

2013

Towards an Understanding of Needs, Capabilities and Alignment Mechanisms in Digital Preservation: Results from an Explorative Case Study

Daniel Burda

University of Osnabrueck, Research Group on Accounting and Information Systems, Osnabrueck, Germany, dburda@uni-osnabrueck.de

Frank Teuteberg

University of Osnabrueck, Research Group on Accounting and Information Systems, Osnabrueck, Germany, frank.teuteberg@uni-osnabrueck.de

Follow this and additional works at: <http://aisel.aisnet.org/wi2013>

Recommended Citation

Burda, Daniel and Teuteberg, Frank, "Towards an Understanding of Needs, Capabilities and Alignment Mechanisms in Digital Preservation: Results from an Explorative Case Study" (2013). *Wirtschaftsinformatik Proceedings 2013*. 50.
<http://aisel.aisnet.org/wi2013/50>

This material is brought to you by the Wirtschaftsinformatik at AIS Electronic Library (AISeL). It has been accepted for inclusion in Wirtschaftsinformatik Proceedings 2013 by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Towards an Understanding of Needs, Capabilities and Alignment Mechanisms in Digital Preservation: Results from an Explorative Case Study

Daniel Burda and Frank Teuteberg

University of Osnabrueck, Research Group on Accounting and Information Systems,
Osnabrueck, Germany
{dburda, frank.teuteberg}@uni-osnabrueck.de

Abstract. Today digital information is conceived as a firm's most important asset whose availability cannot be taken for granted. As part of an effort to sustain its availability which is threatened by expeditiously changing technologies associated with the risk of obsolete software and hardware, digital preservation (DP) provides effective means. However, to date little is known about DP in the firm. Our study is the first to fill this gap and seeks to provide a deeper understanding of a firm's DP needs, capabilities and alignment mechanisms. We use a multiple-case design to analyze three firms and adopt the information processing theory as our theoretical lens. We find lacking decision making procedures and organizational responsibilities hampering the alignment between DP needs and capabilities facilitating a culture of information hoarding. Based on the consolidated results we suggest a set of propositions to explain DP needs, capabilities and alignment mechanisms.

Keywords: Digital Preservation, Archiving, Organizational Information Processing Theory, Case Study

1 Introduction

The enormous growth of digitized data - sometimes referred to as the data deluge [1] inside and outside a firm's boundary makes it increasingly difficult to systematically manage the data, i.e., to store, retain and eventually dispose of information in compliance with business needs and regulatory mandates [2]. Legislations such as Sarbanes-Oxley Act (SOX) require firms to preserve their data for several years. Section 802 of SOX, for example, requires an accountant to retain "records relevant to the audit or review, including workpapers and other documents that form the basis of the audit or review" for a period of "seven years after an accountant concludes an audit or review of an issuer's financial statements" [3]. During that time, changes in both the firm's external (e.g., technology) and internal environment (e.g., organizational structure) are extant and thus may threaten the accessibility of archived data. That is, long-term access to digital data cannot be taken for granted, rather it has to be actively managed and ensured [4]. As part of this effort, digital preservation (DP) may provide appro-

appropriate means. DP can be understood as “the ability to sustain the accessibility, understandability and usability of digital objects in the distant future regardless of changes in technologies and in the ‘designated communities’ (data consumers) that use these digital objects” [5]. DP comprises techniques like migration, emulation or encapsulation to ensure long-term access to digital information. The meaning of long-term has been defined in the Open Archival Information System (OAIS) standard as “long enough to be concerned with the impacts of changing technologies, including support for new media and data formats or with a changing user community. Long term may extend indefinitely” [6]. Acknowledging this definition, it becomes obvious that the meaning of long-term is rather concerned with the threatening effects of rapidly changing technologies and the lifetime of storage media on the accessibility of digital information, than the notion of time in the sense of several years or decades.

