio (VoIP) conferencing	-Social networking
-Instant messaging	-Document/File sharing
-Chat	-Work grouping / team collaboration
-Screen sharing	workspace

So this is a large list of tool-categories, with many tools underneath that can be used for digital collaboration. In a way it makes clear that we in fact have a lot of digital collaboration tools, but the implementation and use

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[12] http://www.mindmeister.com/nl/12213323/best-online-collaboration-tools-2010-robin-good-s-collaborative-map

of them differs a lot per company. Not every company or process within a company is suited for the use of these tools. Also tools are not or badly integrated in the work & software people use on a daily basis[13]. The approach and strategy used can make a big difference, a tool should not be picked to fast and should really fulfill a certain need, and not be another fancy gadget on the desktop.

The above list will only grow as people seek out new ways to share information or collaborate on the web. Also because many of these tools are combinations of the items in the list above, so there is some overlap in functionality.

3.3 Personas & Clientas

To make the UML use case actors more concrete and real, I have chosen to use and develop some "Personas". A persona is a detailed description of a fictive person, or archetype/model user. Needs, wishes and expectations are documented. This leads to a characterization or stereotype of a certain kind of person/user group. The environment in which the personas work is also described in the form of "clientas". Just like Personas, the clientas describe a fictive real life situation. The idea of using personas in the software development process is described by Cooper [COO99].

3.3.1 Use of Personas

The use of personas is mostly structured by identifying the target groups for a system, and then the personas are created accordingly, resulting in a few stereotypes. Then scenarios are made to analyzer the behavior of the personas in the clientas. This eventually leads to attention points, conditions and assumptions. These can then be used to improve a user interface or the software in general. All related from the perspective of the end-user. This technique is mostly used for interface design, user experience design and usability of systems in general. It can also be used to validate concepts during the design process. [COO99, GEU09, PRU03].
For instance at Microsoft, personas are used in the development process of software. Pruitt & Grudin describe how personas are used and further refined at Microsoft. They state that personas are widely adopted within Microsoft and are used very broadly. From feature specs, vision documents to product strategy meetings arguing for user concerns [PRU03].

One of the main advantages that is seen by Kreitzberg & Little, is the ability to predict about reactions of other people [KRE09]

"Personas tap into a fundamental human skill - the ability to make predictions about how other people will react on mental models of them. One can often predict accurately how a close friends or family member will react to a particular event and decide how to act on those inferences.
With close friends and family one has the history of experiences that make mental models rich and (usually) accurate. But one is also capable of making inferences about people base on relatively little data. Just looking at someone's attitude ore posture as they walk can convince you to cross the street." [KRE09]

This should be interpreted with some skepticism, because inferences can be wrong. The more data you have about a person, the better your predictions will be. In this sense with well described personas and assumptions, predictions can be made in a reasonable accurate way. Because personas are stereotyped users they will provide a "common" view of a group with related characteristics, individual responses from real people can differ in real-life. Not everybody will fit perfectly in a certain type, there will always be differences.

A number of three to four personas are enough for most projects as Kreitzberg & Little explain [KRE09]. Also they describe to use one main persona as primary, and use secondary (the other personas) to test any unmet needs.

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[13] http://www.ittoday.info/ITPerformanceImprovement/Articles/2011-03NSM.html

3.3.1.1 Advantages & Disadvantages

Advantages [COO99, GEU09, PRU03]

-Delivers a common accepted image of certain kinds of users. This helps understanding the customer/end-user in the sense of the target groups for software.
-Leads to better acceptation of systems, because they are aimed at the wishes of the end users. The overall end-system is better suited to their needs. This is something that often goes wrong with interfaces and software in general.
-These personas can be used as "stand-in users" when there are no real end-users available or it takes too much time. By acting by the persona created, and doing actions in a similar way, insight in especially usability can be seen.
-Can be used broadly in various stages of software development, or other user involved issue's.

Disadvantages [GEU09, PRU03, KRE09]

-Personas are hard to get "alive"
-Not very abstract, and narrative in a sense
-Not always adds something useful, because it is aimed at end-user perspective (interface)
-Cannot replace user acceptance completely, when needing real data (quantitative) personas are not sufficient
-Because personas often are reused, that could possible lead to over-extending, instead of creating a new set.

Important to see is that personas are complementary to other techniques, and do not make others obligate. Pruitt and Grudin [PRU03] say explicitly that personas should not be seen as panacea. They should augment the existing design process and enhance user focus.

Using these Personas will lead to a more precise and understandable view on the actual use case described with UML. Therefore the areas where trends will have effect on the personas and their clientas, will be clearer and will enable to discuss real life situations emerging form these trends. The use of UML and Personas, which will are complementary, will lead to a combined approach. This combines the strength of both approaches; the abstractness of UML and the descriptiveness of Personas.

3.3.1.2 Persona template

For the creation of some useful personas I will use an adapted version of the template, as defined by Nina Geurds [GEU09]. During my internship I have attended some workshops about branding and positioning, which also contained the creation of personas. Three of the personas that I have made, and came out of the workshop have been merged together and used in my research.

Figure 3: One of used persona for this research

Please note that the created personas can be found in Appendix A.1!

3.3.2   Clientas

The use of clientas is important to understand the surroundings and environments in which people (personas) work. It also describes the objective and goals of the organization, for the workplace. In essence this contributes to the common understanding of the workplace of the users. It prevents wrong interpretations about the work-environment, and helps think in terms of a real-life situation [GEU09]. Clientas can be seen as an addition to the use of personas.

3.3.2.1   Clienta template

The image below shows a clienta template that is particularly aimed at the work environment for printing (also an adapted version of the clientas [GEU09]). In this case the template was very much aimed at print-shops. Although the clienta in my research are aimed more at the organizational and environmental aspects, this template is a good starting point for describing the clienta.

Figure 4: One of the used clienta for this research

Please note that the created clientas can be found in Appendix A.2!

4   What are the relevant trends for ACM

4.1   Landscape of Adaptive Case Management

Before selecting relevant trends, a landscape of Adaptive Case Management will be formed.

4.1.1   History and current state of Adaptive Case Management

As earlier described, "Case management" is an old term that is used with a new meaning. The old concept of having a case is commonly used in healthcare, law and customer relation applications. These old variants of systems that handled cases where very strict and are often hard coded in the sense of interface en possibilities. With this I mean hard coded forms, only suitable for the same processes, or way of treating cases.

At this time, the concept of case management had been re-defined, and comes in more synonyms. "Dynamic Case Management" [LEC09], "Adaptive Case Management" [SWE10] and "Case-Handling" [AAL01, AAL05, REI03] all essentially address the new case management concept. The core idea of having a case and treating it is not new. The way to handle and support these cases is new.

4.1.1.1   Interest in Adaptive Case Management

Why this sudden interest in the new form of case management? There are a few reasons that fuel the interest in a new level of support as Le Clair describes [LEC09, SWE10]

> *"-Increased need to manage the costs and risks of servicing customer requests: for example, loans, claims, and citizen benefits*
> *-Greater emphasis on automating and tracking inconsistent "incidents" that do not follow a well-defined process*
> *-New pressure on government agencies to respond quickly to a higher number of citizen requests*
> *-New demands that regulators, auditors, and litigants place on businesses to respond to external regulations*
> *-Increased use of collaboration and social media to support business processes with a high percentage of unstructured or ad hoc work."*

It seems the climate is changing for companies in the service oriented area. Requests and incidents are harder to solve in a strict process, the outcome and way of treating changes during the treatment process. Combined with more customer insight and pressure, demand a modern organization which is capable of handling this. Also the right tools are needed to accomplish this.

So ACM can be seen as a new approach to existing problems, which are becoming more important, resulting in automating the unpredictable side of work. The data centric and event driven approach is suited and capable for adapting to new situations. So It leverages the data centric approaches of the 80's and process centric approaches of the 90's to a mix of both worlds, as Swenson describes [SWE10].

It seems that Adaptive Case Management is applicable in more situations, because in more areas of work the same problems occur. Other approaches like BPM are often strict and need a lot of pre-defining and pre-implementation, while ACM can be used quicker, and grows while being used. The modeling of every process and application forms around it is difficult to realize and takes a lot of effort.
That's an important reason why a growing number of municipalities in the Netherlands, are looking for a so-called "zaaksysteem". This system is essentially enables case-management for the municipal sector. Also implementations in the healthcare, education and construction are realized. These are all situations where a certain "case" can occur, and a certain need to record and structure the data is necessary. Processes can change a lot and would take too much maintenance.

BPM   **ACM**
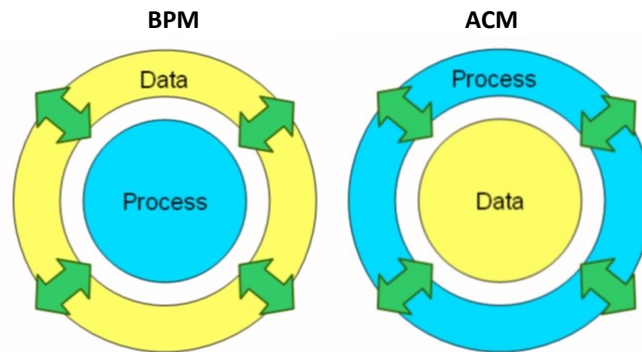
Figure 5: Organization of a BPM system (left) and an ACM system (right) [SWE10]

When comparing BPM and ACM, they differ in placing the data or the process in the center.
The data aimed side of adaptive case management makes it suitable for every situation where a case emerges, and much human decision and interaction is necessary. This makes it also suitable for more agile companies and processes. When high agility is required ACM can fit [SWE10]. The result of a sudden change, external or an internal event does not make the system useless; it can adapt.

4.1.1.2 Challenging barriers

According to McCauly [SWE10] there are a few barriers that have been particularly challenging to support in knowledge work, by ACM to date. He describes the following three:

-Human judgment

> It is not possible to automate all human decision making. An ACM system should support human decision making but not replace it, with an automated system. But this is very complex to support. How would one accomplish that? To what extend does a human need to make a decision, and in what stage? Exceptions can give serious problems when this is strictly implemented (like in old systems)

-Right information, right person, right time

> This is a problem that is also hard to grasp. A case can be placed on hold, because certain information is not available; perhaps someone is waiting for a document or phone call, to be able to make a decision. This causes serious ineffectiveness. These external/internal events are hard to get control on, and have large impact on the processing speed of a case.

-So many systems, so little communication

> A knowledge work-scenario needs the information, documents and other relevant artifacts from all kinds of different information systems. The integration between all these systems is hard, and complex to arrange.

4.1.2   Adaptive Case Management among other technology & trends

According to Keith Swenson [SWE10], ACM can be place between other trends like human workflow and email. In the history of computing and computers, their always has been a gap in supporting the more structured and predictable work, and unpredictable ad-hoc work. The following figure gives an overview of the technologies supporting different sides of the "predictability" of work spectrum.
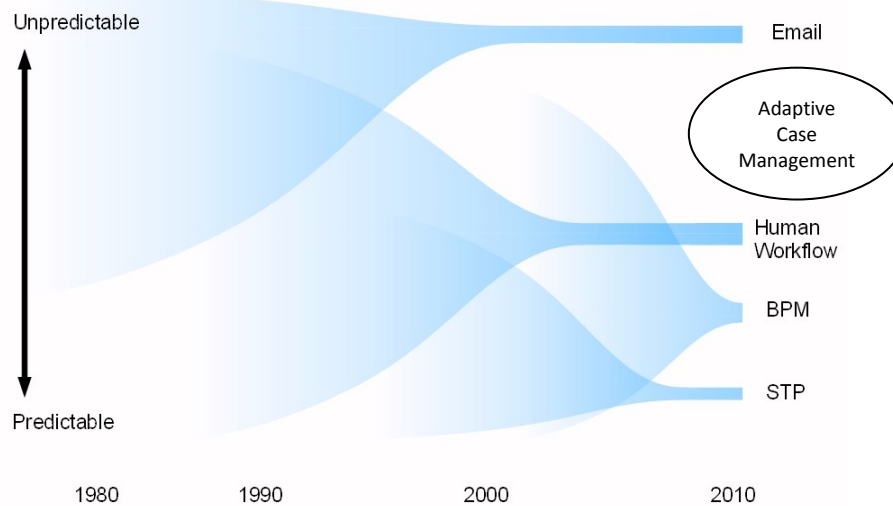
Figure 6: Historical Trend Chart by Keith Swenson [SWE10]

I will briefly explain the five trends, beginning at the bottom, from predictable to unpredictable.

-STP   Abbreviation for "Straight through processing". Essentially comes down to processing without human intervention. This can be done for predictable processes, because steps are mostly the same and can be repeated in a strict way. If the correct input is given, the output will be processed correct as well. Typically a bank transaction is straight through processed.

-BPM   Abbreviation for "Business process management". As described before, this term covers the management of processes in the broad sense of the word. Many techniques are combined, for example WFM like human workflow. BPM relies on modeling the processes and updating tem in an iterative circle. In this way BPM is very predictable, because only the modeled steps can be executed.

-Human workflow   This is workflow processing aimed at the actions that people have to do, to complete a step within a process. It essentially coordinates business processes, where people are involved and communicate with various systems and other people. This includes actions & decisions taken by humans. (The most general understood description of a workflow)

-Adaptive Case Mgt.   Adaptive Case Management aims at the unpredictable side of processes, but with giving some structure. People are in control of their processes and can adjust and configure steps in the system to let it work their way.

-E-mail   This trend ends the line of unpredictable processes at the other end of the spectrum. E-mail is a broad and universally accepted method to communicate. Because e-mail is used in many situations it covers unpredictable processes

Le Clair et al. from Forrester [LEC09] also describes the areas from where dynamic case management drains it powers. The image below shows that all areas have their own roots in certain techniques.
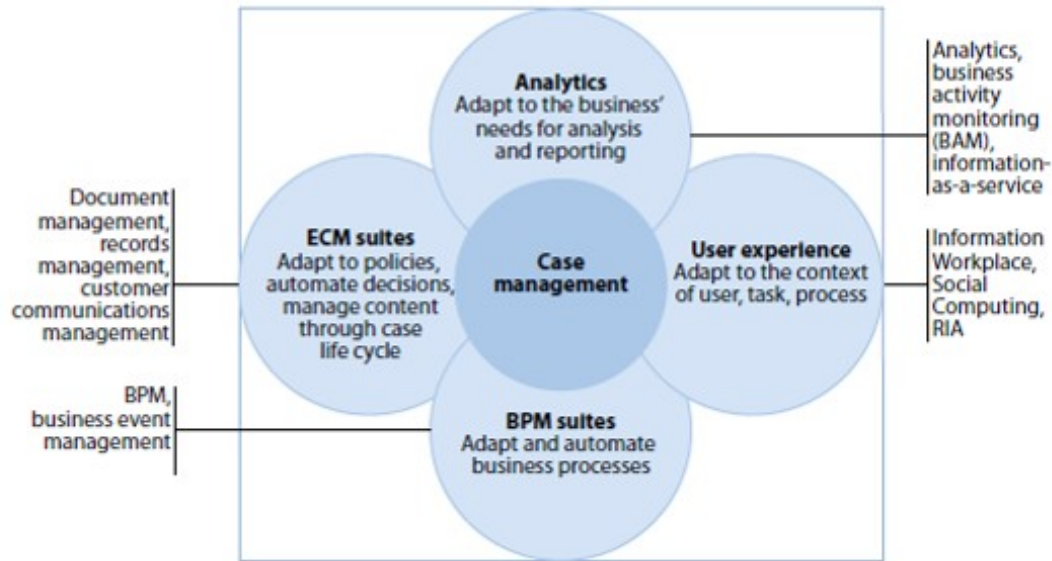
Figure 7: Case Management combines ECM, BPMS and analytics with user experience advances [LEC09]

It appears that the new case management, as a concept, fits on the gaps that other approaches have. It has close relation to BPM and ECM. These aim at tight control and structured workflow. These solutions benefit from adding the new case management. The two added other areas seen are analytics and user experience. Reporting and analysis are required to get the transparency managers need. The user experience is important because the workspace should adapt to the specific context and need of the user. The way in which these can be realized can of course differ.

