An applicability framework for adaptive case management

Defining the applicability of adaptive case management by means of process characterization

Author: J.J.C. Pillaerds

BSc. Industrial Engineering and management science – TU/e 2013
Student identity number: 0718760

In partial fulfilment of the requirements for the degree of

Master of Science
in Operations Management and Logistics

Supervisors TU/e:
Dr. ir. H. (Rik) Eshuis, TU/e Information Systems (IS)
Prof. dr. E.J. (Ed) Nijssen, TU/e Innovation Technology Entrepreneurship & Marketing (ITEM)

Supervisors Deloitte:
G. Teerhuis, Deloitte Consulting (Technology)
TUE. School of Industrial Engineering

Series Master Theses Operations Management and Logistics

Subject headings: Business information systems, business processes, Information systems; organization, Software selection
This master thesis is the result of a graduation project fulfilled in order to obtain the degree of Master of Science in operations management and logistics at the Eindhoven University of Technology. This graduation project is done at Deloitte in Amsterdam.

Through this preface I want to thank my Deloitte supervisors Gerdien Teerhuis and Jason Jie for their dedication in this graduation project. Through your network I was able to interview some of the most prominent adaptive case management vendors, whose information proved to be essential for this thesis. By showing dedication and providing critical feedback you motivated me to finish this thesis the way I did. Furthermore I would like to thank you for providing the proper support in order for me to get a job offer at Deloitte.

Secondly I would like to thank Rik Eshuis and Ed Nijssen for their dedication to this thesis. Your high involvement in this thesis and regular feedback provided a huge support to increase the quality of this thesis. Especially in the last phase of my thesis your feedback has improved the quality to an end result I am proud of.

Above all I would like to thank my family for supporting me not only through my master thesis but through my whole study career and helping wherever they can.

Lastly I would like to thank my friends for making my student time truly a great time.

Jeroen Pillaerds
ABSTRACT

This thesis focuses on the topic of adaptive case management which is a new BPM paradigm focusing on supporting knowledge intensive processes in a flexible manner. The thesis starts with giving a precise characterization of these knowledge intensive processes after which it continues with analyzing differences between these KiPs and the processes other business process support systems as workflow management systems, production case management systems and groupware management systems can support. Lastly the identified differences are used to create a framework which assesses the applicability of adaptive case management to a business process and is able to provide suggestions for other business process support systems when ACM is not or less applicable.
MANAGEMENT SUMMARY

Introduction:
This thesis reflects a qualitative research to the application of adaptive case management (ACM) systems to business processes. (ACM) is a sub paradigm of business process management (BPM), aimed at flexibly supporting knowledge intensive processes. BPM is a paradigm consisting of concepts, methods and techniques to support the design, administration, configuration, enactment, and analysis of business processes [1]. Knowledge intensive processes (KiPs) are defined as processes whose conduct and execution are heavily dependent on knowledge workers performing various interconnected knowledge intensive decision making tasks.

Deloitte advises their clients amongst other things, on designing and implementing business process support systems (BPSSs). This involves a careful consideration of proposing the right BPSS for a client’s business processes. An increasing number of clients of Deloitte think that ACM systems might be a good BPSS support their business processes, and Deloitte wants to respond to this trend by providing their clients with advice about whether or not an ACM system is an applicable BPSS for their client’s business processes. Although Deloitte suspects ACM systems might provide a good solution for some of their clients, they do not possess enough knowledge about the process characteristics ACM systems are applicable to and hence do not have a structured way of whether ACM systems provide a good solution for their client’s business processes. In order to solve this problem for Deloitte, the goal of his thesis is formulated as:

Research goal:
“To identify the processes characteristics an ACM system is applicable to and to structure this information in a framework that assists Deloitte in predicting upon the applicability of ACM systems to business processes.”

In order to structure the thesis four research questions were formulated.

RQ.1. What process characteristics influence the applicability of an ACM system?
RQ.2. What are the differences in applicability between ACM systems and other BPM systems (workflow management systems, production case management systems and groupware systems) based on these characteristics?
RQ.3. How can these characteristics, be structured in a framework that can determine the applicability of ACM?
RQ.4. How valid is the framework?

Method
The first research question is addressed by performing semi-structured interviews with five prominent adaptive case management system vendors. The questions identified to what business process characteristics the ACM systems of the vendors were applicable. This information was combined with the results from the literature study to come to a complete and valid set of process characteristics for processes ACM systems are applicable to (otherwise known as KiPs).

To address the second research question it is investigated how the process characteristics ACM systems support differ from the process characteristics other BPSSs, workflow management systems (WFMSs), production case management (PCM) and groupware systems can support. This is summarized in a table with the different BPSSs on the x-axis and the KiP characteristics on the y-axis. For each characteristic is described how this characteristic should look like for the different BPSSs. Subsequently an analysis is made, describing the differences in business process characteristics the BPSSs can support.
The third research question is assessed by structuring the differences identified in the second research question in a framework. The framework provides the client with a set of 20 questions that can be answered by yes or no. Based on the outcome of the questions it is identified which BPSSs are applicable to a business process.

The fourth research question assesses the validity and the usability of the framework. A multiple case study is performed in which three Deloitte employees use the framework to identify which BPSS is most applicable to the business process described in the case.

**Practical contribution:**

The main problem of Deloitte as that there was no structured way of deciding when ACM was an applicable BPSS for their client’s business processes. The underlying problem was that there was no knowledge available within Deloitte about the process characteristics ACM is able to support.

The thesis provides Deloitte with a list of 13 KiP characteristics from which the prove is grounded in literature and practice. This creates a common understanding within Deloitte about the process characteristics ACM is applicable to, solving the problem of the lack of knowledge within Deloitte about the applicability of ACM systems.

Subsequently the research uses these characteristics to assess other business process support systems along these process characteristics. Which results in an analysis of how these business process support systems differ from each other in supporting the (or not supporting) the different KiP characteristics.

Subsequently these differences are translated to a framework which addresses specific process elements in order to decide which BPSSs can be applied to a business process and which BPSS supports the process in the most ways and is therefore the best applicable BPSS for the process. This framework is tested by means of four real life situations (cases). The framework predicted the BPSS used in each case as the best BPSS for that case, proving the internal validity of the framework.

The framework provided by this thesis provides Deloitte with a scientifically grounded and valid approach for predicting the applicability of the investigated BPSSs to knowledge intensive processes. The framework gives Deloitte an easy and understandable tool for showing their clients which BPSSs are applicable to their business processes and why certain systems are or are not applicable. It therefore addresses the problem stated in the beginning of the thesis “Deloitte does not have a structured way of deciding whether ACM is an applicable solution for a business process” and reached the goal of the thesis by identifying the process characteristics ACM systems are applicable to and translating these characteristics to a framework that predicts the applicability of ACM.

**Contribution to literature**

The thesis pays it contribution to literature by proving the KiP characteristics as defined in literature can indeed be supported by ACM systems and extending these characteristics with the need for transparency, the orientation towards the client and the frequency with which these processes should be executed. Furthermore it gives a clear overview in to which extent other BPSSs can support these KiP characteristics assessing the concrete advantages that can be gained by applying ACM systems to the right processes.

Specifically this thesis confirms KiPs are indeed goal oriented, can have emergent goals, are event driven and require different data sources. Although these characteristics were weakly supported in literature they were unanimously supported by ACM vendors. Furthermore all these process characteristics were found during the case study in an ACM process.

Lastly the thesis provides a framework which is able to assess whether different BPSSs are applicable to a business process and which BPSS supports the process in the best way by means of asking simple
and concrete questions in order to analyze this process. It makes a difference between characteristics that BPSSs can support, characteristics that BPSSs can support but are not ideal and characteristics that the BPSS cannot support. This way the framework provides a transparent and useful outcome about which kind of systems should be used in order to manage the business process to the best extent.
### DEFINITIONS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adaptive Case Management (ACM):</strong></td>
<td>A paradigm consisting concepts, methods and techniques to flexibly support the design, administration, configuration, enactment, and analysis of knowledge intensive processes [2, 3, 1]</td>
</tr>
<tr>
<td><strong>Adaptive Case Management System (ACMs):</strong></td>
<td>A generic software system that aims to flexibly support knowledge intensive and less structured business processes [2, 4].</td>
</tr>
<tr>
<td><strong>Business process (BP):</strong></td>
<td>A set of activities that are performed in coordination in an organizational and technical environment. These activities jointly realize a business goal. Each business process is enacted by a single organization, but it may interact with business processes performed by other organizations [1].</td>
</tr>
<tr>
<td><strong>Business process management (BPM):</strong></td>
<td>A paradigm that includes concepts, methods and techniques to support the design, administration, configuration, enactment, and analysis of business processes [1].</td>
</tr>
<tr>
<td><strong>Business process support system (BPSS):</strong></td>
<td>Software systems that support workers in performing business processes.</td>
</tr>
<tr>
<td><strong>Case</strong></td>
<td>The product which is manufactured by means of a business process [4].</td>
</tr>
<tr>
<td><strong>Case management (CM):</strong></td>
<td>A paradigm for supporting the design, administration, configuration enactment and analysis of knowledge-intensive business processes, considering a case as its main focus [4].</td>
</tr>
<tr>
<td><strong>Event</strong></td>
<td>A change that affects process state, process-related data and knowledge, and process execution context and environment [5].</td>
</tr>
<tr>
<td><strong>Flexibility:</strong></td>
<td>The change that a process can accept in the presence of perturbation [6].</td>
</tr>
<tr>
<td><strong>Information technology (IT)</strong></td>
<td>The hardware and software used to store, retrieve, and transfer information [7].</td>
</tr>
<tr>
<td><strong>Knowledge intensive Process (KiP):</strong></td>
<td>Processes whose conduct and execution are heavily dependent on knowledge workers performing various interconnected knowledge intensive decision making tasks. KiPs are knowledge, information and data centric and require substantial flexibility [5].</td>
</tr>
<tr>
<td><strong>Knowledge worker:</strong></td>
<td>A worker that need to make decisions on the course of action as a process proceeds [8]</td>
</tr>
<tr>
<td><strong>Paradigm:</strong></td>
<td>A distinct set of concepts or thought patterns, including theories, research methods, postulates, and standards for what constitutes legitimate contributions to a field.</td>
</tr>
<tr>
<td><strong>Production Case Management</strong></td>
<td>A highly specialized form of case management which provides</td>
</tr>
</tbody>
</table>
(PCM): a certain amount of flexibility but is made for more repetitive patterns [4, 9].

Support: The coordination and ordering of tasks in a process [10].

Task: An atomic (being either executed or not-executed) work unit that describes an activity to be performed [1].

Workflow Management system (WfMS): A paradigm consisting concepts, methods and techniques to support the design, administration, configuration, enactment, and analysis of business processes through means of explicitly mapping the processes in the form of tasks that have to be performed [1].
LIST OF TABLES

Table 1 - Deliverables research questions........................................................................................................... 6
Table 2 - Characteristics knowledge intensive processes according to literature .............................................. 12
Table 3 - Characteristics thesis ............................................................................................................................ 13
Table 4 - Structured and semi-structured interviews ......................................................................................... 14
Table 5 - Vendors interviewed ............................................................................................................................ 18
Table 6 - Requirements of ACM systems ............................................................................................................ 19
Table 7 - Characteristics processes suitable for ACM according to vendors .................................................... 20
Table 8 - Characteristics processes suitable for ACM according to vendors and literature ............................. 21
Table 9 - Characteristics of processes to which ACM is applicable ................................................................... 23
Table 10 - Differences and similarities between business process support systems ....................................... 26
Table 11 - Process characteristics along business process systems ................................................................. 27
Table 12 - Applicability framework .................................................................................................................... 29
Table 13 - Results case 1 ...................................................................................................................................... 37
Table 14 - Results case 2 ...................................................................................................................................... 38
Table 15 - Results case 3 ...................................................................................................................................... 39
Table 16 - Results case 4 ...................................................................................................................................... 40
Table 17 - Changes in framework ........................................................................................................................ 43
Table 18 - Process characteristics KiPs ............................................................................................................... 60
LIST OF FIGURES

Figure 1 - Paradigms and business process support systems ......................................................... 2
Figure 2 - Example of a process that can be supported by an ACM system .................................. 4
Figure 3 – Cause-effect diagram ACM related problems experienced by Deloitte ...................... 5
Figure 4 - Regulative cycle and relation with thesis .................................................................... 13
Figure 5 - Approach research question 1 ...................................................................................... 15
Figure 6 - Overview cases ............................................................................................................. 34
Figure 7 - Deloitte organization chart .......................................................................................... 54
Figure 8 – Illustration example workflow management process .................................................. 56
Figure 9 – Example of a PCM process .......................................................................................... 57
Figure 10 – Example a groupware environment .......................................................................... 58
Figure 11 - Different paradigms ................................................................................................... 59
CONTENTS

Preface ...................................................................................................................................................... ii
Abstract ................................................................................................................................................... iii
Management summary ........................................................................................................................... iv
Definitions .............................................................................................................................................. vii
List of tables ............................................................................................................................................ ix
List of figures ............................................................................................................................................ x
Contents .................................................................................................................................................. xi

1. Introduction ..................................................................................................................................... 1
   1.1 Definition of adaptive case management ............................................................................... 1
       1.1.1 Business process management ....................................................................................... 2
       1.1.2 Case management ........................................................................................................... 3
       1.1.3 Adaptive case management ............................................................................................ 3
   1.2 Problem statement .................................................................................................................. 5
   1.3 Research goal and research questions .................................................................................... 6

2. Literature review ............................................................................................................................. 7
   2.1 Requirements of an adaptive case management system ....................................................... 7
       2.1.1 Applicability of adaptive case management to business processes ............................... 8
   2.2 Process characteristics knowledge intensive processes ......................................................... 9
       2.2.1 Methods of defining knowledge intensive processes ..................................................... 9
       2.2.2 Characteristics knowledge intensive processes ............................................................ 10
   2.3 Conclusion literature study ................................................................................................... 12

3. Research methodology .................................................................................................................. 13

4. Adaptive case management vendor interviews ............................................................................ 17
   4.1 Interview methodology ......................................................................................................... 17
   4.2 Interview execution ............................................................................................................... 18
       4.2.1 Assessment interviewees .............................................................................................. 18
       4.2.2 Assessment ACM systems ............................................................................................. 19
       4.2.3 Process characteristics mentioned by vendors ............................................................. 20
   4.3 Conclusion research question 1 ............................................................................................ 21

5. Comparison business process support systems ............................................................................ 24
   5.1 Related business process support systems amongst process characteristics ....................... 24
       5.1.1 Workflow management systems along process characteristics ................................... 24
       5.1.2 Production case management systems along process characteristics .......................... 24
       5.1.3 Groupware along process characteristics ..................................................................... 25
Appendix C
Characteristics knowledge intensive processes found in literature

Appendix D
Template vendor interviews

Appendix E
Interview report per vendor
IBM
Be Informed
ISIS Papyrus
Formetis

Appendix F

Appendix G
Case 1: Employee course subscription
Case 2: Contracting between a semi-public organization and client (adaptive case management)
Case 3: Subsidy request at a public organization (production case management)
Case 4: New product development at a large consumer business (groupware)
1. INTRODUCTION

This thesis presents the result of a master thesis project on the topic of ‘adaptive case management (ACM)’ conducted at Deloitte Consulting (Technology). ACM can be considered as a sub paradigm of business process management aimed at managing knowledge intensive processes [2, 3, 1] business process management (BPM), is a paradigm consisting of concepts, methods and techniques to support the design, administration, configuration, enactment, and analysis of business processes [1]. Although both paradigms include concepts, methods and techniques to support business processes, ACM is associated with knowledge intensive processes (KiPs) specifically. KiPs are “processes whose conduct and execution are heavily dependent on knowledge workers performing various interconnected knowledge intensive decision making tasks” [5]. Ever since the 1950’s information technology plays an increasingly central role in BPM [1], making the provision of business process support systems (BPSSs), software systems that support workers in performing business processes an important part of the paradigm. Note that in the remainder of the thesis BPSS refers to a type of BPSS instead of a specific system.

Deloitte advises their clients amongst other things, on designing and implementing BPSSs. This involves a careful consideration of proposing the best applicable BPSS for a client’s business processes. An increasing number of clients of Deloitte think that ACM systems might be a good BPSS to support their business processes, since the client’s notice their current BPSSs cannot always provide the flexibility their business processes demand. Deloitte wants to respond to this trend by providing their clients with advice about whether or not an ACM system is an applicable BPSS for their client’s business processes. Although Deloitte suspects ACM systems might provide a good BPSS for some of their clients, they do not possess the knowledge to argue this and hence do not have a structured way of deciding whether an ACM system provide a good BPSS for their client’s business processes. In order to provide their clients with advice, Deloitte needs an overview of the process characteristics (KiP characteristics) an ACM system can be applied to and a way of deciding whether ACM systems are applicable for a client’s business processes.

This thesis focusses on identifying specific process characteristics ACM systems are able to support (otherwise known as KiP characteristics). Generally ACM systems are associated with KiPs however, as becomes clear from the literature study (see chapter 2), the definition of KiPs and the specific characteristics such a process possesses differ amongst academic literature. Therefore this thesis starts with giving a complete characterization of a KiP, while simultaneously checking whether ACM systems are indeed able to support these process characteristics, by interviewing ACM vendors. Subsequently other business process support systems (workflow management systems (WfMS), production case management (PCM) systems and groupware systems) are analyzed along these process characteristics which ultimately translates in a framework which addresses specific process characteristics and assists Deloitte to predict whether an ACM system is applicable to a business process or whether other BPSSs should be considered.

The remainder of this chapter describes ACM, BPM and case management (CM) in section 1.1. Section 1.2 describes the problems related to ACM encountered by Deloitte and elaborates on the problem this thesis addresses. Finally section 1.3 formulates the goal of the research and defines the research questions which are answered in the remaining chapters of the thesis.

1.1 DEFINITION OF ADAPTIVE CASE MANAGEMENT

This section focusses on providing more information about ACM and its corresponding BPSSs referred to as ACM systems. In order to fully understand ACM this section first describes the umbrella paradigm of BPM. This paradigm can be divided into three sub paradigms which are WfM, CM and groupware. CM again consists of two sub paradigms, PCM and ACM. From these paradigms
WfM and PCM are no defined yet. WfM can be defined as a paradigm consisting concepts, methods and techniques to support the design, administration, configuration, enactment, and analysis of business processes through means of explicitly mapping the processes in the form of tasks that have to be performed [1]. PCM is defined as a highly specialized form of case management which provides a certain amount of flexibility but is made for more repetitive patterns [4, 9].

As can be seen from the definitions each of these paradigms include a technique component, part of this component are the BPSSs on which this thesis focuses. Figure 1 depicts the described taxonomy; note that although the BPSSs are part of the paradigm, these are depicted separately to emphasize the focus of this thesis.

The remainder of this section starts with describing BPM and CM after which it elaborates on ACM and its corresponding BPSSs. The other paradigms (WfM, PCM and groupware) along with their corresponding BPSSs (WfM’s, PCM systems and groupware systems respectively) are described in Appendix B.

Figure 1 - Paradigms and business process support systems

### 1.1.1 Business process management
BPM is an active area of research and is based on the observation that each product a company provides to the market is the outcome of a set of interrelated activities performed. These activities are referred to as a business process. Typically an organization involves a multitude of business processes. BPM aims to understand the organization and interrelationships of these activities, to eventually manage and/or improve them [1].

Information systems play a central role in BPM and lately more and more activities are supported by information systems or even completely automated [1]. In order for a company to reach its goals efficiently and effectively it is important that information systems, employees and organizational business aspects are aligned well [1].

Since business processes appear in great variety, BPM includes different sub-paradigms to manage these processes. On the one hand there is WfM (explained in paragraph 0) which is very suitable for processes in which the activities and execution constraints can be predefined in advance, also known as structured processes [1], but shows serious shortcomings when it comes to managing less
structured processes [1]. Therefore BPM also includes the paradigm of case management (explained in paragraph 1.1.2) and groupware (explained in paragraph 0) which are aimed at managing these less structured processes.

1.1.2 Case management
Case management (CM) is defined as “A paradigm for supporting the design, administration, configuration enactment and analysis of knowledge-intensive business processes, considering a case as its main focus [4]”. As the definition already implies this paradigm focusses on a case rather than a process. In this context a case can be seen as the product which is produced along with all contextual information regarding that product [4]. In order to handle a case, activities have to be performed, which are defined as logical units of work [4]. Note that these activities are non-atomic which means they can consist of multiple tasks [4] e.g. an activity can be organize a meeting, this activity however consists of multiple tasks as booking a room, inviting required participants etc.

In order for a case to be completed, related activities have to be performed (a business process). However in CM (unlike WfM) these activities (consisting of tasks) do not have to be predefined. Instead the worker needs to decide which activities have to be performed in order to reach the goal of a case, based on the information about a case that is available. These workers who have to actively make decisions to determine the progress of a case are referred to as knowledge workers [4]. It could be said that these workers focus on the goal to be achieved rather than the process itself, also referred to as goal-oriented [3, 11].

In order for knowledge workers to be able to make these decisions, they need to be aware of a whole case. In order to ensure this, the knowledge worker should be aware of all the information regarding a case and the progress of a case [4]. This is ensured by providing a knowledge worker with the right data through means of electronic or physical sources. Contrasting to workflow management, case management is also driven by data-flow instead of exclusively by control flow [4]. This can also be referred to as being data centric.

The freedom a knowledge worker perceives is not unlimited, by means of authorization, business rules and legal regulations a worker is still restricted in the activities he/she can perform [2, 4, 12]. Within these regulations however a knowledge worker is free to decide upon the activities he/she needs to perform in order to reach the goal of a case.

Lastly case management is based on collaboration [4] Business processes can involve multiple process participants who have to collaborate in order to achieve a goal [2]. This requires communication and cooperation between knowledge workers which makes it important to keep track on who performed which activity with which result in order to keep the process transparent [2].

According to Swenson et al. [9] case management can be divided into two different approaches called production case management (PCM) and adaptive case management (ACM). It is important to note that these paradigms both rely on the described principles of case management.

1.1.3 Adaptive case management
The definition of ACM has a lot of similarities with the definition of CM. The difference between CM and ACM however lies in the fact that ACM focusses on the flexible support of knowledge intensive processes whereas the word flexible is not used in the definition of CM.

Just like CM, ACM revolves around a case instead of a process [2, 4]. There does not have to be a predefined process and the paradigm relies on knowledge workers to make decisions based on available case related information in order to reach their goal [2, 13]. The freedom knowledge workers perceive is restricted by authorization, business rules and legal regulations and the paradigm relies on collaboration between knowledge workers and transparency [2].
The uniqueness of ACM lies in the ability of ACM’s BPSSs to flexibly react to unpredicted changes or events [2]. The paradigm states knowledge workers may find themselves in situations that never happened before, and may have to deal with changes that could not be foreseen. This can cause them to adapt a process or a case on the fly [9]. Furthermore the paradigm aims at supporting learning organizations by realizing exceptions should become a pattern when they occur more often [12, 14].

ACM systems are data-centric instead of process-centric in order to capture this information about a case in a so called case-folder [2]. This way an ACM system is able to provide contextual information to a knowledge worker, based on which a knowledge worker can make decisions [3, 2]. Furthermore ACM systems have to be able to work towards a goal and do not have a process defined a-priori. This leaves room for a knowledge worker to decide which activities should be performed to achieve a certain goal [2]. Lastly a knowledge worker needs to be able to register the activities he performs [2]. This way the processes a knowledge worker follows in order to reach a goal become insightful, creating a transparent process.