Reviewing the research on DP, we assert that DP has gained little attention in the Information Systems (IS) field so far. However, firms have to be able to consciously determine what information to preserve for how long in line with compliance and business objectives [7]. To our knowledge, current literature is lacking in empirical studies that examine DP in firms from an organizational point of view. We set out to fill this research gap while conceiving DP as an issue of decision making as to the question of what (and what not) to preserve. Toward this end, we conduct an explorative case study in three firms adopting the organizational information processing theory (OIPT) as our theoretical lens. The OIPT provides us with an adequate lens for several reasons: it enables us to uncover a firm’s (1) DP needs, (2) DP capabilities and (3) applied alignment/decision making mechanisms in the area of DP.

This paper is structured as follows: First, we review extant research on DP and OIPT and present our research questions. In section 3 we delineate our research approach followed by a cross-case analysis (section 4). Based on our findings, we derive a set of propositions in section 5 before we summarize our contributions in section 6.

2 Theoretical Background and Research Questions

2.1 Digital Preservation

Conceiving DP as a special case of digital archiving, where the need to store data exceeds the lifetime of both the software used to interpret it and the media that stores the bits [8], we analyzed extant research on DP and related work of other domains pertaining to data archiving. In this section, we describe our findings along the theoretical constructs of DP needs, DP capabilities and alignment mechanisms.¹

From a technological perspective, DP needs are mainly driven by “the rapid changes in technologies, file formats and information systems [that] make the longevity of digital information a challenging problem” [9]. From the economic and legal point of view, Chen [10] argues that “private companies facing discovery orders for their digital information in connection with lawsuits often find that recovering this information

¹ For a detailed description of the literature review approach see: www.uwi.uos.de/DpCSLr.pdf.

costs more than the computer system itself." Other authors support this argument by stating that regulatory compliance and legal issues oblige firms to keep data over decades and that legislations are increasingly enacted worldwide [4], [5]. Looking at DP from a knowledge perspective, Rusbridge et al. [11] claim that "the long term value of data rests in their potential as evidence, their reuse possibilities" whereby DP is also recognized as a means to catalyst innovation [12] and progress [13].

While reviewing extant research on DP capabilities we find Factor et al. [8] positioning the need for preservation aware storage and Barateiro et al. [14] who propose a risk management approach to DP. Storer et al. [15] elaborate on security threats to DP while Lee et al. [16] present the inventory of common preservation techniques such as emulation or migration and discusses their pros and cons [see also [17], [18]. Nevertheless, we rather see DP being examined through the technological lens aiming to provide answers on how to preserve information. Primarily, articles cope with the development of IT artifacts, such as preservation software prototypes [19-23], DP planning systems [24], [25] or architectures for DP [26], [27] while empirical evidence for the adoption of DP solutions and strategies in a firm is lacking.

Looking at the alignment mechanisms between DP activities and organizational objectives, we find several articles consistently pointing towards unsolved organizational issues. For instance, Becker et al. [28] report lacking cost-benefit models to support DP decision making from an economic point of view [see also, [4], [29] while other publications refer to missing alignment mechanisms of business needs and DP activities [30], such as governance frameworks [31]. While pertinent DP literature lacks empirical and organizational investigations of DP challenges, we analyzed related work in the area of Enterprise Content-/Electronic Document Management (ECM/EDM), Information Lifecycle Management (ILM) as well as Information Governance that are more organizational in nature and that holistically consider the information lifecycle including its retention and archiving [32], [33]. Nevertheless, only the case studies of Munkvold et al. [34] and vom Brocke et al. [35] explicitly point towards the issues associated with preservation und disposal of information. Other ECM articles deal with the alignment of business processes and ECM [36], [37], the value of ECM solutions [38], their acceptance [39] and implementation/customization strategies [40], [41] while keeping a balanced view on the whole information lifecycle rather than its retention (see [42] for a comprehensive review on recent ECM research). Retention and preservation are not the focal subjects in the context of recent ECM, ILM [see, e.g., [1], [43] or Information Governance [see, e.g., 44] research so that an explicit examination of DP alignment and other organizational issues is left aside.