Also I would like to point out that I feel there is also much resemblance with the current CRM approaches, which also hold information about customers. The file of a customer and recorded interactions can also be seen as cases. For example "sword ciboodle", offers an adaptive form of case management from a CRM starting point. So I feel that this is missing in the picture above.

4.1.2.1   No pure Adaptive Case Management

All the above figures in this chapter point out that the actual implementation of the new case management differs a lot, this is influenced by the starting points. No solution is one hundred percent pure Adaptive Case Management. Most solutions come from a certain area, for example BPM. Now that case-management has become important, they choose to incorporate this new approach into their solution. But for some applications the addition of a lot of BPM could be have negative effect instead of a positive.
The needs and desires differ per exact application. This results in many flavors and also misunderstanding of what Adaptive Case Management really is.

4.1.3   Starting points for Adaptive Case Management

Adaptive Case Management has emerged to fulfill the demands of customers and the increasing information and decisions that have to be made by knowledge workers. There are more situations where case-management is seen as a possible solution for the problems with conventional systems. Also Keith Swenson states that Adaptive Case Management itself can be seen as a trend, as previously described [SWE10]. Although I think this can (maybe) be a seen as a bit premature at this moment, because everybody is still trying to define the concept of ACM and what to really do with it.

Looking at the market and vendors that sell case-management solutions are a number of different start orientations for case-management or very similar applications:

> -**Starting from a content/dossier orientation**.
> These are ECM and DMS suites, which are very good at controlling content. These are often enriched with the use of some workflow and process modeling.
>
> -**Starting from a business process orientation**.
> BPM suites (or BPMS), with WFM systems that are being tuned to cope with case-handling (exceptions, ad-hoc).
>
> **-Starting from a customer relation orientation.**
> CRM systems or alike, which have outside events like customer requests as main driver, and place the customer central. A request or complaint is seen as the case.
>
> -**Starting from a specific expertise, resulting in custom applications.**
> Here pure custom build applications support a very specific kind of case management (mostly the old kind of (rigid-)case management). Take for example the very specific law/legal case management or healthcare-case systems.

These orientations also represent the mainstreams in sorts of Adaptive Case Management applications. Vendors stay close to their core-products and will expand their products rather than taking a big new step. This broadens the functionality without losing the old functionality. As a result a sort of case management is mostly added on top, or integrated with the existing solutions/orientation. This case management on top is certainly not immediately "adaptive". Also there is overlap in the functionality of these systems, all aiming at a side of the spectrum but in the end doing the same things in different ways.

The biggest developments are seen in the Business process and content oriented applications. For instance BPM/ECM solutions are becoming very popular (for example SharePoint). What they lack is proper case-management for loose processes, so that is being added, but keeping their original workflow support and process capabilities. So they keep the control for strict processes, but try to also look at looser process support. It looks that these forms are growing more to each other.

From the content-oriented side, there are many software products around. These have strong roots in content management and are expanded with some process possibilities. Because Adaptive Case Management is data driven or content oriented, these systems could have a slight advantage.

This leads to the following picture:
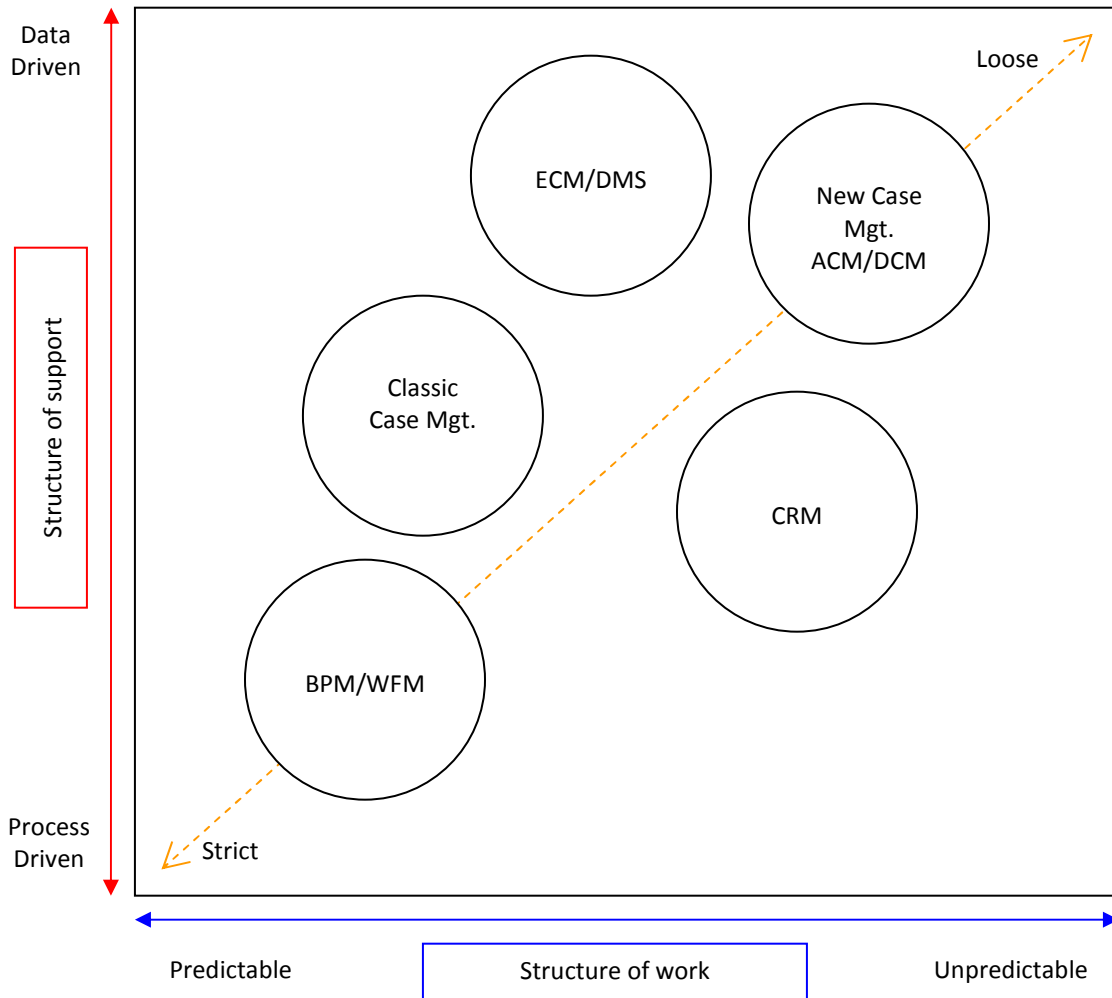
Figure 8: Positioning current approaches to automate/support work versus structure of work

Looking at the picture I have placed the current approaches in a graph presenting the balance between structure and support of work. This also makes clear that the step from a DMS to Adaptive Case Management should be easier to make than from a BPM/WFM solution.

4.1.4   Kinds of (adaptive) case management software

Besides their starting point, I think most of the current case management offerings can be categorized into three "maturity" or solution levels. The different starting point as named before can still be possible, but the degree of maturity differs per solution. I see the following three levels.

-Framework/Toolbox
Flexible solutions that provide a start point to work with some kind of case management. These tend to be very generic and need a lot of customization to be able to do proper adaptive case management, or case management at all. Most of the systems that fall under this umbrella are the ECM/DMS like systems such as Alfresco and SharePoint. These systems can be used for a variety of applications, because they are flexible and versatile. But with needed customization, these can in principle be suitable for adaptive case management.

-Solutions
More complete and structured offerings for case management. By configuring the system different case management applications are supported more out of the box, by configuring some things, like case types and alike. So: configuring instead of customizing. A solution could be seen as more developed or mature than a framework, by offering more body. But still these kinds of solutions can be generic, and can require specific customization to be used in a certain market as healthcare. In a sense a solution is adaptive because it is still widely applicable.

-Specialized products
These are the offerings that are specialized for a very specific type of market, and thus aimed at specific cases for that market. For instance for the healthcare, where care cases with specific parameters and functions (market specific) are build-in to the solution. This makes the software very inflexible, and only suitable for one vertical market. Although a lot of market-special functionality, these kinds of software can take it too far and make the new Adaptive Case Management impossible.

Figure 9: Positioning "maturity" of case management software

4.1.5   Sorts of case management abroad

When looking for the term case management abroad, the use of the term "case management" for the new case management and the "old" healthcare/psychology and law aimed case management is not always clear. When searching for "fall management" in Germany, the term is mainly used for healthcare cases. The same occurs in the USA, for the term case management, which is much linked to healthcare.

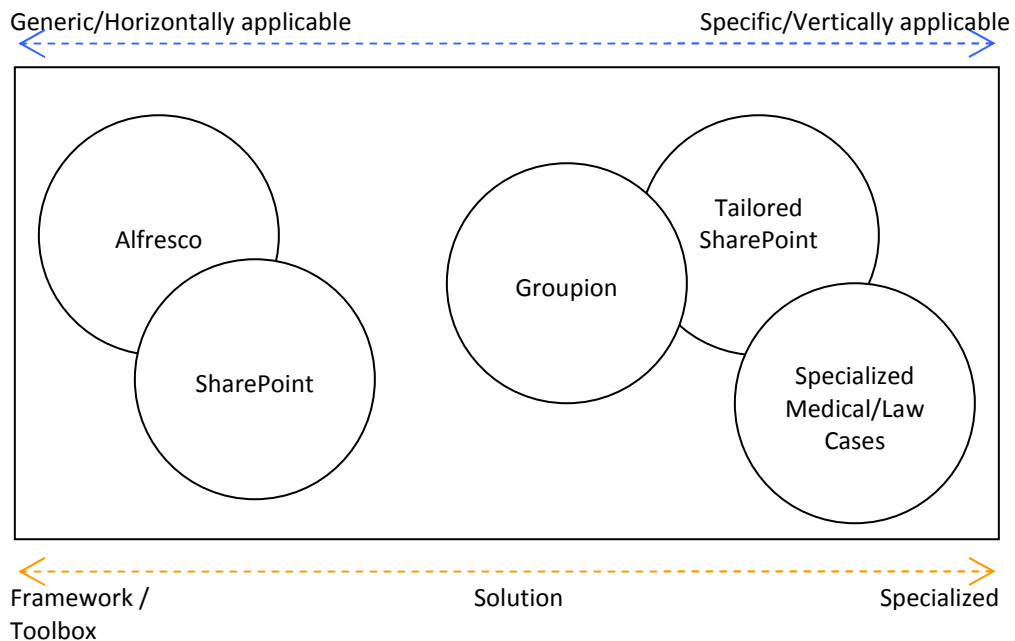The (American-) English terms "Advanced"-, "Dynamic"- and "Adaptive"- Case Management are much more used here, addressing the flexible case management we are talking about. There are different implementations of case management. Slowly the meaning of the term case management is changing. Also it seems very common that the English term is used in other countries, for instance in the Netherlands. Let's take a look at some translations[14]:

-Dutch (Flemish)	Zaak Management / Zaak gericht werken
-German	Fall Management (healthcare) / Case management
-French	Gestion de dossier (dynamique) Administration des cas d'accidents
-Italian	Gestione dei casi
-Spanish	Gestión/Administración/Manejo de casos[15]
-Danish	Dokumenthåndtering
-Swedish	ärendehanterings
-Russian	Случае управления

After some searching with the translated terms, it becomes clear that the subject is also alive in other countries. It seems that case management is also offered in other countries. For instance Pega-systems offers case management in the languages Italian, Spanish, French, besides English. Also IBM offers an "advanced case management" solution in more countries and languages.

The number of offered solutions per country seems to differ. To give a concrete example; IBM offers ACM for banking and government in the Netherlands[16], but for the USA there are also solutions available for Energy & Utilities and Healthcare & Life sciences[17]. The adoption for specific markets varies per country. Concentrations of manufacturing of these systems can be found in Europe and North America. This is in a way explainable because the origins of the new case management can be found the USA.
Just like in the Netherlands, in Sweden there are CM solutions for the government. For instance the solution offered by Formpipe[18]. The Swedish Formpipe uses the DMS and document creation functionality from SD [19]. So there is exchange of software and knowledge around the use of case management systems.

So system providers are active (or have partners) in different countries, and case management systems are offered in those countries. The problems facing customers of CM systems in the Netherlands seem to be partly comparable with other western countries. Otherwise the need and offerings of case management would not be there. I will not go into a deep abroad market research, for this research. Language and understanding of individual countries becomes a problem here, this is not something trivial. A market research can be an assignment at its own. But it is certainly smart to keep a look at nearby countries and the vendors that are active there; often the same problems occur. With this small section I made clear that the subject is alive in more countries. Also in the benchmark, some SaaS software-products from other countries will be viewed.

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[14] Translated with http://translate.google.nl
[15] Translation to Spanish approved by native Spanish speaker, Santiago from Ecuador
[16] http://www-01.ibm.com/software/nl/data/advanced-case-management/
[17] http://www-01.ibm.com/software/data/advanced-case-management/
[18] http://www.formpipe.se/sv/Produkter/W3D3/Applikationer/Dokumenthantering/
[19] http://www.docufacts.nl/4874/high-concept-sluit-partnerovereenkomst-met-zweedse-formpipe-software-voor-smartdocuments/

4.2   Relevant trends

There are a lot of people that give their vision on trends and developments. A lot of hype and buzz words are used, predictions differ and there is just little consensus. Seeing what the real trends are, and how everything is related can be rather complex. With the use of statistics and generally accepted trends, I will build my vision on these trends and developments for ACM. First I will take a look at trends seen by other researchers.

4.2.1   Trends seen by others

4.2.1.1   Trends seen by Forrester

Forrester delivers a clear vision in the paper "Dynamic Case Management - An Old Idea Catches New Fire" [LEC09] and in the "Dynamic Case Mgt. Wave" [LEC11]. The most relevant trends, which drive the need for Case Management, seen by Forrester are:

-People driven
        -Work is changing, more focus on knowledge, information and skills
        -Ad-hoc and less scripted process flow
        -Collaboration and social media tools are added

-Regulatory environment
        -Documenting how and why a decision is made
        -Increasing compliance and transparency

-Dynamic processes
        -Increased focus on problem resolution and complaint management
        -The need for dynamic business app, built for change and designed for people

I will now examine the statements of Forrester and discuss how these fit to the trends I have proposed. Forrester proposes that Dynamic Case Management is suited for handling these trends and gives a view on how it will fit. Conventional solutions have problems to cope with especially trends "People driven," and "Dynamic processes". Case Management supports the actions that where not supported before. This results in much more information about decisions and previous actions (history). In the end this can also help to comply with the regulatory environment, because audit trials and decisions (which conventionally would not be documented) are now possible.

