An Impact-oriented Maturity Model for IT-based Case Management

Jana Koehler[a,*], Roland Woodtly[b], Joerg Hofstetter[a]

[a] *Lucerne University of Applied Sciences and Arts, School of Engineering and Technology, Technikumstr. 21, CH-6048 Horw*

[b] *Lucerne University of Applied Sciences and Arts, School of Social Work, Werftestrasse 1 Postfach 2945, CH-6002 Luzern*

Abstract

Case management comprises various complex activities. Consequently, case managers have to balance very diverging requirements and needs, while at the same time facing increasingly complex decisions. *Case management software systems* (CMS) provide capabilities such as information assessment and handling, decision and collaboration management as well as flexible process guidance to support case managers.

When introducing a CMS into an organization, a maturity model of IT-based case management helps in mastering different levels of technology adoption by exploiting technological benefits and carefully addressing associated risks.

In this paper, we propose the C3M maturity model for IT-based case management that links maturity levels with sets of capabilities that are typical for case management in social work, health care, and the handling of complex claims in insurance. The model focuses on the impact of technology and is linked to a map of benefits and risks across five impact areas. Each impact area is characterized by six impact factors that we consider as especially important when managing IT technology adoption within case management.

1. Introduction

Recently, case management practices have been very influential in discussions about the next evolution of business process management and knowledge-intensive work in general [1, 2]. Historically, case management has emerged as a management discipline within social work to ensure the continuity of care in the United States in the 1970/1980 years where social work and health care were extended into a coordinated end-to-end process involving different institutions and professions. Elements of case management can be found much earlier in social work, but the management discipline was coined in this decade. For comprehensive introductions into the field see for example [3, 4, 5].

*Corresponding author

Email addresses: jana.koehler@hslu.ch (Jana Koehler), roland.woodtly@hslu.ch (Roland Woodtly), joerg.hofstetter@hslu.ch (Joerg Hofstetter)

> *Case management is a specific approach for the coordinated handling of complex situations in social work, health care and insurance. A bundle of services is provided to a client based on her/his individual needs in a systematic and cooperative process in order to effectively achieve jointly defined objectives in high quality. Case management coordinates inter-professional and inter-institutional services and respects the autonomy of the clients while preserving resources in the client's and the supporting systems.* [1]

Case management defines how a complex situation is handled and how the services, which respond to the needs of the client, are determined and implemented. It is considered as a coordinated response to a differentiated landscape of offerings that can constitute a solution to a client's complex problem. It has the goal of empowering clients and also often initiates a change in the resource system when necessary. As is observed in [2], "...the knowledge worker in charge of a particular case actively decides on how the goal of that case is reached, and the role of a case handling system is assisting rather than guiding her in doing so." Five phases are commonly distinguished in the client-facing processes of case management, see also Figure 1:

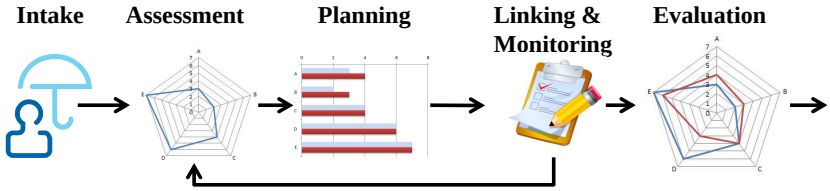

Figure 1: The 5 phases of the case-management process.

1. **Intake**: Is a client in a situation in which case management can and should be applied?
2. **Assessment**: What detailed situation is the client facing? How is the case structured? What services could be of help, reaching which possible objectives?
3. **Planning**: What objectives can be jointly agreed with the client? Which services are possible and can be bundled to achieve the objectives?
4. **Linking and Monitoring**: How are the services put in place and how is the partner network established? How effective are the services?
5. **Evaluation**: Which results and change are achieved in the client's situation before she/he exits the case-management process? Are the objectives met?

Phase 1 covers the entering of a client into the case-management process. Phases 2 to 4 are highly iterative. The assessment often happens in a continuous way leading to changes in the planning and linking of services when necessary. Phase 5 concludes the case management process with a final evaluation.

[1] Definition of case management by the case management network of Switzerland http://www.netzwerk-cm.ch.

In previous work [6], we investigated the capabilities of case management software systems (CMS) and the requirements of case managers. We compiled a set of key capabilities that we related to five different levels of maturity in our C3M maturity model for IT-based case management.[2]

In this paper, we extend the C3M maturity model with a detailed benefits & risks analysis that helps understanding and mastering the impact of IT-related decisions within case management. Our benefits & risks analysis is based on a thorough investigation of impact analyses proposed by various fields. We compile a benefits & risks map, which recombines and extends existing models from the literature to obtain a more holistic view on the manifold aspects of technology-related benefits and risks. At the core of the map are *five impact areas* that are not specific to case management software, but that are widely recognized as relevant when assessing the impact of IT systems. Each impact area is refined with *six impact factors* that allow us to obtain a focused, yet comprehensive view on the potential risks and benefits of a CMS. The impact factors are clearly tailored towards the characteristics of CMS based on the capabilities that we identified in [6] and are thus clearly influenced by the nature of case management work.

We propose our maturity model and benefits & risks map as a methodological guideline for the following types of empirical work:

- The identified capabilities help organizations in determining their requirements when making purchasing decisions for case management software.
- The maturity levels support organizations to clearly identify the stages in which they want to advance their IT technology and help to determine which level of maturity in using IT is appropriate for which organizational processes.
- Software vendors can position their CMS products with respect to capabilities and maturity levels.
- The benefits & risks map allows to steer technology planning and implementation processes towards achieving improved IT value.

Our focus is clearly on case management and case management software systems in the fields of social work, health care, and insurance. However, case management has become a metaphor to characterize knowledge-intensive work. As a metaphor it combines collaborative and complex decision making with high needs in assessing and handling different sources of information. In this sense, our maturity model and benefits & risks map can also be applied to evaluate and manage the introduction of other types of software systems for knowledge-intensive work such as for example software in the fields of business analytics and intelligence.

The paper is organized as follows: Section 2 discusses key capabilities of case management and summarizes the C3M maturity model as presented in [6]. Section 3 extends our model with a refined map of CMS-related benefits and risks based on five

[2]The acronym C3M combines CM, which stands for case management, and 3, which stands for the three aspects our model brings together: maturity level characterizations, benefits, and risks.

key impact areas and a collection of six impact factors for each area. Section 4 reviews related work, whereas Section 5 concludes with a brief summary and discussion.