In summary, prior DP research rather focuses on technological issues and lacks a particular examination of DP in the context of a firm by means of empirical studies. Our study sets out to fill this gap taking an organizational perspective and empirical approach to provide a better understanding why and how firms consider DP. To this end, we adopted the OIPT as our theoretical lens as described subsequently.

2.2 Organizational Information Processing View

We examined extant IS theories seeking to identify an effective theoretical lens for this study with the ability of explaining why and how DP occurs rather predicting or prescribing this phenomenon because of the early stage of research. Such theory, referred to as “*theory of explaining*” [45], should guide our investigation. We decided to draw from the OIPT introduced by Galbraith [46] since we believe it parallels major constructs of interest and provides an appropriate lens to view DP from an angle of information processing.

The theory deals with the design of organizations and particularly their structures or capabilities to handle their information processing needs. In other words, the theory considers “the linkage between a key organizational resource (information) and its management (i.e., the use of information) to be an organization's most critical performance factor” [47]. OIPT suggests that an organization has to process more information under increasing uncertainty to sustain its desired level of performance and therefore has to apply specific strategies. To cope with uncertainty Galbraith [46] suggests seven strategies. When uncertainty is low, there are three ways to resolve it: 1) coordination by rules or programs, 2) employment of hierarchies or 3) coordination by targets or goals. However, when uncertainty and hence information processing needs of an organization increase, it can proceed in either two general ways: reduce the information processing needs or increase its information processing capability. The former can be either achieved through the creation of 4) slack resources or 5) self-contained tasks whereas the latter can be attained through 6) support of information systems or 7) the creation of lateral relations [46]. In summary, uncertainty can be mitigated with any of the described not mutually exclusive options [48]. Since the theory's initial explication in 1973, it has been applied in the IS field in various contexts, such as interorganizational supply chains [49], [50], data integration [48], ERP implementations [51] or organizational performance measurement [47].

2.3 Research Questions

Conceiving an organization as an “open social system” dependent on their larger and potentially unstable environment, Tushman et al. [52] generally distinguish between external and internal sources of uncertainty that organizations have to deal with by developing information processing capabilities. In line with this argument Daft et al. [53] and Galbraith [46] consider factors like technological change, higher performance standards or competition as drivers for uncertainty and in turn for information processing needs. In this study, we abstract this view to DP needs of a firm, as a specific instance of an organization affected by legislation, regulation and technological change while considering DP needs as the need for information in the long-term. This leads to our first research question (RQ1) of this study: What are the internal and external factors that drive the need of a firm to digitally preserve information?

Drawing further from the OIPT, organizations typically have two strategies to deal with increased uncertainty, that is, reduce its information processing needs to reduce the effect of uncertainty or increase the information processing capability through

structural mechanisms (e.g. adjust the organizational structure) or the implementation of IS. This leads to our second research question (RQ2): What are structural mechanisms and IS which constitute the DP capabilities of a firm?

Further, OIPT claims that aligning information processing needs and information processing capabilities fosters organizational performance [47], [49], [52]. There is a lack of clarity as to what constitutes fit but it can be assumed that the various strategies mentioned in the theory are associated with different amounts of cost and other effects such as division of labor. Thus, deciding upon a strategy will also be a problem of balancing those effects against the firm's objectives aiming to choose a strategy that is least expensive [46], [52]. Galbraith [46] claims that if organizations not consciously match their information processing needs and processing capabilities by choosing one of the aforementioned strategies, the organization's quality standards or desired level of performance is reduced automatically. Transferring this claim to the realm of DP while focusing on the decision making mechanisms, our third and final research question is (RQ3): What decision making mechanisms do firms use to align DP needs and DP capabilities?