To efficiently facilitate a worker in handling a case an ACM system needs to provide workers with tasks he can perform, time constraints and information that is available to efficiently reach his goal. Case participants and managers should be able to keep track of the progress of a case and after completion of a goal an ACM system needs to be able to show which worker performed which actions with what result [2]. Lastly an ACM System facilitate integration of resources giving knowledge workers access to the organization’s knowledge base and intermediate results of a case [2].

Like stated before the key objective of ACM systems is to handle cases in a flexible manner which makes these systems unique. ACM systems provide workers the flexibility to adapt an ACM system to the needs of a case on the fly. If a worker gathers information or has to react to unpredictable events he/she is able to adapt an ACM system e.g. by creating a new task that has never been executed before. A knowledge worker is still restricted in the ways he/she can adapt an ACM system by means of business rules and legal regulations that are modelled in an ACM system. These on the fly adaptations can again be re-used if necessary to ensure continuous improvement of an ACM system as a whole.

An example of a process that can be supported by an ACM system is a consult of a GP which can be highly knowledge intensive. A patient arrives at the consult and informs the GP about any complaints the patient experiences. Based on these complaints the GP has to take a decision about what to do next. This decision is highly dependent on the specific situation of the patient and the GP has to make a decision based on expertise in order to ultimately diagnose the patient (see Figure 2 - Example of a process that can be supported by an ACM system).
1.2 **Problem Statement**

As stated before the master thesis is conducted at Deloitte consulting (technology) and within the BPM group in particular (see Appendix A).

The BPM group focusses on three central areas in serving their clients which are:

1. Set up of a long term process architecture which supports the re-use of processes for projects
2. Advise on, design and set up of case management to support processes
3. Extract, analyze and validate processes data to give a fact based insight and advice on how processes within an organization really work.

Within these areas one of the main focuses of the BPM group is to provide their clients with the right software support for the client’s business processes. The BPM group sees ACM as an interesting paradigm to support their clients more knowledge intensive processes and wants to expand their offerings with advice about ACM.

The vision of Deloitte is “to be the standard of excellence” meaning Deloitte has to provide their clients with applicable innovative solutions. In order to live up to this demand the BPM group wants to extent their advice with advice about the paradigm of ACM and its corresponding BPSSs. On top of that Deloitte’s clients get more interested in ACM, meaning Deloitte might be missing potential sales by not including ACM in their assortment.

In order to advice their clients about ACM, Deloitte needs to possess knowledge about the applicability of ACM to business processes and should be able to argue their advice about whether ACM is a suitable solution for the client or not. At this moment Deloitte lacks a structured way of deciding whether ACM is applicable to the business processes of the client or not.

The two main problems Deloitte encounters regarding ACM are the lack of knowledge about the process characteristics an ACM system is applicable to and the lack of a structured way of deciding upon the applicability of an ACM system. Although Deloitte’s clients are interested in ACM systems, and Deloitte suspects ACM systems might be a good solution for some of their clients, they have no scientifically grounded and structured way to argue this advice and are therefore unable to properly advice their clients about these systems. Figure 3 gives an overview of the problems regarding ACM encountered by Deloitte

![Figure 3 – Cause-effect diagram ACM related problems experienced by Deloitte](image-url)
Van Aken et al. [15] state that the problems at the very right side of the cause-effect diagram are mainly relevant, while the problems at the left side are more feasible. The problem which this thesis focusses on finds itself in the middle part of the diagram making it both relevant and feasible. This thesis assesses the problem that there is no structured way for deciding upon applicability of ACM yet. This problem is feasible and provides a relevant solution to Deloitte’s problems regarding ACM.

1.3 Research goal and research questions
To structure this thesis, its goal is defined. In order to achieve this goal, the thesis is structured along four research questions.

Research goal: “To identify the processes characteristics an ACM system is applicable to and to structure this information in a framework that assists Deloitte in determining the applicability of ACM systems to business processes.”

Research questions:

RQ.1. What process characteristics influence the applicability of an ACM system?
RQ.2. What are the differences in applicability between ACM systems and other BPM systems (workflow management systems, production case management systems and groupware systems) based on these characteristics?
RQ.3. How can these characteristics, be structured in a framework that can determine the applicability of ACM?
RQ.4. How valid is the framework?

Table 1 gives an overview of the deliverables the different research questions provide.

<table>
<thead>
<tr>
<th>Research question 1</th>
<th>Research question 2</th>
<th>Research question 3</th>
<th>Research question 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A list of process characteristics that influence the applicability ACM systems are applicable to.</td>
<td>An overview of the applicability of WfMs, PCM systems, ACM systems and Groupware systems to these characteristics</td>
<td>A set of questions, combined in a framework that determines the applicability of ACM</td>
<td>An analysis of the validity of the framework</td>
</tr>
</tbody>
</table>

Table 1 - Deliverables research questions
2. LITERATURE REVIEW

In order to assess the problems encountered by Deloitte a literature study is performed to identify the knowledge currently reflected in literature. The study focusses on the process characteristics ACM is applicable to, mentioned in literature. From the definition of ACM becomes clear that ACM is mainly applicable to KiPs which is why both literature about ACM and KiPs is considered. The literature review starts with stating the requirements for an ACM system to get a better understanding about the ACM systems themselves, along with the process characteristics an ACM system can support. Secondly it identifies the process characteristics of knowledge intensive processes (KiPs). Lastly this chapter discusses what conclusion can be drawn from this study.

2.1 REQUIREMENTS OF AN ADAPTIVE CASE MANAGEMENT SYSTEM

The increased popularity of ACM can be considered as a response to the increasing number of knowledge workers in a typical workforce of an organization. The fact that more and more routine processes are automated or soon to be automated, in combination with the emergence of new knowledge intensive work, leaves organizations with a larger proportion of KiPs [16, 17, 5]. Before focusing on the process characteristics ACM systems are applicable to, it is useful to have a closer look at the requirements for an ACM system.

R1: Flexibility during run time

One of the main requirements of an ACM system is the flexibility during run time [9, 11, 8]. This enables the knowledge worker to add or alter tasks that might or might not have been performed in the past, during runtime [9]. The flexibility during runtime makes it possible for knowledge workers to react to a changing environment [2] and unexpected events [18] in a quick and adequate manner without having to consult programmers first.

R2: Evolving cases and templates

This requirement allows the system to evolve through being able to add new tasks and adapt tasks in a collaborative manner. When a task defined or adapted by knowledge workers prove to be useful to reach the goal of a case, the knowledge worker can publish this task or change in the system, making it available for other knowledge workers as well. The task can now be used by other knowledge workers who find themselves in similar situations [2, 8]. This way knowledge worker help continuously improving the ACM system. Ideally the ACM system should be able to suggest these tasks to knowledge workers involved in similar cases by detecting trends and potential developments [11], and in this way support the knowledge worker in its decision making [19, 2].

R3: Transparent responsibilities

An important requirement is the rightful assignment of responsibilities of knowledge workers [20, 21]. ACM systems should support collaborative process and in order to support this collaboration it is important it is transparent how responsibilities are distributed amongst knowledge workers [21].

R4: Visible progress of a case

It is important for knowledge workers to have an overall view of the information regarding a case, the goals that have to be achieved and the progress of a case in reaching these goals. By providing knowledge workers with this information the risk of context tunneling is reduced. The context tunneling effect causes workers to only provide the work which they are required to do and not having insight in completed and future tasks [12]. Furthermore knowledge workers cannot determine their contribution to the outcome which might drop the quality of their work [12]. By providing aggregated information and keeping track of activities performed on a case and making this
information available for all stakeholders authorized to consult this information, it makes collaboration easier and more efficient [11].

R5: Flexible assignment of roles

ACM systems should be able to support collaborative processes [8, 2]. This means it should be possible for knowledge worker to join a case during execution [21]. More importantly these workers should be able to execute, skip or redo a task to prevent a static workflow like process [4].

R6: Definition of case objectives

ACM systems are goal oriented, meaning workers can express objectives and goals for which the process towards the objective/goal is still unclear [3, 11]. This provides knowledge workers with flexibility in deciding which tasks to execute in which sequencer to reach the goal [2].

R7: Hierarchical structuring of tasks

In order to make it easy and accessible for workers to create a new task, tasks are structured in a hierarchical manner [21]. Tasks can be defined on an abstract level in the beginning and be refined more and more over time [21]. This also prevents a sprawl of interlinked and double tasks in the system, since hierarchical structures make it intuitive for knowledge workers to know where to find tasks when needed.

R8: Integration of data in a case

Instead of being activity centric adaptive case management is a data centric system meaning data sources are highly integrated in ACM systems [3, 22, 23, 24, 9, 12, 8, 25, 26, 20]. The inclusion of data in ACM systems also reduces the risk of context tunneling since it combines a lot of different sources. By enabling the possibility of combining this information derived from both physical as digital sources into one case folder (a digital folder containing information about a case), it becomes easy to provide the right information for the right task [11, 9, 3]. The status of a case is defined by data objects which have a specific value, instead of the control-flow [3, 11].

R9: Definition of logical dependencies between tasks

Dependencies should exist between tasks since tasks might have certain pre-conditions that have to be fulfilled before the task can be executed [21, 20].

R10: Understandable and adaptable for business users

One of the key features of ACM systems is that the workers without any technical programming expertise are able to use and adapt the system [20]. This increases the flexibility the worker experience and also increases the business-IT alignment since the risk a mismatch between what the users wants and what the programmer delivers is reduced [27].

2.1.1 Applicability of adaptive case management to business processes

Throughout the academic literature there is consensus that ACM systems are applicable to KiPs. A KiP however is a comprehensive concept, and contains multiple characteristics. It can be seen that throughout the literature the definition, characteristics and the definitions of those characteristics differ which is why this section reflects the different views on the applicability of ACM. In order to do this, four articles consulted to identify the process characteristics mentioned to which ACM is applicable. These articles either have a descriptive nature of the ACM paradigm or describe the relation of ACM and business processes.

Swenson [28] focusses mainly on the unpredictable nature of the processes ACM systems can be applied to. He states ACM systems should be applied to processes which differ every time, but are still predictable enough to re-use certain parts of the process. Furthermore he mentions the
processes rely on knowledge workers to use their expertise to control the progress of a case, the processes are goal-oriented and users may want to share information, which suggests a collaborative nature. However Swenson does not give any explicit definitions of process characteristics ACM can support.

**Motahari Nezhad and Swenson** [3] categorize processes based on the predictability of the process and the involvement of the knowledge worker in the process. They state a process becomes unpredictable when “one cannot predict in advance the exact course of what will be done” [29]. The involvement of the knowledge worker is related to this, since the less predictable a process becomes, the more it depends on the decision making and expertise on the knowledge worker. Furthermore they state the processes often require collaboration between knowledge workers [8]. The article does not elaborate on this collaboration.

**Herrman and Kurz** [2] provide a more extensive description of the process characteristics ACM is applicable to. Just like Swenson [9] and Motahari Nezhad et al. [29] they state that knowledge work is generally unpredictable since the exact flow of activities is not known upfront. They also mention the processes are goal oriented. KiPs processes are highly collaborative, meaning knowledge workers have to communicate, coordinate and cooperate with each other [2]. They state the knowledge workers are often triggered by external events or case related findings to which they must adapt [2].

**Huber, Hauptmann, Lederer and Kurz** [30] focus on the fact that processes are goal oriented, which they define as “processes without a pre-defined process” [30]. Secondly they mention emergence, with which they mean the process becomes clear during its enactment [30]. Lastly they mention the collaborative nature of knowledge intensive work, which they define as “human interaction in the form of cooperation” [30].

As becomes clear, a clear description of the processes characteristics ACM support, or a clear definition of what exactly is meant by KiPs cannot be found in the analyzed articles. The characteristics and their definition differ from each other making it hard to determine whether they give a complete overview of the process characteristics to which ACM is applicable. The one thing all authors agree upon is that ACM is applicable to KiPs, therefore the second part of the literature study elaborates on the process characteristics of knowledge intensive processes.

### 2.2 PROCESS CHARACTERISTICS KNOWLEDGE INTENSIVE PROCESSES

Section 2.1 reflects information about the requirements of an ACM system and show that ACM systems are mainly applicable to KiPs [2, 13]. Through literature knowledge intensity is often defined on a continuum of complexity [31], this however gives a one-dimensional view on knowledge intensity. In order to get a more complete and detailed understanding about the definition of a KiP and its characteristics this section reflects a literature study to KiPs.

#### 2.2.1 Methods of defining knowledge intensive processes

In order to define KiPs and examine which characteristics such a process contains, five scientific articles are analyzed and compared to each other. Although the complete literature study involved more articles, these five articles are especially interesting since they all claim to characterize (knowledge intensive) processes. The aim of this study is to name set of characteristics that are able to define a KiP. This section describes the methods used by each of the five articles and also quickly discusses why the article is relevant.

**Di Ciccio, Marrella and Russo** [5] conducted a literature study to KiPs. The article gives a fairly complete of the characteristics a KiP possesses. Furthermore it discusses requirements for modelling techniques to manage these processes. Di Ciccio et al. [5] however state that although they use scientific literature to come to their conclusions they also make use of personal experience and
background. This reduces the reliability of the article, meaning this article should be complemented with others.

**Marjanovich and Freeze** [16] define KiPs by combining BPM with knowledge management theories. They explicitly explain how strategy, processes, people, knowledge and technology fit together for different types of business processes. The main value adding component of this paper is the inclusion of worker types and a more knowledge management orientated perspective.

**Van der Aalst** [32] takes a wider view at the BPM sector and does not only describe the characteristic/nature of KiPs but also their relation to other business processes. He lays a focus on the people involved in the process and their relation to the applications and the structuredness of the process and classifies the processes along the diagonal of those two.

**Sarnikar and Deokar** [17] take a knowledge management approach to define KiPs and pay less attention to the BPM aspect in KiPs. Interesting in this article is that the characteristics of KiPs are linked to requirements a knowledge management system for KiPs should have. One of their data sources are expert opinions, the number of experts however is quite limited.

**Isik van den Bergh and Mertens** [31] combine a literature study with expert interviews to validate this study. This results in not only a characterization of KiPs but also insights in how they differ from non-KiPs.

Concluding the literature review involves articles with various approaches to KiPs, using different methods. Some of the articles seem to take a BPM approach, while others come from a knowledge management point of view. Furthermore different methods as literature review and expert interviews are used.

### 2.2.2 Characteristics knowledge intensive processes

In this subsection the characteristics mentioned in the different articles are analyzed to eventually come to a set of process characteristics.

The first characteristic that stands out is the processes’ dependency on knowledge. All five articles mention that KiPs are driven by data collection rather than the completion of activities [5, 16, 24, 31]. Di Ciccio et al. [5] stress the need for both explicit (sources that can be formalized in some sort of knowledge base) and implicit (capabilities and experience of workers) knowledge in a KiP [5]. Especially this tacit knowledge stresses the central role of the knowledge worker in the process which has a large impact on its outcome, as also pointed out by the other articles [16, 24, 17]. Isik et al. [31] add to that that although the knowledge worker plays a central role in the KiP, still parts of the KiP can be automated.

Secondly there is the need in KiPs to share information between process participants with different roles to make process progression [5, 17, 16]. Sarnikar et al. [17] make distinction in this criterion between information sharing between individuals and information sharing between organizations. Van der Aalst [32] confirms this by stating processes get more human-centric (which involves collaboration and exchange of information between people) as they get more knowledge intensive. Isik et al. [31] do not explicitly mention the sharing of knowledge although they acknowledge the fact that KiPs depend heavily on human involvement and information.

A third characteristics mentioned in the literature is the fact that in a KiP the knowledge worker may not know what the process is going to look like before executing it, and the process might change during execution [5, 16]. This also includes, that the knowledge worker may not know which tasks he/she has to perform or which data sources (including other knowledge workers) he has to consult before executing the process [5, 16] and the events that are going to take place [5]. Van der Aalst [32] refers to this concept as “unframed”, meaning there is no explicit process model defined a priori.
Isik et al. [31] stress what other articles are implying, namely the fact that KiPs can be unpredictable but not necessarily, as becomes clear from their interviews amongst expert interviews.

As a fourth characteristic, states the processes of KiPs evolve as they progress [5, 16, 17]. Each action and decision made by knowledge workers alters the knowledge available and state of the process. This Based on this new knowledge and state, the process is assessed and next actions are determined in order to reach a pre-defined goal [5, 16, 17]. Isik et al. [31] state again that KiPs can evolve over time but can be pre-defined as well. Van der Aalst [24] also states that although most of the times an ideal process is defined, the process progression may alter tasks and their sequence, needed in order to reach a goal.

As a fifth, two out of five articles explicitly mention that KiPs are goal oriented [5, 16]. Which means the process progresses along a set of goals and/or milestones? Marjanovich et al. [16] state that the knowledge created in a KIP is related to achieve organizational goals. Isik et al. [31], Sarnikar et al. [17] and van der Aalst do not mention anything about KiPs being goal oriented. The do acknowledge that KiPs are not process oriented (unframed) and therefore not process driven. Implicitly one might conclude these processes therefore have to be goal driven. This assumption is based on the consensus in academic literature (including van der Aalst [13]) that processes are either goal or process driven [12, 2].

Sixth, Di Ciccio et al. and Marjanovich [5, 16] mention that these goals can be pre-defined but not necessarily have to be. Just like the process itself these goals can be emergent and dependent on the earlier knowledge obtained while executing the process.

Seventh, KiPs are affected by events which can occur in any sequence and which require the process to be dynamic [5, 17]. An event is defined as “a change that affects process state, process-related data and knowledge, and process execution context and environment” [5]. A knowledge worker has to react to such events, influencing his decision making [5]. The other authors do not explicitly mention this characteristic. An explanation for this might be that they see this included in a term as predictability in which also includes unpredicted influences from the environment on the process.

As an eight characteristic the decision making of knowledge workers is subjective to business rules [16] which exist as explicit knowledge in the process. Di Ciccio et al. [5] add that indeed rules and constraints can be explicit but they can also be “implicitly embedded in participants’ personal work practices”. A business rule is defined as “the definition of how an organization performs its business processes” [33]. The other authors do not mention this criterion. Isik et al. [31] also found that the decision making of knowledge workers was influenced by rules and constraints, although they focused mainly on external (legal) regulations.

As a ninth characteristic, the process used to solve a certain case is usually unique and hardly repeatable [5, 24, 17]. Van der Aalst [32] even sees knowledge intensive and repeatable as two opposites of a spectrum. Di Ciccio et al. [5] specify that often parts of the processes can prove to be re-usable; however the complete process is not. Marjanovich et al. [16] state process are only repeatable on a high level, however vary a lot on a more detailed level. This is also confirmed by Isik et al. [31].

Tenth, a KIP can need information from various data sources which the knowledge worker has to combine and base his/her decision upon [16, 31]. These sources can contain either structured or unstructured data [16] and can be internal or external [31].
2.3 CONCLUSION LITERATURE STUDY

Analysis of relevant literature has led to a selection of ten characteristics of KiPs which are presented in Table 2 (green is supported, red is not supported). Some of these characteristics are found in all studied articles and some only in a few, which suggests there is still some indistinctness about the precise characteristics of KiPs. Appendix C gives a short description and an illustrative example for each of the characteristics derived from the literature.

As can be derived from this table C1, C2, C3, C4 and C9 are unanimously supported through the articles studied. Remarkably the claim that knowledge intensive processes are goal oriented (C5) is only weakly supported. A possible explanation for this could be that, since they all state the process itself might be unpredictable and emergent, it is implicitly suggested that these processes are goal oriented. This is however an assumption and more research to this characteristic is necessary. The same is true for C6, this characteristic is however directly related to C5, and therefore logically not mentioned by the same authors. The dependency on events (C7) is only mentioned by Di Ciccio [5] and Sarnikar et al. [17] which means this characteristic is only weakly supported by literature. Again this characteristic requires further investigation.

Lastly the characteristic of diverse data sources is mentioned (C10). This is also a characteristic that is weakly supported. An explanation might be that this can be considered a technical requirement and therefore maybe left out of scope by some authors. The characteristic mentioned in Table 2 however focuses on the fact that the knowledge workers have to deal with different kinds of information from multiple sources (both people and technical sources). This characteristic should be further investigated.

There is consensus about the fact that ACM systems are especially suitable for managing KiPs. As becomes clear from the literature study, the precise definition of KiPs and the precise characterization of these processes differ amongst literature. Even though the literature review tried to reach consensus about the characteristics of KiPs there is still ambiguity within four out of ten characteristics [5, 16, 32, 17, 31]. This makes the statement that ACM is applicable to KiPs ambiguous as well.
3. **RESEARCH METHODOLOGY**

This section reflects the methodologies used in order to reach the goal of this thesis, “To identify the processes characteristics ACM is applicable to and to structure this information in a framework that assists Deloitte in predicting upon the applicability of ACM to business processes” as given in section 1.3.

The thesis is structured along the regulative cycle of van Strien [34]. At this point the problem analysis and problem selection phase are completed. This section elaborates on the approach of the remaining phases of the van Strien cycle and elaborates on how these phases are addressed. Figure 4 illustrates how the circle of van Strien relates to the answering of the research questions.

![Figure 4 - Regulative cycle and relation with thesis](image)

Since the goal of this thesis involves creating a new framework rather than validating an existing one, the thesis follows a grounded theory approach. With the grounded theory approach, a framework can be developed from raw qualitative data. Other benefits from this approach are that it can be used for small sample sizes [35], which is beneficial since Deloitte’s network regarding ACM is limited and that it is often used to supplement information derived from other sources [35], which is in line with this thesis. As becomes clear from this section, this thesis is conducted in a qualitative and partially inductive manner. These two characteristics are briefly explained in Table 3. The research is partially inductive since the research starts from the KiP characteristics defined in literature, but is open for additional process characteristics.

<table>
<thead>
<tr>
<th>Qualitative research</th>
<th>Inductive research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>A nonmathematical process of interpretation, carried out for the purpose of discovering concepts and relationships in raw data and then organizing these into a theoretical explanatory scheme [19].</td>
</tr>
<tr>
<td></td>
<td>A process in which the researcher begins with an area of study and allows the theory to emerge from the data. Data collection, analysis and eventual theory stand in close relationship to one another [15].</td>
</tr>
<tr>
<td>Motivation</td>
<td>A qualitative research is performed since only little research is performed in this specific field, and qualitative research has the advantage of revealing complexity and has a strong handle on what real life is like. This way the characteristics can be identified as accurate as possible [18].</td>
</tr>
<tr>
<td></td>
<td>The research approach is inductive, since the theory should evolve from the data. This way the theory will stay the closest to reality, offer insights, enhance understanding and provide a meaningful guide to action which are amongst the demands of Deloitte and streamlines with the main objective of the project which is providing an understandable, transparent advice which is scientifically grounded [18].</td>
</tr>
<tr>
<td>Alternative</td>
<td>Quantitative research</td>
</tr>
<tr>
<td></td>
<td>Deductive research</td>
</tr>
</tbody>
</table>

*Table 3 - Characteristics thesis*
1) **Research question 1 (Diagnosis and analysis):**

The first research question addresses data collection. The aim of this phase is to get a clear understanding about which process characteristics influence whether ACM systems are applicable for a business process. This is reached by combining information derived from literature and information derived from vendors of ACM systems [36].

