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Constructing a Framework for Investigating and Visualizing ERP Benefits and Business Change

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Abstract

Realising business value and identifying the benefits arising from implementations of ERP systems remains a significant challenge for both research and practice. A review of existing work on ERP benefits reveals that current frameworks pay limited attention to contextual and temporal variations; socio-technical and business change; and levels of benefit realisation. This paper presents findings from an ongoing research project to develop a framework for investigating ERP benefits and business change, which addresses the identified limitations of previous research and provides a more detailed analysis of ERP benefits and their contextual variation. Using an iterative content analysis, the preliminary study presented here is based on 15 case studies. The final study will draw on data gathered from more than 60 case study organisations of differing size, maturity and industry sector.

Keywords: ERP benefits, enterprise system, benefits framework, business change

1 Introduction

Identifying, managing and realising ERP benefits and obtaining value from investments in enterprise systems is an ongoing challenge for research and practice. A recent survey of 625 CFO's identified that "achieving the expected benefits from IT investments" ranked as the second most critical issue overall for organisations of all sizes and was the most critical issue for large organisations (greater than $1 billion in revenue) (CSC, 2008, p: 14). The same survey reveals that return on IT investments remains an issue

with 43% of respondents reporting low, negative or unknown returns (CSC, 2008, p: 17) and that only 40% of responding organisations perform post completion audits of major IT projects (CSC, 2008, p: 18). Organisations' failure to identify ERP benefits may be partly related to the level of information available to monitor performance; information quality was the most critical issue identified in the survey (CSC, 2008, p3; p14) and corporate performance management (CPM) is seen as a significant challenge flowing on from this.

Identifying and managing ERP benefits is also an area of theoretical and practical concern for scholarly researchers and extensive research effort has been directed towards understanding the nature of ERP benefits (Legare, 2002; Murphy and Simon, 2002; Shang and Seddon, 2002; Staehr, Shanks, and Seddon, 2002; Stratman, 2007). In a previous paper (Schubert and Williams, 2009) we identify a number of limitations of existing ERP benefits frameworks. We argue that they include little insight into, or distinction between variations in:

1. *Motivations* for undertaking an ERP project and how these shape the identification and presentation of benefits;

2. *Timing of benefits*. For example, is the benefit desired/expected (declared as part of the project business case), an emergent or unanticipated benefit that arises during the project (an unintended consequence) or one that is realised (or not) as a project outcome?

3. *Variations in reach and scope* of ERP projects. Projects vary in reach from those narrowly focused into one functional area to those covering multiple functional areas or spanning multiple organisational boundaries. Projects also vary in scope from implementation of a single ERP module, expanding or upgrading an existing system, through to full suite implementations.

4. *Locus of ERP benefits.* Existing frameworks pay little attention to the locus of the benefit and to whom the benefit applies.

To understand the benefits organisations obtain from their ERP systems requires an in-depth understanding of the benefits they were initially seeking to obtain from the implementation, the way those benefits evolved (or not) over time and the nature of the change that arises from the benefits that were realised. Whilst existing frameworks make progress towards identifying lists and groupings of benefits they are largely descriptive and limited in the extent to which they address the distinctions outlined above. In particular, they do not provide insights into the *varying contexts within which ERP projects are situated*, or to the *type and nature of ERP benefits and the changes that they enable*.

Our research project addresses these limitations by investigating project motivations and the expected and realised ERP benefits. This work represents the preliminary stage of a long-term programme of research that seeks to:

assist organisations to identify, manage and realise the benefits of their investments in enterprise systems and

contribute to knowledge about benefits identification and realisation and to extend theorisations about how these can contribute to our understanding of business change and IT value in organisations.

The first stage of the research is to provide a *comprehensive, heterogeneous, empirically derived classification* of the drivers and benefits of ERP systems implementations. Such a framework extends current research by:

- deriving an extended classification to track benefits in context and over time

- providing insights into the range and complexity of motivations and a framework for mapping and discussing the ERP motivations and benefits in the context of individual implementations

- identifying and (where they exist) describing and explaining variations within and between organisations, for example in organisations: in different industries; of different size; in different stages of maturity; and with different project motivations and goals.

The paper is organised as follows. In the next section we present our research approach and the methodology for deriving the extended ERP benefits framework. We introduce and explain the dimensions of the framework as well as the values for the appraisal of benefits. The results section contains preliminary findings from the coding of the first 15 case studies. We conclude the paper with a discussion of our approach and an outlook on future research.