3 Research Methodology

Case studies are considered to be a reasonable approach to answer why and how questions and when there is a need for capturing real-world context and richness of a contemporary phenomenon without requiring the control of behavioral events [54]. Since this study sets out to provide a deeper understanding of DP needs (why?), DP capabilities and alignment mechanisms (how?), we decided upon case study research.

Our overall research approach is described in the following sections and serves as our case study protocol [54]. Since knowledge about DP in an for-profit environment is limited the nature of this case study is more exploratory, aiming to establish a foundation for future research by uncovering constructs and formulating propositions [54], [55]. In this vein and compatible with both our research scope and questions, we applied a hybrid approach referred to as "soft positivism" [56] which has been recently used in IS case study research [e.g., 57]. This approach enables us to draw from positivist view [58], [59], assuming DP being relatively stable and objectively existing phenomena while bringing first preconception to data analysis to present factual results. On the other hand and in line with the interpretive perspective [60], [61]; we also allow surfacing other constructs that emerge from the data.

3.1 Unit of Analysis and Case Selection

The unit of analysis of the present study is the adoption of DP in firms. We selected a multiple-case design to increase evidential significance of our findings and external validity while aiming for replication of results [54], [62]. For site selection we applied a "criterion"/"purposeful random" strategy [55], [63]. We decided to select the sites following Benbasat et al. [58], based on key characteristics of a firm. Based on our prior literature review, we therefore identified three criteria, i.e., industry sector, prof-

it/not-for-profit status and geographic coverage. First, the case organization should either operate in a highly regulated industry sector or at least be affected by the SOX regulation. Second, the organization should have a for-profit status. Third, it should operate in various countries and hence may be affected by several legislations [e.g. 4].

We therefore searched for subject matter experts in the area of DP using social networks for business professionals like LinkedIn. We used the advanced search functionalities of the social network portals and queried for contacts that offered DP experiences/knowledge or were employed in the area of DP. We collected all search results in a list and excluded all contacts affiliated with not-for-profit organizations. We yielded a list of 98 contacts which we prioritized according to the contact's level of experience, job role and geographical distance. Since our literature review particularly indicated DP needs in industry sectors, such as pharmaceuticals, financial services, aviation, and software we further narrowed our list down to those industries which led to a reduction to 14 contacts. Then, we asked all 14 persons for their participation in this case study. We received three declining answers for various reasons (e.g. lack of time/interest or effective non-disclosure agreements) and two positive replies committing to participate in the case study (case A/B) which equals a positive return rate of 14.3%. In all other cases we have not received a reply. To increase the study's external validity, we were aiming for an additional case and hence applied the snowballing strategy [55] by starting to query affiliated partners and thereby eventually identified case C. A summary of the selected cases out of the pharmaceuticals, aviation and software sector along with key company data is provided in table 1.

Table 1. Case Selection (All Company Names Are Pseudonyms)

Case	Case A	Case B	Case C
Company (Staff)	MainCo (> 15,000)	LifeCo (> 100,000)	SofiCo (> 50,000)
Industry Sector	Aviation	Pharmaceutical	Software
Core Business	Aircraft maintenance and overhaul	Production of pharmaceuticals/vaccines	Development of enterprise software
Market Presence	Operations in 30 countries	Operations > 150 countries	Operations in > 50 countries

3.2 Data Collection and Data Analysis

Prior to data collection, taking place between February and April 2012, we were in contact with the participating informants via e-mail and telephone. We provided them with a PDF-document containing general information regarding the scope of the case study, our initial research questions and the structure of our interview guide indicating the focus of our questions. To increase the study's validity and reliability we follow the recommendations given by Yin [54] who proposes three principles of data collection, namely: 1) use of multiple sources of evidence, 2) creation of a case study database and 3) to maintain the chain of evidence. In line with the first principle, this study uses multiple sources aiming to increase the robustness of our results through triangulation of sources [54], [64]. However, semi-structured interviews provided the primary corpus of data since they are considered appropriate for in-depth exploration

and one important source of IS case research [54], [65]. Most interviews were recorded and lasted between 40 and 100 minutes whereas the interview guide was once adjusted by removing a set of questions [62]. We transcribed the interviews within 24 hours after they took place and additionally took field notes [55]. Table 2 illustrates our used sources.