People driven

-Work is changing, more focus on knowledge, information and skills
This argument is also supported by other researchers. White [WHI10] says that between 25% and 40% of the workforce can be seen as knowledge workers. This proportion will increase he says. This confirms the first trend stated by Forrester. Also Davenport [DAV05] states a percentage of 25% to 50% of the workforce is essentially a knowledge worker. So this gives a clear signal that knowledge is key.

-Ad-hoc and less scripted process flows
The things that cannot be straight through processed (STP) is the work that remains for knowledge workers to be solved. The nature of ad-hoc work is that it cannot be entirely scripted in advance. As an statement Forrester says [LEC09] *"exceptions are so much the norm that they aren't "exceptions" any more - they're unpredictable."* This results in an approach which leaves much freedom.

-Collaboration and social media tools are added
When looking at collaboration and social media tools, there is a shift starting. Companies want that the people become more in control. E-mail is just not efficient anymore[20]; therefore companies are looking for new communication tools, for example in the form of social media and share portals. The choice of communication "vehicle" is something that is getting important.

A good example is the e-mail trend which has made the fax obsolete. In some cases there will still be some fax usage (although very limited), but the majority uses e-mail these days. Something comparable can also happen to e-mail over time. In that sense collaboration and the modern organization will change the way of communication in work.

Regulatory environment

-Documenting how and why a decision is made
There is a growing need for Insight in how decisions are made and which information was involved. A case folder contains all the information that is necessary to solve a case, including the decisions and information on which it is based. This helps also in reasoning and using solved cases as a reference to solve a similar new case. Besides it gives inside who made a decision, which can be used for auditing and tracking.

-Increasing compliance and transparency
Transparency is required to show how things are done according to the regulations. Every action on the documents and case itself can be tracked for history and audit purposes. This is necessary to comply with the new regulatory and transparent environment.

Dynamic processes

-Increased focus on problem resolution and complaint management
Customers want more insight en quick response when having a request or complaint. To support an adequate response and solving trajectory, Case Management concentrates around the information that is necessary to solve for instance a complaint. When the customer calls, all interactions and documents are available. As Forrester states *"all business make mistakes, but it's how they are handled that will increasingly differentiate companies"* [LEC09]. This leads to an increased focus on problem resolution and complaint management.

-The need for dynamic business apps, built for change and designed for people
Products and services nowadays change in months or less, and not in years. Product life cycles are much shorter; take for instance your smart-phone. Looking at the other side; with the coming of more web services and the whole cloud hype, new services should adapt and change quickly. This results in the need for flexible systems that can cope with changing processes. Furthermore also work itself is changing; knowledge intensive processes remain.

4.2.1.2   Trends seen by White

White also sees a few trends, mostly concerning the knowledge work which is becoming more important. [WHI09] The following trends for knowledge work are underlined:

-Number and importance of knowledge workers is growing *-Knowledge workers have a large impact on the companies and economics they work in* *-Limited effort made to improve knowledge centric processes*

These are the trends he sees as relevant to justify the use of Adaptive Case Management in a setting in which knowledge is combined with process.

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[20] http://www.computable.nl/artikel/ict_topics/ecm/3770865/1277020/atos-origin-stopt-met-emailen.html

4.2.2   Developments in forms of case management

I will now discuss some forms of case management which are present at the current market. This resembles the current spectrum and developments that are offered.

4.2.2.1   BPM and Case Management

As Bruce Sliver states [SIL09], case-processes suffer from the same problems as conventional structured processes.

> -*They take too long to complete.*
> -*Recourses are not used efficiently.*
> -*Information is misplaced or not retained.*
> -*No standardization across the organization.*
> -*Difficulty of enforcing compliance with policies, regulations and best practices.*
> -*Lack of visibility into key performance indicators.* [SIL09]

He continues that BPM suites offer a solution, to all the above issues for conventional processes, which are pre-defined. Case management processes, and thus flexible processes, need the same capabilities. He states this will require a different type of BPM platform. Further he underlines the need of support for conventional processes and case management in one solution. So combine the best of both worlds.

He then introduces a special purpose BPMS dedicated to case management, which supports conventional processes as well, either standalone or as aspects of a case folder. To make this more specific, the Standalone processes he mentions are the ad-hoc and flexible processes started by a knowledge worker.

At the end, Integration of both worlds is the solution, he claims. Bridging the gap between BPM and ACM to create a total solution. But the technical challenge is great. BPMS vendors stick with their core-product, and promote their case management features, rather than a true case management BPM platform as he states [SIL09].

Please note that some parts of the BPM are filled in by the use of tools like WFM systems.

4.2.2.2   WfMS and Case handling

The search for support of flexible processes by a workflow system is researched a lot in the last ten years. One of the main contributors is Van der Aalst which wrote about so-called product-driven case handling [AAL01].

Reijers gives an overview of the actual effects of case handling systems [REI03]. He finds that some weaknesses of WfMS are partly elevated, but also some strengths are partly impaired. Because CHS is not that strict and is flexible, there can be less coordination effort, efficiency, quality and maintainability. But at the other hand, CHS will partly tackle the lack of flexibility and context tunneling that is present in current WfMS.

It is logical that processes that can be strictly followed or entirely STP (straight through processed), are better off with a WfMS instead of a CHS. The image of Reijers (below) makes clear that a CHS is not the best option in all situations. Some strengths of a WfMS approach are undone, by allowing more flexibility in a system. This is something that should be kept in mind.
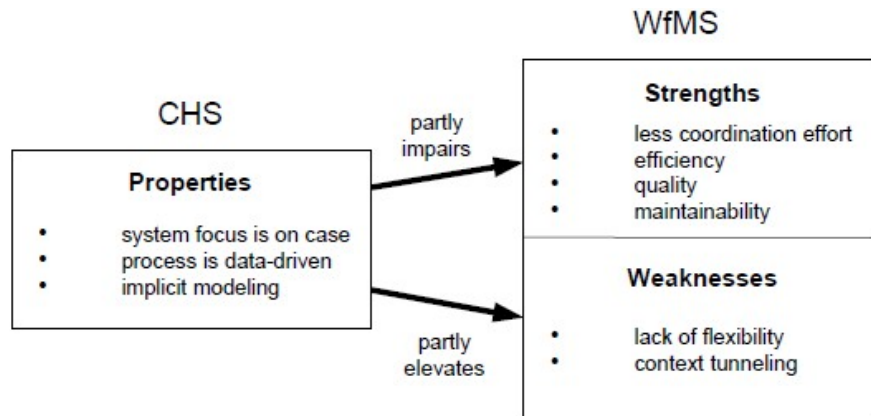
Figure 10: Actual effects of CHSs [REI03]

So this results in a tradeoff between flexibility and support as Reijers describes [REI03]. Looking at the image below case handling is situated in the middle of flexibility and support. So giving structuring but not giving up flexibility; exactly the sweet spot where case management systems are needed.
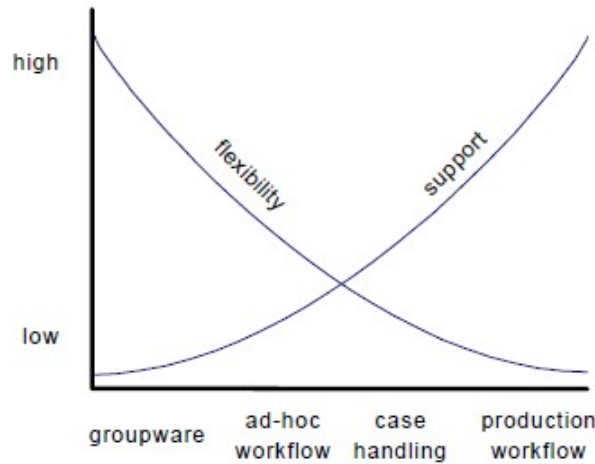
Figure 11: The trade-off between flexibility and support [REI03]

After these ideas from colleague Reijers, van der Aalst continues on this research with a framework how case handling can implemented in a workflow application [AAL05]. He introduces a concrete case handling product that is used by Pallas Athena (BPM style case-management approach), called FLOWer[21]. This tool consists out of a few parts including a designer (FLOWer Studio), which is essentially used to create workflows which leave room for exceptions. Realized by skipping and bypassing activities, knowledge workers should have more freedom, but also structure. Also there is a module (FLOWer Case Guide) that is the client application which is used to handle the individual cases. This is then strongly integrated together, with forms and overview of activities to be done. This also leads to the advantages of being able to control the process and mining relevant data.

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[21] Currently this product is integrated into the BPMone solution of Pallas Athena

4.2.2.3   CRM and case management

CRM has a close relation to case management in the sense that every request or compliant is treated like a case. Customers can have multiple cases and the organization wants to keep close relation with the customer. So interactions around cases, such as telephone calls and meetings, become import. These data is than stored around the case to provide insight in the interaction history.

When compared tot Case management it seems that only CRM is not sufficient enough to support loose processes [WHI09]. A process change during the processing of a case is not possible with a CRM system, so it is not possible to follow an ad-hoc process path.
This flexibility is something that the current offerings of CRM also try to realize. But this cannot be seen as proper case management yet.

4.2.2.4   ECM/DMS and case management

Content centric applications that are made for the long-term storage of documents and all actions related are expanded with case management. Because case management needs a good base to store and work with documents, a DMS partly suites well. The support for versioning, check-in/check-out of documents and retention management is all supported by systems that build upon ECM/DMS systems. What is added is mostly a case definition in which the documents fall (a sort of container), so more structure is added, together with progress/status overview.

4.2.3   Markets where case management can be applied

I will now discuss some markets where case management is already done in a way, or applicable. These are environments with a lot of professionals, where also Adaptive Case Management could be placed. The markets or sectors that are described are the most present in the application of case-management at this time. Other markets like the "financial sector" seem not be active in the case-management scene at this moment, so these have not been further described.

4.2.3.1   Healthcare

Healthcare organizations often already use a sort of case management that is very specialized. This can be classified under the rigid, old style of case management. The need for a CMS is very depending on the department and purpose. A horizontal application like HRM within the Healthcare can be seen as quite generic and not so demanding in terms of availability and security.

But looking at the vertical application; a specialized application for medical professionals, there are many pitfalls. This would be hard to realize in a more generic CMS because of all the customization. Experience in the medical sector is necessary to be a candidate at all. Companies like PinkRoccade have specialized solutions for the healthcare, which are fully customized to realize their needs. More generic applications have a hard time to survive in the medical sector.

Recently the first chamber in the Netherlands, voted against the national wide obligate connection to the EPD[22]. So it is not mandatory yet to join the EPD network, this could result in new possibilities and opportunities for CM/ACM suppliers.

4.2.3.2   Education

Looking at the educational application of case management systems, there are also some possibilities. The managing of cases and dossiers related to students, can also be supported with CM. Most "high-schools" use

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[22] http://www.rijksoverheid.nl/onderwerpen/elektronisch-patientendossier

dedicated custom applications like "magister" to administrate all information around students, like grades, time schedules, complaints, student tracking, etc.

These systems are very complete and are specialized for an educational environment, but also lack some flexibility. Case management is certainly applicable on information like the dossiers of students. Progress and feedback on the students' performance could be managed in a CMS.

4.2.3.3 Municipalities (decentralized government)

Municipalities in the Netherlands use a form of case-management which is called "Zaakgericht werken". This kind of case management is usually a bit more rigid than ACM, but also more adaptive forms occur. The main idea is that every request that the municipality receives - whether by telephone, e-mail or online form - is registered and treated like a case. Essentially this is realized by a so-called fat-midoffice between front and back-office applications. This mid-office is formed by a case-system as a core, and connects with the front-office and back-office applications. So the data and cases are centrally stored in one place.

The following image from the Computable, in an article from Sanders [SAN11] gives a good overview of the current use of case-management within governments. When looking at the image, the central case management system is the main node in the whole architecture.
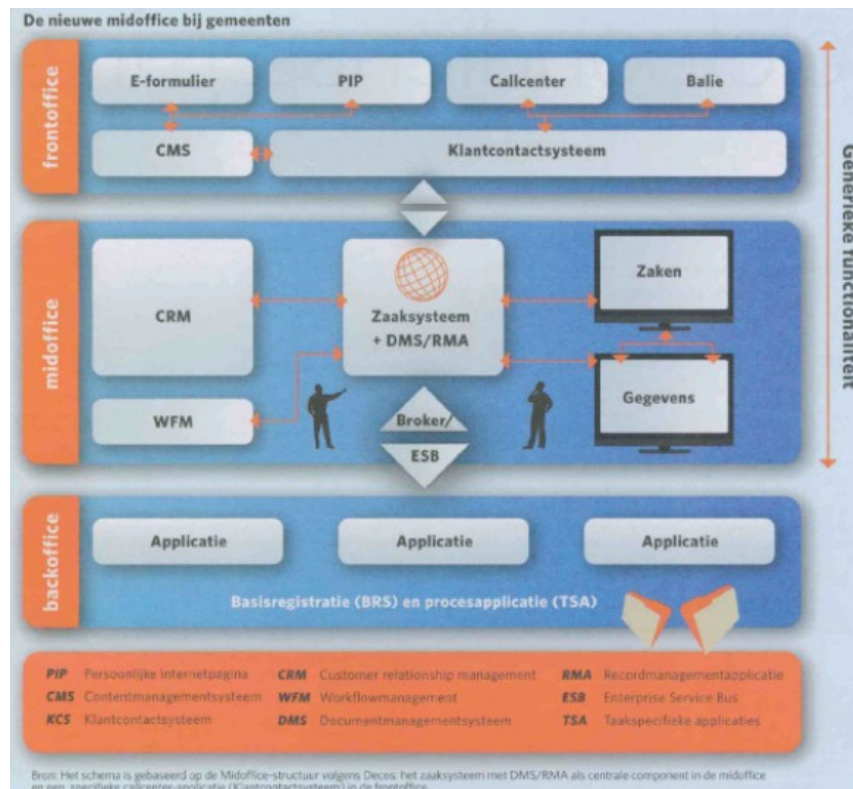
Figure 12: "De nieuwe midoffice bij gemeenten" - Computable [SAN11]

Front office   Mainly consists of applications that are important for the relationship with the customer. E-forms and Customer contact is important to get a good service portal for the customer.

Mid office   The mid office has a case-system as core and interfaces with the cases, data, customer and workflow data. This is mostly formed by a main application, where the case management plays a main role.

Back office   Specific applications like base-registration (GBA) and for instance a passport request application that the municipalities use in order to get new passports at the central government. Connections with nationwide base registration are also made here.