2. The C3M Maturity Model

Case management is widely recognized as a successful practice for effective service delivery. Three characteristics of case management work stand out: (1) the setting of objectives jointly with the client, (2) a planning phase where the case manager selects possible services, but also needs the buy-in of the client that these services can be applied and constitute a solution to the complex problems faced by the client, (3) the controlling (and revision) of service execution towards achieving the objectives. At its core, case management work thus comprises complex assessment activities as well as coordination, controlling and monitoring. These characteristics can also be found in knowledge-intensive work in general, see for example the discussion in [7]. We find two aspects of case management especially interesting: First, the personalization of the solution for the client, which is a key challenge and trend in the service economy. Second, the role of the business professional that increases in the service economy and for whom information is the key resource, see also [8]. Similar to the case manager, who is instrumental in case management and who balances complex needs and resources in an information-heavy process, knowledge workers face corresponding challenges today.

Table 1 summarizes key capabilities that are required by case managers and that can be found in current CMS independently of the specific technology approach that a CMS implements [6]. The table groups capabilities by functional areas that are relevant for more than one phase of the case-management process: management of the information and data belonging to a case, tracking and obtaining insights into the case history, recording and managing case-related decisions, support for collaboration among case managers and organizations, support for administrative tasks such as benefits or worktime accounting. In this table, we distinguish three levels of IT usage. “Low” means no dedicated CMS is used, but the IT support comes from other tools, e.g., office tools or database applications. “Average” stands for today’s typical CMS capabilities. “Advanced” represents innovative CMS extensions implemented or envisioned by some players in the case-management market.

Information-related Capabilities: Case information is often unstructured. In particular in the context of social work, graphical representations such as genograms or ecomaps are used to capture the situation of a client and to visualize case assessments. Notes taken by a case manager, emails, and interviews are predominant entities of information. When the usage of IT systems is low, many of these information entities are often recorded on paper, whereas others are spread across various IT tools. With the introduction of a CMS, paper-based documents are replaced by electronic solutions and information entities are better coordinated, but duplicated information recording can still happen. With an advanced usage, duplicated information is eliminated and information entities are integrated and checked for consistency. Heterogeneous information sources play a key role in the assessment of a case. At the lowest level, the quality of the assessment depends on the qualification of the responsible case manager who follows organizational guidelines. With the introduction of a CMS, assessments are

Capability	**Degree of IT usage**		
	low	average	advanced
Information	spreaded/paper-dominated	coordinated	integrated & consistent
- visualization	genogram, ecomap (paper)	diagrams	task-specific
- forms	simple	templates	intelligent
- access	individualized	role-based	inter-organizational
- assessment	guided	unified	standardized
Case History	spreaded across documents	tracked	visualized
- management	difficult	available	advanced insights
- insights	descriptive	diagnostic	predictive
Decisions	individually taken	systematically recorded	best practices
- case groups	none	possible	case similarity
Collaboration	disintegrated	partially integrated	seamlessly integrated
- transfer	difficult	supported	inter-organizational
Administration	separated	embedded forms	partially automated

Table 1: Capabilities grouped by functional area and degree of IT usage.

unified by templates and forms encoding guidelines. At the advanced level, sophisticated standardized assessments are introduced, which encode deep insights into a case management domain and enable the multi-faceted analysis of a case. Access to a case remains with the individual case manager at the lowest level, whereas role-based access control is introduced with the usage of a CMS. At the advanced level, information can be exchanged and coordinated between organizations with security and privacy issues being resolved.

History-related Capabilities: Tracking cases and obtaining aggregated information about a case or a case group is a major management need and often the reason why CMS are introduced into an organization. Understanding the history of a case, in particular, how effective the planning and linking worked, but also controlling and predicting its potential development, and recognizing complex cases early (including the detection of social trends), is a major challenge today. The history of a case comprises the assessments and evaluation(s), the objectives agreed between case stakeholders, the benefits and services provided as well as their outcomes. At the lowest level, this information is spread across many documents and a unified view on the history of a case is very hard to obtain. With the introduction of a CMS, the information related to a case is managed in a more coordinated manner and the history is tracked, but problem-specific views on the history might not yet be available. Advanced levels integrate heterogeneous and unstructured information sources and provide sophisticated visualizations of the case history.

Decision-related Capabilities: Effectiveness of decision-making is crucial for the case-management process to succeed. Different case evolutions require different responses: different wrt. time to react, costs, coordination, benefits, experience, and qualification of the case manager. Knowledge of how a case is handled is often formulated as rules that guide or constrain the human decision maker. Some of these rules are made explicit in a case-management organization and are regulated by law, others remain implicit. Achieving and maintaining compliance of case management with legal regulations is a major challenge today as the complexity of cases as well as the regulation of case management are increasing. At the lowest level, decision-making is

not directly supported by the IT infrastructure. In a CMS, decisions are supported by an improved view on the case situation. With advanced usages of CMS, benefit/service usage patterns can be extracted from the case data and a specific case can be compared to a representative case group. A refined understanding of case groups can help in establishing best practices of case-management processes, but also risks that a "one-size-fits-all" approach replaces the individualization paradigm of case management. Trying to realize cost savings through standardized approaches is a major risk.

Collaboration-related Capabilities: It can be often observed that the longer a case lasts, the more stakeholders get involved and the more information needs to be coordinated between them. Low IT system usage hinders effective collaboration as information is scattered, must be manually transfered, and easily gets out of sync. With the introduction of a CMS, role-based access control is established, documents can be transfered using small workflows, and document exchange with office tools is made easy. Advanced solutions require to address in particular inter-organizational issues, which are mostly unresolved today. Each stakeholder of a case acts within his own law-regulated space and is not or only partially aware of the spaces of other stakeholders. Coordination and opportunity finding is therefore difficult. Furthermore, coordination needs vary for each case, which is a challenge for advanced CMS implementations.

Administration-related Capabilities: Accounting of benefits and tracking work efforts put into a case by stakeholders is supported by forms and templates. With low IT usage, these forms exist either on paper or in separated IT systems. CMS embed and facilitate accounting. Advanced levels partially automate these tasks.

The C3M maturity model for IT-based case management that we originally proposed in [6] introduces five maturity levels combining key capabilities with major risks and benefits, see Figure 2.