2 Constructing the Extended ERP Benefits Framework

The research approach we use to develop the extended ERP benefits framework is discussed below. Our research design and methodology is presented in greater detail in (Schubert and Williams, 2009).

2.1 Data Source: eXperience Initiative

The empirical data used in this study is derived from a longitudinal research project underway since 1999 (the *eXperience initiative*, Schubert and Wölfle, 2007). This project has developed more than 120 in-depth case studies of real world IS implementations. The majority of these cases deal with enterprise systems implementations. Drawing on this extensive source of detailed data we performed a comprehensive and in-depth content analysis applying open and axial coding techniques (cf. Miles and Huberman 1994, Boyatzis 1998).

The eXperience methodology (Schubert and Wölfle, 2007) has been specifically designed for the collection and the transfer of best practice experiences in enterprise systems projects. The cases have been developed using a standardised approach, which enables us to develop detailed profiles of individual organisations and the motivations for their ERP projects and to compare organisations and conduct structured cross-case analysis. Each research case includes an in-depth description of an existing enterprise system solution and respective practices in an organization. It encompasses:

- a description of the organisations and actors involved as well as the national regulations;
- the business scenario, partners, and company strategy;
- the objectives, expectations, and desired benefits;
- the actual outcome of the project (enterprise system solution);
- the advantages achieved and the shortcomings observed (learnings).

2.2 Research Design

The process of deriving and developing the benefits framework consists of three main phases. The *first phase* is a preparatory phase where the literature was reviewed and analysed to motivate the research, formulate key research questions and identify the limitations of existing ERP benefits frameworks.

The *second phase* is performed to iteratively code the research data. The project researchers use text analysis and open and axial coding. Cases are coded independently and a subsequent coding review is conducted to develop the basic framework. Every time agreement about codes has been achieved, the next set of cases is coded and the results are added to the framework.

In the *third phase*, the results are consolidated and the final taxonomy is agreed upon. The research steps are displayed in Figure 1.
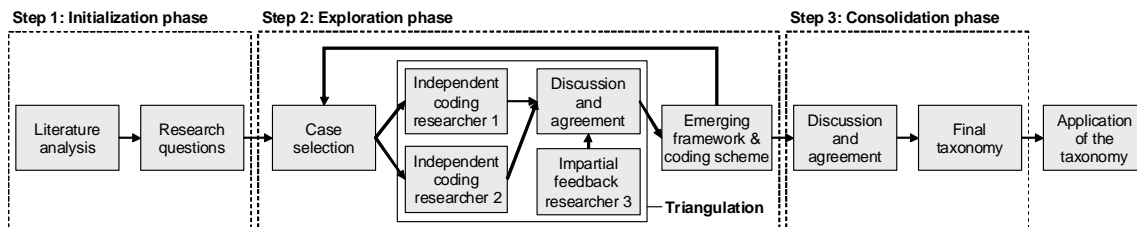

Figure 1: Research steps for the development of the benefits framework

2.3 The Extended Benefits Framework

Table 1 shows the basic framework that emerged from the early stages of the coding process. It is derived from analysis and coding of the first 15 case studies and comprises *five categories* (rows) and *three dimensions* (columns). The first phase of coding followed a process of open coding; here the aim is to reveal all the benefits that are described in the data and give a code to them. The second phase of coding, axial coding, is concerned with organising the codes into more meaningful categories and subcategories, moving the analysis towards the identification of key themes emerging from the data.

Table 1 provides a summary of the three dimensions emerging from the coding the first two dimensions represent the categorised data in terms of business area and the aspects of the business area; the third dimension contains the item which is actually being appraised (e.g. the item "*time*" can be described by the appraisal values "*increased*" or "*decreased*"). The codes are *three-component constructs* containing symbolic values for the three dimensions. The code "*BDE-PRO-CXY*" e.g. stands for "*business design – processes – complexity*".

Table 1: Dimensions of the extended benefits framework

1st dimension	2nd dimension	3rd dimension
1. Business design	Processes and functional structure of a company	Typical criteria for this area are automation, complexity, effectiveness, and efficiency.
2. Company management	Resources of a company which are essential for running the business (finance, employees, information, products, strategy)	Typical criteria for this area are cost, awareness (missing skills), productivity, satisfaction, time, and availability.
3. Business function	The business functions which relate to departments (marketing, procurement, manufacturing, sales)	Examples of criteria for this area are transparency of the process, complexity, number of transactions, sales opportunities, and turnover.
4. Supply chain	External view of the company, namely the interaction with customers and suppliers	Typical criteria are customer loyalty, integration, quality of service, satisfaction, and time.
5. Information technology	The actual enterprise systems landscape of the company (applications, databases and operating systems)	Typical criteria for this area are integration issues, adequate functions or functionality, customisation, usability, use, availability, complexity, flexibility, reliability, and stability.