The trend that can be seen in the municipal context is that the mid office is getting fatter. Keller [KEL08], who is an active researcher at this area, even wants to get rid of the whole back office and combine everything in a fat mid office. In this fat, the "zaak-system" or case-management system is leading.

A much heard new term is the so-called KCC (Dutch), or Customer Contact Center. The KCC is the main application in the front office, and takes care of the service support to customer and company who interact with the government. This should result in better service. So there is a shift going to CRM like applications in which "cases" and case-management play a big role. The customers are placed more central.

Also Keller has named the following trends in his latest seminar[23], which are relevant for municipal case management market:
-Bring your own device
-Cloud/SaaS
-Web based
-Shared service center (provides services for several municipalities like a KCC service)

4.2.3.4 Emerging areas in dynamic case management by Forrester

Forrester foresees three areas in which dynamic case management applications will emerge, all aimed at a specific category [LEC09]. These are:

-Investigative
-Service requests
-Incident management

These three are situations in which Adaptive Case Management can fit. This can be explained fairly easily, because CM has a close fit with some fields like CRM, BPM and other related specializations (starting points).

Service requests are now often taken care of in a CRM application.

Investigative case management such as investigations and other law-applications are often supported by a custom application.

Incident management comes forth out of the exceptions that occur out of various processes. For example complaints and exceptions that occur at the order process.

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[23] http://www.kellerseminar.nl

4.2.4   Relevant trends for Adaptive Case Management

Now I have described the trends and developments in the application of case-management in different markets at this time, I will look at other relevant trends. I will first give a definition of a trend and the ways they can be analyzed. The oxford pocket dictionary of current English[24] defines a trend as follows:

trend / trend/• n. a general direction in which something is developing or changing: an upward trend in sales and profit margins.▪ a fashion: the latest trends in modern dance.• v. [intr.] (esp. of geographical features) bend or turn away in a specified direction: the Richelieu River trending southward to Lake Champlain.▪ change or develop in a general direction: unemployment has been trending upward.

Concluding from this definition; a trend can be seen as a development or change in a certain direction. This definition is rather loose, but a trend is no exact science. A trend is a way to describe or capture the changes and the directions of those, which occur in the world (at various levels and situations). Eventually predicting and concluding from trends is something that can help make decisions.

4.2.4.1   Trend analysis

The most exact form of trend-watching is statistically analyzing (historical) data-sets and concluding that a certain trends can be seen. For instance if a data-set shows that, over a number of years the use of certain products increases, this can be seen as a trend. So this is in a way to explain events that have occurred in the past. In some fields of study/sciences this kind of trend analyses is referred to.
For my research this is hard to apply.

Other kinds of trend watching, mainly to predict the future (, that are used in marketing or other fields) are no exact science. It is a loose and rather instinctive process which is influenced by various insights, research reports and analysis of historical data. The conclusions drawn from these sources are never completely correct. They indicate.

I have looked at trends in a more holistic way, and used the insights of other researchers, domain-experts at Océ and my own gained insights, to form a list of trends which are relevant for Adaptive Case Management. I have tried to split trends from their drivers. For instance the internet is a powerful driver for many trends. Also terms like digitalization and technological development which are essentially mega-trends are left out the relevant list. These are too broad and wide to form new functionality. Maxi-trends give more structure for product development. For the analysis of trends I have used the theory of trend pyramids by Roothart and Van der Pol [ROO01].

4.2.4.2. Trend level pyramid

Can trends be more structurally placed? Looking at ways of describing trends, the trend-pyramid by Hilde Roothart and Wim van der Pol [ROO01] can be used to place trends in a more holistic view. This pyramid gives handles to think about trends in a more structured way.

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[24] The Oxford Pocket Dictionary of Current English. 2009. http://www.encyclopedia.com
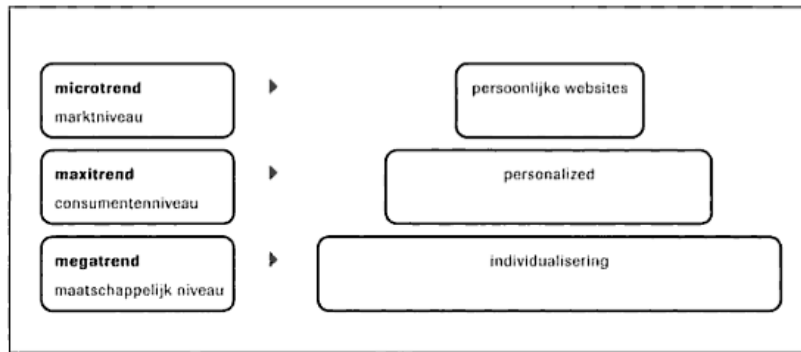
Figure 13: Trend pyramid [ROO01]

10-30   years   Mega trend: Social/Society level. In a way directly or indirectly influences everyone.
5-10   years   Maxi trend: Consumer level. Changes in behavior, needs, mentality and lifestyle
0-5   years   Micro trend: Market/product level. These are short trends, often concrete products.

A megatrend, can lead to more maxi trends, and maxi trends can lead to more micro trends. I will classify the trends in the trend pyramid on the level they belong. Also some megatrends combined create specific maxi trends.

Trendfactors

Trends are influenced by the following six factors, also known as "DESTEP"-factors. (Demographic, Economical, Sociological, Technological, Ecological and Political. These factors have influence on each other, and also empower some megatrends, like technological development or globalization.
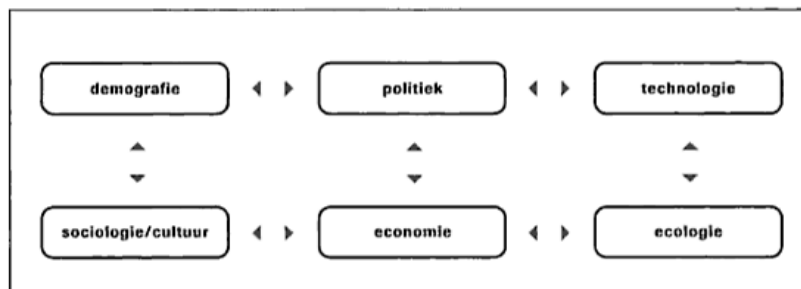
Figure 14: Trend factors [ROO01]

4.2.4.3. Relevant trends list

Based on the previous explanation, I found that the following found maxi-trends can be seen as relevant for Adaptive Case Management and its context. First I will describe the relevant trends; afterwards I will place them in the trends-pyramid structure.

The following seven trends are selected as relevant for ACM and its context.

Customer placed central
> Everything is more and more aimed at the customer[25]. In many different areas, customers can be defined. For instance in the healthcare, a patient can be seen as a customer. Customers of all sorts

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[25] http://www.intromartgfk.nl (GfK Jaargids 2011)
http://app2.channelweb.nl/downloads/CR1006_56_049.pdf
http://www.managersonline.nl/nieuws/8511/klantcentraal-denken-kent-een-aantal-valkuilen.html

are more demanding and want insight in status, in for example delivery processes. People do not except slow and bureaucratic processes anymore. This affects the way processes are structured and how services are offered.

Compliance

Companies increasingly need to give insight in the complete process and application to law and other regulations. More rules will be set to get a certain level of transparency or at the side of sustainability, Green-IT and other regulatory requirements given by the law. Compliance is essentially complying with all relevant legislation. Take for instance the regulations on security by the WBP (Dutch law, protection of personal data) and the SOX law. Also the financial crisis has had impact on this, therefore more transparency is required. Abdullah et al. [ABD10] state that failing to comply is no longer an option and non-compliance leads to losing customers. This not only counts for the large multinationals, but also to smaller national companies and organizations. Also complying with NEN and ISO regulations are closely related (for instance ISO/IEC27002 - Information Security). Although in the governmental market, the compliance to NEN2082[26] is not mandatory; doing without it will result in many customers that will look for others that do have this. So customers can be lost, by non-compliance.

Modern organization

Employees are the most important asset of an organization and will make the difference. Flexibility and knowledge workers are much heard terms. An organization will have less hierarchy but will be about the connections. Borders will fade, due to international collaboration. Driven by globalization and internet virtual teams will collaborate over the internet. Working at home will become normal. Work will be judged on quality, less on presence at work. Although this is currently hyped, it will go more this way. How many people do you know that work 1 or 2 days at home? In professional work, many people do work at home, as results confirm[27]. Although the need for working at home is there; still a lot of companies do not offer structural changes yet[28]. Companies in the IT are currently the leaders in working at home. Powered trough internet and connectivity, the digital office will arrive.

Social media

That Social Media is booming, needs almost no explanation. There is wide interest for this new phenomenon. The user numbers of different social media services are huge[29]. It is interesting to notice that the Netherlands has the "highest internet penetration" on Twitter and LinkedIn (more than one in four Dutch Internet users visits these sites during the course of the month), as a recent research from comScore shows[30]. Social media will have influence on marketing, HR and the communication between people. LinkedIn for example had a total of 70 million users in 2010[31], now recently at 22 March 2011 the counter stands at 100 million[32]. This is an explosive growth. In combination with the use of smart phones and tablets it will have influence on the way we work and

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http://www.vanadgroup.com/txmpub/files/?p_file_id=109

[26] http://www.nen.nl/web/Actueel/NEN-2082-Eisen-voor-functionaliteit-van-informatie-en-archiefmanagement-in-programmatuur.htm

[27] http://tweedekamer.groenlinks.nl/files/onderzoeksresultaten_thuiswerken.pdf

[28] http://www.managersonline.nl/nieuws/9927/werkgevers-hebben-het-niet-op-thuiswerk.html (Results: http://www.telewerkforum.nl/files/Onderzoeken/100127%20resultaten%20onderzoek%20thuiswerken-01.pdf)

[29] http://mashable.com/2009/04/17/web-in-numbers-social-media/

[30] http://www.comscore.com/Press_Events/Press_Releases/2011/4/The_Netherlands_Ranks_number_one_Worldwide_in_Penetration_for_Twitter_and_LinkedIn

[31] http://techcrunch.com/2010/06/20/linkedin-tops-70-million-users-includes-over-one-million-company-profiles/

[32] http://blog.linkedin.com/2011/03/22/linkedin-100-million/

are available for work. Also new business concepts will arrive to use social media as another channel for business. Social media is currently on the top of the hype cycle.

Knowledge work

To have the right knowledge in your organization will mean the difference, especially for companies in modern western countries. Supporting the knowledge worker will eventually lead to more productivity and creativity. Because in all the sectors the knowledge work remains, there are more transactional and especially collaboration workers, than production workers[33]. The number of people that participate in higher education is still on the rise in the Netherlands and abroad. So the percentage of knowledge workers is growing each day.

This is also seen by gurus like Drucker, and also Davenport [DAV05]. Drucker also stated that the most valuable asset of a 21st-century institution, business or non-business, will be its knowledge workers and their productivity [DRU99]. Similar perspectives are made by other researchers, as Ascente states in her literature around knowledge workers [ASC10]. So making progress on this terrain will be crucial, this confirms the need for solutions like case management.

Cloud

Small solutions can become big through the cloud. Companies can take a subscription at a certain software solution, and do not have to worry about hardware and integration. Simply a computer with a browser will be sufficient. Small organizations with little employees can also become big through the new cloud possibilities. This new kind of software and services creates a new market. Sure there are concerns around cloud computing, but it gives a lot of new possibilities. The ICT market in Europe has grown the past year through cloud computing[34]. Gartner and IDC have done predictions about the market size and growth and both predict a rise (although the exact numbers differ). Important is to understand that "the cloud" is an umbrella-concept, this makes a comparison of various "cloud"-products and market hard. Due to this the exact numbers of sales and market potential are hard to estimate at this time.[35]

Connectivity

With the coming of better smart-phones and tablets, the line between the various platforms will become less important. You can browse the internet from your TV, laptop, pc, tablet or other device. You can have the same application (in some shape) on different devices. This will result in an increasing tend to connectivity. Access everything from anywhere. GfK-intromart[36] calculated that the number of smart phone users is growing rapidly. To give some numbers: In 2010 there where more than 2 million smart phones sold. At the end of 2010 there were a total number of 3.3 Million smart phones. This is an explosive grow.

That the tablet market will be important in the coming years is clear. The sales numbers of the first apple iPad where astonishing. The iPad 2 is already hyped before it was available in stores. Now more and more vendors become active on the tablet market[37]. At the mobile convention of 2011, GfK-intromart predicts that there will be used over 1 million tablets by the end of 2011.

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[33] http://whatmatters.mckinseydigital.com/internet/using-technology-to-improve-workforce-collaboration
[34] http://www.automatiseringgids.nl/markt-monitor/markt-in-cijfers/2011/10/eito-ict-markt-blijft-groeien.aspx
[35] http://www.computable.nl/artikel/ict_topics/cloud_computing/3545254/2333364/op-zoek-naar-de-echte-cloudmarktgrootte.html
[36] http://www.intromartgfk.nl
[37] http://www.cnbc.com/id/39501308
http://www.tabletguide.nl/4171/verkoopcijfers-galaxy-tab-en-viewpad-7-bekend/
http://www.idc.com/about/viewpressrelease.jsp?containerId=prUS22660011&sectionId=null&elementId=null
&pageType=SYNOPSIS

4.2.4.4. Placing the relevant trends in the pyramid

As earlier described the focus is on Maxi-trends. These offer the perspective for products to stay for 5-10 years (or longer). For software this time-span is realistic (when constantly improving). The found trends can all be found in the maxi-trend level. The example below gives an overview of micro, maxi and mega-trends.

Placing all relevant trends

Concrete products like: twitter, SalesForce, Ipads & SmartPhones
-Social Media -Cloud -Compliance -Customer placed central -Modern Organization -Connectivity -Knowledge work
Underlying trends like: globalization, digitalization, technological development & individualization

Figure 15: Trends in the Trend-Pyramid[38]
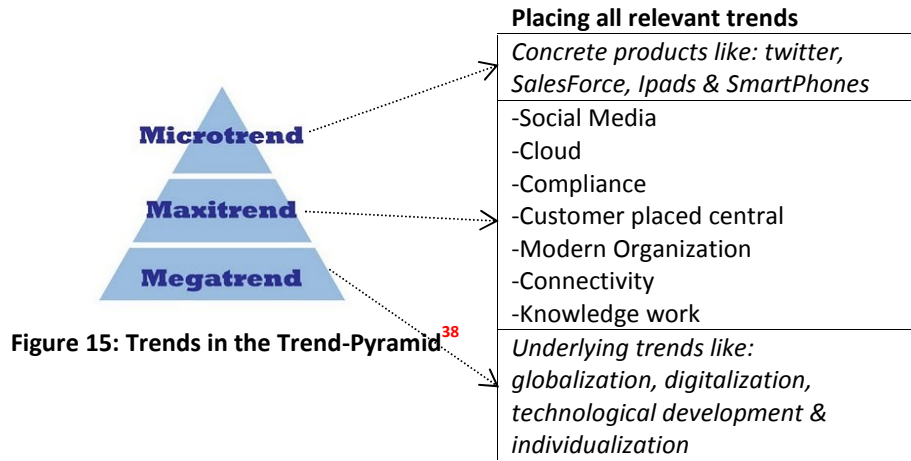
Know I will give trend pyramids for the relevant maxi-trends.