In accordance with the second data collection principle, we created a case study database using NVIVO which allowed us both to centrally store all types of acquired data for subsequent analysis and to separate the raw data from our findings and interpretations of evidence [54], [55]. In order to maintain a chain of evidence (third principle), we provide “thick descriptions”, i.e., representative verbatim quotations [59], [65] from the recorded data to link the empirical material with our interpretations. Further, NVIVO allows us to trace forth and back between the raw data and our interpretations, research questions and conclusions to maintain the chain of evidence.

The analysis strategy was designed to respond to our three research questions. In a first step we conducted within-case analysis for each case to get familiar with the data as a “stand-alone entity” [62] followed by a cross-case analysis focusing on the search of cross-case pattern. To this end, we started augmenting the interview transcripts with “reflective remarks” [55]. Next, we commenced open coding whereby statements in the transcripts, secondary data and field notes pertaining to some DP need, DP capability or alignment mechanisms were used to define conceptual labels. Some of the applied labels were provisional and consolidated or renamed later during axial coding where we compared and grouped the codes in an iterative approach to form (sub-)categories [66]. Consistent with our soft-positivist approach, i.e., being open to the softer or interpretivist position, gave us the freedom during coding to inductively develop themes and categories based on the underlying data while purposely framing them into deductively defined categories of DP needs, DP capabilities and alignment mechanisms suggested by the OIPT [57]. Due to space limitations we have to abstain from presenting the results of the within-case analysis in this paper which is, however, a commonly accepted approach in case study research [54].² We thus present the cross-case analysis in the next section where we compare our findings and present differences/similarities between the cases [58].

Table 2. Data Sources

Case/Company	A/MainCo.	B/LifeCo.	C/SoftCo.
Primary sources	1 on-site interview	1 on-site interview	3 on-site interviews, 2 telephone interviews, 3 informal talks
Key Informants	Archival Manager	Information Governance Manager	Archive Administrator, Security Officer, Process Owner, Solution Architect
Experience of interviewees	8 years on average	25 years on average	13 years on average
Secondary sources	System documentation, architecture diagram, annual report, regulatory documents	Organizational charts, internal presentations, archival records, regulatory documents	Data architecture policy documents, internal presentations and functional design documents

² A PDF containing the within-case analysis is available at: www.uwi.uos.de/DPWCaseAn.pdf.

4 Cross-Case Analysis

Based on the results of the within-case analysis of the three firms, we present a cross-case analysis along the theory-driven factors of DP needs, DP capabilities and alignment/decision making mechanisms seeking for differences/similarities between the three cases [59], [62]. As stated above, DP needs refer to internal and external factors that drive a firm's need to preserve specific information while DP capabilities represent the employed structures, methods and information systems to manage the needs. Moreover, alignment and decision making mechanisms comprise the applied mechanisms to match a firm's DP needs with the respective DP capabilities.

Table 3 summarizes our findings as a case-ordered meta-matrix [67] and further indicates the convergence (H = high, M = medium, L = low) of the findings, i.e., the degree of similarities between the three cases along the constructs of DP needs, DP capabilities and alignment mechanisms and their inherent key factors. As a result of the within-case and cross-case analysis, we derive six propositions in section five, aiming to explain the observed constructs in the light of the organizational information processing theory.