The most important method of data collection is the qualitative inductive research, performed by means of (explorative) semi structured interviews with vendors of ACM systems. Semi-structured interviews are well suited for exploration of the perceptions and opinions of respondents regarding complex issues and enable probing for more information and clarification of answers [37]. By using semi structured interviews it is also possible to interview multiple sources and providing the possibility to adjust the interview to people from a different environment [38]. For each interview the following procedures are followed [39]:

1. The interviews were recorded (with permission)
2. The interviews were transcribed (as soon as possible)
3. The results were presented to the interviewee for review
4. Remarks were processed in the final interview results
5. The recordings will be erased after completion of the thesis

The interviews are aimed at identifying process characteristics ACM systems are applicable to. The questions were developed along the guidelines for semi structured interviews of Laforest et al. [35], and contain questions about the background of the interviewee and the organization, the identified ACM system requirements [30] and the identified KiP characteristics. The development of the questions is discussed in detail in section 4.1.

The alternative for semi structured interviews are structured interviews, Table 4 depicts the differences between them. Since the thesis is of an exploratory nature, the rigid form of structured interviews does not fit this thesis. Furthermore it is possible that questions are added, or changed during an interview which is not possible with structured interviews.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Structured</th>
<th>Semi-structured or unstructured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Exploratory and descriptive</td>
<td>Learning the respondents’ viewpoint regarding situations relevant to the broader research problem</td>
</tr>
<tr>
<td>Instrument</td>
<td>Questionnaire (i.e. specified set of predefined questions)</td>
<td>Memory list, interview guide</td>
</tr>
<tr>
<td>Format</td>
<td>Fixed to the initial questionnaire</td>
<td>Flexible depending on the course of the conversation, follow-up and new questions raised.</td>
</tr>
</tbody>
</table>

*Table 4 - Structured and semi-structured interviews*

The interviewees are chosen according to snowball sampling [40]. This is a way of sampling through referrals made among people who share or know of others who possess some characteristics that are of research interest. Starting from the network of Deloitte supervisors and TU/e supervisors, a target group of five ACM system developers is put together. The interviewees are employees at an organization which develops ACM systems and find themselves on the intersection between business
and IT and can look at the problem from both an organization and a technical perspective. Depending on the size of the organization different interviewees can have different functions.

Once the interviews are conducted they are coded and compared to each other to identify common topics of interest [15]. This results in a list with mentioned influential characteristics of business processes. The coding of these interviews is based on the KIP characteristics and the ACM system requirements derived from the literature. However when additional characteristics or requirements are mentioned, a new code is for these characteristics is developed.

This list is then compared to the literature study to find common influential characters which results in a combined list of influential characters, along with how frequent they are mentioned in both the interviews and literature. Based on a frequency analysis the characteristics mentioned in literature and vendor interviews are labelled as influential or not influential. The categories are unanimously supported (5 out of 5), strongly supported (4 out of 5), mostly supported (3 out of 5), weakly supported (2 out of 5), scarcely supported (1 out of 5) and not supported (0 out of 5). From these categories the first three are included in the list of characteristics.

The list of influential characteristics is then fed back to the various vendors in order to receive feedback. This feedback is processed to eventually come to a valid set of business process characteristics ACM systems are applicable to. Figure 5 graphically summarizes the approach to research question 1.

![Figure 5 - Approach research question 1](image)

2) **Research question 2 (diagnosis and analysis):**

The second research question investigates how the process characteristics ACM systems are applicable to differs from the process characteristics other BPM systems are applicable to. Based on academic literature, it is explored to which extent WfMS’s, PCM systems and groupware systems support the identified KIP characteristics. In analyzing this literature the identified KIP characteristics from RQ1 are used as a coding scheme.

The results are summarized in a table with the different BPSSs on the x-axis and the KIP characteristics on the y-axis. For each characteristic is described how this characteristic should look like for the different BPSSs. Subsequently an analysis is made, describing the differences in business process characteristics the BPSSs can support.

3) **Research question 3 (Design):**

Based on specific differences identified in research question 2, a framework is developed which shows through means of a set of carefully chosen questions, which BPSSs are fit to manage the analyzed process and which BPSS fits best to the situation.
Each of these questions can be answered with either yes or no. This way ambiguity and room for interpretation is minimized. Also the outcomes of the questions do not have to be quantified, since quantification of a qualitative research can lead to inaccuracy [15]. The answers to these questions, for a specific process, are compared with a reference sheet for each BPSS. This sheet contains the ideal outcomes for each question for that specific BPSS. When the outcome of a question matches the ideal outcome for a BPSS the applicability of a system becomes higher. When the outcome of a question does not match the value for a certain BPSS the applicability either drops, or becomes zero (in case it is impossible to manage the process with such a system).

Lastly, this framework makes it easy for Deloitte to quickly analyze a process in collaboration with the client by posing relevant and relatively easy to answer questions. By answering these questions with the client, Deloitte can give a scientifically argued advice about which kind of business process support system should be considered for the client’s processes.

The binary approach of answering questions with yes or no, comes with limitations as well. Although the framework tries to focus on questions that can be answered with either yes or no, some questions might require a more fine grained approach. This binary approach limits the possibility for respondents to apply nuance to their answers, which can possibly increase the margin of error.

4) Research question 4 (validation):

In this research question a number of case studies are performed to test the internal validity of the developed framework [41]. First the validity is tested by performing multiple feedback meetings with Deloitte experts. After processing the feedback the framework is exposed to multiple case studies. These cases contain real life situations in which the application of a business process support system was successful or not.

The cases are first assessed by the researcher after which Deloitte consultants are asked to assess these situations and use the framework to come to a decision about which business process support system should be implemented. Exposing the framework to real life situations tests whether the framework comes to the right decisions and meets the internal validity requirements. Making three Deloitte consultants perform a case study tests whether the framework is useable and clear for Deloitte consultants.

In order to test all facets of the framework a case is selected for each business process support systems considered in this thesis (WfMS, PCM, ACM and groupware). These cases are handed out to the three Deloitte consultants along with a list of questions, which is designed in research question 3. The session takes 2 hours and after each case, the results are discussed to get a clear view of the reasoning of the consultants and explain similarities and differences.
4. ADAPTIVE CASE MANAGEMENT VENDOR INTERVIEWS

In addition to the literature study in chapter 2 expert interviews are conducted with various vendors of ACM systems to identify the process characteristics ACM systems are applicable to. In total five vendors were interviewed from which three are categorized as leaders in the ACM field and one as a strong performer by Forrester [42]. The last one is not mentioned in the research of Forrester. The vendors interviewed are Pega, IBM, Be informed, ISIS Papyrus and Formetis.

The remainder of this chapter gives the interview methodology, after which is continues with a description of the interviews conducted at each vendor. Lastly the thesis gives the conclusion based on the analysis of the interviews.

4.1 INTERVIEW METHODOLOGY

The interviewees had to comply with some requirements (VRQ) in order to be a qualified participant for the conducted interviews.

VRQ.1. The interviewee has to work at least three years at vendor in question.
VRQ.2. The interviewee has to have experience in implementation of the organization’s ACM system to their client’s business processes.
VRQ.3. The interviewee has been involved in evaluation procedures with clients.
VRQ.4. The BPSS the vendor supplies has to meet the ACM requirements identified in the literature study.

The first criterion makes sure the interviewee has enough experience and knowledge about the vendor’s ACM system. The assumption is made that interviewees meet this requirement after being active for three years at the organization. The second criterion is assessed during the interview, this criterion is included to make sure the interviewee has experience with applying ACM to business processes and is able to approach ACM from an organizational perspective. Thirdly the interviewee needs to have participated in evaluation procedures with clients to assess whether the implementation of ACM was considered successful. Lastly the system the vendor offers, has to meet the ACM requirements identified in literature in order to be labeled as an ACM system.

The interviews are carried out in a semi-structured way [15]. The semi-structured nature of the interviews make them well suited for exploration of the perceptions and opinions of respondents regarding complex issues and enabling probing for more information and clarification of answers [37]. By using semi structured interviews it is also possible to interview multiple sources and providing the possibility to adjust the interview to people from a different environment [38]. Combined with the grounded theory approach the interviews can be adjusted based on information gathered in previous interviews to ultimately obtain a complete view about the application of ACM according to vendors.

The interview itself is structured according to “interviewing guidelines for semi-structured interviews with key informants” by Laforest et al. [35]. After an introduction of interviewer and interviewee the introduction identifies the role of the interviewee in their company, and whether they are suitable for conducting the interview. This is done by means of general open-ended questions. The “company description” sketches the context by identifying the core business of the organization and identifies their history with ACM. In “definition ACM” the interviewees are asked to define ACM and the ACM requirements are checked to verify the business process support system is indeed an ACM system. Although the technical capabilities of ACM systems are not the main focus of the thesis, differences in these capabilities may explain differences in the processes they apply ACM to. Subsequently it is asked to which process characteristics ACM is applicable according to their expert opinion. In this part the interviewer makes sure the ten KiP characteristics are addressed, and leaves room for extra suggestions from the vendor.
Next in the “evaluation” phase there is asked what the main advantages and challenges are customers experience when an ACM system is implemented. Next the interviewee is asked to suggest additional topics that he/she thinks are important but are not yet discussed. Lastly an open question is asked to identify their vision on the future of ACM. A template of an interview is given in Appendix D.

For analyzing the interviews, the KiP characteristics mentioned in literature are kept in mind in order to code the output in a structured way. Additional characteristics mentioned by interviewees are labelled right away and included in the remaining interviews. To ensure the validity of the interviews the results of the interviews are communicated to the interviewees and feedback received is processed accordingly. Since the interview is conducted in a semi structured way some characteristics of processes might become clear later in the process. This is why the results of each interview are fed back to the interviewees in which the established characteristics are discussed once more. This improves the completeness and validity of the interviews. This section gives the results obtained after the second iteration.

4.2 INTERVIEW EXECUTION
This section describes the execution of the interviews. It starts with describing the assessment of the interviewees, after which it continues with the assessment of the ACM systems. Finally it describes the process characteristics that ACM systems can support according to vendors. A more elaborate report of each interview is given in Appendix E.

4.2.1 Assessment interviewees
As shown in Table 5 the functions of the interviewees differ from each other. This has to do with both the size of the company (in smaller companies the task description of an employee usually incorporates more responsibilities than in a larger company), and, since the snowball sampling method is used [40]), the available contacts in the researchers personal network and the network of Deloitte employees.

The range of work experience reaches from 4 years active at the organization till 18 years active within the organization. Since all interviewees are active within the organization for longer than three years all the interviewees meet VRQ1. From the interviews becomes clear that all interviewees have been engaged in actual implementation of an ACM system at the client (VRQ2), and have also been involved in evaluation procedures (VRQ3). VRQ 4 is explained in section 4.2.2.

<table>
<thead>
<tr>
<th>Function</th>
<th>VRQ1 (years active in organization)</th>
<th>VRQ2 (experience with implementation of ACM systems)</th>
<th>VRQ3 (involved in evaluation procedure)</th>
<th>VRQ 4 (BPSS has to meet ACM system requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pega Principal Alliances solutions consultant</td>
<td>4 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>IBM ECM client solution professional</td>
<td>16 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Be Informed Chief operating Officer</td>
<td>9 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>ISIS Academy manager</td>
<td>16 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Papyrus Director</td>
<td>18 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

Table 5 - Vendors interviewed
4.2.2 Assessment ACM systems

The literature review of chapter 2 identified ten requirements for an ACM system. In order to inspect whether the systems provided by the vendor are indeed ACM systems, the systems have to meet all ten requirements identified in literature. Table 6 shows that indeed all vendors’ ACM systems meet the requirements which were identified in the literature.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Pega</th>
<th>Formetis</th>
<th>Be Informed</th>
<th>ISIS Papyrus</th>
<th>IBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1. Flexibility during run time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R2. Evolving cases and templates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R3. Transparent responsibilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R4. Visible progress of case</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R5. Flexible assignment of roles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R6. Definition of case objectives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R7. Hierarchical structuring of tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R8. Integration of data in the case</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R9. Definition of logical dependencies between tasks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R10. Understandable and adaptable for business users</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6 - Requirements of ACM systems

All vendors stated their systems could be adapted during run time (R1), giving the knowledge worker the ability to modify the system on the fly. This could be done in the form of modifying or creating new tasks, goals or business rules. These tasks could be shared with other knowledge workers, and if proven useful be generalized so that they become standardly available in similar situations (R2). Especially ISIS papyrus focusses on the continuous evolution of the system as a whole (by generalizing new tasks, rules and goals), and aims to even predict the tasks a knowledge worker could perform next based on compatible cases.

All vendors state their systems enabled the possibility to make the responsibilities of knowledge workers transparent (R3). This is mainly done to give the workers a proper overview on a case. A side note was made that the responsibilities might not be transparent for everyone, but only workers with the proper rights. The transparency of the responsibilities in combination with the provision of the right data to the knowledge worker also makes the progress of a case visible for the workers (R4). Furthermore all systems provide the possibilities for assigning new roles to knowledge workers during the process and also allow for knowledge workers to join a case during the execution of the progress (R5).

All vendors stated the system is able to set goals and milestones with the process to actually reach these objectives still unclear (R6). It is possible to define certain tasks that have to be executed in order to make progress in the process (R9). IBM clearly defined there are three types of tasks, mandatory tasks which have to be executed in order to reach a goal, optional tasks which are up to
the knowledge worker to perform, and ad-hoc tasks that the knowledge worker can define during the execution of the process. For all vendors the tasks could be structured in some kind of hierarchy (R7), this was especially elaborated at Pega.

The integration of data in a case is one of the most important elements of ACM (R9). An ACM system should allow for knowledge workers to save all data regarding a case directly into the system and the system should also be able to provide the relevant data for a knowledge worker to make decisions (R8).

Lastly ACM systems try to bridge the gap between business and IT by allowing the knowledge worker to easily adapt the system ad-hoc to make it fit for his/her specific needs.

4.2.3 Process characteristics mentioned by vendors

This section describes the conclusions that can be derived from the interviews conducted at multiple vendors. A quick overview of the characteristics mentioned in the vendor interviews is depicted in Table 7.

As can be concluded from Table 7 that the characteristics of knowledge intensive processes defined in literature are unanimously supported by the vendors of ACM systems. This increases the validity of the identified process characteristics. On top of that the vendors added three characteristics which are transparent, client oriented and large volume. Also the vendors formulate an extra requirement for collaboration which is the fact that the besides collaborating with employees within and in between organizations, collaboration with the client is possible as well.

The transparency of a process (C11) is a characteristic that is not mentioned in literature, but was mentioned by Formetis and after that confirmed by the other vendors. The need for transparency of these processes has to do with the desire to make it transparent which knowledge worker did which task, and why did that knowledge worker decide to do that task. ACM is especially applicable for these kinds of processes since the worker is able to model every task he performs himself and therefore does not have to perform tasks “outside of the system”.

What is also notable is that all vendors specified ACM systems are especially applicable for demanding customers and therefore have to be client oriented (C12). This characteristic involves the fact that the clients for these processes typically need a custom made solution. Since ACM provides a
lot of flexibility it is able to model more exceptions, which leads to an increased possibility in providing custom made products/services for the client.

Lastly the frequency with which the process is executed is mentioned. Opinions about this characteristic differ amongst vendors. Pega, Formetis and IBM agree ACM is best suited for processes with a high frequency however ISIS Papyrus and Be Informed state ACM is made for processes with a low frequency. The arguments for a high frequency are that it has to be lucrative to even develop an ACM system in the first place. Furthermore although the process is executed frequently, each process instance can differ from each other. On the other hand it is argued ACM is especially applicable for the more unique processes with a low frequency, since it has the abilities to perform processes which have never been performed before.

4.3 Conclusion research question 1

In order to come to a conclusion of the first research question the literature and vendor interviews are compared as reflected in Table 8.

![Table 8 - Characteristics processes suitable for ACM according to vendors and literature](image)

Table 8 - Characteristics processes suitable for ACM according to vendors and literature

Concluding from Table 8 it can be seen that C1, C2, C3, C4, C8 and C9 are unanimously supported amongst literature and vendors. A side note has to be made for C2 (collaboration) since besides the collaboration mentioned in literature between employees vendors also mention the collaboration with the client as an important part of the definition.

Furthermore it stands out that C5 is unanimously supported amongst vendors, however only weakly supported amongst literature. An explanation could be that it is implied amongst literature but not explicitly mentioned since these processes often do not possess a pre-defined process. Naturally the literature which did not mention the goal oriented nature of these processes also didn’t mention the emergence of these goals. Since there is general consensus amongst both literature and vendors processes applicable for ACM are not processes oriented it is assumed that they are goal oriented, based on the vendor analysis these goals can be emergent.

The next variable that is unanimously supported amongst vendors but weakly supported amongst literature is the fact that these processes are event driven which means it can thrive in a dynamic environment in which events occur in a random sequence influencing the business process directly. A possible explanation is that literature includes this in the unpredictable nature of these processes,
which is not always explained in detail. In this thesis there is a clear separation between unpredictable (whether the process is going to initiate in the first place) and event driven which includes the events influencing the process during runtime.

C10 is a characteristic that stands out as well, this may seem like a more technical characteristic however is unanimously mentioned amongst vendors since their ACM systems are specialized in retrieving data from multiple legacy systems. In literature this characteristic is mentioned amongst articles who take a more “enterprise content management” oriented approach. Possible is that an ACM system might not be distinctive in this characteristic compared to other content based systems. It remains however a characteristic of processes suitable for ACM systems.

C11 is supported amongst vendors once this characteristic was discovered by the interviewer. It seems a very distinguishing characteristic. ACM provides advantages related to this characteristic by offering flexibility to allow the knowledge worker to model exactly what he/she has done. This in contracts to WfMS’s in which workers sometimes have to perform activities which they cannot model on the system. Furthermore according to vendors, ACM provides significant advantages on this characteristic compared to groupware. Based on vendor interviews this is an important characteristic which is also an important point of interest at their clients.

The fact that these systems are aimed at the clients (C12) and can assess the specific needs of clients is another characteristic only mentioned by vendors. This is a very commercial characteristic which might be a reason why it is left out of literature, based on vendor interviews however ACM is especially suitable when the client demands a custom made solution.

Lastly, frequency is a characteristic on which opinions differ (C13). Some claim ACM is especially useful for very low frequencies where others claim the frequency should be high enough to derive certain parts of structured sequences. There might be ambiguity about the meaning of this characteristic in the interviews since the understanding of it was not clear to the interviewer until later in the process. All vendors however mentioned that an ACM process contains certain process elements, and although the exact sequence of activities and process elements might differ it seems logical that the frequency should be high enough to at least define process elements.

An analysis of the information sources used to assess the specific characteristics of processes to which ACM is applicable has led to a definition of 13 variables which are defined and illustrated with an example in Table 9.
<table>
<thead>
<tr>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C1. Knowledge driven</strong></td>
<td>Progress is made through satisfaction of knowledge requirements, experiential knowledge and the impact of a knowledge worker on the process. e.g. In an immigration process the process progresses based on information documents obtained about the immigrant and decisions made by the knowledge worker.</td>
</tr>
<tr>
<td><strong>C2. Collaboration oriented</strong></td>
<td>Process creation, management and execution occur in a collaborative multi-user environment where human-centered and process-related knowledge is co-created, shared and transferred between individuals and enterprises. e.g. Process with a low collaboration level only exchange input and output as at an assembly line. Processes with a high collaboration level share information in order to reach their goal, as in an immigration process where different departments have to exchange information about a person in order to decide whether this person can get a residence.</td>
</tr>
<tr>
<td><strong>C3. (Un)predictable</strong></td>
<td>It might not be possible to define tasks, their sequence, events that are going to take place, and required data sources before initiating the process and the process might change during execution. e.g. In an assembly line of a car the actions and course of actions can be predicted end to end and the execution of certain tasks lead almost always to the same results. However, in an diagnostic procedure of a patient the outcome and order of tasks is highly patient-specific.</td>
</tr>
<tr>
<td><strong>C4. Emergent</strong></td>
<td>The process evolves gradually based on the state of the process and knowledge that becomes available by achieving goals. e.g. In an assembly line the tasks and their order are defined end to end already, in an immigration process new data, for example the immigrant has committed a crime in his past, may influence the next task.</td>
</tr>
<tr>
<td><strong>C5. Goal-oriented</strong></td>
<td>The process evolves through achieving certain goals and milestones, instead of completing activities. e.g. In an assembly line the an employee focuses on finishing his task in the line. In an immigration process employees are working towards a goal, which is being able to decide whether the immigrant gets a residence.</td>
</tr>
<tr>
<td><strong>C6. Emergent goal</strong></td>
<td>The goals evolve gradually, based on the state of the process and knowledge that becomes available by achieving earlier goals. e.g. In an immigration process the goal is clear, deciding whether a person gets a residence, however in a process with multiple stakeholders the outcome of a task may decide whether the goal is to meet the requirements of one stakeholder, or meet the requirements of another.</td>
</tr>
<tr>
<td><strong>C7. Event driven</strong></td>
<td>The process is dynamic and able to react to events that affect the process state, process-related data and knowledge, and process execution context and environment. e.g. An assembly line of a car finds itself in a relatively stable environment (once a year safety and environmental regulations can change). However during a surgery complications may arise, influencing the decision making of the surgeon.</td>
</tr>
<tr>
<td><strong>C8. Compliance</strong></td>
<td>Workers may be influenced by or may have to comply with constraints and rules that drive actions performance and decision making. e.g. In an assembly line a worker has a very clear job and the tasks he has to perform are documented explicitly (this is not rule driven), in a KPI more flexibility is needed. e.g. A scientist has to hand in a research paper before a certain deadline, meeting a certain number of pages etc.</td>
</tr>
<tr>
<td><strong>C9. Non-repeatable</strong></td>
<td>The process varies every time when executed, although parts of the process may be similar the complete structure of the process usually varies. e.g. An assembly line of a car has a couple of variations (the car can be green or blue, contain air-conditioning or not etc.) the amount of choices can still be modelled. Also when performing the process it is quite certain that when performing the same tasks the output is a similar car. A complex surgery however can have a lot of choices considering the situation of the patient, too many to model. Also when he performance the process twice, at the same manner there is no guarantee to achieve the same output. However certain parts of the process can be repeatable.</td>
</tr>
<tr>
<td><strong>C10. Requiring diverse data sources</strong></td>
<td>The process requires information and data from different data sources including both structured and unstructured information. e.g. at an assembly line the process progresses by workers finishing a certain part of, for example, a car this requires a structured guide which explains which steps have to be taken. An intensive screening of an immigrant at an immigration process may require information from multiple sources like data bases but also other persons.</td>
</tr>
<tr>
<td><strong>C11. Transparency</strong></td>
<td>The process demands insights in which employee performs which tasks and comes to which output desired to track how many papers he delivers. However it is not necessary to track how he delivered every paper to a certain house. In a surgery it can be very important to track which steps doctors took to come to which outcome in order to determine whether the doctor made proper decisions.</td>
</tr>
<tr>
<td><strong>C12. Customer oriented</strong></td>
<td>The process has to comply with specific needs of the customer. e.g. If a customer orders a certain car it only has a few variants it can choose from, however if the customer wants to build a house this solution will be much more unique for this specific customer.</td>
</tr>
<tr>
<td><strong>C13. Frequency</strong></td>
<td>The amount of times a process is executed. (Note this does not have to be in exactly the same way). e.g. A specific surgery can vary every time executed though still have some elements that are used more frequently. An emergency plan has to be formed ad-hoc and might only be executed once, it might not be worthwhile to develop an ACM system for this process.</td>
</tr>
</tbody>
</table>

Table 9 - Characteristics of processes to which ACM is applicable
5. COMPARISON BUSINESS PROCESS SUPPORT SYSTEMS

Having defined the process characteristics ACM is applicable to, the next step is to analyze how other BPSSs (WfMS, PCM system and groupware system) perform amongst these characteristics (see Table 11). Since WfMSs, PCM systems and groupware systems are considered to find themselves in a mature stage and are well embedded in the literature, the analysis of these systems is based on the literature [43]. Based on this analysis, specific differences between the characteristics the BPSSs are applicable to are identified providing an answer for the second research question.