Table 2 shows the appraisal values that emerged from the coding and are attributed to the codes. The values are *two-component constructs*. As displayed in

Figure 2 there are two different sources (the branches in the mind map) for *expectations* as well as for *outcomes*. Expectations can either arise from the initial situation before the investment decision is made (quite often reflecting a mandatory requirement) or from desired changes (drivers), which look at improving business performance. The actual benefits (outcome) are classified as realised changes (effects) or a final situation (result).
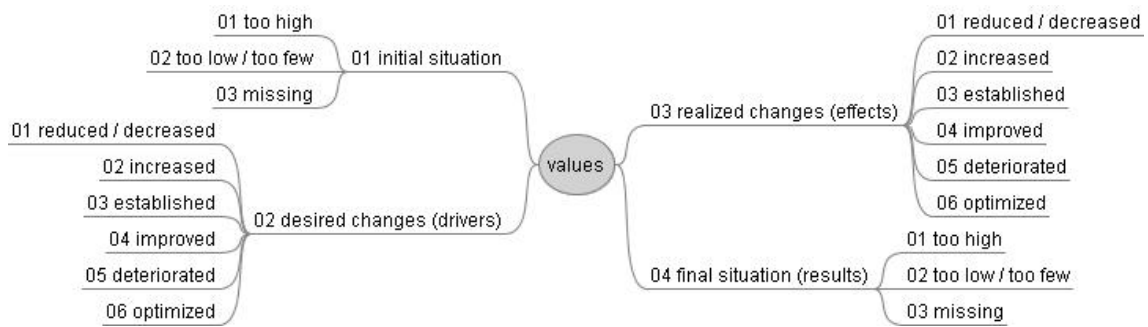
Figure 2: Hierarchy of appraisal values

For an easy comparison between expectations and realised benefits each appraisal value is annotated with an additional code containing the values (explicitly met, implicitly met, undesired negative, undesired positive, and partly met). This gives the researcher a valuable source for evaluating the explicitness of the benefit.

Table 2: Appraisal values of the extended benefits framework

01	Initial situation	01	too high
		02	too low / too few
		03	missing
02	desired changes (drivers)	01	reduced / decreased
		02	increased
		03	established
		04	improved
		05	deteriorated
		06	optimized
03	realized changes (effects)	01	reduced / decreased
		02	increased
		03	established
		04	improved
		05	deteriorated
		06	optimized
04	final situation (result)	01	too high
		02	too low / too few
		03	missing
		04	unclear

3   Visualising ERP Benefits

The final taxonomy will enable us to derive quantitative results from the code base. The coded case studies will be analysed in order to answer our research questions. There are two different pathways for the analysis of the data as shown in

Figure 3:

Analysis of the codes (= benefits) used in the case studies (searching for patterns in the codes themselves)

Profile analysis (looking for patterns in the company/project profile information of the cases)

The first analysis pathway describes the possibility to show patterns arising in the code structure itself. The second possibility is a cross comparison between the coded benefits and the company profiles/different project types. We profiled each case according to its demographics and characteristics regarding industry sector, size, age, level in supply chain, reach and scope of the project, etc. The following section describes the two basic data sources (tables) in more detail.
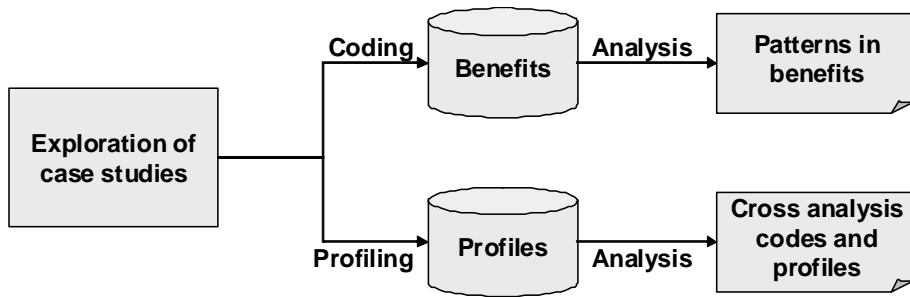

Figure 3: Coding process: resulting tables and possibilities for analysis

3.1 Benefits Analysis (Coding)

The benefits table contains the name of the case study, the verbatim quote and page number of the benefit as it appears in the source text, the assigned code for this benefit as well as the appraisal values and the assessment of the explicitness.