Customer placed central

-Real-time insight in process
-Do-it-your-self websites
-Customer portals
-Customer placed central
-Digitalization
-Indivualization

Compliance

-ISO
-NEN
-Regulations
-Compliance
-Crisis
-Digitalization

Modern organization

-Digital/Virtual teams
-New organization forms
-Modern Organization
-Digitalization
-Technological development
-Globalization

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[38] Image from: http://t3.gstatic.com/images?q=tbn:ANd9GcRCyZo-44kzxyxFgOXjjNnF09SUcR9Kj7KxKEs8pzSf7jIvhZSw

Social Media

	-Twitter
	-Linked-in
	-FaceBook
	-Social Media
	-Digitalization

Knowledge work

	-Knowledge management suites
	-ACM suites
	-Knowledge Work
	-Digitalization
	-Technological development

Cloud

	-DropBox
	-GoogleDocs
	-SalesForce
	-Cloud
	-Digitalization
	-Technological development

Connectivity

	-Tablet pc's
	-Smartphones
	-Bring your own device
	-Connectivity
	-Digitalization
	-Technological development

5   Where is ACM going?

5.1.   Influence of trends & developments

5.1.1   Trend influence

Every found trend influences knowledge work and collaboration in a degree. Some influence can be seen at this time, others are developing and the end-effects and results remain uncertain.

What can be seen at this moment is that there are big changes coming in the way we work. Because of internet on almost every device the connectivity really drives the change. So the internet is a powerful driver for the relevant trends. What is exactly the influence of these trends on the way we collaborate and work, if we look in the context of Adaptive Case Management?

Customer placed central

For case management this means that there will be more attention and service at the customer side of the case. This is seen during the whole process and especially in the interaction between the customer and the organization that delivers a product or service. How the customer places submits his problem or request (the case) should not matter. By telephone, e-mail or online web form, it all is registered in the same application. During the process of handling the case, the customer wants insight in the status of the case and the time remaining or expected ready date. The status can be seen in the case management system for the employees who are busy with the case, but also fo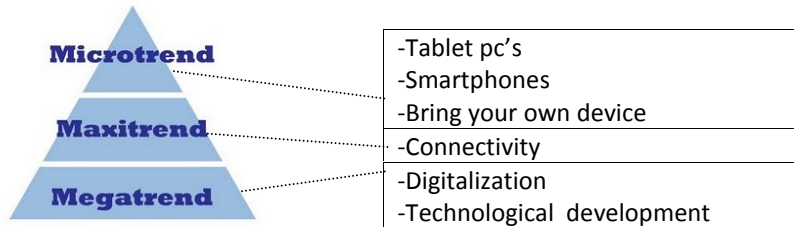r the customer who can see his status after logging in online, or in another way by sending an e-mail with status updates. This creates transparency for the customer, but also for the employee's involved with a certain case.

This influences collaboration in a sense that everybody can access the same data, so matches the understanding of the case between employees.

Compliance

Showing how certain decisions are made, become important to be able to comply with certain regulations. This will mean that when collaborating in a case management system, many things will be logged and tracked to have an audit trail for example. Also regulations have effect on the storage of content around the actual work.

Modern organization

Collaboration will be more digital due to this trend. Information sharing and meeting could be held over Skype or other mediums. The modern organization is mostly driven by technologies like social media, cloud and mobility. Together with a change in work, that no longer requires everyday presence at the office, the trend is further fueled.

For case management this will mean the case-folder should also be accessible from other location and other (mobile) platforms. Employees will have the same information everywhere. People who work at home could also start handling the case or pick up a case that has been entered by a colleague at the office.

Before jumping into all kinds of collaboration and social media tools and providing home-access, a certain kind of strategy or plan has to be created. A strategy makes sure that the tools and structure that are going to be used, have real purpose and add real value instead of having an opposite effect.

Social media

Social Media has its influence on digital collaboration. For instance group white-boarding, private-twitter and instant messengers are used to communicate with colleagues or contact another professional. So communication possibilities beside the conventional forms are used.

In knowledge work the direct colleagues are very important. Often problems or new events are of a complex nature, that collaboration of knowledge workers is necessary to make decisions. Through social media trend discussions and questions are made at various mediums, from blogs to instant messengers. In a way this trend is changing the way we communicate.

For case management it could be necessary to incorporate files or links form/to certain social media tools. Also there could be made use of notifications over social media, for case status. The effect and use of these kinds of tools can differ widely, so it should also be incorporated in a strategy for social media tooling.

Knowledge work

Knowledge work is getting more important, and the work that is remaining will be knowledge work. So knowledge work itself is a trend that in a sense cannot be reversed, we automate what can be automated, stripping out as many production and transactional workers as possible. This will also influence collaboration, because knowledge workers need to collaborate to get things done. Complex problems cannot be solved alone and require the support to support the work that needs a lot of knowledge.

Cloud

Cloud solutions like SaaS and PaaS will influence case management as software offering. The case management suites can now be offered as a service online. Take a subscription on the software and start using it right away, without having to worry about the hardware and software maintenance and scalability. This could be a good alternative for smaller companies who want to use case management.

In terms of knowledge, crowd sourcing could be a new way of getting it. Crowd sourcing essentially makes use of a lot of people to solve a problem.

Connectivity

Mobile devices will have effects especially on communication and thus collaboration. For case management this means there should be possibilities to view and work with a case on tablets and other mobility solutions like smart phones. Also notifications and status updates could be provided by sms, social media or other applications. To send or read e-mail on smart phones is already common.

Increased connectivity and platform independence almost asks for web based development, with the use of xml and open source communication standards. Access everything from anywhere.

5.2   From ACM vision and trends to functionality to test

To bridge the gap between trends and the actual support by systems I need to express the found trends in a concrete way. How do these trends influence current functionality and how should some future or improved functionality look like? This translation is crucial for my research. If have used the following three techniques:

Personas & Clientas:
-Describing the actors/environments more precise, in real-life situations and persons
-Think in terms of needs and desires of end-users.
-Linking respondents to personas after the Kano-questionnaire.

UML - use cases:
-Framework to think about general functionality, combined with the view gained from the personas.
-Think about possible new functionality that is derived from the trends.
-Creating functionality lists

KANO model (Questionnaire):
-Testing which functionality creates satisfaction for each user-type/persona (user-value)
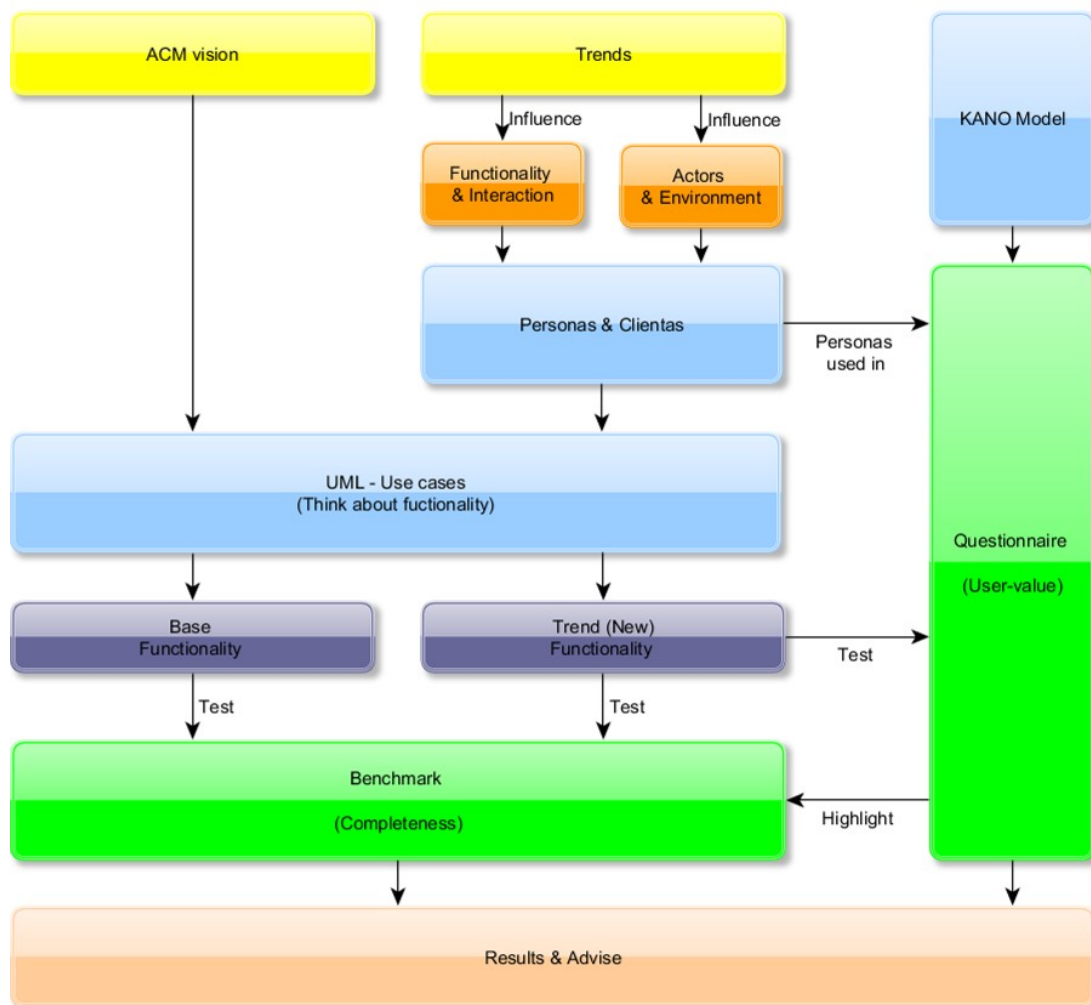-Using the outcome to highlight certain tested functionality in the benchmark.

Figure 16: Schematic overview of the analysis

These eventually lead to:

> **Benchmark:**
> -Testing functionality (base functionality), from literature about case management.
> -Testing the possible new trend functionality, and highlight the user-value of the trend requirements (questionnaire).
> -Results of the tests show which software products already have the functionality that give a lot of satisfaction
>
> **Results & Advice:**
> -Give a vision on ACM
> -Give the results and interpretation of the complete benchmark/questionnaire
> -Which functionality creates the most satisfaction, and is important to consider?
> -Make conclusions about what other systems have (current state), and what could be interesting to consider.

5.2.1   UML use case diagrams

It is important to get a view on the possible functionality gaps, therefore I have chosen for the "UML use case diagrams"[39] to think about the needed functionality. The model will be used as a base or framework to think from, because I will look at the functionality that ACM should have according to the literature, but also differences or improvements that follow from of the trends. The functions will be grouped and listed in an excel sheet which will be used for the creation of the specific part of the questionnaire and the benchmark of software-products. I will shortly give an introduction of the UML technique.

A use case diagram describes the interactions of users with a system. Such a diagram has the elements:
-System, the system which holds certain functionality
-Actors, users of the system (also other systems)
-Interactions, use of functionality by the actor(s)
-Use case, represents the functionality (for instance: view document)
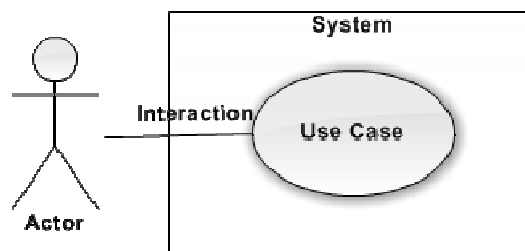
Figure 17: Basic "use case diagram" example

Furthermore the diagram has a textual description with a specification of the "interface" interaction between the user and system. This includes a basic course of events and pre- and post-conditions per use case.

An important characteristic of a Use case diagram is that it abstracts from the way certain functionality is technically realized. Only the function and interaction is described. The actual technical implementation is not specified, giving the freedom to think about the use and not the way in which the system realizes certain functionality. That is one of the mayor reasons why I have chosen to use UML as a thinking-base.

Although some rough basic course of events and pre-post/conditions have been made, the images themselves are the most valuable for the creation of new functionality. *The use cases can be found in Appendix B.*

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[39] http://www.uml.org/   (Unified Modeling Language - specification)

6   What do users think of trend-functionality? (Questionnaire)

To test which trend-related functions give to most user-value/satisfaction, a questionnaire has been made. Using the KANO method, it is possible to give a user-value to each function (that is derived from the trends). This questionnaire has been spread across customers of Océ. Also the questionnaire is further spread to a list of candidates, acquired by information at the "Overheid & ICT 2011"- seminar and "Keller"-seminar. These candidates use other kinds of case-management software.

6.1   Questionnaire structure & setup

The questionnaire is constructed out of two sections:
-General, the some basic and demographic questions are asked.
-Specific, where the "Kano-questions" are asked. *(I will explain this method in 6.2)*

6.1.1   General section

The basic and demographic questions will be used to be able to make difference between certain aspects like age, gender and some basic computer literacy level. Also the organization type, and intensity of use (of the CMS) is asked.

Also it gives some basic insight in a few trend related items:
-Homework by respondents (reason not, and time if done)
-Social media use by respondents (which and the kind of usage)
-Mobile device use by respondents (which are owned and internet/social media use on these)

No personal information like name or phone-number is asked, to prohibit that this information could lead to an individual person. The acquired general and demographic data is anonymous

6.1.2   Specific section

The most important part of the questionnaire is specific part, which contains the Kano-questions. By letting the respondents choose their main user function for the system, it will be linked to a persona. Depending on the persona, one of the three Kano-question-pair-sets are asked. This is done to ask the right questions to each respondent, so questions will be filtered. For instance a manager can answer more questions than a basic user, and an IT-manager will probably not use the system, but will have responsibility for the hard- and soft-ware of the CMS.

6.1.3   Setup

6.1.3.1 Sample selection

The total population of ACM users in the Netherlands is hard to estimate, and certainly hard to reach. This is caused by the different kinds of case management. Therefore it could be hard to select a correct sample population.

The resulting sample should be representative for the complete population on a set of characteristics. So when the characteristics of the sample population are the same, as the characteristics for the complete population it can be called representative.

The more population can be reached; with other words how larger the sample is, the more reliable the results will be. Also the margin of error will drop, the larger the selected sample is. The margin of error tries to catch how much the collected result will differ from reality.

First I will calculate an "ideal" sample; then the spreading of the questionnaire will be explained.

6.1.3.2   Sample calculation

To be able to get a representative sample an estimation of the total population has to be made, and with various variables, the needed number of respondents can be calculated. The following formula[40] is used:

$$N=Z^2(P.Q)/E^2$$

N = Sample population
Z = Confidence level (expressed in z nr)
P.Q = Standard deviation (or estimated level of difference in answering of questions)
E = Margin of Error

A reasonable set-up would be a total population of 20000. Above this number differences are flattened out, so a larger population makes, less or little difference. Combined with a margin of error of 10%, confidence level of 95% (z=1,96) and standard (answer) deviation of 50%, the sample respondent number should be: $N=1,96^2(50.50)/10^2=96,04$. Leading to around 100 respondents as a reasonable number.