	Individualistic	**Supported**	**Managed**	**Standardized**	**Transformative**
	Cases handled in non-CM software (e.g. Office tools)	Cases handled in dedicated software (CMS introduced)	CMS data analyzed for management decisions	Case assessment standardized and visualized	Case histories analyzed & compared Best practices
Main Capability	Documents personally organized using (non-CMS) standard software	Documents organized in case folders with role-based access Templates facilitate administrative work	Data aggregated over case groups Inter-case aspects included in planning phase	Assessments guided by software Case state, objectives and history visualized	Similar cases & best practices identified Intra- and inter-case data visualized
Main Benefit	High Personal Identification	Increased Productivity	Management Transparency	Improved CM Phases	Increased Effectiveness
Main Risk	Lack of Traceability	Inacceptance of CMS	Cost thinking dominates	Costs of Change increase	Loss of Individualization
	Pre-CMS	CMS	Post-CMS		

Figure 2: The C3M maturity model for IT-based case management.

At the *pre-CMS level*, no dedicated CMS is used in an organization, whereas at the *CMS level*, a CMS is introduced for the first time. At the three *post-CMS levels*, existing CMS technology is further advanced. In the following, we briefly summarize the model. Further details can be found in [6].

At the *individualistic* level, the individualization paradigm on the side of the client as well as the case manager dominates. Documents are personally organized with the help of various IT systems. The main benefit is the high personal identification of the case manager with a case. The main risk lies in the lack of traceability. At the *supported* level, a CMS is used to better organize documents and provide templates that facilitate case-related work. Productivity increases, but an organization might face acceptance problems of the CMS as well as lack of management support in particular in the initial phase of technology adoption. At the *managed* level, the organization exploits the data aggregation and analytics features of the CMS as a basis for management decisions. Data of one case can be compared with data of other cases. Management transparency is the main benefit, but the risk is a cost thinking that overdominates other aspects. At the *standardized* level, a unified assessment methodology is implemented in the CMS and standardized assessments are introduced. Similar assessment outcomes lead to similar objectives and measures, helping to improve the effectiveness of case management as the main benefit. Visualizations of the case state, its objectives and history are provided by the CMS and exploited during decision making. As the main risk, changing assessments and their implications becomes more costly as with any work approach that is implemented in a software system. At the *transformative* level, similarity of cases is defined including data from the case history, which enables an organization to extract and establish best practices. This helps the organization as a whole to improve the effectiveness of its case management, but also bears the risk that the tailoring of a solution to the individual needs of a client is lost as cases are managed based on the most similar case group.

In the following, we focus on how the impact of IT on case management can be assessed and managed in the form of benefits and risks. Organizations need to respond to IT developments. Their response decides whether they can build new business models upon an IT innovation and manage the associated risks in order to keep up with the competition or whether they will disappear from the market. We thus present in the next section a systematic refinement of the model with a detailed map of benefits and risks, which allows us to systematically and comprehensively address IT-related impacts.

3. A Benefits & Risks Map

It has become evident over the past decades that innovations in IT have dramatic impact on all aspects of a business system. Accordingly, measuring the impact of IT and with that its value for an organization has been in the focus of research for a very long time, e.g., [9, 10]. As IT systems require significant investments and have been accompanied by spectacular stories of failure and success, there has been a significant interest in measuring the value of IT investments for an organization and understanding in more detail the benefits and risks such an investment can bear. Detailed impact

analyses have been conducted in three major areas of research leading to very different perspectives and complementary results on how to assess IT systems:

- Research in economics wants to understand the value of information systems mostly from a financial perspective and focuses on the classical problems of costs, profitability, and return on investment. The impact of information systems on firm size, operational costs, profit margins, return on assets, inventory turnover, asset utilization, accounts receivable turnover, or transaction costs is discussed by numerous publications studying certain classes of IT systems (notably ERP system introductions, e.g., [11, 12, 13] within or across various industry sectors. Different systems of measurement variables to be observed are proposed and validated by empirical case studies, e.g., [14, 15, 16]. In addition, the problem of quantifying operational risk has received considerable attention over the last years, in particular in the financial sector [17].

- Behavioral sciences are studying the impact of software on people and organizations and are especially interested in problems of IT systems usage and user satisfaction [18, 19, 20]. They look at IT value from the perspective of end-user stakeholders and try to assess it using subjective perceptual measures. Furthermore, mastering the organizational change that usually accompanies the introduction of an IT system is in the focus of attention [21].

- Computer science concentrates on software impact analysis as a broader theme, but mostly under the aspect of change management, i.e., how changes at the code level affect various aspects of the software system and how software developers can effectively deal with such changes, e.g., [22]. Impact analysis must also be distinguished from a so-called trade-off analysis, which compares functionalities vs. requirements and usually conducts a so-called fit-gap analysis.

The literature in all three areas is vast [23, 24] and often reports on empirical studies with a specific focus. Collections of measurement parameters are proposed in these publications that are often tailored to the specific area and goal of study. Although several authors emphasize that a more holistic view on the impact of IT technology is necessary [25, 23, 26, 27], such a view is hard to achieve because of the complex multidimensional influences of various factors. Many of them cannot even be directly measured, think for example of the popular term of user satisfaction, which is often measured based on the purely subjective perception of individuals. Nevertheless, it is commonly agreed that a pure focus on either economic indicators or user-centered investigations cannot yield an adequate assessment.

Let us begin with a brief discussion of the terms *benefit* and *risk* before we dive deeper into how benefits and risks of IT technology can be assessed and predicted. A *benefit* is a form of an advantage, an act that leads to something that is positively perceived.[3] Although intuitively quite clear, the benefit of something is not so easy to measure or capture in some objective form. Specific forms of benefit analysis, e.g., cost-benefit analysis, compare the relative costs and outcomes (effects) of different courses

[3]See the Merriam Webster definition of benefit at http://www.merriam-webster.com/dictionary/benefit.

of action and assign a monetary value to the measure of effect. This leads to quantitative results, but is also considered as measuring only some aspect of benefit. A *risk* is defined by the ISO 31000 standard as the effect of uncertainty on objectives with the effect being either positive or negative. However, in a commonsense understanding, a risk is usually associated with a negative or undesirable outcome or impact caused by the uncertainty inherent in any activity. The Basel II standard of banking regulation defines operational risk as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events, focusing clearly on the negative outcome of activities and relating it to potential sources of risks in the form of business processes, people, and (IT) systems. In the following, we use the term benefit to denote the positive outcomes, whereas we use the term risk to denote the negative outcomes of introducing an IT system into an organization.