Table 3 shows an example for the results of the coding process.

Table 3: Example of the coding of benefits

No	Case	p.	<- Literally in Text ->	Business Area	Aspect	Criterion	Code	Branch	Value	Met
1	FREITAG AG	57	Number of transactions has increased	business design	processes	complexity	BDE-PRO-CXY	01	01	02
		57	Organic growth could not be handled economically with IT any more	IT	software	efficiency	ITE-SOF-EFI	01	02	02
		57	Isolated data silos	IT	data	integration	ITE-DAT-INT	01	03	01
		57	Isolated, self-made programmes	IT	software	integration	ITE-SOF-INT	01	03	01

In the following sections we will show some selected benefits which are (1) most often expected by companies, (2) most often realised, and (3) some unexpected benefits which result from the implementation of a new enterprise system ("side effects").

Benefits which are most often expected by companies

Table 4 lists the benefits according to the frequency of citation in the source texts. It is interesting to note that among the benefits most often mentioned in the case studies there seems to be no single business area (1st dimension) that stands out from the others. The top five benefits stem from each of the five different categories; one each. It is not surprising that availability of information is the number one benefit expected from the

implementation of a new enterprise system. The aspect of "integration" is also often mentioned, from a supply chain perspective (integration of partners) as well as for the information technology area (technical integration). Business design and company management are the most important categories for expected benefits.

Table 4: Benefits ranking according to total number of appearances; N=15

				expected benefits
company management	information	availability	COM-INF-AVA	7
business function	sales	usage of ecommerce channel	BUF-SAL-ECO	5
supply chain	suppliers	integration	SCH-SUP-INT	5
IT	data	integration	ITE-DAT-INT	5
business design	processes	transparency	BDE-PRO-TRA	4
company management	strategic management	requirements for future growth	COM-STM-FUT	4
supply chain	customers	quality of service	SCH-CUS-SER	4
business design	processes	efficiency	BDE-PRO-EFI	3
business design	processes	optimization	BDE-PRO-OPT	3
company management	products	range of products	COM-PRO-RAN	3
IT	systems: old, new	reliability	ITE-SYS-REB	3

Expected benefits which are actually realised

Table 5 shows the ranking according to compliance with the expected benefits. The last column shows the percentage of how many of the expected benefits were finally realised (and explicitly mentioned in the text). Compliance between expectations and outcomes in the case studies is relatively high, the values ranging from 67% to 100% for the top eleven codes.

Table 5: Benefits ranking according to compliance; N=15

				expected benefits	expected + realised benefits	%
					01 (explicitly met)	
company management	information	availability	COM-INF-AVA	7	6	86
business design	processes	transparency	BDE-PRO-TRA	4	3	75
company management	products	range of products	COM-PRO-RAN	3	3	100
company management	strategic management	requirements for future growth	COM-STM-FUT	4	3	75
supply chain	customers	quality of service	SCH-CUS-SER	4	3	75
supply chain	suppliers	integration	SCH-SUP-INT	5	3	60
IT	data	integration	ITE-DAT-INT	5	3	60
IT	systems: old, new	reliability	ITE-SYS-REB	3	3	100
business design	processes	efficiency	BDE-PRO-EFI	3	2	67
business design	processes	optimization	BDE-PRO-OPT	3	2	67
supply chain	customers	satisfaction	SCH-CUS-SAT	2	2	100

New, unexpected benefits

Table 6 shows the top eleven unexpected *positive* benefits that were mentioned in the case studies. It is interesting to see that most of the unexpected benefits arose in the categories company management and information technology. Most often mentioned were *time gains for employees*, *process efficiency* and *cost reductions*.