In this case this number is not feasible; also it is not possible to pick a real representative sample through the limitation of candidates to reach. But a sort of indication must still be possible with a smaller sample. Therefore the margin of error is increased to 15%. This leads to a new calculation:
$N=1,96^2(50.50)/15^2=42,68$. Resulting in a more feasible number of around 42 respondents in total. The problem with this is that the limitation in reaching enough respondents will be a problem. So it will probably not be possible to do an aselect respondent selection

6.1.3.3   Spreading of the questionnaire

A list has been created of potential candidates, by using Océ information about customers, and to a list of candidates that have other CM systems running. Also the questionnaire is further spread to a list of candidates, acquired by information at the "Overheid & ICT 2011"- seminar and "Keller"-seminar. Because this further spreading in a chosen direction, it is not possible to do an aselect respondent selection.

For all possible candidates who have users that could respond to the questionnaire, an e-mail has been send to invite them and more users to fill in the online questionnaire (by using a link and password). The e-mail clearly stated that there is no identifying data is gathered, which can lead to individual persons. The results are processed completely anonymous. Where applicable, the main-contact, where the e-mail is send to, has been called by phone, to ask if the e-mail was received and there was time to pass the questionnaire to more users. In that way, some pressure is put on getting more respondents.

6.1.3.4   Questionnaire tool

The complete questionnaire is made in the online survey system "ThesisTools"[41]. This enables quick spreading of the questionnaire and easy result-processing & -analysis. ThesisTools is free of charge up to 500 respondents, which is more than sufficient for my research. It is well known under students and has a simple but good interface for the respondents. It supports different question structures and matrices, and has possibilities to secure the questionnaire with a password. This is necessary to ensure that only the contacted

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[40] Formula used from, Franken, W.M. (2002) "Wiskunde voor statistiek", Coutinho, 135 p.
[41] Thesis Tools - www.thesistools.com

respondents will fill the questionnaire. Numbers of respondents that have filled the questionnaire are tracked and live-updated. The results are available in an online overview, and the complete results per respondent can be downloaded in an excel sheet.

6.1.3.5 Final respondent selection

The non-response is something that has to be taken in to account. The total number of contacted respondents may not want to fill in the questionnaire, or could partly fill the questionnaire, resulting in to little respondents to make conclusions.
The results are explicitly split in a generic and specific section, giving room to select only the generic part, if the specific part is not or partly filled. The specific part needs the correct filling of the answer pairs; if pairs are not answered correctly the respondent will not be selected. In the results I will describe the used selection in more detail.

6.2   Kano method

In the following chapters I will discuss the used KANO-questionnaire method and will talk through the interpretation of the results leading from the questionnaire. Afterwards the results will be discussed.

This questionnaire has been made with the use of a common method [BER93]: the Kano method. The Kano model can be used to represent the needs and desires of the customer. Kano uses a two-dimensional model, in which the concepts satisfaction and dissatisfaction are treated as independent. The different attributes of a system can be given a certain service attribute level. There are five levels based on the degree of functionality and customer satisfaction. The model originates from the 1980s and is still used for product development and customer satisfaction. This model can be valuable in different situations, from the strategic positioning of usability in the corporation, to getting insight in which requirements or functional are interesting to develop. For this research I will use the work of Berger et al. [BER93] which provides a lot of examples and information about the application of this model. The image below shows the Kano diagram with the satisfaction axis and functionality axis. There are three lines (two curved, one straight) which indicate specific attributes of satisfaction and functionality.

-       **Attractive curve**, shows areas in which the customer is more satisfied when the product is more functional but is not dissatisfied when the product is less functional.
-       **Must-be curve**, shows aspects where the customer is more dissatisfied when the product is less functional, but where customers satisfaction never rises above neutral, no matter how functional the product becomes.
-       **One-dimensional line**, shows the situation in which satisfaction is proportional to how functional the product is.
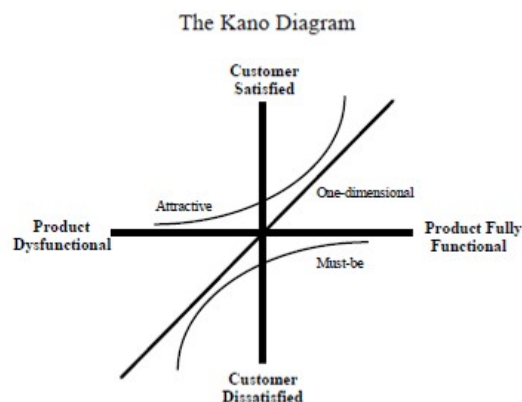

Figure 18: The Kano model by Berger et al. [BER93]

6.2.1   Choice for the Kano method

With the Kano method can be verified how the end/target users of ACM systems perceive the added functionality leading from the trends. So importance and satisfaction of certain functionality can be checked. If the need for certain functionality is highlighted, it should be smart to research or develop this certain feature. Also ranking of product functions (features) in a product development roadmap can be influenced by outcomes of this test.

The Kano model combined with the personas will give much more information if the functionality leading from the trends is desired by the actual users, and thus really suites their needs. The main reasons are:

-       Avoiding that a lot of money and effort are spend in certain features, which relatively do not deliver a lot of user satisfaction, or even worse cause dissatisfaction.
-       The use of the Kano Method shows the right features to gain maximal satisfaction from the user and really addresses their opinion.
-       Importance of features can be determined, which can help in making choices for positioning and roadmap development.

6.2.2   Application of the Kano model in this research

The application of the Kano model is used for getting user-value for the created functions that have lead from the research in Trends. The functions that are derived from the trends are split up in a set of Kano-questions (a minimum of 5 Kano question pairs per trend). By a selection-question in the questionnaire the respondents (users) will be linked to a certain persona. With this questionnaire can be validated what the users see as important functions leading from the trends. It could be possible that some requirements leading from the trends are found more important than others or not important at all.

6.3   Interpretation of Kano-questions

The second part of the questionnaire (Kano-questions) is the most valuable for rating the different trend functions. The question-pairs are directly composed from a requirement. By the answer on a question-pair, the score per requirement on a certain category is recorded. Hereby the final category or attribute of a certain requirement can be mapped.

6.3.1   Used Attributes (categories)

The original version of the Kano uses six attributes or categories to rank the impact on satisfaction (A/O/M/I/Q/R). A problem is that all reverse or negative reactions are put in one pool (R). Berger et al. [BER93] describes a method with more nuances in negative (or reverse) results. The impact on satisfaction is now calculated with seven attributes (MTB/D/MH/I/S/AD/LTB/Q), the negative are expressed in spoiler (S), absence delighter (AD) and less the better (LTB). See table below:

Impact on Satisfaction				
Kano Attr	**Used Attr**	**Graph**	**Short**	**Description**
O	MTB		More the better (Linear like)	A linear response where more of it is better (e.g. horsepower)
A	D		Delighter / Excitement	Absence isn't noticed but presence is highly values
M	MH		Must have / Expected	Absence is highly negative but, after a certain threshold level, more doesn't make any difference
I	I		Indifferent / neutral	It makes no difference if present or not
R	S		Spoiler / Dis-excitement	Presence above a threshold is highly negative otherwise it makes no difference
R	AD		Absence delighter / Better not	Presence doesn't matter or isn't noticed but absence creates a strong positive
R	LTB		Less the better (Linear dislike)	An inverted linear response where less of something is viewed as better
Q	Q		Questionable response	The response is highly questionable response, because the answers contradict each other

If the tested functions are addressing relevant things, the number of negative responses should be very low. If bad functions are made, they will probably lead to more negative responses. So the results should contain as little negative responses as possible.

So these attributes represent the lines as seen in the Kano model in the previous chapter. The different attribute lines can be plotted on the Kano model, as shown in the graph. The answer combination of 1-3 leads to the classification of category D, or Delighter.
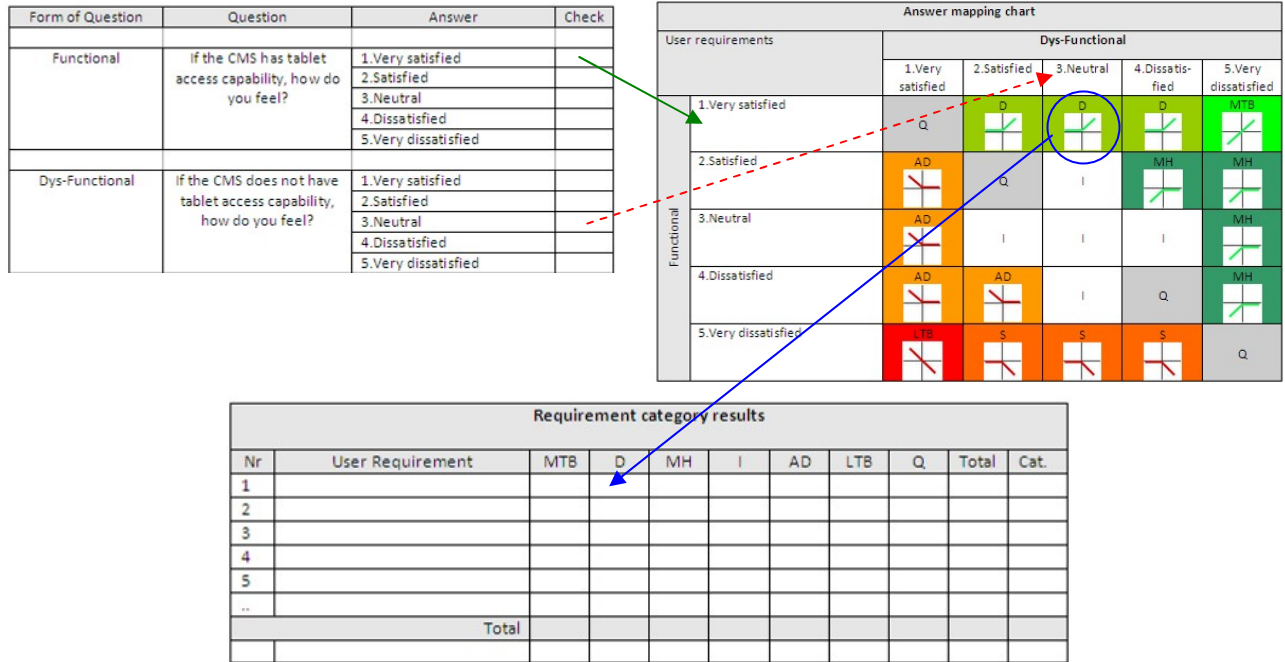
Figure 19: Applied Kano Structure

The results will also be mapped on a modified version of the "Customer satisfaction"-coefficient (CS) from Berger et al [BER93]. This gives another representation, of how much influence on satisfaction and dissatisfaction a certain feature gives. So if a certain requirement is fulfilled, how satisfied would one be, and if not fulfilled how dissatisfied? This can be helpful when refining the results to a few key functions.

Coefficient mapping

The coefficient gives more information and nuance, for better categorizing. For example a certain function has the MTB score of 18 and a D score of 20. The difference is only 2 respondents, which is very small and there could be discussion about placing it in a certain category. The coefficient will help to decide which category is chosen in the end. The formula for the coefficient is as follows:

$$IS = \frac{(D + MTB)}{(D + MTB + MH + I)} \quad ID = \frac{-(MTB + MH)}{(D + MTB + MH + I)}$$

IS represents the impact on satisfaction if a certain function is fulfilled.
D represents the impact on dissatisfaction if a certain function is not fulfilled.

The same could be done viewing from the other side (dissatisfaction) So if a certain function is not fulfilled, how satisfied would one be, and if fulfilled how dissatisfied.

$$IS = \frac{(AD + LTB)}{(AD + LTB + S + I)} \quad ID = \frac{-(LTB + S)}{(AD + LTB + S + I)}$$

This would only be useful if a lot of functions are not chosen right. So if a lot of functions are proposed that make no sense for the users/respondents. This should be avoided in general by thinking about functions in the first place. So in this case this last formula will be used, only when there are functions that should be left out,

by opinion of the respondents. The mapping of the coefficient is shown in the image below:

	Quality Attributes										Impact on Satisfaction	Impact on Dissatisfaction
Nr	M TB	D	M H	I	S	A D	L TB	Q	Total %	Cat.	$IS = \dfrac{(D+MTB)}{(D+MTB+MH+I)}$	$ID = \dfrac{-(MTB+MH)}{(D+MTB+MH+I)}$
1	15	45	20	10	5	2	3	0	100	D	IS= 60/90= 0,66	ID= 35/90=0,38
2												
3												
..												

Requirement result chart

Satisfaction / Dissatisfaction - Impact (Coefficient) chart

Nr	1,0	0,9	0,8	0,7	0,6	0,5	0,4	0,3	0,2	0,1	0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0
1																					
2																					
3																					
..																					
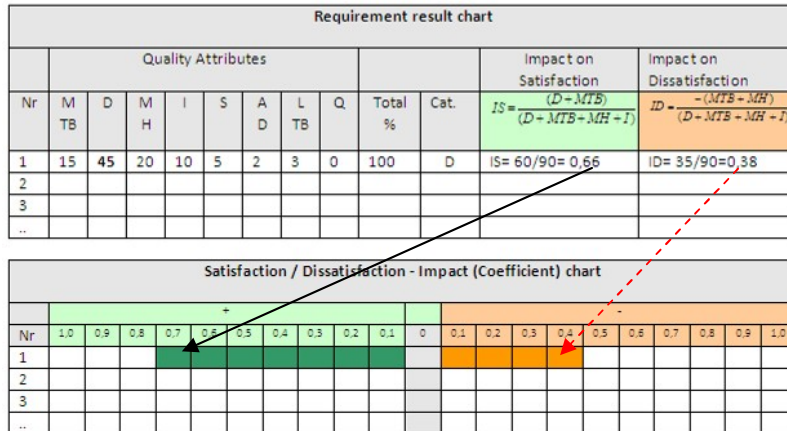
Figure 20: Coefficient mapping

The positive and negative coefficient both have the same range, positive from 0 till 1 and negative from 0 till -1. These measure the level of satisfaction and dissatisfaction. The above example shows that the requirement has higher influence on the satisfaction if met, in comparison to the dissatisfaction if would be realized.

Positive side of the chart:
How closer the result value is to 1, the more influence a certain requirement/feature has on the user satisfaction. So for instance, a requirement/feature with 0,7 has a high influence on the satisfaction

Negative side of the chart:
How closer the result value is to -1, the more the influence a certain requirement/feature has on the user dissatisfaction, if the product feature is not fulfilled. So for instance, a requirement/feature with -0,4 has an low to intermediate influence on the satisfaction if the analyzed requirement/feature is not fulfilled.