5.1 RELATED BUSINESS PROCESS SUPPORT SYSTEMS AMONGST PROCESS CHARACTERISTICS

This section reflects how the other BPSSs (WfMS, PCM systems and groupware systems) perform along the identified process characteristics.

5.1.1 Workflow management systems along process characteristics

WfMSs are generally process driven instead of data-driven (like ACM systems) [29]. Although data can be incorporated in WfMSs, it is usually only used for routing e.g. when a risk factor is higher than 0.7 decline an offer, else accept. This makes WfMSs less suitable for processes which revolve along information objects like documents and dossiers (C1). Also the process does not rely on the worker to make decisions based on his/her own expertise since the choices he/she can make are pre-modelled (C1) [4, 13]. Although these days almost all processes involve a certain amount of collaboration, WfMSs do not support collaboration based on the exchange of information between workers since they usually do not incorporate data in the system (C2) [4, 2, 13]. This is also why workers usually do not have to derive data from various data sources in order to make progress (C10) [4, 2, 13]. Furthermore WfMSs are only suitable for processes which are entirely predictable [24]. Since the system is explicitly modelled every task and choice needs to be modelled upfront, leaving little flexibility during the enactment of the process. This makes the BPSS suitable for predictable (C3) and non-emergent processes (C4, C6) [5, 2]. This also makes it difficult for these systems to react dynamically on events which influence the system (C7) [12]. These processes are often routine and highly repeatable (C9). As becomes clear the focus of these processes lays mainly on the process itself rather than the goals it works towards (C5) [5].

WfMSs aim at standardization both in the process itself as in the output (C12) and the processes are usually performed with a high frequency (C13) [13]. Legal regulations and business rules are usually enforced through explicit modelling of the tasks a worker can perform, however due to their inflexibility these systems are less applicable to environments in which these rules and regulations change a lot [5, 32, 13]. Lastly workflow management systems can be audited easily since they are very structure [5] and have a steady sequence [24].

5.1.2 Production case management systems along process characteristics

PCM systems have a lot of similarities with ACM systems however according to Swenson et al. [9] the difference is mainly in the adaptive nature of ACM systems. First of all Swenson state that PCM systems should be used when the amount of knowledge workers doing the same job is large (C13) [28] but the process itself is not entirely predictable (C3). “It should be possible to define the required tasks ahead of time, even though the exact usage and sequence of those tasks cannot be predicted in advance” [44]. This results in the fact that the work is not repeated the same way every time (C9), however it should be noted the ways of processing a case are limited and repetitions occur more frequent than in ACM processes [20, 45]. Noticeable is that KING disagrees with this statement and states that the volume of these processes should rather be low [45]. The process unfolds during runtime however, the worker is bound to a specific set of tasks he can perform (C4).
PCM systems are good at data integration, so the knowledge worker can derive data from various sources [9, 45] (C10). Just like ACM systems, PCM systems include are data centered and knowledge workers have to use their own expertise to make progression (C1) [20, 45]. It should be noted that in processes suitable for PCM systems, the knowledge worker receives less freedom than in processes suitable for ACM systems, the knowledge worker is guided by a certain amount of predefined goals which cannot be changed during the process (C5, C6) [45].

The systems are able to keep track on which worker performed which task and why (C11) and the system supports collaboration between employees and clients based on knowledge exchange (C2) [45]. One of the aims of PCM systems is to involve the client in the process and give him insights at certain points in the progress of a case and with the flexibility a PCM system offers it is possible to provide the client with custom made products (C12) [45]. Since PCM systems do not allow for the creation of new tasks on the fly they provide limited possibilities to react to events that influence the process (C7). Lastly the system is implicitly modelled by means of business rules and legal regulations (C8) [28].

5.1.3 Groupware along process characteristics
Groupware systems focus on supporting human collaboration and co-decision (C2), they offer a high degree of flexibility and allow users to control the ordering and coordination of tasks while executing the process on the fly (C4) [10]. Groupware is a very data centric process and relies heavily on the knowledge worker to make decision based on expertise (C1). This also means information has to be derived from multiple sources (C10). Groupware systems do not offer the possibility of defining process models and are therefore specially applicable to non-repeatable processes (C9) [32]. According to Swenson this is correlated with processes being unpredictable (C3) [9].

Di Ciccio et al. [5] also state groupware systems are typically applicable for unpredictable systems. This is also why these groupware systems are often low in volume (C13). Because of this groupware can support the execution of individual but not the management or enactment of processes [13]. Since the system cannot define process models, the system is mainly applicable for goal oriented processes, these goals can be emergent since groupware provides this flexibility (C5, C6). The knowledge workers are usually influenced by rules and have to comply with constraints however which can be modelled in the groupware system. Because of the flexibility that groupware offers, it can deal with unexpected events influencing the decision making of the knowledge worker (C7) [12]. Due to the high flexibility a groupware system offers, it can meet up to very custom made orders of client (C12).

5.2 Differences between business process support systems
Table 10 summarizes the different BPSSs along the identified process characteristics. From a first glance at the Table 11 WfMSs differ a lot from the other BPSSs. This mainly has to do with the fact that workflow management is a process oriented system and does not include data (except for routing) [3]. Also WfMSs are explicitly modelled, which means every possible choice and task has to be known upfront. This dramatically reduces the flexibility of the system and makes it unsuitable for unpredictable or emergent processes [43, 13].

Looking at the other BPSSs, one can see the differences are often more subtle. Looking at PCM systems and ACM systems it can be seen a lot of similarities exist. This mainly comes from the fact that they both emerged from CM [1]. The inclusion of data enables the possibility to provide knowledge workers with aggregate information and let them make their own decisions in order to proceed in the process [4, 2, 28]. Furthermore both ACM and PCM systems are (partly) implicitly modeled, which means in both systems the sequence tasks have to be pre-defined and the process is able to rely on the expertise of the knowledge worker to proceed in the process [13]. The process can therefore be less predictable and emergent. This however is also where the main difference between those two systems is. PCM systems are only applicable to processes in which all possible tasks are
known upfront (although their sequence can differ) [17]. Furthermore the goals and milestones and
their sequence should be known upfront as well [28]. ACM provides the possibility to model both
tasks and goals ad-hoc [45]. This means ACM systems can be applied to processes for which these
goals and possible tasks cannot be defined upfront. This makes it hard for PCM systems to deal with
events that cannot be mapped upfront since exceptions have to be made as a result of these events.
ACM is able to cope with a more dynamic environment. PCM processes are also usually more
repeatable, which goes hand-in-hand with being more predictable, and are executed more
frequently [20].

Lastly the differences between ACM and groupware are discussed. Again the difference lies in the
predictability but for slightly different reasons. Although both systems support processes which have
to be defined ad hoc, groupware does not contain process elements [4]. This is why groupware is
best applied to processes that are none or very rarely repeatable and are so varied no process
elements can be defined. Furthermore these processes are often performed once or rarely which
explains the difference in frequency. Lastly groupware systems are less able to track which
performances led to which outcomes and were performed by whom. ACM documents this to a high
extent [2].

These differences can be interpreted and turned into a framework which will be elaborated upon in
section 6. The differences are shortly presented in Table 10.

<table>
<thead>
<tr>
<th>Workflow management systems</th>
<th>Production case management</th>
<th>Adaptive case management</th>
<th>Groupware</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C4</td>
</tr>
<tr>
<td>C5</td>
<td>C6</td>
<td>C7</td>
<td>C8</td>
</tr>
<tr>
<td>C9</td>
<td>C10</td>
<td>C11</td>
<td>C12</td>
</tr>
<tr>
<td>C13</td>
<td>C14</td>
<td>C15</td>
<td>C16</td>
</tr>
<tr>
<td>C17</td>
<td>C18</td>
<td>C19</td>
<td>C20</td>
</tr>
</tbody>
</table>

Table 10 - Differences and similarities between business process support systems
| Table 11 - Process characteristics along business process systems |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| **C1. Knowledge driven** | Information has a low relevance in the process and is only used for routing, no dependency on implicit knowledge. | Process is made through satisfaction of knowledge requirements, experienced knowledge and the impact of a knowledge worker on the process. | Process is made through satisfaction of knowledge requirements, experienced knowledge and the impact of a knowledge worker on the process. | Process is made through satisfaction of knowledge requirements, experienced knowledge and the impact of a knowledge worker on the process. |
| **C2. Collaboration oriented** | There is no or little exchange or creation of knowledge between coworkers. | Process creation, management and execution occur in a collaborative multi-user environment where human-centered and process-related knowledge is co-created, shared and transferred between individuals and enterprises. | Process creation, management and execution occur in a collaborative multi-user environment where human-centered and process-related knowledge is co-created, shared and transferred between individuals and enterprises. | Process creation, management and execution occur in a collaborative multi-user environment where human-centered and process-related knowledge is co-created, shared and transferred between individuals and enterprises. |
| **C3. Unpredictable** | The process is unpredictable. Some events can be foreseen, whereas all possible tasks should be known in advance. | The process is not entirely predictable. Some events can be foreseen, whereas all possible tasks should be known in advance. | The process is not entirely predictable. Some events can be foreseen, whereas all possible tasks should be known in advance. | The process is not entirely predictable. Some events can be foreseen, whereas all possible tasks should be known in advance. |
| **C4. Emergent** | The actual flow of the process is emergent but limited to a predefined path. | The process evolves gradually based on the state of the process and knowledge that becomes available by executing tasks and achieving goals. | The process evolves gradually based on the state of the process and knowledge that becomes available by executing tasks and achieving goals. | The process evolves gradually based on the state of the process and knowledge that becomes available by executing tasks and achieving goals. |
| **C5. Goal-oriented** | The process evolves through means of sequential tasks rather than the accomplishment of goals. | The process evolves through achieving certain goals and milestones, instead of completing activities. | The process evolves through achieving certain goals and milestones, instead of completing activities. | The process evolves through achieving certain goals and milestones, instead of completing activities. |
| **C6. Emergent goal** | Since the process is not goal oriented, the goals are not emergent. | The goals and milestones are known in advance. | The goals and milestones are known in advance. | The goals and milestones are known in advance. |
| **C7. Dynamic environment** | The process is not influenced by events that cannot be mapped a priori. | The process is not influenced by events that cannot be mapped a priori. | The process is not influenced by events that cannot be mapped a priori. | The process is not influenced by events that cannot be mapped a priori. |
| **C8. Compliance** | There are rules defined but these are implicit. The rest of the process is defined explicit. | Workers may be influenced by or may have to comply with constraints and rules that drive actions performance and decision making. | Workers may be influenced by or may have to comply with constraints and rules that drive actions performance and decision making. | Workers may be influenced by or may have to comply with constraints and rules that drive actions performance and decision making. |
| **C9. Non-repeatable** | Processes are highly repeatable, the same actions have to be performed in order to reach an output. | The process varies every time when executed, although parts of the process may be similar the complete structure of the process usually varies. | The process varies every time when executed, although parts of the process may be similar the complete structure of the process usually varies. | The process varies every time when executed, although parts of the process may be similar the complete structure of the process usually varies. |
| **C10. Requiring diverse data sources** | DSS is often complex and uncertain instead of being interpreted by the knowledge worker. | The process requires information and data from different data sources including both structured and unstructured information. | The process requires information and data from different data sources including both structured and unstructured information. | The process requires information and data from different data sources including both structured and unstructured information. |
| **C11. Transparency** | It might be needed to trace the process and see which worker performed which action. | It might be needed to trace the process and see which worker performed which action. | It might be needed to trace the process and see which worker performed which action. | It might be needed to trace the process and see which worker performed which action. |
| **C12. Client-oriented** | The customer orders are standardized. There is limited variation in the customer's order. | The process is designed to be performed with a high frequency. | The process is designed to be performed with a high frequency. | The process is designed to be performed with a high frequency. |
| **C13. Frequency** | The process is executed with a high frequency. | The process is designed to be performed with a high frequency. | The process is designed to be performed with a high frequency. | The process is designed to be performed with a high frequency. |
6. FRAMEWORK DEVELOPMENT

The information reflected in Table 11 provides the basis for a framework which assists Deloitte in determining which BPSSs can be applied to a certain business process. This section starts with explaining how the framework is designed after which it continues with explaining the framework itself.

6.1 DESIGN OF FRAMEWORK

This section focusses on the development of a framework that can assist Deloitte consultants in advising upon the applicability of ACM systems, at the same time this framework is able to provide the alternatives of WfMSs, PCM systems and groupware systems when ACM systems are less or not applicable to a business process. Through interviews with four Deloitte consultants, a number of design requirements are derived for the framework to be useful and usable. The interviews were repeated until no more new design criteria were mentioned to eventually reach synthesis [15]. The interviews focused on the usability of the system and the manner in which the results of the framework should be presented.

1. What are the main requirements in the usage of the system?
2. What are the main requirements in the outcome of the system?

During the interviews became clear that Deloitte demanded a framework based on which they could advise the client about whether or not apply ACM to a business process, however it should also be able to provide clients with suggestions about other applicable BPSSs when ACM was less applicable. The main categories in which BPM group of Deloitte advices are WfMS, PCM systems and groupware systems hence it was decided to include these three systems in the framework as well.

The next requirement involved the interaction with the client. The framework should be understood by both Deloitte and client in order to initiate a discussion about which BPSS should be applied to the business process. In order to initiate the right discussion it was decided to focus on specific differences in the characteristics these BPSSs can support. By formulating the right questions to analyze the process, the consultant and client can make sure they address the right topics in their decision.

In order to provide the client with a clear overview of his possibilities, the framework should also show which BPSSs can be applied to a business process, which BPSSs cannot be applied to a business process, and which BPSS can best be applied to a business process.

This lead till the five design requirements as presented below.

DR1. The framework has to be understandable for Deloitte consultants.
DR2. The framework has to be understandable by clients.
DR3. The framework has to address specific process characteristics.
DR4. The framework has to show which systems are applicable to a process.
DR5. The framework has to show which system fits best to the process.

One of the most important design requirements for the framework is that it has to be understandable by both Deloitte consultants and clients (DR1 and DR2). The framework needs to be able to present to clients in a clear way why certain systems are applicable and others are not, and why one of these systems is the best choice for the client’s business processes.

In order to meet up to these requirements it is decided to focus on the concrete observable differences as described in section 5.2. Through means of twenty questions the client can answer with yes or no, the framework calculates the compliance with different business process support
systems. By posing these questions, it forces the clients to think about their processes, and helps them to provide insights in which BPSSs they can consider for their business process.

The output of the framework shows the percentage of questions that are answered in line with a certain system. This way the best fit can be presented to the client. It should be kept in mind that this tool only gives a suggestion about which systems can be applied and which system can best be applied. In the end this framework can serve as a basis for structuring a discussion between client and consultant about the information systems considered.

6.2 **Explanation Framework**

The developed framework is structured around a set of 20 questions which are based on the specific differences between the characteristics a BPSS can support which are derived from the analysis in section 5.2. The framework gives an answer for each of these questions for a BPSS as can be seen in Table 12.

<table>
<thead>
<tr>
<th>Related process characteristic</th>
<th>Questions</th>
<th>WIM system</th>
<th>PCM system</th>
<th>ACM system</th>
<th>Groupware system</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1. Knowledge driven</td>
<td>C1.1 Is the process based on documents and/or desaters?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>C1.2 Does the work need to be analyzed in which he is not directly supported by the system? (so based on his own experience and expertise)?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C2. Collaboration oriented</td>
<td>C2.1 Is there collaboration between employees based on exchange of information?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C3. Unpredictable</td>
<td>C3.1 Is the sequence of activities known in advance?</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>C3.2 Are all possible tasks that can be executed known in advance?</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C4. Emergent</td>
<td>C4.1 Does information obtained during the process determine the course of next tasks?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C5. Goal-oriented</td>
<td>C5.1 Does the process work towards goals, rather than the completion of tasks?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>C6. Emergent goal</td>
<td>C6.1 Are the milestones/goals and their sequence known in advance?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>C7. Dynamic environment</td>
<td>C7.1 Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8. Compliance</td>
<td>C8.1 Does the process adhere to internal business rules?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>C8.2 Does the process adhere to legal regulations?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>C8.3 Can business rules to change during the execution of the process?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>C8.4 Can legal regulations to change during the execution of the process?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>C9. Non-repeatable</td>
<td>C9.1 Can recurring process elements be defined in the overall process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>C10. Requiring diverse data sources</td>
<td>C10.1 Does the knowledge worker need to derive information from different data sources in order to make progress?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11. Transparency</td>
<td>C11.1 Is it important for stakeholders to track the tasks performed by an employee?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>C11.2 Is it important for stakeholders to track the decision making of employees?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>C12. Client oriented</td>
<td>C12.1 Does the client need a custom made solution?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>C12.2 Does the client need to be informed about the state of his order frequently?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>C13. Frequency</td>
<td>C13.1 How frequently is the process executed</td>
<td>High</td>
<td>High/medium</td>
<td>High/medium</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Table 12 - Applicability framework*

As can be seen in Table 12 some of the answers to the questions are marked red. The framework makes a distinction between variables that can be supported by a BPSS regardless of what answer is given to the question but which might not meet the ideal situation for the BPSS, and variables that have to match the BPSS to be able to support the process (marked red). When the process does not
meet this latter category, the applicability of the BPSS automatically drops to 0%. The applicability of each BPSS is calculated by the percentage of questions that are answered according to the ideal situations presented in the framework, however as stated before the applicability drops to zero when one of the red variables is not met. The remainder of this section discusses the questions included in the framework.

C1.1 *Is the process based on documents or dossiers?*

This question addresses the difference between data oriented systems and process oriented systems. Systems like workflow management do not incorporate any data, if not used for routing [13] meaning the process is focused on the process itself rather than the development of a certain dossier [22]. When groupware does support processes which involve documents or dossiers these are often stored in a program like excel. Groupware, ACM and PCM are data based systems meaning they can in fact incorporate the forming of a dossier.

C1.2 *Does the worker have to make decisions in which he is not directly supported by the system? (so based on his own experience and expertise)*?

ACM systems, PCM systems and groupware systems have a high dependency on the expertise of the knowledge worker, meaning the knowledge worker has to read a situation and be able to make decisions themselves [22, 2]. Workflow management systems rather guide the (knowledge) worker in the activities he has to perform meaning the worker has to rely little on his own expertise.

C2.1 *Is there collaboration between employees based on exchange of exchange of information?*

PCM systems, ACM systems and groupware systems are all systems that support highly collaborative processes [13]. This includes the sharing of information about a project, which again is hard to do in WfMS’s since they do not include data in the process [4].

C3.1 *Is the sequence of tasks known in advance?*

WFMS’s are explicitly modelled systems, meaning the sequence of activities should be known in advance. ACM systems and PCM systems do not have this limitation [4, 2]. Although it possible that the sequence is known for part of the process, they also offer the possibility to leave the exact sequence of activities up to the knowledge worker [4, 2]. Groupware systems are systems which are process unaware, meaning it is not possible to model a sequence of activities [46, 22].

C3.2 *Are all possible tasks that can be executed known in advance?*

Again since WfMSs are explicitly modelled systems, all activities a worker can perform have to be known in advance [22, 2]. Although for PCM systems the sequence of activities does not need to be known in advance, it is not possible to model new activities during the enactment of the process [28]. This means for PCM systems all possible activities need to be known in advance as well. ACM systems offer the possibility to model new activities ad hoc, which means the worker can perform activities that were not known in advance [2, 28]. Again, groupware is not process aware, meaning no predefined activities exist in the system. Thus, groupware systems able to support processes for which not all possible tasks are known in advance.

C4.1 *Does information obtained during the process determine the course of next tasks?*

In ACM systems, PCM systems and groupware systems the exact flow of the process can be determined data obtained during the process (although for PCM this needs to be within the boundaries of the predefined activities). Process participants continuously assess process progression and then act or plan the activities to be performed depending on the process status and the available data [5, 22]. Each decision can deliver new data that is can again change the course of activities. In WFMSs, being explicitly modelled this is only possible to the extent of predefined choices [4].
C5.1 Does the process work towards goals, rather than the completion of tasks?

WFMSs typically work towards completion of activities in the sense that a process participant does not necessarily have to be aware of the end goal in order to do his/her job [4]. ACM systems and PCM systems, goals are defined and each activity is performed in order to reach a certain goal or milestone [22, 2, 44]. Groupware systems tend to work in a goal-oriented way as well [46, 13].

C6.1 Is the sequence of milestones/goals known in advance?

Since WFMS’s systems do not work towards goals or milestones, this question is irrelevant for WFMSs. For PCM systems the sequence of goals and milestones has to be known in advance. ACM systems however offer the possibility to change the sequence ad hoc and even define new goals/milestones as the process is enacted [28, 45]. ACM systems do also support processes for which the goals/milestones are known in advance. In groupware the sequence of goals cannot be identified [22].

C7.1 Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance?

Events can influence the decision making of the knowledge worker by affecting process related data, initiation and completion of activities or the environment of the process [5]. These changes require a BPSS to react dynamically which is possible for ACM and groupware [2, 22, 21]. PCM and WFMS’s do not provide possibilities to make ad-hoc changes and therefore do not support the occurrence of unpredicted events [9, 22].

C8.1 Does the process adhere to business rules?

All business processes are submissive to internal business rules, however some support systems support this better than others. Although in WFMSs, business rules are usually not modelled they are enforced by explicitly defining the activities a worker can perform. PCM systems, ACM systems and groupware systems support the modeling of business rules, and use them to determine the restrictions on the actions that can be performed by a worker [2, 46].

C8.2 Does the process adhere to legal regulations?

Some business processes are influenced by legal regulations; the modeling of these regulations is enacted in the same way as the modeling of business rules. Although in WFMSs, legal regulations are usually not modelled, they are enforced by explicitly defining the activities a worker can perform. In PCM systems, ACM systems and groupware systems support the modeling of legal regulations, and use them to determine the restrictions on the actions that can be performed by a worker [28, 46].

C8.3 Can business rules to change during the execution of the process?

Especially with long-lasting projects it is likely for business rules to change during the enactment of the process. This may influence the course of the process and may result in activities that have to be performed again. WFMS, PCM and groupware systems cannot change these regulations ad-hoc [22, 12, 28]. ACM systems however do provide this possibility. Also the system dynamically recalculates the course of the process, showing when activities need to be performed again, or new activities should be performed to meet the new business rules [2].