We are especially interested in a *prospective* analysis of the benefits and risks of an IT system as illustrated in Figure 3. We believe that the process of value creation through IT can be managed more consciously and effectively by carefully conceptualizing related benefits and risks during the planning and implementation stage. However, we could not find any ready-to-use benefits & risks model in prior work. The studies conducted in economics and behavioral sciences often set a different focus, e.g., by analyzing IT impact *after* an IT system has been introduced into an organization, whereas our focus is on the prospective and proactive management of IT impact *during* the planning and implementation phases.

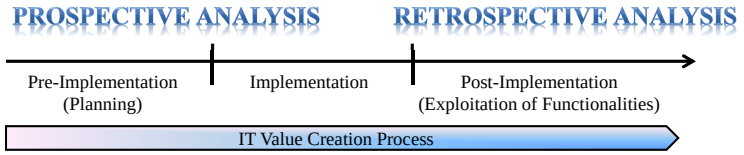

Figure 3: IT value creation and analysis.

By assessing the IT maturity of an organization and by consciously planning the transition to the next maturity level including a consideration of benefits and risks at each level, the technology management process can be mastered more successfully. Whereas we have the impression that the potential benefits and risks may not differ significantly for smaller or larger organizations, the potential of an organization to concern itself with the potential impact of a technology may differ significantly with its size and IT-related maturity. Case management is mostly found in three types of organizations: social and public organizations, insurance companies, and larger companies managing work force absences through case management. Social and public organizations are often characterized by underdeveloped IT systems compared for example to modern insurance companies. An underdeveloped IT infrastructure is also often accompanied by a lower level of IT management Know-How. Thus, these organizations are likely confronted with more drastic impacts when modernizing their IT systems and the associated risks are likely to be bigger.

The benefits & risks map that we propose is influenced by three key building blocks:

1. The DeLone and McLean model of information system success [28], which in-

vestigates the relationship between system, service, and information quality, human use, and the resulting impacts.

2. Various models of IT value from the field of economics, which emphasize the need to assess value from several different views on an organization. On the one hand, these models propose that the strategic, tactical, and operational levels should be considered. On the other hand, they introduce different views, e.g., mostly on the *How?* (processes), the *What?* (resources and information objects) and the *Who?* (organizational structures) that must be considered, see for example the Basel II model of operational risk.
3. Three key properties of case management work and their related capabilities: uncertainty, information richness, and decision making. They provide the focus to further refine the impact areas into impact factors.

The DeLone and McLean model of information system success [28] is shown in Figure 4. It has been one of the most influential models in information systems research in the field of economics dating back to 1992. The original version introduced system and information quality as the key parameters to be observed. These parameters influence the use of a system and with that the user satisfaction leading first to an impact on the individual and subsequently to an impact on the organization. After 10 years, the authors revised their model by adding service quality as another key observable. The authors abandoned the distinction of individual and organizational impacts and summarized the two impact levels into a simplified category of net benefits.

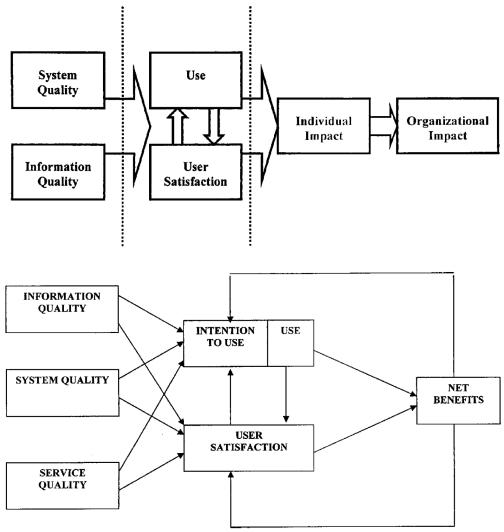

Figure 4: The DeLone & McLean Model of Information System Success, original version (top), revised version (bottom).

The operational, tactical, and strategic levels of IT systems distinguish the level of setting overall business objectives (strategy), the level of organizational initiatives converting strategies into specific action (tactical), and the level of specific processes

and services implementing this action (operational). The levels are usually associated with a long-term, medium-term, and short-term horizon, respectively. There is some overlap between these three distinguished levels and models proposing *who-what-how* views. The *Who-What-How* views clearly refine the operational dimension, but some aspects of the *Who* and the *What* can also be related to the tactical level. The DeLone and McLean model incorporates the operational dimension in its three key observables and refines the *Who* view with its focus on users and their satisfaction. Tactical and strategic impacts have been captured in the original model, but are further abstracted into a single net benefits category in the revised model. Combining the three levels with the various proposed views into a complex multi-dimensional model seems to yield a too complicated result. We thus decided to base our map on the following five key impact areas:

1. **Strategy**: Making explicit the strategic impact of IT-related decisions seems to be crucial for a model that focuses on managing benefits and risks across several IT-related maturity levels. First, advancing IT-related maturity should have a long-term focus. Second, relevant technology-related impacts occur with a significant temporal delay. A model that only focuses on a short- to mid-term horizon would not capture the evolutionary aspects and relevance of IT technology and its related management processes.
2. **Organization**: Impact at the organizational level is a central theme in many models and also relates to the tactical dimension. Modern IT technology very often causes significant organizational changes. Thus, we decided that the organizational dimension should be part of our map.
3. **People**: The DeLone and McLean model stresses the importance of use and with that of users. Many other models emphasize the importance of the *Who* view when describing IT impact, which also manifests itself in the vast number of user-centered studies conducted in the field of social sciences. Case management work is centered around qualified human work and decision making and therefore this area must be present in our map.
4. **Processes**: The area of (business) processes represents the operational dimension and incorporates the use and service quality aspects from the DeLone and McLean model as well as the *How* view. It is thus contained within almost all models that we studied, albeit under different names. Therefore and because case management is about complex and dynamic business processes, it must be also be present in our map.
5. **Technology**: This area of our map summarizes the system and information quality aspects from the original DeLone and McLean model. As our model is intended to serve in the proactive management of advancing IT maturity, the technology dimension must clearly be present in it. However, we decided not to divide the technology dimension into several distinguished observables as DeLone and McLean do for example, but address its various aspects at the level of the refining impact factors.

Figure 5 summarizes the proposed benefits & risks map with its five impact areas. Each area clearly influences the others. However, Figure 5 depicts one major direction of influence that we briefly explain starting from the strategy area. The strategy

clearly influences the operational level and with that sets directions for the processes. Processes require effective support through technology today, which in turns influences organizations and with that people, who again set the strategy. In contrast to the DeLone and McLean model that focuses on the direction of influence from people to organizations, we favor a more top-down approach linking strategy and technology impacts to organizational changes and then to impacts on people. However as we initially said, this is just one direction of influence.