6.3.2   Value-Map

After applying the Kano model on the results of the questionnaire, also a "value map" of the different questioned functionality categories per persona can be made. Because there are 37 trend-functions questioned, the functionality is grouped into the corresponding trend-category. These categories will be presented in a spider-web chart, giving a profile of the importance of the different trend-categories for a certain persona type. Because the scores of the Kano methodology are different, the attribute-categories are mapped to fit in the spider-web chart by counting the number of functions that fall in a certain trend-category:

The image below shows an example spider-web chart with trend-categories {T1..T7} and the resulting attribute. There are six functions in the trend-category 1. All of these are rated positive but in various attribute categories; 3 in must have, 1 in delighter, 1 in more the better and 0 in all other attribute-categories. For the overview on positive (MTB/D/MH) and neutral rating (I), and negative ratings (LTB/AD/S) are cumulated (leading to a score of 5 fort T1) and showed in the overview diagram:
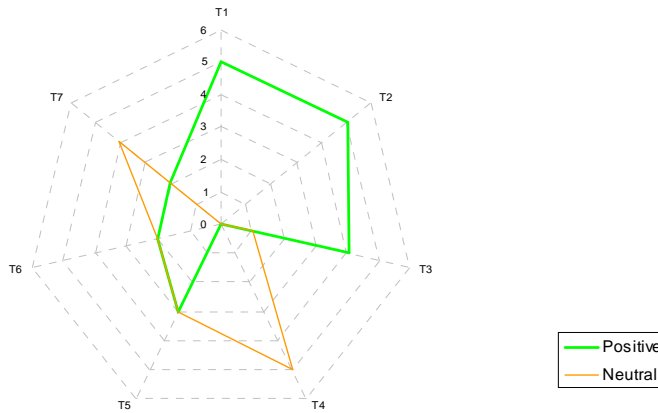
Figure 21: Example "Persona Value-map" overview

In this case the scores where from indifferent (orange) to positive (green), no negative scores (red) where recorded. Afterwards a detailed diagram can be given on the composition of the positive/negative score.
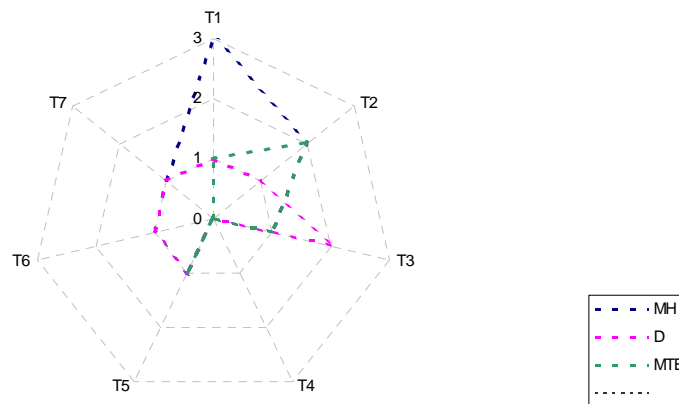
Figure 22: Example "Persona Value-map" detail

The above detail value-map shows that this persona type averagely rated the functions in the category "T2" as MTB. This means that the case-information functionality is interesting to focus on. It seems that the category "T4" is not important, because the persona is generally indifferent about it.

Later on, after the benchmark has been made, the scores of the tested trend functions in the software can also be mapped at the spider-web chart. This makes clear what the importance of certain requirements is for the personas, versus the implementation as realized by the software solution. In the spider-web chart below the importance of certain requirements for persona 1 {P1} are mapped besides the actual realization by the systems {S1..S4}.
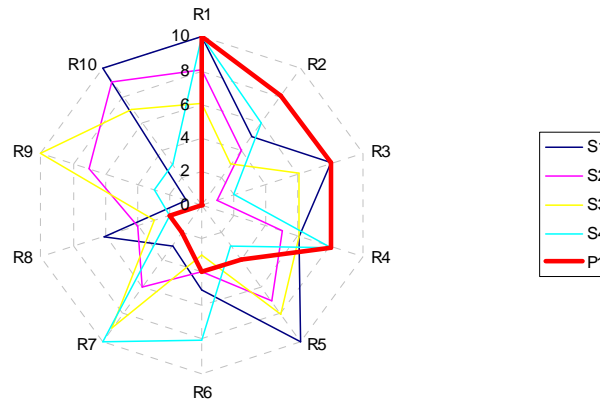
Figure 23: Example "Persona Value-Map" plotted in "Software Products Value-Map"

In this case it seems that {S1} suits the best to the needs of persona {P1}. Function categories {R2,R4} are not completely satisfied; this could be points on which the system should improve. Depending on applying further weight on each of the requirements or categories {R1..R10} some nuances in importance can be made.

6.4   Results (appendix E)

The results of the questionnaire can be found in appendix E.

6.5   Analysis

Reaching enough respondents that have experience with "zaak/dossier-systemen" or case management systems was very hard in practice. The majority of respondents reached, are from municipalities in the Netherlands. From other segments too little respondents have been reached.

When the questionnaire was in progress, it was clear that the focus should shift to municipalities to get more useful results. More municipalities where contacted as a consequence to increase the number of respondents from this segment. So no aselect respondent selection has been done, meaning that these results cannot be generalized for a larger group of case-management users.

In the end this questionnaire gives a reasonable indication for municipalities in the Netherlands, with 91% or 41 respondents. Because the total number of respondents is quite low (45), it was not useful to apply any further selection to the respondent list. Generalizing these results to the total population of ACM is not possible. So this questionnaire can be seen as a pilot. It gives an indication of important trend-related functionality regarding personas in a municipality environment, while keeping in mind the previous words.

6.5.1   General part

Confidential see appendix E.3.1

6.5.2   Specific part

Confidential see appendix E.3.2

The specific part is the most important part of the questionnaire, giving user-value to functions.

7   What has been realized so far? (Benchmark)

To test what has been realized in comparison to created vision as presented in the previous chapters, a benchmark is created. First the selection of the software for the benchmark will be explained. Afterwards, several available ACM software products will be tested through a feature list, based on the created model. This will lead to a certain score per software product. Some analysis-techniques from the field of Information Retrieval (IR) will be used to get some extra insight.

7.1   Software Selection

The selection of software-products that will be compared in the benchmark is not trivial. There are many sorts of case management solutions, or software-products that claim to have some kind of case management. Also the exact shape which supports case management the best way is not fixed. Actual implementations differ widely; there are more approaches to support case management. This makes it an opaque market; where real hands-on a product evaluation gives the best information.

The availability of software products is a problem in general because software manufacturers do not give away their products for free. Some trial-versions will be available, but mostly for a limited time-span.

Because of the scope, risks and limitations named above, I have formulated a set of criteria which where leading in the selection of the different software. The trends investigated for the first two sub-question of my research (literature research) have also lead to some criteria. The main-streams found in case management; ECM/DMS and BPM are also present. This gives an overview of the current state of products in these streams. I found the CRM approach of placing the customer in the center is also interesting to take in.

Besides the criteria, also the number of software products to be compared is taken into account, therefore limited to a maximum of six. The main aim is to get some useful results without staying too high level. This means selecting a few and do a good hands-on analysis is preferred over selecting many and fail to go deep enough. Therefore the benchmark is split in a long-list and short-list. The short-list will be hands-on tested, and the long-list will be rated by reading information and viewing specifications, brochures and whitepapers. The long-list results will be less reliable as a consequence.

The short-list of course gives problems with generalizing the results, because a limited set of systems is hands-on tested. But from a practical point of view it is just not feasible to test the entire long-list on my own in this way. Even more important; testing all products is not the goal to reach.

7.1.1   Selection criteria

1: The software-solution must be available for the Dutch market
        If the software is not available on the Dutch market, the software will probably will not be
        international known and thus reach enough companies, to be interesting for the comparison.
        Language of the software should be Dutch or English (or better, configurable).

2: At least one software-solution must have collaboration tools incorporated
        Leading from the found trends knowledge work and Social media, collaboration support can be
        important for the success of future case management applications.

3: At least one software-solution must be a SaaS solution
        Also leading from the found cloud trend, many vendors are offering their software as SaaS these days
        or have a SaaS partner to realize this in the nearby future. Looking what such vendors can deliver on

the web is interesting. Testing a vendor trough SaaS gives insight in the current state of products through this technique.

4: At least one software-solution must have connectivity solutions.
    As leading from the trends connectivity, it is good to look at systems that have incorporated some solutions to access certain functionality on a mobile device.

5: At least one software-solution must be a BPM case management solution.
    To know what current BPM solutions offer in term of case management, BPM case management software should be included in the benchmark.

6: At least one software-solution must be an ECM/DMS case management solution.
    To know what current ECM/DMS solution offer in terms of case management, ECM/DMS case management should be included in the benchmark.

7.1.2   Selected software

After viewing various software I have come to the conclusion that the current offerings of case management are mainly found in the content starting area (DMS/ECM), process starting area (BPM/WFM) and related starting area (CRM). These are by my opinion the most interesting to watch. For a real hands one with some software I am somewhat limited to the systems that can be made available for me. Derived from the criteria and available systems I have chosen the following ones:

	Start-area	
-Appian (Cloud BPM)	BPM	*Not tested before writing of thesis!*
-Groupion	BPM/CRM	
-Pallas Athena Bomana	BPM	
-SharePoint 2010	ECM	
-Océ DossierFlow	*DMS*	
-Zaaksysteem.nl (Mintlab/Bussum)	CM	

As the list shows I have selected a mix of different start-areas. It will be interesting to see in what degree the software products differ to each other, and also to the different start-areas. So let's take a look at each solution:

7.1.2.1   Appian (Cloud BPM) *not tested before writing of thesis*

In the BPM and even DCM market Appian is known described as one of the innovative leaders (Forrester and Gartner). Appian offers a very complete BPMS with functionality from design to case automation and reporting. All those elements are strongly integrated to build a rich case management application, with focus on processes. Also Appian "Tempo"-module provides support for mobile/web access (connectivity) from various devices, which makes it possible to access cases and information about status wherever you are. Also there is much integration possible with SharePoint mainly focused on content and collaboration, through the use of web parts.

Starting point	BPM
Strong points	-Completely SaaS (or On-premises)
	-Connectivity support
	-Collaboration
	-Business Rules

7.1.2.2 Groupion

Groupion is a system that combines BPM/CRM and ERP in one groupware style software-product. At the first glance this may seem a very strange combination, but in fact this system integrates different functionality into one portal. Offered completely on-demand in a SaaS structure it costs much less than conventional on-premises solutions. The kind of case-management offered in Groupion is aimed at incident/change-processing, combined with automated billing and used inventory/material (ERP functionality). It has a bit the feel of a customer complaint registration or helpdesk tool, but with much more functionality that you would not expect.

Starting point   BPM/CRM
Strong points   -Completely SaaS
                           -Combines ERP/CRM
                           -Collaboration
                           -Connectivity support

7.1.2.3 Pallas Athena BPMone

BPMone from Pallas Athena is a system which is aimed at process control. Coming from the BPM area, Pallas Athena has added case management on top of the BPM functionality. The routing or workflow functionality BPMone has is very strong. Tasks and processes that the worker should worry about are presented when they are needed. So the system tracks and controls as many actions as possible. Process mining is imbedded in the system which enables the discovery and monitoring of activities. As one of the strongest contesters in the current market with a large customer base, this is a competitor to closely watch. When looking at the ACM vision fit, Pallas Athena is one of the more strict solutions, which can limit the applicability of its case management.

Starting point   BPM
Strong points   -CM & BPM (support predictable & unpredictable)
                           -Process control (& routing)
                           -Extensive customer base (more than 2000 installations)
                           -Integrated user view (task & process)

7.1.2.4 SharePoint 2010

Microsoft SharePoint is a generic system which is used for various purposes. The main aim of SharePoint is collaboration & content. Trough so-called sites and workspaces can team-members share documents and information. The individual team-members will work with SharePoint through a portal, which gives access to sites, communities and documents or other content. This portal can be customized by the use of various plug-ins or web-parts. Although no BPM suite, SharePoint does offer some basic workflow functionality out of the box. The windows workflow foundation (WWF) allows configuring more advanced workflows if needed. Of course SharePoint integrates very well with other Microsoft products like Office.

Starting point   ECM
Strong points   -Collaboration
                           -Content
                           -Generic applicable
                           -Customizability

7.1.2.5 Océ DossierFlow

Océ DossierFlow is a DMS at heart which has evolved to a (adaptive) case management system which can be used in various applications. It is based on two main principles "smart flow" and the "dossier concept". The first stands for the use of some activities and basic workflow, to structure the work around dossiers. The second principle is about the way the system handles documents. Every document and sub dossier belongs to a dossier, which is transferred completely (entire dossier), if another person needs to work on the case. All content and information of one single case is available as a consequence. The resulting system is mainly aimed at content, and provides a non-complex interface to be suitable for people with little technical knowledge.

Starting point   DMS
Strong points   -Usability
                    -Content
                    -Generic applicable
                    -Quick implementation

7.1.2.6 Zaaksysteem.nl (Mintlab/Bussum)

Zaaksysteem.nl is an open source CM system, which is created to satisfy the needs of the municipalities. By joint effort of the municipality Bussum and the company Mintlab, a simple but effective, modern feeling application has been created, and is further developed in an incremental/agile way. Zaaksysteem.nl is aimed at concrete and practical product-driven, no-nonsense case management that works for a municipality. The user-interface looks very sharp and is not hard to understand. Surprisingly the concepts and dealing with cases in this system, fit very well to the ACM vision. Determining status and progress is done by the phase and milestone concepts (often used in project planning). The end-products are leading for giving the actual case status, instead of process steps. As a consequence the system does not require complete described processes in advance, but only some phase(s) and milestone(s) to work. More advanced and mandatory fields or documents can be specified, but these are also not needed in advance. Although the software is completely structured for the use within municipalities only, it could be changed to fit on more segments. The open-source nature of this product could be a benefit in reaching this goal.

Starting point   CM
Strong points   -Usability
                    -Created by Municipality for Municipality (open source)
                    -Completely SaaS
                    -Quick Implementation

7.3   Benchmark setup

7.3.1   Hands-on & long-list

The benchmark is split up into two parts:
-A Hands-on of the selected software in the previous chapters.
-A Long-list survey of other software-products with the use of information found on website/whitepapers/etc.

Hands-on
This will be done on a deep level for the selected software solutions. These solutions will be hands-on tested, by individually looking at an installed version of the solution. Functionality can be tested by trying what is possible and not. This will give a much clearer insight in the way of supporting different functionality.

Long-list
Besides this hands-on a longer list of software will be reviewed by looking at functional specifications. This could be seen as a long-list survey. The information provided by each manufacturer about their software product is leading for this long-list survey. Results coming from this review should be viewed, keeping in mind the way the data is gathered. Also not the entire long-list can be rated through the lack of information that is available.

The benchmark contains two major parts:
-Testing the base functionality
-Testing the trend functionality

7.3.2   Testing Base & Trend functionality

For the hands-on as the long-list the base & trend functionality will be rated. This will be done by using the feature set of base and trend functionalities that are derived from the literature study, and gained insights during this research.

Base functionality
The base functions that can be expected from a system that says to have a form of (adaptive) case management, are tested according to the literature. It could be that certain systems not have the base to be called ACM or case management at all. This will be tested by individually rating the scores for a set of base-functions, which are made during the literature study.

Trend functionality
The functions that are derived from the trends are also tested in a similar way. Which trend functionality is already realized and where are the gaps? This becomes clear by testing the functions on each software-product.

The results of the questionnaire are used to highlight the trend-functions that have a lot of user-value. This should result in better insight of the trend-functions, at the perspective of the end-users.