C8.4 Can legal regulations to change during the execution of the process?

Especially with long-lasting projects it is likely for legal regulations to change during the enactment of the process. This may influence the course of the process and may result in activities that have to be performed again. WFMS, PCM and groupware systems cannot change these regulations ad-hoc [22, 12, 28]. ACM systems, however, do provide this possibility. Also the system dynamically recalculates
the course of the process, showing when activities need to be performed again, or new activities should be performed to meet the new legal regulations [2].

C9.1 Can recurring process elements be defined in the overall process?

WfM, PCM and ACM systems all incorporate the support of process elements [2, 29]. When the process incorporates a certain sequence of activities (this can be the whole process or part of the process), these systems are able to model it as such. Since groupware is process unaware, groupware is not able to support this characteristic [12].

C10.1 Does the knowledge worker need to derive data from different data sources in order to make progress?

For knowledge intensive processes, knowledge workers typically need data from multiple data sources in order to make the decisions they need to make for progress. PCM systems, ACM systems and groupware systems are able to connect to different data sources and capture relevant data for the knowledge worker to make his/her decision. Since workflow management systems do not incorporate data as a main part in the process, these systems are typically less aimed at deriving data from other systems [22].

C11.1 Is it important for stakeholders in the process to track the tasks performed by an employee?

Knowledge intensive processes typically require transparency. Knowledge workers need to know what tasks are performed by whom and with what result [2] and how it relates to the completion of a case/process. WfMSs, PCM systems and ACM systems are able to provide this transparency. Groupware systems support this characteristic to a lesser extent.

C11.2 Is it important for stakeholders in the process to track the decision making of employees?

In WfMS’s the knowledge worker rarely has to make decisions on his own, instead the system prevents him from making a wrong choice. PCM, ACM and groupware systems however, rely on the expertise of the knowledge worker and trust them to make the right decisions. These systems provide the possibility for these workers to motivate their choices so at a later point in time, it can be decided whether the choice was justified or not.

C12.1 Does the client need a custom solution?

When a client need a custom solution, the process often consists of a lot of decision points in order to give the client the possibility to modify the product in such a way that is suitable to him/her. When these choices become too much it might be difficult to model all these choices explicitly making WfMS’s less suitable for custom made processes. In PCM, ACM and groupware systems the processes are not modeled explicitly. Instead they strive towards a goal which is meeting the client’s requirements. This makes these systems better fit for custom made solutions.

C12.2 Does the client need to be informed about the state of his order frequently?

ACM and PCM systems are often used to incorporate the client in the process and keep them up to date about the state of their order. Ideally this requires a dossier for each client, making case managements systems especially suitable for keeping the client up to date about the state of their order.

C13.1 How frequently is the process executed?

This is a more ambiguous variable since it cannot be answered with a simple yes or no. Unfortunately this thesis does not consist of enough data to give an exact answer to with what frequency a process has to be executed in order to be suitable for a specific BPM system. Literature and do however give indications about the frequency in terms of high/medium/low. Processes suitable for WfMS’s are
often executed with a high frequency, PCM process with a high or medium frequency, ACM process with a high, medium or low frequency and groupware process typically with a low frequency. This variable should be decided upon in collaboration with the client, and might contain certain cost factors as well. Further research is needed to be able to draw more specific conclusions from this question.
7. **Validation**

This chapter focusses on the fourth research question of the thesis “*how valid is the framework?*” In order to test the validity of the framework a multiple case study is performed. Four cases are selected from various sources and the researchers along with three Deloitte employees assess these cases with the designed framework. The amount of cases used for validation is limited due to the time restrictions of the master thesis. Four cases was the minimum amount of cases to select a case for each BPSS included in the framework. This way the validation session does not only test the validity but the usability of the framework as well. The chapter starts with explaining how the four cases are selected, after which it continues with a brief description of the execution of these cases. Lastly the chapter reflects on the validity and the usability of the framework.

7.1 **Case selection**

In order to validate the framework, the framework is tested against fur real life situations in the form of a multiple case study. A multiple case study is considered more compelling than a single case study and the overall study is regarded as being more robust [41]. Yin [41] states that it is neither preferable nor necessary to make a random selection of the cases. Instead the cases should be selected to assess certain theoretical categories in the framework. This is why a case for each of the BPSSs (WfMS, PCM system, ACM system and groupware system) is selected.

In order to acquire the cases the personal network of the researcher, the network of Deloitte and literature are consulted. Although the preference was to acquire cases through the network of either Deloitte or the researcher, it became clear it was not possible to acquire a groupware case. This is why the groupware case was derived from literature. Each of the four cases had to meet the following requirements;

- The case should provide a clear description of a business process addressing or indicating the process characteristics defined in Table 11.
- Should provide answer to the questions included in the framework.
- A case for each of the BPSSs has to be obtained.
- The BPSS used in the case should be accepted by the client and implemented in the organization to determine its successfulness.

This selection resulted in the four cases as presented in Figure 6.

<table>
<thead>
<tr>
<th>Case</th>
<th>Used BPSS</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee course subscription</td>
<td>Workflow management system</td>
<td>Deloitte</td>
</tr>
<tr>
<td>Contracting between a semi-public organization and client</td>
<td>Adaptive case management system</td>
<td>Formotis</td>
</tr>
<tr>
<td>Subsidy request at a public organization</td>
<td>Production case management system</td>
<td>KING</td>
</tr>
<tr>
<td>New product development at a large consumer business</td>
<td>Groupware system</td>
<td>Literature [42]</td>
</tr>
</tbody>
</table>

![Figure 6 - Overview cases](image)

7.1.1 **Case 1: Employee course subscription (workflow management)**

The case considers handling an employee’s request of a course subscription. On a high level this process consists of three sub processes which are the enrollment, the payment and the evaluation.
The enrollment is initiated by a request of the employee. This request is either approved or declined according to strict criteria. Once the request is approved the request is processed and the employee is enrolled in the course. At the same time the course portfolio of the employee is updated (which is an excel file) and if necessary hotel bookings are made. Once a confirmation is received from the course institute and the hotel (if applicable) the enrollment can be completed and the employee is enrolled.

The payment process is initiated by the receipt of a course application. This receipt can either be received before the start of a course or afterwards. This bill has to be checked. In this check it is investigated whether the receipt is indeed related to the course and whether the employee in question is entitled to participate in the course. The receipt is either accepted or not accepted. When the payment is accepted the receipt is forwarded to the administration office who in eventually pays the bill.

After finishing the course the employee fills out an evaluation form and the overall process is completed.

7.1.2 Case 2: Contracting between a semi-public organization and client (adaptive case management)

The case reflects a real life study to a large semi-public organization that provides the infrastructure of electricity and gas to their clients. Their clients can be both private persons and various types of companies with both a wide range of specific requirements. The process studied in this case considers the contracting between this organization and their clients.

The contract is a complex and custom made document, or set of documents, that should comply with various requirements. The contract is developed in cooperation with their clients, which makes the client an active co-producer of the document. The development includes, besides client and organization, several subcontractors. The contract covers issues such as type of service provided, costs, costs calculation methods, conditions for payments, instructions for the subcontractor, correspondence etc. Other documents as inspection reports, approvals originating from several sources are part of the contract or related to this specific contract.

The contract starts with the client setting up a dossier, the client and organization come to various agreements amongst which the delivery of a contract proposition which should be delivered in a specified period of time after a customer’s request. This is also defined by law. The contract is produced in a collaborative environment in which both client and organization are involved. In this collaboration it is decided what is reflected in the contract. The production of this contract is highly structured, certain parts have a controlled sequence and in consultation with the client certain checks may be implemented in the process to decide whether to continue the process, this can differ per contract. The contract should always be checked after the delivery of a contract proposition and the final delivery by client and organization. In response to these checks requirements of the contract might be changed during its lifetime however changes have to be made within legal regulations and business policies. Changes to the contract might also occur as a result of changing legal requirements, these changes can occur during the development of the contract or after finishing the contract.

7.1.3 Case 3: Subsidy request at a public organization (production case management)

The case involves a subsidy request at a public organization. Handling the request consists of five phases (on a high level) which are the intake of a request, the completeness check of the request, the assessment of the request, the decision making, and (if applicable) the payment of the subsidy.

The process is initiated by a subsidy request after which it is handled by a specialist. In order to process the request information about the client is needed. The specialist is responsible for
acquiring this information and the request can only be registered once this information is complete. It is important to keep the client up to date about whether the request is accepted or not.

Once the request is registered it needs to be tested whether the request contains the required documents to start processing the request. This again has to be checked by a specialist. When the request does not contain the required documents the client is contacted to request additional information. Only when these documents are complete the request can be progress in the process. When the client fails to deliver the required documents the request is marked as non-receptive and the client is informed about the decision.

Once it is assured the request contains the necessary documents and information, the assessment of the request begins. The specialist categorizes the request and checks which legal regulations and business policies are applicable, and whether there is room in the budget to grant the subsidy. The final assessment of the subsidy requires intensive studying of documents and comparing them to regulations and possibly earlier cases. It is up to the specialist to decide this on his own, or in collaboration with coworkers. Based on this assessment the subsidy is either approved or declined. When the subsidy is declined a concept disposal is developed. When the subsidy is granted reservations are made in the budget after which a concept disposal is developed as well.

Once this disposal is authorized, the client is informed about the decision and receives a motivation which explains why the decision was made. If necessary the client is also informed about the amount of the payment.

7.1.4 Case 4: New product development at a large consumer business [47] (groupware)

The case considers the decision making about new products at a large consumer business. The process can be structured in four high level phases which are idea generation, feasibility, capability, implementation/roll-out). At the end of each phase so called “gates” exist which serve as a formal filter. In these gates top management decides on the approval, based on the documents that accompany the development phases of each project.

After the idea generation the ideas are screened, these ideas come from different sources and each idea needs to be described and supported by at least two physical elements in order for the internal control to evaluate the ideas. The idea can be passed on to the next phase or dropped out.

The next check is charter, at this check the idea is accompanied with a one or two page outline of a project describing the product the consumer needs, the business it will generate and the way it will be achieved from marketing and technical perspective. After this phase, the idea can be dropped or continue to the next phase.

If the idea passes the charter check, it continues to the contract book in which the contract is assessed. Here a contract is developed between the idea generator and the organization and resources are allocated. This contract has to comply with internal business rules.

Lastly the launch proposal defines the project in all its components and contains the result of a market survey rapport which supports the request for launching the product. After assessing this report three things can happen:

- Nothing is done because the idea is not interesting enough
- The idea is interesting and the internal control is charged to bring forward the concept
- The idea is interesting and for a series of reasons the author is involved in the development of the idea.
7.2 Case Execution

This section describes the execution of the cases which are presented in section 7.1. For this case study three Deloitte employees were asked to assess the cases with the developed framework. His way the validity of the framework could be tested and at the same time it could be tested whether the framework is usable by Deloitte employees. The participants of the case study were selected based on three requirements:

- **ER1.** The employees have to have experience in the BPM field.
- **ER2.** The employees have to be familiar with the paradigm of adaptive case management.
- **ER3.** The employees are not involved in the development of the framework.

The first two requirements (ER1 & ER2) are included to make sure the employees are somewhat familiar with the terminology used in the framework, and can understand the goal of the framework. Since the framework is discussed with numerous Deloitte employees ER3 is included, to make sure the employees are not aware of what answers to choose in order to reach a certain result. Furthermore the outcomes could be biased if some participants have more knowledge about the specifics of the framework than others.

In order to reduce the bias, no specific companies were mentioned in the cases, and the sequence in which the cases were assessed was random. Furthermore the participants were not aware of which BPSS was used in which case nor were they aware that there was once case for each BPSS.

Before the case study started a brief explanation was given by the researcher about the thesis, the goal of the framework and the specific questions of the framework. This way it could be ensured the participants performed the case study with the same pre-knowledge about the framework.

This section presents for each case the answers the researcher and employees gave to the questions and the outcome of the framework. The answers are presented in detail in Appendix G this section focusses on the questions in which the answers given by participants and researcher differ from each other.

### 7.2.1 Case 1: Employee course subscription

<table>
<thead>
<tr>
<th>Question</th>
<th>Researcher</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.1 Is the process based on documents or dossiers?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C1.2 Does the worker have to make decisions in which he is not directly supported by the system (so based on his own experience and expertise)?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C1.3 Is there collaboration between employees based on exchange of information?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C1.4 Is the sequence of tasks known in advance?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C9.1 Does the process adhere to internal business rules?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C9.2 Does the process adhere to legal regulations?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C9.3 Is it likely for business rules to change during the process?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C9.4 Is it likely for legal regulations to change during the process?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C10.1 Can recurring process sequences be defined in the overall process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C10.2 Does the knowledge worker need to derive information from different data sources in order to make progress?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.1 Is it important for stakeholders to track the tasks performed by an employee?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.2 Is it important for stakeholders to track the decision making of employees?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.1 Does the client need a custom made solution?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C12.2 Does the client need to be informed about the state of his order frequently?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C13.1 How frequent is the process executed?</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BPSS</th>
<th>Workflow</th>
<th>Production case management</th>
<th>Adaptive case management</th>
<th>Groupware</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workflow</td>
<td>85%</td>
<td>80%</td>
<td>75%</td>
<td>80%</td>
</tr>
<tr>
<td>Production case management</td>
<td>65%</td>
<td>10%</td>
<td>50%</td>
<td>20%</td>
</tr>
<tr>
<td>Adaptive case management</td>
<td>40%</td>
<td>45%</td>
<td>50%</td>
<td>45%</td>
</tr>
<tr>
<td>Groupware</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 13 - Results case 1
Although the researcher and participants agreed most (90%) of the questions, two questions were answered differently by at least one of the participants. As can be seen in Table 13 question C5.1 the answer of participant 2 differs from the answers of participant 1 and 3. Participant 2 argues that all processes are performed in order to reach a certain goal. Participant 1 and 3 argue that the worker could perform every activity without being even aware of the goal. The researcher agrees with participant 1 and 3 about the fact that the process workers rather to the completion of certain tasks than working towards a specific goal.

The participants all agree that the client should be frequently informed about the state of his order (C12.2). The researcher disagrees with this since according to the process description the client is only informed about the approval or decline of his request. There is no indication the worker is kept up to date about the process before the result of the process.

Analyzing the outcomes of the four cases, it can be seen the researcher and the participants came to the correct BPSS four out of four times. Interesting to see is that in this case, the groupware systems are ruled out. This has to do with the fact that groupware is not process aware while WfMSs have to have a pre-defined process. It can be see that when WfMSs are applicable, automatically PCM and ACM systems can still be applied since both case management systems are process aware. In this case they are however less suitable for the situation since, the process is very well defined (the sequence of tasks is known in advance and all possible tasks that can be executed are known in advance). Furthermore the process does not work through means of reaching goals, there are no events influencing the process and there aren’t any legal regulations influencing the process let alone change during the enactment of the process. Although PCM and ACM systems are able to manage this process, their score is somewhat lower since these are not the characteristics ACM or PCM systems are meant for initially.

7.2.2 Case 2: Contracting between a semi-public organization and client (adaptive case management)

<table>
<thead>
<tr>
<th>Case 2</th>
<th>Researcher</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.1</td>
<td>Is the process based on documents or dossiers?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C1.2</td>
<td>Does the worker has to make decisions in which he is not directly supported by the system? (see based on his own experience and expertise)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C2.1</td>
<td>Is there collaboration between employees based on exchange of exchange of information?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C3.1</td>
<td>Is the sequence of tasks known in advance?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C3.2</td>
<td>Are all possible tasks that can be executed known in advance?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C4.1</td>
<td>Does information obtained during the process determine the course of next tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C5.1</td>
<td>Does the process work towards goals, rather than the completion of tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C6.1</td>
<td>Can goals/milestones, or their sequence, change over time?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C7.1</td>
<td>Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.1</td>
<td>Does the process adhere to internal business rules?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.2</td>
<td>Does the process adhere to legal regulations?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.3</td>
<td>Is it likely for business rules to change during the process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.4</td>
<td>Is it likely for legal regulations to change during the process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C9.1</td>
<td>Can recurring process sequences be defined in the overall process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C10.1</td>
<td>Does the knowledge worker need to derive information from different data sources in order to make progress?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.1</td>
<td>Is it important for stakeholders to track the tasks performed by an employee?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.2</td>
<td>Is it important for stakeholders to track the decision making of employees?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.1</td>
<td>Does the client need a custom made solution?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.2</td>
<td>Does the client need to be informed about the state of his order frequently?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C13.1</td>
<td>How frequent is the process executed</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Table 14 - Results case 2

Analyzing the results of case 2 it can be seen the researcher and participants gave the same answers for 17 out of twenty questions. For question 3.1 participant 1 gave a different answer than participant 2 and 3. Participant 2 and 3 stated they were confused since the case clearly that for
some parts of the process are very structured. Participant 1 argues that although parts of the process were defined in a structured sequence of the tasks from beginning to end could not be defined upfront. The researcher agrees with participant 1. In processes suitable for ACM systems it is not uncommon certain parts can be defined in a controlled sequence. However looking at the complete process the sequence of activities cannot be defined upfront since demands can differ, and it should be possible to change the contract during development and during its lifetime.

C11.1 was answered differently by participant 1 than participant 2 and 3. Participant 1 argued it was not necessary to track every task an employee performs. Instead the participant proposes to only document certain points in the system. Participant 2 and 3 stated that the development of a contract is a very precise process with a lot of stakeholder. Therefore it is very important to check which worker performed which task. The researcher agrees with participant 2 and 3.

The opinions on the frequency of the process differ from each other. This characteristic is open for the interpretation of the participant and it is therefore hard to draw any conclusions on this question. Participant 2 and 3 stated the frequency of the process would probably be low since contracts are usually made once per client. Participant 3 did not know how to answer this question and therefore went with medium.

Looking at case two it can be seen that the researcher and participants all reached the outcome of adaptive case management. Striking to see is that according to this framework only ACM systems can be applied to this case, mainly since on the one hand the sequence of activities, and the possible activities that can be executed is not known upfront (ruling out WfMS and PCM respectively) and the goals and milestones can change over time which is also cannot be supported by PCM. On the other groupware is ruled out since although the process cannot be determined a-priori, it is desired to model parts of the process in a controlled sequence. In groupware it is not possible to define these controlled sequences since groupware is process unaware. Furthermore the compliance with influential and changing business rules and legal regulations make this process especially suitable for ACM systems.

7.2.3 Case 3: Subsidy request at a public organization (production case management)

<table>
<thead>
<tr>
<th>Case 3</th>
<th>Researcher</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.1 Is the process based on documents or dossiers?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C1.2 Does the worker has to make decisions in which he is not directly supported by the system? (so based on his own experience and expertise)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C2.1 Is there collaboration between employees based on exchange of exchange of information?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C3.1 Is the sequence of tasks known in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C3.2 Are all possible tasks that can be executed known in advance?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C4.1 Does information obtained during the process determine the course of next tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C5.1 Does the process work towards goals, rather than the completion of tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C6.1 Can goals/milestones, or their sequence, change over time?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C7.1 Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C8.1 Does the process adhere to internal business rules?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.2 Does the process adhere to legal regulations?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C9.1 Can recurring process sequences be defined in the overall process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C10.1 Does the knowledge worker need to derive information from different data sources in order to make progress?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.1 Is it important for stakeholders to track the tasks performed by an employee?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.2 Is it important for stakeholders to track the decision making of employees?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.1 Does the client need a custom made solution?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>C12.2 Does the client need to be informed about the state of his order frequently?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C13.1 How frequent is the process executed</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Workflow</th>
<th>0%</th>
<th>0%</th>
<th>0%</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production case management</td>
<td>90%</td>
<td>90%</td>
<td>90%</td>
<td>85%</td>
</tr>
<tr>
<td>Adaptive case management</td>
<td>75%</td>
<td>75%</td>
<td>85%</td>
<td>70%</td>
</tr>
<tr>
<td>Groupware</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 15 - Results case 3
As can be seen in Table 15 the participants and researcher reached the same answers for 15 out of twenty questions. For question C5.1 participant 1 and 2 stated the process was goal oriented while participant 3 the process was aimed at the completion of tasks. Participant 1 and 2 argued that the process was defined in the form of reaching certain milestones in the process like, acquire necessary information, judging a request, reaching a decision about the request and if approved eventually granting the subsidy. After discussion participant 3 agreed with this point of view.

For question C8.3 participant 1 and 3 state the business rules, a process has to comply with is unlikely to change during the execution of the process. Participant 2 stated that since the process is usually long lasting, business rules are more likely to change. Participant 1 and 3 stated that the request of a subsidy is more influenced by legal regulations than specific business rules.

For question C11.1 participant 2 and 3 state it is important to track ever task a participant performs, participant 1 states only certain points should be checked. Since there is usually a lot of money and stakeholders involved in the granting or declining of a business process, the researcher agrees with participant 2 and 3.

For question C12.1 participant 2 and 3 state the client usually needs a custom solution while participant 3 states the subsidy is not a custom made solution. Although it can be decided by the worker whether or not to grand the subsidy, the subsidy and the criteria for granting or declining a subsidy do not change. Therefore the researcher agrees with participant 3.

In case three it can be seen that the researcher and participants all arrived at the conclusion of PCM systems. WfMSs are ruled out here, since the sequence of activities cannot be determined in advance. However in this process, all possible tasks that can be performed are known in advance. Furthermore the groupware systems are again ruled out since they cannot provide support for the recurring structured process parts. ACM systems could still be applied to the process. This situation however is less suitable for ACM systems, since the process is predictable enough to define steady goals and milestones and all possibly tasks can be determined upfront.

### Case 4: New product development at a large consumer business (groupware)

<table>
<thead>
<tr>
<th></th>
<th>Case 4</th>
<th>Case 5</th>
<th>Case 6</th>
<th>Case 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.1</td>
<td>Is the process based on documents or dossiers?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C1.2</td>
<td>Does the worker have to make decisions in which he is not directly supported by the system? (so based on his own experience and expertise)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C2.1</td>
<td>Is there collaboration between employees based on an exchange of information?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C3.1</td>
<td>Is the sequence of tasks known in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C3.2</td>
<td>Are all possible tasks that can be executed known in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C4.1</td>
<td>Does information obtained during the process determine the course of next tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C5.1</td>
<td>Does the process work towards goals, rather than the completion of tasks?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C6.1</td>
<td>Can goals/milestones, or their sequence, change over time?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C7.1</td>
<td>Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C8.1</td>
<td>Does the process adhere to internal business rules?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.2</td>
<td>Does the process adhere to legal regulations?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.3</td>
<td>Is it likely for business rules to change during the process?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C8.4</td>
<td>Is it likely for legal regulations to change during the process?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C9.1</td>
<td>Can recurring process sequences be defined in the overall process?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C10.1</td>
<td>Does the knowledge worker need to derive information from different data sources in order to make progress?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.1</td>
<td>Is it important for stakeholders to track the tasks performed by an employee?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.2</td>
<td>Is it important for stakeholders to track the decision making of employees?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.1</td>
<td>Does the client need a custom made solution?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C12.2</td>
<td>Does the client need to be informed about the state of his order frequently?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C13.1</td>
<td>How frequent is the process executed?</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>WorkFlow</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Production case management</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Adaptive case management</td>
<td>65%</td>
<td>60%</td>
<td>65%</td>
<td>70%</td>
</tr>
<tr>
<td>Groupware</td>
<td>65%</td>
<td>70%</td>
<td>65%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Table 16 - Results case 4
For case 4 the researcher and participants reached the same answer for 16 out of 20 questions. Participant 2 and 3 state the process is not influenced by legal regulations (C8.3). However participant 3 state the development of new ideas usually is influenced by legal regulations. Participant 2 and 3 assumed these legal requirements were checked in earlier stages of the idea development. The researcher agrees with participant 3 that the legal regulations play a role in the decision upon the idea.