Table 3. DP Needs, Capabilities and Alignment/Decision Making Mechanisms

Construct	Key Factors	Evidence from the Cases			Convergence
		A – MainCo	B - LifeCo	C - SoftCo	
DP Needs	Legal/regulatory	x	x	x	H
	IP defense	x	x	x	H
	Product liability	x	x	-	M
	Data growth	x	-	-	L
	Trend analysis	x	-	-	L
DP Capabilities	Number of DP systems	- 4 systems, each for different purposes	- 1 OAIS compliant system	- 1 central system	L
	Integration of DP system with business applications	- 1 system directly integrated, 3 systems decoupled	- Not integrated	- Directly integrated	L
	Strategy to mitigate technological obsolescence	- Reliance on software vendor and file format standards (TIFF, PDF/A)	- Reliance on file format standards (TIFF, PDF/A)	- Reliance on software vendor and open file format standards (TIFF, PDF/A) - Preserving system core functionality	H
	Retention/disposal processes	- Semi-automated retention process, disposal partly automated	- Retention schedules defined in application, retention and disposal triggered manually	- Automated retention process triggered by business application, no disposal at all	M
	Organizational responsibility and structure	- 2 dedicated departments within IT responsible for DP and providing advisory - 8 -10 employees	- Strategic Information Governance function mandating guiding principles - 33 employees	- No dedicated formal unit/role - DP implicitly treated in course of implementation projects	L
Alignment/Decision Making Mechanisms	Definition of decision criteria (what to preserve?)	- No formal/ documented procedure or decision criteria - Tendency to hoard information	- Formal process, questionnaire to be filled to justify need - Tendency to drop DP in favor of less costs	- No formal/ documented procedure - Tendency to hoard information	L
	Policies	- No documented retention and disposal policy	- Global retention and disposal policy - Taxonomy classifying information according to legal/business needs	- No documented retention and disposal policy - Determination of retention period by rule of thumb	M
	Distribution of costs for DP	-	- Based on a charge out model costs are distributed across departments	- Based on a charge out model costs are distributed across departments	M

5 Interpretation

Interpreting the findings from the cross-case analysis and responding to our research questions in line with the principles of conducting IS case studies [55], [58], [62], we suggest a set of propositions in table 4. Propositions are only suggested where we could either literally replicate results, i.e., find at least two cases providing evidence for a particular observation or where we could theoretically replicate, i.e. find contrasting results that could be predicted or explained by literature [54]. We derive our propositions subsequently following the theoretical constructs of DP needs, DP capabilities and alignment mechanisms.

With regards to the first question of DP needs, our findings suggest that DP is rather driven by external factors such as regulatory mandates while a few subordinate factors like IP protection or protection against product liability litigations could also be found. Those findings are also supported by extant research [4], [31], [43] and in turn lead to the propositions P1 and P2.

Our findings indicate less congruence in the characteristics of the factors comprising DP capabilities. In the light of a relatively high degree of similarity with regards to DP needs this might indicate their contingency on both external and internal factors such as the company size/industry sector or the firm's IT strategy which is supported by existing research [14], [31]. Moreover, we can observe different organizational design decisions taken by the three firms ranging from no formal assignment of responsibility in less regulated environments (case C) to the installation of a cross-functional globally acting department (case B) in more regulated industry sectors, which indicates a particular factor of contingency. Taking the above into account and assuming that firms cannot influence the legal/regulatory mandates leads to proposition P3/P4.

In cases A/C we could not identify any formal or documented decision making procedure allowing the firms to consciously and rigorously determine what information to preserve if the information are not subject to legal or regulatory obligations. In both cases, informants report of a tendency of organizational information hoarding, which might appear paradox at first sight. But interestingly this observation corresponds to a behavioral pattern being studied in the arena of psychology referred to as *Compulsive Hoarding* defined as the "acquisition of, and failure to discard, large numbers of possessions that have little use or value" [68]. In psychological context, hoarding is thought to derive security from collecting and saving objects allowing individuals to avoid making decisions about what to discard and therewith bypass unpleasant situations such as making mistakes. An indication for this behavior could be found in the cases A/C. For instance, a process owner of SoftCo states "*we are information messies [...] there is a culture of just keeping everything to play safe and avoid mistakes as there might be a situation where information is needed again.*"