Table 6: Unexpected (positive) benefits which were realized; N=15

				04 (unexpected pos.)	%
company management	employees	time needed	COM-EMP-TIN	4	8,16
business design	processes	efficiency	BDE-PRO-EFI	3	6,12
company management	corporate finance	costs	COM-COF-COS	3	6,12
company management	information	availability	COM-INF-AVA	2	4,08
company management	strategic management	competitive advantage	COM-STM-ADV	2	4,08
company management	strategic management	requirements for future growth	COM-STM-FUT	2	4,08
supply chain	customers	quality of service	SCH-CUS-SER	2	4,08
IT	data	currentness / accurateness	ITE-DAT-CUR	2	4,08
IT	data	integration	ITE-DAT-INT	2	4,08
IT	systems: old, new	flexibility	ITE-SYS-FLX	2	4,08
IT	systems: old, new	support of employees	ITE-SYS-SUP	2	4,08

There were also some unexpected negative benefits such as an increase in the complexity of the sales process or an increase in the maintenance effort of the databases.

3.2 Cross Analysis with Company/Project Profiles

The company profiles contain information about the company and the specific enterprise systems implementation project. The company profile table contains the following information:

About the company: ID, Company Name, Year of Writing, Focus Topic, Year of Foundation, Age, Location, No. of Locations, No. of Employees, Turnover, Industry Sector, Products, Business, Role in Supply Chain.

About the project: ERP System, Standard/Individual Software, Targeted Primary Processes, Targeted Secondary Processes, Effects, Reason for Investment Decision, Time for Implementation, Cost of Solution.

Figure 4 shows an example for a cross analysis between expected benefits and company profiles.
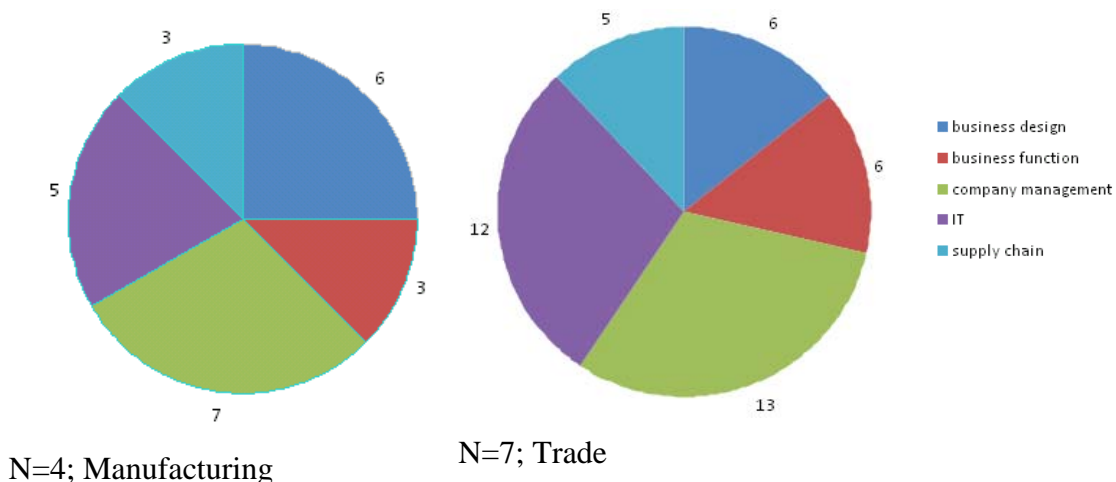

N=4; Manufacturing   N=7; Trade

Figure 4: Cross analysis expected benefits with company profiles

It is interesting to see that, for example, the manufacturing industry puts a focus on company management and business design which include rather basic objectives such as resources (finance, employees, information, products, strategy) and business processes. The trade industry, on the other hand, pursues objectives primarily in the area of company management and information technology (data, software, systems), the latter representing a more detailed view on the effects companies want to realize with the new enterprise system. Further, it is notable that supply chain objectives are of higher importance in trade than in the manufacturing industry.

Due to space limitations we have only shown selected examples of cross analysis with the profiles table. Later studies will assist in answering questions such as:

- Are there typical expected benefits in certain industries?

- Which process areas are most often addressed in successful projects?

4 Discussion

Most research into ERP benefits focuses on *what* benefits (generically) do ERP investments provide and *how* do we measure them? We argue that for an effective benefits realisation process organisations need ways of gathering information across time, being able to map their own benefits profile and identify areas where benefits are achieved and are not achieved and where unintended benefits arise.