For question C8.3 participant 1 and 2 agree there is no indication that business rules will change during the process. Participant 3 states it depends on the length of the process. The researcher agrees with participant 1 and 2 that there is no indication that business rules will change.

For question C11.1 participant 1 and 3 agree that it is not necessary to track every task a user performs, since the process is more about the decision making. Participant 2 states it can be desired to know all the specific tasks an employee performs in order to track whether the right actions were taken in the decision process. The researcher agrees it is not necessary for this process to track every task.

In case 4 the researcher and two out of three participants reached the conclusion of a groupware system, while one of the participants reached the conclusion of an ACM system. Since the sequence of the tasks is not known in advance, and neither are the possible tasks that can be executed during the process, workflow management systems and PCM systems cannot be applied to this situation. ACM could still be applied since it also contains the collaboration features of groupware. ACM however is less applicable here since no recurring process elements can be identified. One of the case participants reached the conclusion of an ACM system mainly, because this participant suspected the legal regulations and business regulations had a larger influence on the process. Groupware (without expansions) does not provide the possibility to model these regulations. Since this case is derived from literature, it cannot be checked how big the influence of these rules and regulations is in real life.

7.3 REFLECTION ON FRAMEWORK

From section 7.2 becomes clear the framework reaches the right outcome most of the times. This indicates the framework gives a good suggestion about which systems could be applied to which business processes. To reflect more in depth on the framework this section analyzes the usability of the framework and subsequently the outcomes.

7.3.1 Usability

The usability of the framework is assessed according to the uniformity of the answers the participants and researcher give for each question. This section quickly summarizes the questions that were not answered uniformly, tries to give an explanation for this and states if necessary what actions were taken to avoid differences in the future.

Question 3.1 “Is the sequence of tasks known in advance?” was not answered uniformly in the second case. Two out of three participants answered this question with yes, although according to the researcher and the other participant this question should have been answered with no. After discussion it became clear the confusion was caused by the fact that parts of the process had a controlled sequence. A suggestion for making this question clearer was to stress that the sequence refers to the complete process.

Question 5.1 “Does the process work towards goals, rather than the completion of tasks?” was not answered uniformly in case 1 and case 3. After discussion became clear the confusion was caused since according to participants every process works to a goal eventually and reaches this goal through means of the completion of tasks. The researcher tried to address the difference between goal-oriented processes and process oriented processes with this question. A suggestion for making
this question clearer was to change the question to “Is progress in the process made through a series of intermediate goals or milestones to be achieved or through the completion of tasks?” This way the focus is less on solely the end goal of the process. Furthermore it is suggested to explain clear definitions of goals and tasks to the users of the framework.

Question 8.2 “Is the process submissive to legal regulations?” was not answered uniformly in case 4. This was mainly caused by inadequate information about the case. Since the case was derived from literature no extra information could be requested which means participants had to take a guess. When applying the framework at a client, this information could be obtained more easily. A general comment to the question was to make it more specific. All processes have to obey legal regulations but these regulations do not necessarily affect the knowledge worker directly. It was suggested to change the question to “Is the knowledge worker influenced by legal regulations in his actions and decisions making?”

Question 8.3 “Is it likely for business rules to change during the process?” was no answered uniformly in case 3 and case 4. Influential factors are how dynamic the environment is and how long the process lasts. With the provided cases it was hard to determine the possibility of business rules to change during the process. When applying the framework at a client, earlier process instances could determine whether it is likely for business rules to change during a process. No action is taken to counter the differences in answers for this question.

Question 11.1 “Is it important to the client to track the tasks performed by an employee?” was not answered uniformly in case 2, case 3 and case 4. This question depends on the demands of the client. Usually in processes with multiple stakeholders, large influences and lots of legal regulations it can be desired to track the tasks an employee performs. This is however a priority for the client to choose.

Question 12.2 “Does the client need to be informed about the state of his order frequently?” was not answered uniformly in case 1. The participants however agreed with the researcher, after discussion, the client was only informed about the end result of the process and not of intermediate states.

Question 13.1 “How frequent is the process executed?” was not answered uniformly in case 2. Although some vendors mention the frequency of a process being influential in the decision about whether or not to apply an ACM system, this research is not able to obtain enough data to give proper (quantitative) definitions about what a low, medium or high frequency means. This question demands further research, it is however included in the framework to give the client at least an indication about the frequency a process should be executed for a specific system.

Concluding, most of the question were clear to the participants and were uniformly answered. On average 85% of the questions were answered uniformly per case. With the proposed changes this percentage is expected to go up, resulting in a usable framework for Deloitte. General feedback was to accompany the framework with a handbook, containing clear explanations about the questions along with clear definitions. Table 17 summarizes the questions which were not answered uniformly, the reason and the proposed change.
Analyzing the outcomes of the framework, it can be concluded that, based on the four cases, the framework gives a good reflection of the reality. In the four cases analyzed the framework reached the right conclusion four out of four times. It should be noted, that due to the time restrictions of a master thesis, the framework could only be tested along four cases. Applying the framework to more cases allows for a more specific validity test, being able to test specific differences whereas now the situations usually differ on multiple points making it hard to specify the influence of each question.

For ACM systems can be concluded that these systems are indeed applied to the process characteristics identified in the framework. The researcher came to a 100% match when assessing the case with the framework and the participants found a match of 95%. Striking to see is that in these processes ACM is also the only applicable system. This might have to do with the fact that the processes are very unpredictable in the sense that nor the sequence nor the possible tasks that can be performed can be defined a priori. Also the sequence and goals can change during the enactment of the process and the system has to comply with rules and regulations that in their turn can change during the enactment of the process. A WfMS needs processes which sequence are defined a priori meaning these systems cannot be applied to this process. PCM systems need predefined goals, and need to pre define all possible tasks a priori, meaning these systems cannot be applied.

On the other hand the process contains certain structured parts, which again cannot be supported by groupware systems. This makes especially unique ACM for processes that typically contain both structured and unstructured part. It can be seen that in all other cases ACM would be applicable as well, although it might not be the best applicable system for a process. This is mainly due to the fact that it is able to react to completely unpredictable situations, while at the same time it is able to form really structured processes.

In case 1 the applicability of ACM goes down to 40-50%. Since this process does not rely on the worker, does not involve collaboration and the tasks and sequence of tasks and goals can be defined in advance this process is better suitable for WfMS’s. Also the rules and regulations for this process are less influential and cannot change during the enactment of the process. So indeed WfMS’s are used in predictable processes, which do not rely much on the knowledge of the worker or on collaboration. Furthermore the processes are not influenced much by rules and regulations. Furthermore the client does not need a custom made solution and does not need to be informed about the state of his order throughout the process. Lastly the process is indeed frequently executed.

It is interesting to see that the process is a document based process, even though workflow management systems are generally not information centric. As the case describes, this is countered by using excel and email/mail to process this information. The framework finds this more suitable for data centric systems as PCM, ACM and groupware. This also relates to the fact that the worker needs

<table>
<thead>
<tr>
<th>ID</th>
<th>Question</th>
<th>Reason for different answers</th>
<th>Change</th>
<th>Change question to: Is the sequence of tasks in the complete process known in advance?</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3.1</td>
<td>Is the sequence of the tasks known in advance?</td>
<td>Not clear it referred to the complete process</td>
<td>Change question to: Is the sequence of tasks in the complete process known in advance?</td>
<td></td>
</tr>
<tr>
<td>C5.1</td>
<td>Does the process work towards goals, rather than the completion of tasks?</td>
<td>Every process works towards a goal</td>
<td>Is progress in the process made through a series of intermediate goals or milestones to be achieved or through the completion of tasks?</td>
<td></td>
</tr>
<tr>
<td>C6.2</td>
<td>Is the process submissive to legal regulations?</td>
<td>Every process is submissive to legal regulations</td>
<td>Is the knowledge worker influences by legal regulations in his actions and decisions making? (Same change is made for C6.1)</td>
<td></td>
</tr>
<tr>
<td>C8.3</td>
<td>Is it likely for business rules to change during the process?</td>
<td>Not clear in the case</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>C11.1</td>
<td>Is it important to the client to track the tasks performed by an employee?</td>
<td>This is a choice the client has to make</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>C12.2</td>
<td>Does the client need to be informed about the state of his order frequently?</td>
<td>Case not understood by participants</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>C13.1</td>
<td>How frequent is the process executed</td>
<td>No enough data</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
to derive information multiple information sources, something the framework finds more suitable for
data centric systems. Despite these two differences the workflow characteristics are still dominant.

The third case shows indeed a high applicability for PCM systems and a somewhat lower applicability
for ACM systems. PCM having the highest applicability corresponds with the BPSS that is actually
used in this situation. As can be seen WfMSs cannot be applied to this process since the exact
sequence of tasks is not known in advance, and the client needs to make decisions based on his/her
own expertise using his/her knowledge. On the other hand groupware cannot be applied since the
process also contains some structure in the sense of a sequence of pre-defined goals which cannot
be modelled in groupware systems. ACM systems are still applicable but less applicable than PCM
systems since the process still contains a certain structuredness. All possible tasks are known upfront
and the goals/milestones cannot be changed during the enactment of the process.

The framework predicts a groupware solution for the fourth case which is in line with the system that
is used to manage this process. The applicability of groupware is mainly due to the dependency on
the knowledge worker, the collaborative environment, the unpredictability of tasks and goals.
Although ACM could be applied as well in this case groupware gets the preference since it is not
necessary to track every task a worker performs and there are no recurring process elements that
can be defined in the process. Furthermore the influence and change of business rules and legal
regulation is limited.

7.3.3 Conclusion validation
In order to assess whether the validation can be seen as successful it is useful to refer to the design
requirements that are set before executing the case studies.

The first design requirement DR1 states the framework has to be understandable by Deloitte
consultants. This design requirement was tested by allowing three Deloitte employees perform the
case study. On average 85% of the questions were answered uniformly by participants and the
researcher. This indicates the framework can be understood and used by Deloitte consultants.
However seven different questions were not answered uniformly at least once in the four cases. For
four of these questions this was due to either not enough information in the case, or a mistake made
by the participants. For three of these questions adaptions were made in order to make them more
understandable for Deloitte employees. Especially with the proposed adaptions it can be concluded
the framework is usable for Deloitte consultants.

The second design requirement DR2 states the framework has to be understandable by clients. This
design requirement is more difficult to validate since the framework was not used in practice yet. In
order to meet this requirements the questions of the framework target specific characteristics of the
process that can be answered with either yes or no which should enhance the understandability of
the framework. In practice Deloitte employees and clients will work together using the framework,
this way the fact that the framework is understandable for Deloitte increases the chance that it is
understandable for clients as well. Although this design requirement cannot be validated by using his
validation method, the fact that Deloitte employees understand the framework suggests the
requirement can be met. However no proof can be given.

The third design requirement states the framework has to address the characteristics derived from
research question one (see Table 9). As the research shows these are included in the framework.

The fourth design requirement states the framework should show which BPSSs are applicable to a
process. Indeed the framework does not only show the BPSS that is best suited for the situation but
also BPSSs that could be applied. This design requirement is met based on the information derived
from literature and expert interviews with vendors. Although it can be concluded this design
requirement is met, extra interviews discussing the applicability of all the suggested BPSSs would
increase the validity of this design requirement. Due to time restrictions this was not possible in this
thesis. However since the information is embedded in scientific literature and expert interviews this requirement is met.

The fifth design requirement state the framework has to show which system best fits the process. This requirement is met by calculating the percentage of process characteristics the BPSS supports (in which the highest percentage would be the best applicable BPSS). As the validation showed the framework gave the right answer (best suggestion = BPSS actually used in that situation) in three of the four cases. In the fourth case the researcher and two participants came to the right conclusion. One participant came to another conclusion. It can be concluded that under the assumption the BPSS used in the case is indeed the best BPSS, the framework provides the best applicable BPSS.

Concluding 4 out of 5 design requirements are met by the framework, for the remaining requirements there are indications they are met. Unfortunately DR2 cannot be tested because of the time restrictions of this thesis. Future research should prove whether the framework is indeed understandable for clients. Overall this framework could be seen as a valid framework, which is usable for Deloitte employees and comes to the right conclusion. The limitation has to be kept in mind that due to time restrictions the framework could only be tested along four cases. The validity would go up when more cases were tested.
8. Conclusion

This chapter concludes the thesis project, first the answers to the research questions are shortly summarized after which the academic and practical contribution of the research will be discussed. Next limitations of the research will be discussed and the thesis concludes with suggestions for future research.

8.1 Reflection on research goal and research questions

In order to come to a conclusion it is useful to reflect on the research questions and the research goal. This section quickly summarizes the research questions after which it reflects on whether the goal of the research is achieved.

The first research question, focused on identifying the characteristics of processes ACM systems are applicable to (otherwise known as KiPs). After a literature study it could be concluded that there was still ambiguity about the precise characteristics of KiPs, which is why ACM vendors were interviewed to verify whether their ACM systems were indeed applicable to these processes. The vendor interviews confirmed all KiP characteristics derived from literature and added three extra characteristics which were not mentioned in literature. The list of characteristics can be found in Table 9.

The second research question addressed the differences between the processes ACM systems support and the processes WFMS’s, PCM systems and groupware systems support. This was addressed by consulting academic literature, using the earlier defined process characteristics as a coding scheme to address the literature. This resulted in a reflection of the different BPSSs along the identified process characteristics (see Table 11), and an analysis of the specific differences between these characteristics.

The third research question used the identified differences in order to come to a framework which identifies the BPSSs that are applicable to a business process. The framework had to meet the following design requirements:

- DR1. The framework has to be understandable for Deloitte consultants.
- DR2. The framework has to be understandable by clients.
- DR3. The framework has to address specific process characteristics.
- DR4. The framework has to show which BPSSs are applicable to a process.
- DR5. The framework has to show which BPSSs fits best to the process.

Finally the fourth research question focused on the validation of the framework. From the validation became clear the framework meets DR1, DR3, DR4 and DR5. DR 2 could due to time restrictions not be tested during the validation. Although the framework is designed to be understandable by only asking questions that can be answered with yes or no and addressing specific characteristics of a process, this can only truly be validated by putting the framework into practice.

The goal of the thesis was defined as “To identify the processes characteristics an ACM system is applicable to and to structure this information in a framework that assists Deloitte in determining the applicability of ACM systems to business processes.” Concluding from the research questions this goal is achieved. Academic literature and vendor interviews are combined to come to a valid set of characteristics ACM systems are applicable to and subsequently the framework assist Deloitte in determining the applicability of ACM systems by showing in a detailed way which process characteristics are supported by the system.
8.2  PRACTICAL CONTRIBUTION

The main problem of Deloitte as that there was no structured way of deciding when ACM was an applicable BPSS for their client’s business processes. The underlying problem was that there was no knowledge available within Deloitte about the process characteristics ACM is able to support.

In order to address these problems this research starts with providing Deloitte with knowledge about the applicability of ACM systems. Although many employees had their own ideas of processes ACM is applicable to already, this research proves ACM systems are indeed applicable to knowledge intensive processes, and provides Deloitte with a list of 13 KiP characteristics from which the prove is grounded in literature and practice. This creates a common understanding within Deloitte about the process characteristics ACM is applicable to, solving the problem of the lack of knowledge within Deloitte about the applicability of ACM systems.

Subsequently the research uses these characteristics to assess other business process support systems along these process characteristics. Which results in an analysis of how these business process support systems differ from each other in supporting the (or not supporting) the different KiP characteristics.

Subsequently these differences are translated to a framework which addresses specific process elements in order to decide which BPSSs can be applied to a business process and which BPSS supports the process in the most ways and is therefore the best applicable BPSS for the process. This framework is tested by means of four real life situations (cases). The framework predicted the BPSS used in each case as the best BPSS for that case, proving the internal validity of the framework.

The framework provided by this thesis provides Deloitte with a scientifically grounded and valid approach for predicting the applicability of the investigated BPSSs to knowledge intensive processes. The framework gives Deloitte an easy and understandable tool for showing their clients which BPSSs are applicable to their business processes and why certain systems are or are not applicable. It therefore addresses the problem stated in the beginning of the thesis “Deloitte does not have a structured way of deciding whether ACM is an applicable solution for a business process” and reached the goal of the thesis by identifying the process characteristics ACM systems are applicable to and translating these characteristics to a framework that predicts the applicability of ACM.

8.3  THEORETICAL CONTRIBUTION

The thesis pays it contribution to literature by proving the KiP characteristics as defined in literature can indeed be supported by ACM systems and extending these characteristics with the need for transparency, the orientation towards the client and the frequency with which these processes should be executed. Furthermore it gives a clear overview in to which extent other BPSSs can support these KiP characteristics assessing the concrete advantages that can be gained by applying ACM systems to the right processes.

Specifically this thesis confirms KiPs are indeed goal oriented, can have emergent goals, are event driven and require different data sources. Although these characteristics were weakly supported in literature they were unanimously supported by ACM vendors. Furthermore all these process characteristics were found during the case study in an ACM process.

Lastly the thesis provides a framework which is able to assess whether different BPSSs are applicable to a business process and which BPSS supports the process in the best way by means of asking simple and concrete questions in order to analyze this process. It makes a difference between characteristics that BPSSs can support, characteristics that BPSSs can support but are not ideal and characteristics that the BPSS cannot support. This way the framework provides a transparent and useful outcome about which kind of systems should be used in order to manage the business process to the best extent.
8.4 LIMITATIONS
Every study, especially master thesis projects [15], has its limitations, this section describes the most important limitations of this project:

1. The framework focusses on knowledge intensive process characteristics since it started from identifying the processes ACM systems are applicable to. Although knowledge intensive processes are a large part of each organization these days [13], organizations can also contain non-knowledge intensive processes. The framework only gives an overview of KiP characteristics however it might be that extra characteristics have to be identified in order to incorporate non-KiPs as well. This would increase the completeness of the framework.

2. The thesis focusses on determining the applicability of BPSSs to process characteristics. Looking back it might have been better to incorporate the paradigm as a whole and decide on processes’ compliance with the paradigms to apply a certain kind of BPSSs. Involving the complete paradigm however would extent the scope to far to finish the thesis within the given time restrictions.

3. The frequency characteristic in the framework is still an ambiguous characteristic. The opinions are divided about whether the frequency of these processes should be large or rather small. Presumably this is a characteristic that depends on the costs of implementation of an ACM system and the benefits it would produce e.g. if a process is only executed once I might not be lucrative use an ACM system. A costs/benefit analysis is out of the scope of this research.

4. It would be preferable to perform an extra round of interviews reflecting on the validation outcomes. This way a more detailed conclusion could be made about the BPSSs that were not marked as best applicable but still applicable. Unfortunately due to time restrictions this was not possible.

5. The groupware case in the validation session dates from 1996, this is quite old and although the situation is representative for a groupware situation it might be possible the company uses another BPSS today. Unfortunately this could not be checked.

6. The intention was to apply data triangulation by interviewing Vendors, consulting academic literature and interviewing Deloitte experts. However since there was little to no experience with ACM within Deloitte, Deloitte employees could not be considered experts on the ACM field leaving only two reliable sources of information. Another valuable extra resource would be to interview organizations that make actual use of ACM systems. These contacts proved hard to obtain and were not present within Deloitte. It was decided that trying to achieve these contacts would be too time consuming.

7. Due to time restrictions only four cases could be obtained in order to validate the framework. Although the framework reached the right conclusion in all four cases, not every question could be separately validated with this limited amount. Although this limitation might have influence on the internal validity of the framework, the questions were all embedded in literature and practice reducing the chance for false statements.
8.5 Future research

The ACM paradigm has become increasingly popular lately and is an active area of research [12]. This research as well provides plenty of possibilities for future research regarding Adaptive Case Management.

1. This thesis is aimed at providing Deloitte with a framework to advise their clients upon the applicability of ACM and other business process support systems based on the applicability of such a system to a process. Another reason for clients to decide upon which business process system to choose for their processes might be the costs of the system against the benefits it provide. An interesting study might be what the cost factors are in implementing such a system and what the benefits are the system produces. The combination of the framework this thesis provides and a cost benefit analysis might reach a more complete advice for the client.

2. This framework focusses mainly on the business process support systems as a whole and does not elaborate much on the specific connection between technological components of the system and these process characteristics, although these are briefly described. A useful research would be to search for a connection between the defined process characteristics and specific technological components of the system. This makes it easier to include BPSSs, other than the ones addressed in this thesis in the framework.

3. Lastly this thesis focusses mainly on isolated business processes in order to identify specific process characteristics. An interesting area of research is to investigate the applicability of ACM enterprise wide. Organizations possess a multitude of different interconnected processes. It might be interesting to see what an enterprise should look like in order to implement ACM enterprise wide successfully.
9. Bibliography


[33] Pega, "Case management," Amsterdam, @2015.


Figure 7 - Deloitte organization chart

On the highest level of the organizational chart there is Deloitte Touche Tohmatsu Limited, which represents the complete network of Deloitte Establishments across the world. All these establishments (members) operate according to the customs and legal standards of their own geographical location, each with their own functions which do not necessarily have to be the same for each member firm. The project takes place within Deloitte Netherlands.

Deloitte Netherlands contains a number of functions which are Audit, Task & Legal Advisory, Consulting, Financial Advisory, Innovation and Staff & Support. On this level the master thesis is conducted within the consulting function. The consulting function engages in advisory on a broad range of topics, which leads to the so called service areas, Strategy and Operations, Technology and Human Capital [48].

As can be seen in Figure 7 the technology box is highlighted on this level. The technology service Area advises, both public and private clients, on the alignment of business and IT. The service area advises its clients in a lot of different areas namely, Deloitte Digital, IT Strategy, SAP solutions, Enterprise Architecture, Program Leadership, Oracle Solutions, Client Solutions and Business Intelligence & Analytics [48].

The Enterprise Architecture department, advises on the adequate alignment of business processes with data-, application- and integration-technologies. It helps their clients in coping with the many changes this environment is subjected to, by an integrated approach which includes business architecture, business process analysis and BPM. Within this service line three subgroups exist, Enterprise Architecture, BPM and Enterprise Content Management [48].
On this lowest level the BPM sub group specializes in setting up a long term process architecture which supports the re-use of processes for projects. It advises on design and implementation and configuration of case management to support processes and extracts analyses and validates process data to give a fact based insight and advice on how processes within an organization really work [49]. Although the thesis overlaps contains aspects of all four subgroups, BPM will be the focus area.
APPENDIX B

RELATED BUSINESS PROCESS MANAGEMENT PARADIGMS
In this section, related paradigms are briefly discussed along with their corresponding BPSSs. The BPSSs discussed in this section are WfMSs, PCM systems and groupware systems respectively.