A closer look on the scoring can be found in the next chapter.

7.4 Score model

As described every software-product will be tested using the same list of base & trend functions. I will explain how the individual scores are given, and results are calculated. Also the use of weighting and additional IR analysis techniques will be further explained.

7.4.1 Scoring

To compare the software in an equal way, there is an excel sheet to give a grade per function {F1..Fn}, for each listed software product {S1..Sn}. For each function a score of {0..5} can be given, where {5} is the highest score, and {0} is the lowest score. So if product {S1} scores very well at function {F1}, a score of {5} is given. This is done for both the base- as the trend- functions.

Then a score is calculated leading to a base-score {BS} and trend-score {TS}. The {BS} is the sum of all base-functionality, and {TS} is the sum of all trend-functionality. One overall-score {OS} per product is given by calculating sum of the base- and trend-functionality; OS = BS+TS

But when some features or function-categories are more important, this is not enough. I will now explain how some basic weighting is applied.

7.4.1.1 Weighting

To be able to give some alternate balance in the scores, it is possible to apply some basic weighting. Domain experts can decide which functions or categories are more important. Weighting is possible for sub-functions, functions, function-categories and finally on base or trend level. Weighting is practically implemented by counting a score {F} for a number of times. So if function {F1} should count three times, it is multiplied with the weighting number {3}. So calculated as: {F1}*{3}. Should feature {F1} count double, then it is calculated as {F1}*{2}. Standard all weighting numbers are set to {1}, which takes the score as originally given: {F}*{1}.

7.4.1.2 Applying user-value

After the questionnaire results are ready, there can be shown which functions have more user-value than others. These results can be used to highlight the functions that have a lot of user-value. Accordingly a domain expert could decide that some functions should get more weight or more interest than others.

7.4.2   Vector approach

The scores for each feature of a software product, can also be represented in another way: by a vector. A certain software product {S} with scores for functions {F1..Fn}, can be represented as vector S(F1..Fn). This gives the possibility to use calculation and analyses techniques, which are often used in the field of information Retrieval (IR). This can be practically applied to compare similarity, and cluster the different software products. I will explain the two used IR techniques below.

7.4.2.1 Cosine similarity

Testing how similar two vectors are, can be done by applying the cosine similarity formula. Cosine similarity in the Information Retrieval (IR), is used to give similarity between the query and document (vectors). The used formula is as follows: *Sim(q,d) = q · d / ||q||.||d||*. Where (q) is the "query" vector and (d) represents the "document" vector. Taking the inner product of q and d, divided by the length of q multiplied with d, results in a similarity measure, between 0 and 1. Where 1 is completely similar and 0 is completely unsimilar. First I will give a short example, before explaining the application to the benchmark:

Let vector q be {1,2,3,4}
Let vector d be {1,2,3,4}

Sim(q,d) = (q · d / |q|.|d|)

q · d   = (1*1) + (2*2) + (3*3) + (4*4)
           = 30

||q|| = √(1^2 + 2^2 + 3^2 + 4^2)
          = 5,477
||d|| = √(1^2 + 2^2 + 3^2 + 4^2)
          = 5,477

Sim(q,d) = 30 / (5,477 * 5,477)
          = 30 / 30
          = 1

So the similarity between q and d, sim(q, d) = 1, this means q and d are completely similar. Note that when two vectors ({1,1,1,1} and {5,5,5,5}) are normalized and compared the similarity is also 1, this is because the vectors length is normalized to one. In practice this will not be a problem because no product will have a vector that has exactly the same set of numbers. If this would occur, it is always possible to take only the dot product of the ideal and the software for comparison.

Application to the benchmark

How can this be applied to the benchmark? When the scores are converted to vectors the following can be measured with cosine similarity:

Similarity between products
But in this case we could apply this formula in another way, by representing (q) with the vector of {P1} and (d) with the vector of {P2}, So similarity between the two software products can be calculated in a same way. Also

Similarity between a product and an ideal product
In essence we could say that when we are looking for an ideal solution which has the best mix of feature scores. This could be seen as the ideal software product. The similarity between a software product and the

"ideal software product" can be measured in the same way. This results a measure of similarity on the scale of 0 to 1, between the chosen software product and the ideal software product.

7.4.2.2   K-means clustering

By using vectors, the use of k-means clustering is now also applicable.
K-means clustering is a method to do a cluster analysis, which clusters documents (with similar characteristics) to the nearest mean, known as a cluster center or centroid. It tries to find the centers clusters in the data, and further refines this by iterating the k-means clustering algorithm, until an optimal clustering has been found (convergence). This is done by minimizing the average squared Euclidean distance between the documents and centroid. [MAN08]

In this case document clustering which is used in IR, can now be used for product clustering. By running the k-means algorithm it is possible to cluster the products in a few iterations to find natural clusters. It could lead to certain clusters which can be described, so a cluster can be clearly identified. For example if a lot of BPM products fall into the same cluster and a lot of ECM products fall in the same cluster, there is clearly a difference between BPM and ECM products.

K-means clustering is done by selecting a predefined number of initial centroids (or seeds) from the data set. A centroid can be seen as the middle-point of a certain cluster. By giving initial centroid positions, new positions are calculated by running the k-means algorithm. The centroid will move to find the best natural centers of the provided data, so clusters can be found. A document is placed in the cluster of the nearest centroid, after the position of the centroid does not change anymore (convergence).

The following image from Wikipedia gives a quick view on the working of the k-means algorithm.
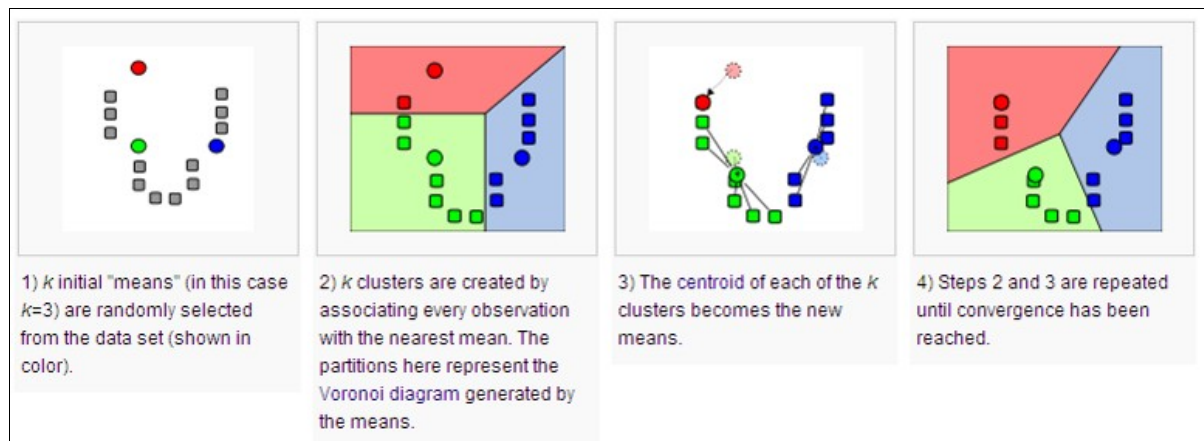

Figure 24: Demonstration of the standard k-means algorithm (Wikipedia[42])

A problem with K-means is determining the number of clusters that should be given. If a wrong number of clusters is chosen, it could give poor results. The K-means algorithm always generates clusters, even if there are no natural clusters. Therefore the number of clusters in the dataset should be tested to get the best minimal distances, or optimal number of clusters.

Also the lack of enough data to analyze can give bad cluster results, the more data, the more useful the clustering. This is something to keep in mind.

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[42] http://en.wikipedia.org/wiki/K-means_clustering

Application to the benchmark

Clustering software products
With k-means I hope to discover clusters in the tested software products to better show differences between them. For the short list (hands-on) this will be hard, because only a few solutions will be tested. But regarding the start-area of software products I hope to see possible clustering differences between BPM/WFM and ECM/DMS like solutions. K-means clustering applied on the long-list could also give similar results, and strengthen this view.

K-means tool & Practical implementation

For k-means clustering I have used a simple but effective tool from "DePaul University"[43], which takes data in a text-file and clusters the data, after giving a wanted number of clusters. I have made a small batch program which reads an excel sheet and tries clustering for a given number of K's, using the cluster program of DePaul.

After running the tool, it indicates the "Mean error per feature value" or "Root mean squared error" (RMSE) to indicate how optimal (measures variance) the final clustering is and gives an "output text file" with the final clustering. The lower the number the better the clustering is. So if with k=3 the RSME= 0.603, and with k=5 the RSME= 0.402, it indicates that the variance is less, so the number of 5 clusters is better.

Of course the "best clustering "is reached by giving each point its own cluster, resulting in a RSME of 0. But this is clearly not the objective of clustering a certain error is always present; therefore I will experiment with various K's to find an optimum by using the RMSE indication.

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[43] http://facweb.cs.depaul.edu/mobasher/classes/ect584/HW/assign4.html

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7.5   Results (Appendix H)

Please not that appendix H contains only the benchmark results of the short-list. Long-list is not rated.

7.6   Analysis

In the chapter below the main results from the benchmark are shortly described and further analyzed.

7.6.1   Long-list

Not possible to rate the long-list in time, possible future work.

7.6.2   Short-list (Hands-on)

The tested short-list gave the following end-ranking:

> *Confidential, End-ranking can be found in Appendix H.*

Note that also other specific benchmark results can be found in appendix H and excel sheets.

7.6.2.1   *Base functionality*

> *Confidential, see Appendix H*

7.6.2.2   *Trend functionality*

> *Confidential, see Appendix H*

7.6.2.3   *Cosine similarity*

> *Confidential, see Appendix H.*

7.6.2.4   *K-means clustering*

> *Confidential, see Appendix H*

8   Conclusion

In this research I have built a vision on ACM and the way it supports knowledge workers in handling more loose and unpredictable processes. I have researched the concept of ACM and positioned it between other methods. I looked at visions, current developments and trends around ACM. From there I have selected a set of relevant trends for ACM. I have shown who the knowledge workers are, and in which kind of organizations they occur. A questionnaire has been conducted to test the user-value, giving an indication for the municipality sector. Also a short-list of software-products that provide different sorts of case management, have been tested in a benchmark to determine the current state regarding the ACM vision and trends that are relevant for this vision.

ACM as a new concept can work very well in various situations. The need for a more adaptive form of case management is demanded by the business. Comparing to conventional methods like BPM, ACM offers better support to knowledge workers. But this ACM is not the "Holy Grail" for supporting all processes. For the strict and control-rich processes, ACM is less suited. The possibility that ACM and BPM will grow to each other is likely. Both sides of the work-spectrum need to be supported; a combination will eventually be needed.

8.1   Questionnaire

Confidential see Appendix J

8.2   Benchmark

Confidential see Appendix J

8.3   Advice regarding the improvement and development of ACMS

Confidential, See Appendix I

Besides the conclusions that can be drawn from the benchmark and questionnaire, I have gathered a list with possible improvements for ACM systems, that where found during testing and after analysis of the questionnaire and benchmark. These are also bundled in Appendix I.

8.4   Recommendations & future work

8.4.1   Benchmark

-Hands-on testing of competitive systems, delivers in my opinion the most useful results and insights. A large issue with this is getting access to these systems. As a student some doors can be opened, but when conducting research for a company, the competition will not give away a trial or demo-environment. That's why you're partly condemned to goodwill of people in providing a trial. This causes availability issues.

-Because of the limited time frame, it was not possible to test the long-list. Therefore the focus has been put on the short-list (hands-on) for the thesis. Also Appian was removed from the short-list due to availability issues. I will take a look at the long-list and Appian in the remaining time at Océ.

-The long-list rating should be revised, because detailed functions cannot be researched on limited information. For the short-list this was possible because almost every function can be tested in the system, for the long-list with no demo available this will be impossible to do. Better is to give a score for a whole category then for individual functions.

-The ratings given to the different software could be revised by a domain-expert to improve the overall quality. As a student my vision and opinion could be regarded as less reliable compared to a domain-expert, with years of field-knowledge. I partly tackled this by making sure there was some kind of weighting possible.

-Rating software for functionality and look & feel, is still a very intuitive process which cannot (or very hard) be formalized. Also the problem with rating software systems is that they are constantly being improved and changed. So the benchmark and questionnaire can both be re-run with other new functions.
It is clear that some ACM-base and trend-functionality will shift to become standard in a few years. A benchmark of various systems is very temporarily as a consequence. This is something to keep in mind.

8.4.2   Questionnaire

-A recommendation for the questionnaire is to remove the option "n.v.t." or "not applicable" for the Kano question-pairs. This could lead to better comparable results, because answer pairs have to be filled and cannot be skipped. Skipping has led to little response on some of the questions.

-Splitting questions for personas in general has proven too been a limiting factor. There are a lot more respondents needed if significant differences are to be proven. Where 45 respondents for one persona would be very reasonable, 45 in total to divide over 3 persona types is a bit too little.

-You need to have a lot of respondents per persona to be able to stratify or apply other selection. Therefore the questionnaire should be shorter and have more general applicable questions, which are suited for all personas. Or an entirely separated questionnaire per persona should be created, but preferably with the same questions. This is also necessary to create a better value map.

-Also the questionnaire has shown reverse categories can be left out of the analysis for trend related functionality, since there was no or very little negative attribute selection in the responses (S/AD/LTB). Note that these categories could be useful when conducting a questionnaire with very exactly described or controversial functionality (other than trend functionality). People will react more negative on controversial questions, and then these attributes are needed.

8.4.3   Future work

For future work the rating of hands-on rating of some extra software-products can be useful. The main problem here is having access to competitive software. Having a student for this is handy in this sense. Especially another system in the BPM starting area is interesting to look at, and investigate if it confirms the set image that BPM systems offer a radical different type of case-management.

Regarding the long-list candidates; rating the created functionality is almost not possible. For most functionality a hands-on test is needed, otherwise functions cannot be rated at all. Therefore it is better to rate the long list at the main categories of the derived base- and trend-functionality. Also then the quality of the gained information should be watched closely. Marketing and real functionality can be worlds apart.

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List of figures

List of abbreviations

ACM	Adaptive Case Management
ACMS	Adaptive Case Management System
CHS	Case Handling System
CM	Case Management
CMS	Case Management System
CRM	Customer Relationship Management
BPM	Business Process Management
DM	Document Management
DMS	Document Management System
DSP	Document Structure Plan
ECM	Enterprise Content Management
GBA	"Gemeentelijke basis administratie", Municipal base administration
PaaS	Platform as an Service (cloud computing)
SaaS	Software as an Service (cloud computing)
WFM	Workflow Management
WfMS	Workflow Management System
ZTC/ZTC+	"Zaaktype Catalogus", Case type catalog

Appendix A: Personas & Clientas

Appendix B: UML use case diagrams

Appendix C: Derived functionality

Appendix D: Questionnaire (Dutch)

Appendix E: Questionnaire results & analysis *(Confidential)*

Appendix F: Long-list

Appendix G: Test Document

Appendix H: Benchmark results & analysis *(Confidential)*

Appendix I: Improvements for ACMS *(Confidential)*

Appendix J: Conclusion (Confidential)