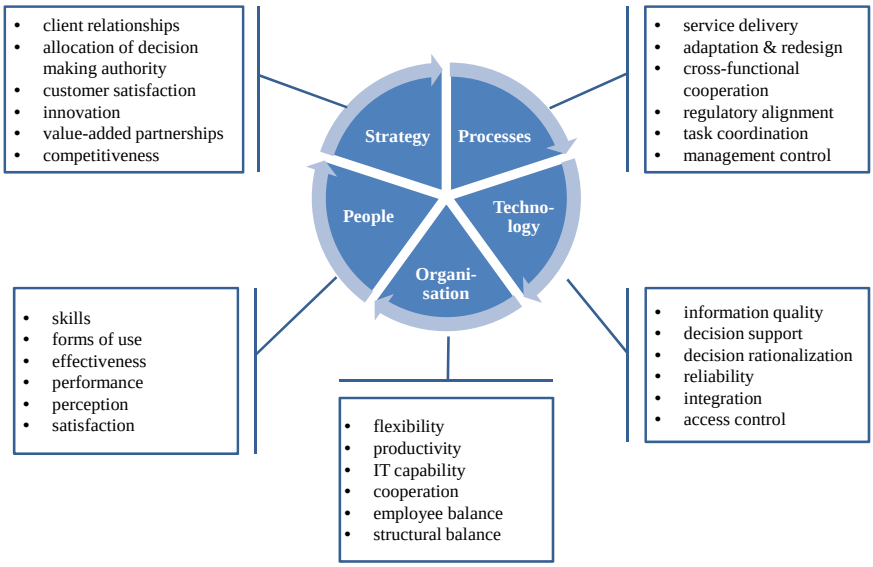

Figure 5: The proposed benefits & risks map with five key impact areas, each refined by six impact factors.

Whereas the impact areas are applicable to the assessment of any IT system, our refining *impact factors* are clearly influenced by the nature of case management work and our intention to use the map when advancing IT maturity related to case management software systems. Case management work often takes place in the form of a very intense and personal interaction between a client and the case manager in the form of consultations and counseling. These interactions are characterized by ambiguous and uncertain information, unsettled and unknown attitudes and motivations, as well as by moving positions on the client's, but also on the case manager's side. Case managers must react to changes and constantly adapt their decisions and actions. Decisions taken one day may be obsolete the next. However, taking the right decisions is crucial for the success of case management work, which often also resists any planning activity, i.e., the process evolves step by step taking one action at a time and deciding upon the next only after having observed the effects achieved by a previous action. This iterative style of management is also discussed under the term of effectuation, see [29].

Each impact factor is neutral in the sense that it can be refined into a specific risk, but also into a specific benefit. Some of the impact factors can be easily refined into tangible measures, e.g., calculating cost savings or measuring time savings. Others address more intangible factors such as improved processes or improved customer re-

sponsiveness. Furthermore, there can be a difference between an observable quantifiable impact and its perception by the human users of a system. The refinement may also differ for each organization. However, we believe that by going through these factors during technology planning and implementation and by asking what specific impact could occur in an organization, i.e., by discussing how an impact factor may manifest itself in a specific situation, an organization can more successfully master the process of technology adoption. The impact factors help in refining unexplored impact areas into specific risks and benefits as they make specific proposals to which elements of an environment one should pay attention to or which one can (to some extent) ignore.

In the following, we go through each impact area, discuss the proposed impact factors and give examples of specific risks and benefits for each factor as they can manifest themselves when introducing case management software.[4]

Strategy.

Client relationships are of major concern at the strategic level as they influence many other factors of an organization. Case management as a counseling activity focuses in particular on its impact on the client and the relationship between the case manager and the client. A CMS can have a significant impact on the client relationships of an organization as it stores large amounts of client-related data. Access to and analysis of these data is evolving with the maturity of the CMS solution. Potential risks are related to the unauthorized access to the data or the inappropriate correlation of different information sources that can negatively impact the trust between client and case manager. A major strategic risk that we identified at maturity level 5 is the loss of individualization that significantly impacts the way how case managers deal with client problems, i.e., instead of working out individual solutions clients may “get managed” based on problem groups or standardized procedures.

Allocation of decision making authority is a key issue in case management, because decision making is a major activity of the case manager and must be shared with the client and other stakeholders. Novel technology offers new opportunities how decision making can be shared, distributed, or centralized. Potential benefits lie in the improved transparency and communication of decisions, an acceleration of decision making processes, or new ways of sharing decisions between stakeholders. Manifold risks such as for example instranparent decision making or granting inappropriate decision rights can occur when decision making is changed by technology and thus, finding out which and how decisions are affected when moving to the next maturity level is important.

Customer satisfaction is a multi-faceted challenge for an organization practicing case management. The client represents only one of the customers in this landscape. Other customers are the payers of the service, partners financing or providing a benefit, or a contracting party requesting case management. Understanding the customer landscape and how technology can impact it negatively or positively should be part of any technology adoption process. Potential benefits include improved information access for customers concerning quality and timeliness or an improved customer relationship

[4]We do not yet instantiate each impact factor with example benefits and risks at each maturity level as this requires further empirical research.

management in general. Potential risks can result for example from the main risks that we identified at maturity levels 1 and 3—a lack of traceability and a dominating cost thinking can significantly hurt the satisfaction of customers.

Innovation should be enabled through the adoption of technology. However, organizations, in particular when at low maturity levels, can often only partially benefit from the innovation potential. Early and late technology adopters share the well-known benefits and risks. In [6], we summarize CMS-related innovation trends. Understanding and translating these trends into specific benefits and risks should take place when the innovation potential of a CMS at a specific maturity level is discussed.

Value-added partnerships play a key role in the service economy. Organizations introducing case management or introducing a CMS often overlook the need to exchange information with partners or to involve partners in the decision making process and thus, may not pay sufficient attention to the capability of the technology to enable new or improved partnerships.

Competitiveness is a growing concern for service providers in the public sector and is closely related to strategic impact factors such as customer satisfaction, innovation, and value-added partnerships. Understanding a specific competitive landscape and how it will change in the future can help making appropriate technology choices leading to competitive benefits. Impact factors such as organizational flexibility and productivity that we discuss further below also impact competitiveness. Furthermore, major risks such as the inacceptance of a CMS at maturity level 2 or a potential technology lock-in that we brought up for maturity level 4 should not only be addressed under the focus of people and technology, but also at the strategic level.