Workflow management
WfM is a paradigm consisting concepts, methods and techniques to support the design, administration, configuration, enactment, and analysis of business processes through means of explicitly mapping the processes in the form of tasks that have to be performed [1]. As the definition implies, WfMS’s main focus lies on the process, which has to be pre-defined. A process progresses by means of tasks that need to be executed and a worker needs to be aware of the tasks he needs to perform and their sequence.

Nowadays workflow management systems (WfMSs) are well established within organizations and support business processes in a threefold of ways [12]:

- WfMSs liberate human actors from routine work they need for coordination,
- WfMSs offer a higher quality by offering at least the work which is required to deliver the preferred services to the worker.
- WfMSs provide a higher efficiency by offering the worker at most the work which is needed to acquire an acceptable result.

WfMSs are process oriented [2, 12, 8], which means they focus on a sequence of tasks that have to be performed in order to complete the process. These tasks and their sequence have to be structured explicitly before executing the process [13, 9]. This means every possible task a user might have to perform in order to complete a process, and the sequence of these tasks, have to be defined before process execution. This provides a lot of support for a worker, since the system shows the worker exactly which task he/she has to perform next. On the other hand WfMSs leave little room for flexibility since there is only little room for modelling of exceptions, which makes reacting to unexpected events that influence the process more difficult [2, 8, 12].

An example of a process to which is managed by a WfMS is depicted in Figure 8. The process concerns the production of a specific car. Although small varieties can occur in this production line (a car can be red or blue and can contain an air-conditioning or not) the process is largely the same every time and can be automated to a high extent and the WfMS is able to provide the worker exactly which tasks he needs to perform in order to deliver a car meeting all quality standards (see Figure 8).

Production case management
Production case management (PCM) is defined as “A highly specialized form of case management which provides a certain amount of flexibility but is made for more repetitive patterns” [4, 9]. Just like CM, PCM revolves around a case instead of a process [2, 4]. There does not necessarily have to be a
predefined process and the paradigm relies on knowledge workers to make decisions based on case related information available in order to reach their goal [28]. The freedom knowledge workers perceive is restricted by authorization, business rules and legal regulations and the paradigms relies on collaboration between knowledge workers and transparency [28].

Compared to ACM, PCM is less focused at providing flexibility and limits knowledge workers in their freedom to a greater extent [28]. Knowledge workers receives some flexibility in working towards their goal, however there are certain milestones defined in the process that cannot be changed.

Swenson describes a PCM system as “an approach to supporting knowledge workers which is programmed by specially trained programmers to produce a CM application” [9]. Key to this paradigm is that, these systems contain pre-programmed tasks, knowledge worker can decide to execute or not and in what sequence [8, 9]. A PCM system shows progress by the achievement of certain goals [9] which again are achieved by obtaining certain data elements. PCM provides workers with flexibility to decide how to obtain goals however it restricts this flexibility by the modelling of business rules and legal regulations [28]. Note that this system does not allow the knowledge worker to make on the fly adaptions to the system, like adding new tasks that can be performed.

An example of a process supported by a PCM system can is depicted in an immigration process. A PCM can provide the worker with a checklist of documents that have to be received and filled out (e.g. the immigrants passport and some immigration forms) in order to reach a certain goal (deciding about the approval of an immigration request). The worker should use his own expertise the find out how to obtain these documents and can make decisions to a certain extent whether there is enough information gathered to proceed in the process (see Figure 9).

![Figure 9 – Example of a PCM process](image)

**Groupware**

Groupware provides systems aimed at collaboration and communication between users. Groupware is completely unstructured and therefore offers a high extent of flexibility [13]. Groupware is completely process-unaware, meaning it cannot provide support in this sense. Instead groupware is made for knowledge workers to share data elements, stressing the data-centric nature of groupware systems. These collaborative features are bounded by rules that mediate group interactions and work practices, like organizational policies and protocols [46].

Examples of groupware focused on communication are, instant messaging, which allows users to send each other text/voice/video messages which pop up in real time at the receiver. Video conferencing is another example of groupware technology, which allows participants in different locations to see and hear each other from a different location [50]. From a collaboration point of view, SharePoint is a fine example. SharePoint is a tool aimed at forming solutions through collaboration. It is a tool for organizing, sharing and using information safely from almost every device with a web browser [51].

An example of how groupware can support workers is the writing of a research paper. It makes no sense to define a process for writing a research paper since the topics are often too different. However when multiple scientists are working on a paper together they can make use of groupware
systems to share information and communicate what they wrote and adaptations they made (see Figure 10).

![Figure 10 – Example a groupware environment](image)

**9.1.1 Oversight paradigms**

Based on the information presented in the former sections the different paradigms can be distinguished based on a couple of criteria which are summarized in Figure 11.

Firstly the focus of the different paradigms differs from each other. The focus of workflow management lies very much on the process itself (process centric), while the focus of production case management and adaptive case management lays on a case and its related information (data centric) [4, 2]. Lastly groupware’s focus lays mainly in collaboration and communication between knowledge workers [46].

Secondly the way of making process progression in the different paradigms differs from each other. In workflow management progress is made is through completion of tasks in a predefined process. Although a process works towards a goal eventually, the focus lies on a pre-defined sequence of activities that are have to be executed [4]. The progress of PCM and ACM is made through decisions based on case related data [4]. It is hard to speak of progress in a groupware paradigm since groupware is not a process aware system. However decisions are made based on data [46].

Thirdly there is the dependency of the progression in a process on a worker. In WfM a worker is guided in what to do and a worker is very limited in making decisions creating a low dependency [5, 22, 12]. In PCM the dependency is larger already. Although a worker is still restricted in the activities he/she can perform, he/she can decide whether he/she executes the activities and in which sequence [20]. In ACM the dependency on the knowledge worker is high since the knowledge worker cannot only decide on the sequence of activities [2, 20]; he can also decide to perform completely new activities that have never been executed before (within regulations). Lastly groupware also relies on a knowledge worker to a large extent since there is no pre-defined process; again a knowledge worker is free to move within the modelled restrictions [46].

Lastly the paradigms could be placed on a continuum of providing flexibility. With WfM providing the least flexibility, followed by ACM, PCM and groupware respectively.
### Figure 11 - Different paradigms

<table>
<thead>
<tr>
<th>Main focus</th>
<th>Workflow management</th>
<th>Production case management</th>
<th>Adaptive case management</th>
<th>Groupware</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Process sequence</td>
<td>Data</td>
<td>Data</td>
<td>Data</td>
</tr>
<tr>
<td>Progress progresses through</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Dependency on knowledge worker</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX C

### CHARACTERISTICS KNOWLEDGE INTENSIVE PROCESSES FOUND IN LITERATURE

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1. Knowledge driven</td>
<td>Progress is made through satisfaction of knowledge requirements, experiential knowledge and the impact of a knowledge worker on the process.</td>
<td>e.g. in an assembly line the worker the progress depends on finishing a certain part of, for example, a car. In an immigration process the process progresses based on information documents obtained about the immigrant and decisions made by the knowledge worker.</td>
</tr>
<tr>
<td>C2. Collaboration oriented</td>
<td>Process creation, management and execution occur in a collaborative multi-user environment where human-centered and process-related knowledge is co-created, shared and transferred between individuals and enterprises.</td>
<td>e.g. process with a low collaboration level only exchange input and output as at an assembly line. Processes with a high collaboration level share information in order to reach their goal, as in an immigration process where different departments have to exchange information about a person in order to decide whether this person can get a residence.</td>
</tr>
<tr>
<td>C3. Unpredictable</td>
<td>It might not be possible to define tasks, their sequence, events that are going to take place, and required data sources before initiating the process and the process might change during execution.</td>
<td>e.g. In an assembly line of a car the actions and course of actions can be predicted end to end and the execution of certain tasks lead almost always to the same results. However in a diagnostic procedure of a patient the outcome and order of tasks is highly patient-specific. Also its evolution is subject to unpredictable situations the patient finds itself in (which a doctor cannot control).</td>
</tr>
<tr>
<td>C4. Emergent process</td>
<td>The process evolves gradually based on the state of the process and knowledge that becomes available by achieving goals.</td>
<td>e.g. In an assembly line the tasks and their order are defined end to end already, in an immigration process new data, for example the immigrant has committed a crime in his past, may influence the next task.</td>
</tr>
<tr>
<td>C5. Goal-oriented</td>
<td>The process evolves through achieving certain goals and milestones, instead of completing activities.</td>
<td>e.g. In an assembly line the an employee focuses on finishing his task in the line. In an immigration process employees are working towards a goal, which is being able to decide whether the immigrant gets a residence.</td>
</tr>
<tr>
<td>C6. Emergent goals</td>
<td>The goals evolve gradually, based on the state of the process and knowledge that becomes available by achieving earlier goals.</td>
<td>e.g. In an immigration process the goal is clear, deciding whether a person gets a residence, however in a process with multiple stakeholders the outcome of an task may decide whether the goal is to meet the requirements of one stakeholder, or meet the requirements of another.</td>
</tr>
<tr>
<td>C7. Event driven</td>
<td>The process is dynamic and able to react to events that affect the process state, process-related data and knowledge, and process execution context and environment.</td>
<td>e.g. An assembly line of a car finds itself in a relatively stable environment (once a year safety and environmental regulations can change). However a law firm constantly has to deal with legal changes that immediately influence their work.</td>
</tr>
<tr>
<td>C8. Compliant</td>
<td>Participants may be influenced by or may have to comply with constraints and rules that drive actions performance and decision making.</td>
<td>e.g. In an assembly line a worker has a very clear job and the tasks he has to perform are documented explicitly (this is not rule driven), in a KIP more flexibility is needed e.g. A scientist has to hand in a research paper before a certain deadline, meeting a certain number of pages etc.</td>
</tr>
<tr>
<td>C9. Non-repeatable</td>
<td>The process varies every time when executed, although parts of the process may be similar the complete structure of the process usually varies.</td>
<td>e.g. An assembly line of a car has a couple of variations (the car can be green or blue, contain air-conditioning or not etc.) the amount of choices can still be modelled. A complex surgery however can have a lot of choices considering the situation of the patient, too many to model.</td>
</tr>
<tr>
<td>C10. Requiring diverse data sources</td>
<td>The process requires information and data from different data sources including both structured and unstructured information.</td>
<td>e.g. at an assembly line the process progresses by workers finishing a certain part of, for example, a car this requires a structured guide which explains which steps have to be taken. An intensive screening of an immigrant at an immigration process may require information from multiple sources (diverse data bases) and multiple structures (text, video, audio).</td>
</tr>
</tbody>
</table>

Table 18 - Process characteristics KIPs
APPENDIX D

TEMPLATE VENDOR INTERVIEWS

1. **Introduction:**
   a. Personal introduction of interviewer and interviewee
      i. Make sure to identify role in the company.
   b. Interviewer introduces research project & interview approach

2. **Company description**

   Questions to sketch a profile of <<company name>>.
   a. How would you describe the core business of <<company name>>?
   b. Since when does <<company name>> engage into adaptive case management systems?
   c. Who are the main customers of <<company name>>’s systems?
      i. Why these particular customers?
   d. How does a sales process work?
      i. Who is involved?
      ii. Do customers ask you for a specific system or do you advise a system?
      iii. Does <<company name>> analyze the suitability of implemented system?
   e. Why did <<company name>> decide to engage in adaptive management systems?
      i. Push or pull?

3. **Definition adaptive case management system:**
   a. How would you describe case management?
      i. Do you think adaptive case management is interpreted the same across the industry?
   b. What kind of processes do you think adaptive case management is especially suitable for?
      i. Make sure to avoid vague terms like complex, flexible etc.
   c. Which features of adaptive case management make ACM suitable for these processes?
      i. Try to ask per mentioned characteristic in 3c.
   d. Why are other systems not suitable for these processes? Are there alternatives?
      i. WfMS, BPM, Groupware
   e. Do you notice a certain industries make more use of ACM than others?

4. **Evaluation**
   a. Looking back on successful projects, what are the main advantages your customers perceive of the case management systems?
   b. Are there any drawbacks <<company’s name>> customers’ experience?

5. **Topics suggested by interviewee**
   a.
   b.

6. **Closing**
   a. What does the future hold for <<company’s name>> and adaptive case management?
APPENDIX E

INTERVIEW REPORT PER VENDOR
Pega

This section describes an interview conducted with Pega. It reflects an assessment of the interviewee along the vendor requirements, a description of the processes the ACM system is applicable to and a description of how their system supports these processes. In the interview the characteristics of KiPs and requirements of ACM systems as derived from literature are used as guidelines and referred to when appropriate.

1. Assessment interviewee

The interviewee fulfills the function of principal alliances consultant at Pega and is an expert on PegaSystems (VRQ1). In his function he supports partners of Pega developing business with PegaSystems, which gives him insights in client processes (VRQ2). In doing this the focus lies heavily on the client which is why a project is only successful when the client has accepted and implemented PegaSystems (VRQ3).

2. Assessment ACM system

Pega defines ACM as an infrastructure in which an unlimited amount of data elements summarized in cases, are organized in such a way you can adapt ad-hoc. Pegasystems is aimed at being easy to operate for business users (R10), making it possible for them to adapt the system by creating new tasks during run time and react to the unpredictable nature of business processes (R1). These tasks can be structured in a hierarchical way as a so called “child” of an over coupling task (R7). All these tasks are structured around a network of specializations and generalizations. When these ad hoc created tasks prove to be useful, a worker can choose to share them with coworkers who can use the task in a comparable situation (R2). Furthermore PegaSystems is best applied in a situation in which it derives data from multiple data sources and providing it to the user in a relevant way, giving the user a clear view of a case (R8, R4). The user again can make decisions based on this information in order to reach the goal he has committed to (R6). It is however possible the user has to complete certain sub-goals, before being able to reach the end-goal (R9). The system consists 183 elements on which dynamically can assign roles to workers (R7), this makes it also transparent to see which worker is responsible for which part in a case (R3).

3. Process characteristics

According to Pega ACM systems are applicable for processes that find themselves in problem situation A, and need to go to situation B which provides a solution (C5). How to get to this solution is highly dependent on the skills and capabilities of the knowledge worker who has to reach this goal by gaining information and act upon this information (C1). Often the process towards these goals cannot be predicted upfront, because there are too many uncertainties (C3). Besides the situation uncertainty, there is also the possibility of events taken place during the process which influence the process that can often not be mapped upfront (C7). The process becomes clear as the knowledge worker gathers more information and reaches milestones (C4, C6), by consulting data bases or talking to colleagues (C10). Although the milestones are frequently set in advance, Pega offers the possibility to make the add or alter milestones during process execution. This is also why ACM thrives in processes in which people have to collaborate by sharing information with one another (C2). A not is that the collaboration is mainly executed within a case, and not so much between cases. Like stated before the processes are highly situational and case dependent which means that executing a process multiple times does not guarantee the same output (C9). The workers usually have to comply with business rules in their work, which restrict them in tasks they can perform or data they have
access to (C8). Lastly the process should embrace enough volume to at least define process elements, to make it profitable to implement an ACM system (C13). Although Pega offers the possibility to keep track of activities of workers, their motivations and their results, this is not often done by organizations. Pega however does offer the possibility to keep track (C11).

They focus on business process which find themselves in problem situation “A” and have to reach situation “B” (C5). How to get to this point is up to the knowledge worker, and the process depends heavily on the implicit of the knowledge worker. The knowledge worker reaches its goal by acquiring knowledge on which he can base decisions to proceed in the process (C1). The way from “A” to be is often complicated, as ACM is suitable for simple processes. A process gets complicated when the variation becomes too much for a worker to handle (C9), in terms of possible decisions and parameters. Furthermore the worker often has to receive data from multiple sources and being able to combine this data to come to his decisions and conclusions (C10). Besides the expected tasks a knowledge worker can execute a so called “escalation” or exception can occur which is not possible to predict in advance (C3). Pega also states that although the activities do not have to be clear in advance and can gradually emerge (C4) the outline of the process should be clear which means the goals should be known in advance. These processes usually take place in a collaborative environment (C2) which includes collaboration between individuals, departments but also collaboration with the client. Continuing on the client, ACM is applicable to processes which have to provide a tailor made service/product for the client (C11). Lastly the process should incorporate enough volume in order to make an ACM system beneficial (C12).

IBM

This section describes an interview conducted with IBM. This section reflects an assessment of the interviewee along the vendor requirements, a description of the processes the ACM system is applicable to and a description of how their system supports these processes. In the interview the characteristics of KiPs and requirements of ACM systems as derived from literature are used as guidelines and referred to when appropriate.

1. Assessment interviewee

The interviewee fulfills the function of ECM client solution professional and is an expert in the IBM ACM system (VRQ1). In his function he consults clients on the use of IBM software and is therefore aware of how ACM systems should be applied to client’s business processes (VRQ2). From the interview becomes clear he is involved in evaluation procedures with clients to evaluate the performances of IBM software (VRQ3).

2. Assessment ACM system

From a technical perspective the ACM system aims to provide its knowledge worker with relevant data which enables him to make decisions and gives him a clear view over a case and its context (R4, R8). The user interface of IBM is dynamic which means it shows data and possible actions specifically for a worker, based on his responsibilities and history (R5). This also makes it transparent to see which worker performs which task and comes to which result (R3). It is possible for users to define tasks ad-hoc (if they have the authority) (R1), and it is possible to share these ad-hoc tasks with other users if proven useful (R2). Besides ad hoc tasks there are also mandatory tasks involved, which have to be performed to make progress and optional tasks, tasks the knowledge worker can decide to perform or not. These optional tasks become available at a certain point in the process. Furthermore there are discretionary tasks that are optional but can be performed at any point in the process. This amount of different tasks enables IBM systems to focus on the goal and not define the process explicitly upfront (R6). It is possible that certain tasks become mandatory based on the progress of the process (R9, R7). Lastly they state one of the main benefits clients perceive is the lack of custom code and the ease of use for business users (R10).
3. Process characteristics

The first thing IBM looks at when assessing whether ACM is an appropriate system for the analyzed business process is predictability (C3). If it is possible to completely model a process from beginning to end a workflow would be suitable solution. However when a process is less predictable ACM comes into play. This can be because it is unpredictable what initiates the process, but also dependent on outside events that may influence the process which are out of your control (both internally as externally) (C7). This unpredictability is also caused by (changing) internal or external rules influencing the process over time (C8). Especially with long lasting processes, legal regulations or internal regulations that influence the decision making of the knowledge worker. This is also why these processes focus on reaching certain goals rather than the process itself (C5). The achievement of these goals can define next goals and tasks (C4, C6). The next thing IBM assesses is how knowledge intensive the process is. In pure BPM solutions only structured data is of importance (with a risk factor of higher than 0,2 we go one way, else another way). In ACM unstructured data plays a role as well which the knowledge worker has to read and interpret to base his decisions upon (C1). Based on the knowledge gathered during the process he can assess which tasks he needs to perform next and can he change the (sub) goal he is working towards (C4). The knowledge worker usually has to derive this data from multiple sources which can be structured and unstructured (C10). A next criteria, which is mainly distinctive between ACM and groupware processes is the auditability (C11). When it is desired to make a process transparent and auditable ACM would provide a good solution. Another distinctive criteria between ACM and groupware processes is that groupware processes usually do not involve any workflow because they are to unique, ACM processes are usually unique as well but still contain parts that can be re-used even though usually the complete process itself is non-repeatable (C9, C13). Lastly due to its content oriented perspective, ACM is especially applicable in environments with lots of knowledge exchange between workers, organization but also with the customer (C2).

Be Informed

This section describes an interview conducted with Be Informed. This section reflects an assessment of the interviewee along the vendor requirements, a description of the processes the ACM system is applicable to and a description of how their system supports these processes. In the interview the characteristics of KiPs and requirements of ACM systems as derived from literature are used as guidelines and referred to when appropriate.

1. Assessment interviewee

The interviewee of Be informed is the Chief Operating Officer of the company. He has a lot of experience as employee of Be Informed which implies a good understanding of Be Informed’s ACM system (VRQ1). Furthermore he has experience with implementation of Be Informed at client’s processes (VRQ2) and has a good understanding about the benefits and challenges the client’s perceive once Be Informed’s ACM system is implemented (VRQ3).

2. Assessment ACM system

The ACM system of Be informed can support workers performing these KiPs in numerous ways. First of all the system automates the routine tasks involved in the process, so the worker can focus on the creative part of the job. Secondly the system provides data e.g. in the form of documents, to the knowledge workers to support him/her in the creative part of the process (R8). By providing a wide range of contextual information they give the worker a clear view of a case and how it evolves (R4). It compares the current case with earlier cases causing the system to evolve (R2). They provide flexibility during runtime by enabling the worker to decide for himself whether he performs a task or not and allow a worker to create new tasks when necessary (R1) these tasks can be shared with coworkers if proven useful and embedded in the system (R2, R7). This can be done in an easy intuitive way by business users (non-technicians) (R10). The rules influencing the process can be
adapted during run time as well, causing this change the course of the process completely, the system will automatically calculate a new path in how to achieve the goals. Just like these rules the rules that determine the authorization of workers can be adjusted as well during run time (R5). The system lets the process evolves by the achieving of goals and sub goals (R6). Which also means usually certain sub goals have to be achieved to arrive at the main goal (R9)? Lastly one of the goals of the ACM system is transparency. The tasks and responsibilities of workers become transparent along with their progress (R3).

3. Process characteristics

Be Informed states that ACM is applicable to knowledge intensive processes. This means workers should possess contextual knowledge, but also process related knowledge in order to make progress in a case (C1). Contradictory to more traditional processes knowledge is not physical which has the advantage it is not bound to physical rules. This means the sequence of activities becomes less relevant and the process becomes emergent since the knowledge worker can decide how to perform the process based on retrieved information (C4). The knowledge worker plays a central part in deciding how to achieve the goals he committed to (C5). Based on gathered information these goals can change as well (C6). In doing this he has to obtain knowledge from various sources to base his decisions upon (C10). His decisions however are bounded by business rules (C8). The rules can be internal of external and are often dynamic, influencing the process (C7) and making the process unpredictable and situational (C3, C9). Lastly ACM is especially applicable in processes where people have to collaborate by sharing information (C2). Lastly the interviewee mentions ACM can give a clear view on how a process develops and who performs which task to reach which goal, meaning ACM can be applied to processes where transparency is required (C11).

ISIS Papyrus

This section describes an interview conducted with ISIS Papyrus. This section reflects an assessment of the interviewee along the vendor requirements, a description of the processes the ACM system is applicable to and a description of how their system supports these processes. In the interview the characteristics of KiPs and requirements of ACM systems as derived from literature are used as guidelines and referred to when appropriate.

1. Assessment interviewee

The interviewee from ISIS papyrus is an academy manager and has been working at ISIS papyrus since 1999 which gives him a good understanding of ISIS papyrus systems (VRQ1). In the past he has been senior project manager in which he manager implementation of ISIS papyrus at clients worldwide (VRQ2). From the interview appears he has a good understanding about the challenges and benefits clients receive after implementation of the ACM system (VRQ3).