In the literature we often find discussions of *IT-induced* benefits (Devadoss and Pan 2007). We argue that today many companies derive their business excellence from the effective use of software systems. So instead of using the term "IT-induced" we would suggest the use of the word *IT-enabled*. In a study of 1500 large organisations, Weill and Ross (2004) showed that "IT savvy" companies get a higher return on their IT investment than the non-savvy ones. Enterprise systems help companies build process excellence (Schubert, 2007). In an analogy this means that companies which explicitly pursue objectives with the introduction of enterprise systems instead of just acting out of a mere necessity are more likely to reap benefits than the ones that do not.

The first setting of objectives regarding benefits usually happens during the evaluation phase (i.e. in the decision process). This is a once and only look at benefits. We argue that the measurement of the realization of benefits is a continuous process, which needs to be performed before and after the introduction of the system as well as at recurring points in time during the actual system use. We argue that companies need to perform a continuous benefits measurement in order to see how effective they are using their enterprise system. This should therefore be incorporated and reflected in ERP benefits frameworks.
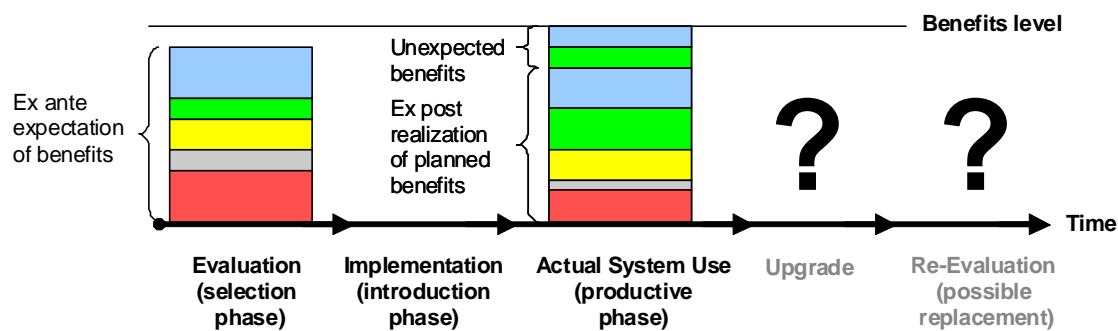
Figure 5: Benefits measurement over time

Benefits need to be observed over time (cf. Figure 5): The first step is *ex ante evaluation* of possible enterprise systems and defining the desired benefits. Once the decision is taken companies need to *ex post measure and observe* the actual realisation of the desired benefits.

The final objective of our research is to develop a tool set with which companies can plot their benefits progress over time. We want to move away from a mere assessment at *one point in time* to a process of benefits measurement *over time*. This way we could subsequently analyse possible links between business process excellence (Schubert, 2007) and the innovative use of enterprise systems. With the rich data contained in the eXperience case studies we will be able to set up a benchmarking database of typical industry benefits, project characteristics (e.g. reach and scope), integration issues and so forth. In illustrating typical benefits profiles in specific industries the final tool should enable practitioners to identify business opportunities.

5 Conclusions

Unlike previous approaches (e.g. by Sedera, Gable, and Chan, 2003 or DeLone and McLean, 2003), which propose models for measuring success, our taxonomy was developed in an explorative way analysing the expectations and realised benefits of *real-world* companies. Our analysis will eventually incorporate data from the actual experiences of more than 60 companies. The results will provide valuable insights into what companies usually aim to achieve when they implement new systems and in how far they feel they have been successful in their pursuit. This includes the analysis of actual reasons and realizations, issues of reach and scope, as well as unexpected effects. One of the major strengths of our approach is that we actually "appraise" benefits with values showing in how far benefits were actually achieved (or not achieved) or even identifying (desired or undesired) unexpected outcomes.

There are some limitations to our findings. Firstly, the eXperience cases all reflect "success stories" which were recorded from companies that volunteered to share their experiences with the researchers. Consequently, the remarks made by the interview partners might in some cases gloss over problems or show the outcome in a somehow better light than experienced by the people involved in the project. Secondly, the case studies were not written with an explicit focus on benefits. The description of the intentions and the outcome of the projects are sometimes scattered over the case study text and thus hard to find for the coders. Nevertheless, when looking at the (sometimes also quite critical) remarks in the outcome section of the case studies we came to believe that the interview partners were quite candid in most cases and that the data is thus sufficiently reliable for the purpose of this study.

In summary, most current ERP benefits research appears to address the question "*what benefits do ERP investments provide?*" and does not fully address the questions of "*why, where, when, how,* and *to whom* do these investments provide benefits and value?*". The extended benefits framework developed in this research project provides the analytical tools to begin to answer these questions more fully.

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