Processes.

Service delivery is a core activity not only in the linking phase of case management. CMS impact service delivery to the client and other customers due to their overall impact on the case management process. Potential benefits can be a better overview on existing services and benefits, an easier adaptation of a service to the needs of the client, or a simplified scheduling of service provisioning in the case of short resources. Potential risks can be a suboptimal service selection at maturity levels 1 and 2 caused by transparency and technology-inacceptance problems or by providing "one-size-fits-all" services at maturity level 5.

Adaptation & redesign of business processes is usually required by any technology adoption. Organizations should be concerned with identifying those processes that are affected by a CMS introduction and identify the necessary changes. Process optimization while retaining the flexibility of case management is a desired benefit at the operational level. Typical risks can for example result from IT solutions that add inflexibility by enforcing certain pre-implemented procedures.

Cross-functional cooperation is becoming increasingly important for knowledge-intensive work. Past IT systems were designed to improve a business function within an enterprise and enabled cross-functional cooperation often only in a limited manner, e.g., through streamlined workflows. Case management organizations are facing growing needs to work across functions and organizations and face operational risks when a CMS does not provide the required cooperation support, including secure and controlled data exchange and integration.

Regulatory alignment is mandatory for all organizations and undergoing constant change due to changing legal conditions. For example in many countries, the benefits that a mandatory health insurance must provide are constantly changing as are the accounting requirements. In particular, for complex insurance cases incurring high costs, making sure that a CMS can keep pace with evolving regulations is important and can constitute a source of hard to detect future risks. Another major risk area is related to the handling of sensitive personal data that is also subject to evolving regulations. Benefits can result from CMS providing detailed monitoring and auditing capabilities.

Task coordination is a key requirement of case management as processes cannot be predefined, but evolve step-by-step. It requires more than dropping a predefined activity from a business process or adding another activity to it. Effective task coordination means to involve new stakeholders, share sensitive information in a way appropriate for the task, or provide new stakeholders with information from the case history such that they quickly obtain an overview on the state of a case. Cross-organizational task coordination is usually not well supported in today's CMS and can in particular incorporate many risks due to undetected divergences in the goals of the various stakeholders. Benefits that result from good task coordination capabilities of a CMS are for example a simplified, but controlled access to information, flexible processes, and improved case-management phases, which we list as a major benefit for maturity level 4.

Management control and with that improved management transparency as a potential benefit is one of the drivers to introduce a CMS that we list for maturity level 3. Being able to aggregate information across cases, form case groups, and improve management decisions are important benefits. Potential risks are related to inappropriate monitoring that is negatively perceived by users or by pushing decision rights too far upwards in the hierarchy, which can negatively impact the personal identification of case managers with their cases.

Technology.

Information quality is a major impact factor that should improve with the introduction and advancement of CMS. Information quality comprises many aspects such as content quality and accessibility of the information including information reach, integration, standardization, accuracy, acquisition, intensity (information overload), quality, and speed. Achievable benefits can be found in the timely dissemination of information, an improved delivery flow across organizational subunits, and improved information visibility where relevant information can be quickly accessed by users and its correctness is easier assessable. A potential risk can lie in the increase of organization-wide coordination of information integration, which can result in risks related to a loss in local autonomy and flexibility wrt. the handling of information due to centralized storage and processing solutions for example.

Decision support is an impact factor that matters most in case-management processes. As a potential benefit, organization-wide decision making at all levels should be facilitated by technology. Risks lie in inappropriate decisions due to insufficient information quality or poorly redesigned business processes.

Decision rationalization addresses the need of evolving the information culture within an organization. An increased usage of technology, heterogeneous information

sources, and advanced visualizations increases the need (or pressure) to establish a culture of fact-based decision making, which bears many risks. Decisions taking by case managers are often based on their experience, empathy and intuition developed around a case. For some decisions, a rationalization might be appropriate and lead to better decision outcomes, for others, a fact-based decision making can yield inappropriate results. In particular at maturity level 5 where case-management processes are significantly transformed and based on case similarity and best practices, inappropriate decision rationalization can cause a loss of individualization, i.e., become a major risk for client relationships.

Reliability of the technology influences many impact areas, such as for example the perceived quality of the IT solution, usage behavior, user satisfaction, operational and organizational efficiency. A CMS should function properly not only in routine situations, but also under unexpected circumstances or in critical situations. An identification of such circumstances and situations should take place when discussing technology reliability as "the exception is the normal" in case-management processes.

Integration interfaces of a CMS become increasingly important when we think of impact factors such as cross-functional cooperation, task coordination, or value-added partnerships. Not only does a CMS need to be able to exchange information with other systems, grant access to various stakeholders, or combine different information sources, but it also needs to respond to new trends such as access via mobile devices or business analytics. We listed the risk of a technology lock-in leading to high change costs at maturity level 4 when significant investments have been made into a CMS, but the system reaches its limits in supporting the strategy, processes, and users of a case-management organization.

Access control is without doubt a fundamental impact factor given that information and decision making play such a crucial role in case management. Does the technology provide appropriate solutions for controlling information access? Will these solutions be able to keep pace with evolving strategic and operational concerns of an organization as well as new technology trends? A careful examination of these and other related questions is fundamental in identifying and managing benefits such as simplified information access and risks such as information leakage.

Organization.

Flexibility needs of an organization must be carefully analyzed and matched with the right technology solutions. Inflexible, but also too flexible CMS can constitute a risk when they lead to processes that remain unclear and cause violations of business conduct or regulations. As a major benefit, CMS should help evolve organizational skills, i.e., add new capabilities to an organization to better deal with existing or upcoming challenges.

Productivity of an organization is a result of good structures supported by technology, operational efficiency, and people-related factors. Measuring productivity of knowledge-intensive work is difficult, however, in a specific organizational context it is possible to explore how a CMS influences organizational productivity and if such influences constitute a benefit or risk. Setting tangible productivity goals as part of technology management is clearly desirable.

IT capability of an organization clearly evolves when advancing IT-related maturity levels. When successfully mastered, it enables an organization to mobilize and deploy IT resources in combination with other resources and capabilities in an increasingly effective way. An organization may be able to make extended use of a technology, i.e., discover and create alternative ways of using existing system functionalities or it may get stuck with a very limited use where application features are only partially exploited and the understanding of a system's functionality by its users remains limited.