2. Assessment ACM system

The ACM system of ISIS papyrus completely let go of the process view and rather focusses on the content that is needed to manage a certain case (R8). Workers need to be provided with the right information in order to make decisions. This information should give the worker a complete overview of a case (R4) however the data should remain relevant for the worker in a specific function. For example a manger might have the possibility to view the progress of other workers (R3). To cope with the processes the ACM system it also focusses on achieving goals rather than the process (R6). The worker can choose from a variety of tasks and can execute them in every sequence he sees fit. When necessary he can define new tasks in order to achieve a goal (R1). The creation of a task is usually structured in a hierarchical way (R7) and can, if proven useful be shared with other workers (R2). The goals and tasks can be structured in such a way though that certain sub goals have to be achieved in order to reach the end goal which means logical dependencies between tasks and goals.
have to exist (R9). Lastly the aim of ISIS papyrus is to improve business-IT alignment by cutting IT largely out of the equation and letting business users develop and adapt the system itself (R10).

3. Process characteristics

ACM systems, according to ISIS Papyrus, are especially suitable for collaborative processes (C2). They state the processes are all about people. This includes collaboration between individuals and departments, but also collaboration with the customer. The workers work towards a specific goal (C5), but which tasks to complete and in which order are might not be known in advance (C3). Instead the course of the process emerges while executing it (C4 and C6). Workers can look to previous situations however it is not guaranteed that these tasks lead to the same result. Usually parts of previous processes are used, however processes are usually not executed the same way twice (C9). On top of that it can also occur that there is a situation that never occurred before and the worker has to react in a way that has never been done before (C3). Once a process is executed usually the situation changed and it has to be performed in another way the next time. These processes depend because of this on workers who know their business and know by experience what has to be done in a certain way (C1). In order to be able to do this, he needs data from various sources (C10). The process is often subject to business rules that influence the process (C8). Lastly the dependency of the process on its context (C7) is stressed, which might directly influence the flow of the process.

Formetis

This section describes an interview conducted with Formetis. This section reflects an assessment of the interviewee along the vendor requirements, a description of the processes the ACM system is applicable to and a description of how their system supports these processes. In the interview the characteristics of KiPs and requirements of ACM systems as derived from literature are used as guidelines and referred to when appropriate.

1. Assessment interviewee

The interviewee of Formetis fulfills the role of director, he helped developing the ACM system of Formetis giving him a deep understanding of this system (VRQ1). He has been involved in a lot of implementations at customer processes (VRQ2) and keeps track of the performance of the ACM system once implemented (VRQ3).

2. Assessment ACM system

The system is data oriented and supports its knowledge workers by providing data so they can make the right decisions (R8). This data gives a clear and contextual view of a case which allows the workers to keep an overview (R4). It defines end states which the users should achieve (R6), but also defines logical dependencies between tasks so the users cannot reach the end state at once (R9). The completely eliminated the difference between design and run time, meaning workers can ad hoc create new tasks (R1) and share them with colleagues (R2). These tasks are next logically embedded in the system (R7). The system is able to define tasks per role (R3) which can be created ad hoc (R5). Lastly Formetis states that business users should develop and alter the system which means it should be useable by non-technicians (R10).

3. Process characteristics

According to Formetis ACM systems are applicable to process which involve a demanding client which implies the processes are very client oriented (C12). Often it is not clear how to clear how to meet the demands of client (C4), sometimes the client cannot even define his demands properly
(C6). Because of this cooperation is an important factor in these processes, between individuals but also with the client (C2). The agreements with this client have to be defined by terms of rules (C8). Furthermore the process has to evolve around documents containing data (C1). The process is goal oriented (C5) and depends heavily on the knowledge workers expertise (C1). The knowledge worker can decide how to reach these goals since processes towards the goals are often not predictable and are can change depending on gather information in earlier tasks (C3 and C4). However the knowledge worker is restricted by rules which influence the decisions he can make and the tasks he can perform (C8). Furthermore the worker should be able to handle and interpret data coming from various sources (C10).
## APPENDIX F

### Questions framework

<table>
<thead>
<tr>
<th>Related process characteristic</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1. Knowledge driven</td>
<td>C.1.1 Is the process based on documents and/or dossiers?</td>
</tr>
<tr>
<td></td>
<td>C.1.2 Does the worker have to make decisions in which he is not directly supported by the system? (so based on his own experience and expertise)?</td>
</tr>
<tr>
<td>C2. Collaboration oriented</td>
<td>C.2.1 Is there collaboration between employees based on exchange of exchange of information?</td>
</tr>
<tr>
<td>C3. Unpredictable</td>
<td>C.3.1 Is the sequence of activities known in advance?</td>
</tr>
<tr>
<td></td>
<td>C.3.2 Are all possible tasks that can be executed known in advance?</td>
</tr>
<tr>
<td>C4. Emergent</td>
<td>C.4.1 Does information obtained during the process determine the course of next tasks?</td>
</tr>
<tr>
<td>C5. Goal-oriented</td>
<td>C.5.1 Does the process work towards goals, rather than the completion of tasks?</td>
</tr>
<tr>
<td>C6. Emergent goal</td>
<td>C.6.1 Are the milestones/goals and their sequence known in advance?</td>
</tr>
<tr>
<td>C7. Dynamic environment</td>
<td>C.7.1 Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance?</td>
</tr>
<tr>
<td>C8. Compliance</td>
<td>C.8.1 Does the process adhere to internal business rules?</td>
</tr>
<tr>
<td></td>
<td>C.8.2 Does the process adhere to legal regulations?</td>
</tr>
<tr>
<td></td>
<td>C.8.3 Can business rules change during the execution of the process?</td>
</tr>
<tr>
<td>C9. Non-repeatable</td>
<td>C.9.1 Can recurring process elements be defined in the overall process?</td>
</tr>
<tr>
<td>C10. Requiring diverse data sources</td>
<td>C.10.1 Does the knowledge worker need to derive information from different data sources in order to make progress?</td>
</tr>
<tr>
<td>C11. Transparency</td>
<td>C.11.1 Is it important for stakeholders to track the tasks performed by an employee?</td>
</tr>
<tr>
<td></td>
<td>C.11.2 Is it important for stakeholders to track the decision making of employees?</td>
</tr>
<tr>
<td>C12. Client oriented</td>
<td>C.12.1 Does the client need a custom made solution?</td>
</tr>
<tr>
<td></td>
<td>C.12.2 Does the client need to be informed about the state of his order frequently?</td>
</tr>
<tr>
<td>C13. Frequency</td>
<td>C.13.1 How frequently is the process executed</td>
</tr>
</tbody>
</table>
**APPENDIX G**

**Case 1: Employee course subscription**

| Case 1.1 | Is the process based on documents or dossiers? | Case 1.2 | Does the worker have to make decisions in which he is not directly supported by the system (so based on his own experience and expertise)? | Case 1.3 | Is there collaboration between employees based on exchange of information? | Case 1.4 | Does information obtained during the process determine the course of next tasks? | Case 1.5 | Does the process work towards goals, rather than the completion of tasks? | Case 1.6 | Can goals/milestones, or their sequence, change over time? | Case 1.7 | Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance? | Case 1.8 | Does the process adhere to internal business rules? | Case 1.9 | Is the sequence of tasks known in advance? | Case 1.10 | Does the knowledge worker need to derive information from different data sources in order to make progress? | Case 1.11 | Is it important for stakeholders to track the tasks performed by an employee? | Case 1.12 | Is it important for stakeholders to track the decision making of employees? | Case 1.13 | Does the client need a custom made solution? | Case 1.14 | Does the client need to be informed about the state of his order frequently? | Case 1.15 | How frequent is the process executed? |
|---------|---------------------------------|----------|---------------------------------------------------------------|----------|-------------------------------|----------|---------------------------------------------------------------|----------|---------------------------------------------------------------|----------|---------------------------------------------------------------|----------|---------------------------------------------------------------|----------|---------------------------------------------------------------|----------|---------------------------------------------------------------|----------|---------------------------------------------------------------|----------|---------------------------------------------------------------|----------|
| C1.1   | Yes                             | C1.2     | No                                                            | C1.3     | No                            | C1.4     | Yes                                                          | C1.5     | No                                                           | C1.6     | No                                                           | C1.7     | No                                                           | C1.8     | Yes                                                          | C1.9     | Yes                                                          | C1.10    | Yes                                                          | C1.11    | Yes                                                          | C1.12    | No                                                           | C1.13    | Yes                                                          | C1.14    | Yes                                                          | C1.15    | High                                                         |
|        |                                 |          |                                                              |          |                               |          |                                                              |          |                                                              |          |                                                              |          |                                                              |          |                                                              |          |                                                              |          |                                                              |          |                                                              |          |                                                              |          |                                                              |          |                                                              |          |

**C1.1** As can be seen the researcher and participants agree that the process is document based. This is not typical for a workflow environment, however the case states the information is kept track of in a separate excel document.

**C1.2** Secondly the researchers and participants agree that the system does not rely much on the expertise and knowledge of the worker since the worker does not have to make decisions in which the worker is not directly supported by the system (e.g. the choices he can make are explicitly modeled).

**C2.1** The worker in this process does not have to exchange knowledge with other workers, the only exchange in information considers the structured information in the form of confirmations and a bill. This makes the researcher and participants agree that there is no collaboration based on the exchange of knowledge.

**C3.1** The sequence in this process is very clear. The case clearly describes the order in which the activities have to be performed. The researcher and participants all agree on this point.

**C3.2** Naturally if the sequence of activities is known, all possible activities that can be executed are known in advance as well. It is not likely that the worker has to perform an activity that deviates from the activities defined in the case. Researcher and participants all agree on this point.

**C4.1** Researcher and participants agree that the data obtained during a the process determines the course of the process.

**C5.1** The researcher and 2 out of 3 participants conclude the process is not goal-oriented but rather focused at the completion of activities. The activities can be executed on its own without being aware of the actual goal. One of the participants state that all activities are performed to reach a certain goal, however agrees after discussion that the process indeed works by completion of tasks rather than the achievement of goals.
C6.1 Researcher and participants agree that the goal of this process cannot change over time (note
that although the process is not goal-oriented it still has a goal). Participants suggest to split this
question into two parts.

C7.1 Researcher and participants agree that it is unlikely the worker needs to react to unexpected
events.

C8.1 Researcher and participants agree that the process is submissive to internal business rules, since
a request has to meet certain requirements which are developed internally.

C8.2 The researcher and participants agree that legal regulations do not directly influence the
process.

C8.3 Researcher and participants it is not likely the worker has to react to changing business rules
during the enactment of the process.

C8.4 Researcher and participants agree it is not likely the worker has to react to changing legal
regulations during the enactment of the process.

C9.1 Researcher and participants agree that process elements can be defined which can be reused in
future execution of the process.

C10.1 Researcher and participants agree the employee needs information from multiple data sources
to make progress in the process.

C11.1 Researcher and Participants agree it is necessary to track the tasks executed by the employee.

C11.2 Researcher and participants agree it is necessary to track the decision making of the employee
since the employee has to make a decision whether to approve the request.

C12.1 Researcher and participants agree the product/service a client (course requester) demands is
not custom made. The courses are pre-defined.

C12.2 The researcher disagrees with the participant about the frequent informing of the client. The
researcher claims the client is only informed about the approval of the request but not about the
state of the process.

C13.1 Researcher and participants agree the process is executed with a high frequency.
Case 2: Contracting between a semi-public organization and client (adaptive case management)

<table>
<thead>
<tr>
<th>Case 2</th>
<th>Researcher</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.1</td>
<td>Is the process based on documents or dossiers?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C1.2</td>
<td>Does the worker have to make decisions in which he is not directly supported by the system? (so based on his own experience and expertise)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C2.1</td>
<td>Is there collaboration between employees based on exchange of exchange of information?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C3.1</td>
<td>Is the sequence of tasks known in advance?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C3.2</td>
<td>Are all possible tasks that can be executed known in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C4.1</td>
<td>Does information obtained during the process determine the course of next tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C5.1</td>
<td>Does the process work towards goals, rather than the completion of tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C6.1</td>
<td>Can goals/milestones, or their sequence, change over time?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C7.1</td>
<td>Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.1</td>
<td>Does the process adhere to internal business rules?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.2</td>
<td>Does the process adhere to legal regulations?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.3</td>
<td>Is it likely for business rules to change during the process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.4</td>
<td>Is it likely for legal regulations to change during the process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C9.1</td>
<td>Can recurring process sequences be defined in the overall process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C10.1</td>
<td>Does the knowledge worker need to derive information from different data sources in order to make progress?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.1</td>
<td>Is it important for stakeholders to track the tasks performed by an employee?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.2</td>
<td>Is it important for stakeholders to track the decision making of employees?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.1</td>
<td>Does the client need a custom made solution?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.2</td>
<td>Does the client need to be informed about the state of his order frequently?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C13.1</td>
<td>How frequent is the process executed?</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

C1.1 Researcher and participants all agree that the process is based on documents and dossiers. The case clearly states the product is a complex contract.

C1.2 Researcher and participants all agree on the fact that the workers have to make decisions based on their own expertise in which they are not directly supported by the system e.g. the worker has to decide in collaboration with the client on the requirements of the contract.

C2.1 Researcher and participants agree that there is collaboration between employees based upon exchange of knowledge. The case states clearly that the contract is produced in a collaborative environment. For example the requirements of the contract are determined in collaboration.

C3.1 The researcher and one of the participants states the sequence of activities is not known in advance, while two other participants state the sequence of the activities is known in advance. This was mainly because the case states certain parts are controlled sequences.

C3.2 The researcher and participants agree that not all possible activities can be known in advance. This is mainly induced by the fact that requirements can differ per client. The clients can have very particular requirements that have not been introduced before which may lead to new tasks that have never been performed before.

C4.1 The researcher and participants agree the information obtained during the enactment of the process determines the course of the remainder of the process. Requirements can be adapted during the development and life time of the contract which can possibly change the course of task.

C5.1 The researcher and participants agree that the process works towards goals and milestones (the completion of the contract) rather than the completion of tasks. Knowledge workers need to be aware of the goal of the process in order to be able to execute the tasks.

C6.1 The researcher and participants all agree that the goals and milestones can change over time since the requirements and check points can change over time.
C7.1 The researcher and participants agree that the worker can be influenced by events which occurrence or sequence cannot be determined a priori.

C8.1 The researcher and participants all agree that the process is submissive business rules. The contract has to be developed according to certain internal rules like deadlines.

C8.2 The researcher and participants all agree that a contract has to meet certain legal requirements.

C8.3 The researcher and participants agree that the business rules can change over time as is clearly stated in the case.

C8.4 The researcher and participants agree that the legal regulations can change over time as is clearly stated in the case.

C9.1 The case clearly states the process contains certain elements that are executed in a structured way hence researcher and participants agree that the process contains recurring process elements.

C10.1 Since the contract contains different document the researcher and participants agree that the knowledge worker needs to derive information from different data sources in order to make progress.

C11.1 Since the process contains many stakeholders and has to comply with business rules and legal regulations, researcher and 2 out of 3 participants agree that it is important to track the tasks performed by the employee. The other participants states it is not necessary to track every tasks but rather certain points in the process.

C11.2 Since the process contains many stakeholders and has to comply with business rules and legal regulations, researcher and participants agree that it is important to track the decision making of the employee.

C12.1 The case clearly states that the contract is different for every client making the solution custom made as researcher and participants agree.

C12.2 The client is an active cooperator in the process meaning it should be continuously informed about the progress of the process as researcher and participants agree.

C13.1 The frequency of the execution of the process is estimated to be between medium and low since usually the complete process is performed once per client.
Case 3: Subsidy request at a public organization (production case management)

<table>
<thead>
<tr>
<th>Case 3</th>
<th>Researcher</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.1</td>
<td>Is the process based on documents or dossiers?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C1.2</td>
<td>Does the worker has to make decisions in which he is not directly supported by the system? (so based on his own experience and expertise)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C2.1</td>
<td>Is there collaboration between employees based on exchange of exchange of information?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C3.1</td>
<td>Is the sequence of tasks known in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C3.2</td>
<td>Are all possible tasks that can be executed known in advance?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C4.1</td>
<td>Does information obtained during the process determine the course of next tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C5.1</td>
<td>Does the process work towards goals, rather than the completion of tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C7.1</td>
<td>Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C8.1</td>
<td>Does the process adhere to internal business rules?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.2</td>
<td>Does the process adhere to legal regulations?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C9.1</td>
<td>Can recurring process sequences be defined in the overall process?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C10.1</td>
<td>Does the knowledge worker need to derive information from different data sources in order to make progress?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.1</td>
<td>Is it important for stakeholders to track the tasks performed by an employee?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.2</td>
<td>Is it important for stakeholders to track the decision making of employees?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.1</td>
<td>Does the client need a custom made solution?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.2</td>
<td>Does the client need to be informed about the state of his order frequently?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C13.1</td>
<td>How frequent is the process executed</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Workflow
- Production case management: 90% 90% 90% 85%
- Adaptive case management: 75% 75% 85% 70%

Groupware
- 0% 0% 0% 0%

C1.1 The researcher and participants agree that the process is based on documents and dossiers, since the main product is a request in document form. Furthermore a dossier is made of the client.

C1.2 The researcher and participants agree the worker has to make decisions that are not directly supported by the system e.g. deciding whether the subsidy is granted or not.

C2.1 The researcher and participants agree that there is collaboration between employees based on exchange of knowledge since the worker can choose the consult with employees about the granting of the subsidy.

C3.1 Researcher and participants agree that the sequence of tasks is not known in advance. Within every activity defined, the worker can choose to perform the tasks in any sequence possible.

C3.2 Researcher and participants agree that the possible tasks that can be executed are known in advance. One participant states all possible tasks are not known in advance. It becomes clear with this the participant means that e.g. it is not known how many times the worker needs to ask the client for information. After explaining these concerns the sequence of activities the participant agrees all possible tasks are known in advance.

C4.1 The researcher and participants agree the information obtained in the process determines the course of future tasks e.g. the number of times a worker has to call the client or whether the process continuous in the first place.

C5.1 The researcher and two out of three participant agrees the workers cannot do their job without keeping in mind the goal and milestones of the process. One participant states the process works towards completion of tasks rather than towards a goal.

C6.1 The researcher and participants agree that the goal and milestones remain the same (first completion of intake, then examining the request, assessing the request, deciding about the request and communicate the decision to the client).
C7.1 The researcher and participants agree that the worker does not have to react to unexpected events.

C8.1 The researcher and participants all agree that the process is submissive business rules. The subsidy has to be developed according to certain internal rules like deadlines.

C8.2 The researcher and participants all agree that a subsidy has to meet certain legal requirements.

C8.3 Although the researcher and participant 1 and 3 state the business rules are not likely to change during the enactment of the process, one other participant states that subsidy are usually long lasting requests, making it more likely for business rules to change during the enactment of the process.

C8.4 Researcher and participants agree that subsidies are often long tracks in which regulations can change.

C9.1 Researcher and participants agree that recurring process parts can be identified.

C10.1 The researcher and participants agree that the worker needs to derive information from multiple sources (information from client, information about regulations etc.).

C11.1 The opinions differ about whether it is desired to track every task the worker performs. Some argue the focus should lay on the result, one participants argues that it is desirable to track whether the employee did everything in his/her power to bring the process to a good result.

C11.2 The researcher and participants agree that it is important to track the worker’s decision making, since it is desirable to know why the worker decided to accept/ or reject the subsidy request.

C12.1 The researcher and participant 3 state the order does not have to be custom made since subsidies themselves do not differ. Participant 1 and 2 state that sometimes the amount that is paid out differs.

C12.2 There are multiple contact points with the client, implying the client has to be regularly informed about the progress of the process. This makes researcher and participants agree on the fact that the client has to be informed regularly.

C13.1 The frequency of the process is scored as medium.
**Case 4: New product development at a large consumer business (groupware)**

<table>
<thead>
<tr>
<th>C1.1</th>
<th>Is the process based on documents or dossiers?</th>
<th>Researcher</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C1.2</td>
<td>Does the worker have to make decisions in which he is not directly supported by the system? (so based on his own experience and expertise)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C2.1</td>
<td>Is there collaboration between employees based on exchange of information?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C3.1</td>
<td>Is the sequence of tasks known in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C3.2</td>
<td>Are all possible tasks that can be executed known in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C4.1</td>
<td>Does information obtained during the process determine the course of next tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C5.1</td>
<td>Does the process work towards goals, rather than the completion of tasks?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C6.1</td>
<td>Can goals/milestones, or their sequence, change over time?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C7.1</td>
<td>Is the decision making of knowledge workers influenced by events whose occurrence or sequence of occurrence cannot be determined in advance?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C8.1</td>
<td>Does the process adhere to internal business rules?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.2</td>
<td>Does the process adhere to legal regulations?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.3</td>
<td>Is it likely for business rules to change during the process?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>C8.4</td>
<td>Is it likely for legal regulations to change during the process?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C9.1</td>
<td>Can recurring process sequences be defined in the overall process?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C10.1</td>
<td>Does the knowledge worker need to derive information from different data sources in order to make progress?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C11.1</td>
<td>Is it important for stakeholders to track the tasks performed by an employee?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>C11.2</td>
<td>Is it important for stakeholders to track the decision making of employees?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C12.1</td>
<td>Does the client need a custom made solution?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>C12.2</td>
<td>Does the client need to be informed about the state of his order frequently?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C13.1</td>
<td>How frequent is the process executed?</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

**Workflow**

- **Production case management**
  - 0% 0% 0% 0%
- **Adaptive case management**
  - 65% 60% 65% 70%
- **Groupware**
  - 65% 70% 65% 80%

C1.1 The researcher and participants agree that the process is based on documents since it involves requests and contracts.

C1.2 The researcher and participants agree that the worker needs to make decisions in which the researcher is not directly supported by the system since multiple checks have to be performed.

C2.1 The process involves exchange of knowledge between multiple employees e.g. at the checkpoints. This makes researcher and participants agree that there is collaboration.

C3.1 The researcher and participants agree that the sequence of tasks is not known in advance. Participant three states that it depends on the definition of task. After explaining task is the smallest chunk of work, the participant agrees the sequence is not known in advance.

C3.2 The researcher and participants agree that not all possible tasks can be defined upfront.

C4.1 The information obtained during the process determines the future course of the process (phases to which the idea continuous). Researcher and participants agree on this.

C5.1 The researcher and participant agree the process works towards a goal and milestones (the checkpoints) rather than the completion of activities.

C6.1 Researcher and participants agree that the milestones and goals do not change during the enactment of the process.

C7.1 Researcher and participants agree there is no reason to believe the worker is influenced by events that cannot be predicted upfront.

C8.1 Researcher and participants agree the process is submissive to internal business rules (like the requirements for the development of an idea).

C8.2 The researcher and participant 3 state the process adheres to legal regulations while participant 1 and 2 state this is not true.

C8.3 The researcher and two out of three participants agree that it is unlikely for the business rules to change. One participant states this depends on the length of the process.
C8.4 The researcher and participants agree that it is unlikely that changes in legal regulations influence the progress of the process.

C9.1 Researcher and participants agree that there cannot be any recurring elements detected.

C10.1 Researcher and participants agree the worker needs money from different data sources since different documents have to be collected in order to ensure progress.

C11.1 The researcher and two participants think it is not important to track the employee in every task he performs. They are rather focused on the outcome. One of the participants does think this is important.

C11.2 Researcher and participants agree it is important to be able to track the decision making of the employees to track how the employee comes to a conclusion about an idea.

C12.1 Researcher and participants agree that the client does not need a custom solution. Since the solution is just a decision whether the idea is approved or not.

C12.2 Researcher and participants agree that the clients need to be frequently informed about the state of their idea.

C13.1 The frequency of the process is scored as high, since a large consumer business typically focusses on innovation.