Cooperation across organizations poses even higher challenges than the cross-functional cooperation that we discussed in the processes impact area. Given the sensitivity of information, the complex landscape of stakeholders and their positioning wrt. a case, a CMS can have major desirable or undesirable impact on the cooperation opportunities and capabilities of an organization.

Employee balance characterizes the mix between core employees, contractors, and outsourced staff as well as the appropriate skill mix. It is also affected by other impact factors such as cross-functional cooperation or partnerships. Understanding how the employee balance may evolve in the future, e.g., evaluating a technology wrt. growth or reorganizational scenarios should be self-evident. Outsourcing potentials have been exploited by other industries with different success. Benefits can be realized when new organizational skills become available to an organization through changing partnerships, but the same changes can also constitute risks when critical skills get lost.

Structural balance of an organization is requiring constant management attention and has seen major shifts in recent years. Moving from a centralized structure to a decentralized one with teams playing an increasingly important role bears manifold risks that must be clarified. New partnerships or market opportunities opened up by technology may lead to structural shifts that should consciously be addressed. Adaptations and redesigns of business processes should be accompanied by the corresponding changes in the organizational structure. The same holds true for changing client relationships or decision making authorities.

People.

Skills clearly change when technology is introduced. In particular, public and smaller organizations may start from a lower level of IT-related skills than larger and technologically more advanced organizations. In addition, the personal and functional competencies of users also change. These changes can range from user empowerment to skill devaluation with different users or user groups being affected differently.

Forms of use of a technology can differ significantly among users. Motivating users to take ownership of a new system and doing their jobs by using the system can be hard and constitutes a risk in particular at maturity level 2 when a CMS is introduced into an organization for the first time. Technology acceptance models such as [30] describe a process where users go from beliefs via attitudes to certain behaviors. Being aware of this process can significantly reduce the risk associated with a technology. Furthermore, user satisfaction is different from effective use and different from creating value by using a technology. Users may experience different degrees of freedom when using the system, their informedness about the system may differ and their usage can be effective or ineffective.

Effectiveness of people using a technology is assessable when investigating how a system helps a user performing effectively within the business process that provides the context of use for the system. An interesting type of risk is to explore whether user errors can propagate differently when introducing or advancing a CMS. Similarly, the degree of dependence on the IT system can constitute a benefit or risk.

Performance per employee is an indicator of interest in the economic sciences and related to productivity measures such as time utilization for example. For knowledge-intensive work, the achieved quality of the work results seems to matter much more than the required time although both must be balanced. CMS, in principle, offer new possibilities of performance evaluation, which can be exploited as a benefit, but also abused leading to a risk wrt. employee morale for example. This impact factor seems to be one of the most unknown in the case-management area as performance indicators for knowledge-intensive work usually fail to address the multidimensional aspects of this type of work.

Perception of an IT system is influenced by many factors, for example by the perceived quality of the IT solution, the accuracy with which it provides information and supports the users in their tasks, the availability and user-friendliness of interfaces, or the available support services. Benefits and risks can be addressed through a careful requirements analysis and by performing for example a fit-gap analysis. In this context, one also needs to consider the subjective perception of the IT system quality as perceived by the users and other (perception-indepedent) measures of IT system qualities.

Satisfaction of users with a technology is a highly subjective indicator, but can clearly be influenced by managing risks and benefits in the other impact areas discussed above, which has also been made explicit by the DeLone and McLean model. However, satisfaction is also related to non-pecuniary values such as honor, team spirit, or pride of achievement as is discussed in many impact studies conducted in the field of behavioral sciences, e.g., [31].

Our C3M maturity model highlights specific impact factors from the above collection as major risks and benefits at the various maturity levels. Figures 6 and 7 position these major benefits and risks wrt. our impact areas.

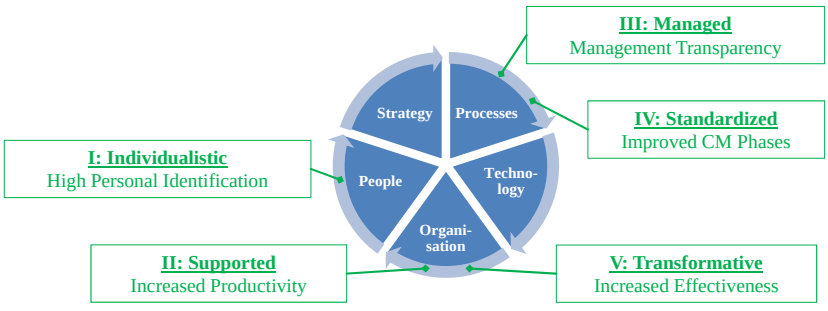

Figure 6: Major benefits of the C3M maturity model by impact area.

The key benefits can be found in the people, processes, and organization impact

areas. This reflects the need for any technology management process to materialize technology benefits in the short- to mid-term in order to justify the associated investments. These three impact areas all relate to the operational level of an organization that drives technology adoption through its requirements.

Our risks are well balanced across our impact areas. Beginning with process-related risks at maturity level 1 due to the absence of technology and continuing to people-related and organizational risks at levels 2 and 3, they reflect technological and strategic risks at the advanced maturity levels 4 and 5, resp.

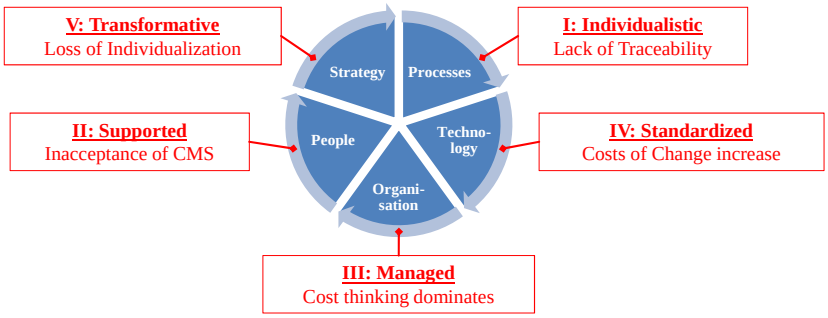

Figure 7: Major risks of the C3M maturity model by impact area.

Although different organizations may face different benefits and risks, we believe that the C3M maturity model together with the proposed benefits & risks map provides a good methodological guideline to manage CMS maturity. However, we understand it as a proposal and subject to work in progress as validating the model requires significant further empirical research. Applying the model requires to instantiate and tailor it to the needs of an organization as it is the case with any project management approach for example. This includes specific answers to the following questions: Are our five impact areas the relevant ones that should be addressed? Are the impact factors in each area well distinguishable? Are they complete and in which sense? How can they be instantiated for the specific organization? Can they be measured and if yes, how? How can the impact factors from the model help identifying those benefits and risks that are of outmost relevance to a technology management process? How can the identified benefits and risks be used proactively in a technology management process and translated into successful decisions and actions?

4. Related Work

Humphrey's seminal maturity model for the software process with its five maturity levels *initial*, *repeatable*, *defined*, *managed*, *optimizing* has inspired maturity models in various areas. Its original focus, as also carried on in the famous CMMI (Capability Maturity Model Integration) is on process improvement, i.e., it provides organizations with the essential elements of effective processes, which will improve their performance. It is thus very natural that maturity levels have been defined for business pro-

cesses by the BPM community as well. We build on these models as we could not find in the literature any maturity models or capabilities sets defined for case management.

One of the first BPM maturity models is defined by Fischer in 2004 [32] who considers the dimensions (levers of change) *strategy*, *controls* (governance), *process*, *people*, and *technology* and defined the following five maturity levels based on capabilities reached along each dimension: *siloed*, *tactically integrated*, *process driven*, *optimized enterprise*, *intelligent operating network*. De Bruin and Rosemann present an improved model in 2005 [33] that replaces the process dimension (which is in fact the one to be defined and should thus not be part of the input) by the dimensions of *methods* and *culture*. The five maturity levels are preserved and follow more closely the original CMMI levels: *initial*, *defined*, *repeated*, *managed*, *optimized*. In 2006, Wolf and Harmon [34] present a maturity model with slightly changed levels focusing on the degree of process organization: *unaware* (no organized processes), *opportunistic* (some processes organized), *standards* (most processes organized), *enterprise* (processes are managed), *transformative* (processes are continuously improved). Also in 2006, Gartner [35] presents a maturity model distinguishing 6 phases, which refines the standards level into two levels of intra-process and inter-process automation and control. In 2007, Hammer [36] introduces the PEMM (Process and Enterprise Maturity Model) that distinguishes four levels of process maturity based on enablers such as *design*, *performers*, *owner*, *infrastructure*, and *metrics* and combines them with four levels of enterprise-wide capabilities based on *leadership*, *culture*, *expertise*, and *governance*. PEMM does not aggregate the two groups into overall maturity levels. Its focus is more on analyzing and guiding transformation processes than on a general assessment of maturity. Finally, the OMG publishes a BPM maturity model specification in 2008 [37] with the five levels *initial*, *managed*, *standardized*, *predictable*, *innovating* and defines detailed process areas. Despite minor differences in naming or emphasis on certain aspects, all models essential share similar levels of maturity.

Recent years seem to have seen less interest in maturity models. Measuring and comparing processes and capabilities is interesting, but not necessarily useful unless it can help guiding improvements and transformations of a business. Our maturity model thus focuses less on measurement, but more on the identification of capabilities, for example as a foundation for a detailed requirements analysis.

As we focus on IT capabilities for case management as well as associated benefits and risks, our work is also related to the general field of software evolution. Standards such as ISO 9000, which focuses on software quality in general, and ISO 9241, which focuses on software ergonomics, define among others quality, functionality and performance criteria for the evaluation of software. Our focus is different as we do not assess how well a particular CMS provides a specific capability, but begin by defining a set of capabilities and relating them to the organization that uses this capability for a complex activity, namely case management. Furthermore, models such as ITIL or COBIT for example also address questions of benefits and risks when introducing and managing IT. However, a detailed comparison with them would go beyond the scope of this paper. Related work from the fields of impact analysis was already discussed in Section 3.

5. Conclusion

Case management is a management discipline within social work, health care and insurance to ensure the continuity of care by establishing a coordinated end-to-end process involving different institutions and professions. It is a specific approach for the coordinated handling of complex situations and as such has recently received significant attention as a metaphor for knowledge-intensive work and unstructured business processes in general.

In this paper, we investigate the usage of IT technology within case management. We discuss key capabilities that are required by case managers and that can be found in current case management software systems and show how these capabilities are supported at the low, average, and advanced levels of using these systems. We propose the C3M maturity model for IT-based case management consisting of five levels, which relates the characteristic capability of each level with the main benefit and risk of technology adoption. The model was derived by combining lessons learned from existing maturity models with results obtained from an empirical investigation conducted in [6].

Existing maturity models focus on the maturity levels, and less on the capability levels, which play a much more prominent role in the original CMMI maturity model. Capability levels apply to individual process areas and enable a continuous and incremental evolution of processes, whereas maturity levels address entire process areas and allow an organization to advance in stages. In our model, we focus on capabilities and their support by IT. Thus in contrast to other maturity models, we focus on the degree of technology adoption by an organization and set technology impact and impact management as the main purpose of our maturity model.

The C3M maturity model helps to govern IT decisions related to case management and to manage their impact by linking capabilities to benefits and risks. Organizations can assess whether a specific capability is needed and are motivated to identify its associated benefits and risks immediately. The model thus supports organizations in evaluating software products and it simplifies purchasing decisions. Software vendors can position their product roadmaps with respect to the model. Furthermore, the model makes explicit the impact of technology on the business.

Based on an extensive analysis of the literature on impact analysis from various fields, we present a detailed map of potential benefits and risks comprising five impact areas that serves to identify organization-specific benefits and risks when advancing the maturity of IT-based case management. The benefits & risks map recombines and extends existing models from the literature to obtain a more holistic view on the manifold aspects of technology-related benefits and risks. Our impact areas are not specific to case management software systems, but are widely recognized as relevant when assessing the impact of an IT system. Each impact area is refined with six impact factors to obtain a focused, yet comprehensive view on the potential risks and benefits when introducing case management software systems. These impact factors are thus clearly tailored towards the characteristics and key capabilities of case-management work.

It is important to acknowledge that higher maturity levels not necessarily mean better case-management processes. Each organization must decide which maturity level in using IT leads to the best support of case-management work. Our highest maturity level corresponds to the most comprehensive and sophisticated usage of IT technol-

ogy, but this is not identical with the best case-management practices. As De Bruin and Rosemann pointed out [33], "it is a case-by-case challenge to identify the most appropriate (BPM) maturity level based on context, underlying objectives, related constraints, possible business cases, etc."

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