Further, the lacking "*ability to distinguish trash from treasure*" and a deficit in the categorization and organization of information are considered causes of hoarding [69]. This lacking ability might also be transferred as to a lacking existence of policies or taxonomies supporting the classification of information. Looking at the alignment mechanisms in the light of *Compulsive Hoarding*, case B also contrasts with cases

A/C. We find case B having at least a semi-formal decision making process and classification taxonomy in place while cases A/C indicate a lack of any formalized approach. In case B, DP is being treated restrictive in favor of fewer costs while accepting the risk of not having information accessible in future. That being said, we finally suggest propositions P5 and P6.

Table 4. Propositions Explaining DP Needs, DP Capabilities and Alignment Mechanisms

	Proposition	Case	OIPT Construct	Related OIPT Support [46]
P1	DP needs in a firm are driven by regulatory and legislative mandates.	A, B, C	DP needs	Firms are dependent on their larger environment and therewith dependent on effective regulation and legislation.
P2	Where no regulation or legislation governs the preservation of information, a firm's DP needs are driven by the objective of protecting its rights or interests.	A, B, C	DP needs	Filed lawsuits against firms can be conceived as a factor of uncertainty driving the need for information in the long-term.
P3	The effective design of DP capabilities of a firm is contingent on external and internal factors.	A, B, C	DP capabilities	The design of the organizational strategy is dependent on the environmental context of the organization.
P4	The greater the effective regulatory/legislative retention requirements, the greater the degree of formalization of DP responsibilities.	A, B	DP capabilities	
P5	Firms that do not consciously decide whether to preserve specific information, tend to hoard information and hence increase cost.	A, C	Alignment/Decision Making Mechanisms	If an organization does not consciously choose one design strategy, the creation of slack resources associated with additional costs will happen automatically. Each organizational strategy is associated with different effects and costs while the creation of slack resources is considered additional cost to an organization.
P6	Firms that do consciously determine what to preserve, tend to dispose of information and hence reduce DP cost.	B	Alignment/Decision Making Mechanisms	

6 Conclusions

6.1 Implications for Scientific Community and Practice

We set out to explore DP in a firm and provide a deeper understanding of DP needs (RQ 1), DP capabilities (RQ 2) and the alignment mechanisms of needs and capabilities firms use (RQ 3). As a result of this study, we see several implications significant for both research and practice.

First, our article fills a research gap in that it contributes first empirical evidence of DP needs, capabilities and alignment mechanism of a firm by adopting Galbraith's (1973) information processing theory. Second, our study extends research on the OIPT to a new topic in IS, namely DP, conceived as a need for information processing in the distant future subject to technological and organizational uncertainty. The study shows that the OIPT also provides an appropriate lens to explain DP needs, capabilities and alignment mechanism. Moreover, the findings suggest that firms not solely emphasize a need for DP but also the importance of conscious information disposal in the same breath, which contrasts pertinent DP literature being focused on the concern of permanent/infinite preservation. We uncovered important DP capabilities adopted by firms such as different types of retention and disposal processes as well as strategies to mitigate technological obsolescence in conjunction with diverse configurations of DP solutions. However, the organizational configuration of DP capabilities varies which suggests contingencies on other factors.

Third, our study contributes to a current stream of research engaged on the alignment between DP and organizational goals by uncovering alignment and decision

making mechanisms utilized in firms today. While prior research has raised the issue of lacking alignment between DP and organizational goals [31] as well as lacking economic DP decision making models, it focused on the examination as to the questions of how [20], [28] rather than what/why (to preserve?). However, following the empirical insights from our case study, the questions of what and why seem to be an important aspect in a for-profit organization since DP decisions need to be economically rationalized. While decision making mechanisms and decision criteria provide an organization with the ability to separate the wheat from the chaff, i.e., consciously decide what information to keep or to dispose of respectively, this seems to be not an easy task. However, it might be a mistake to leave DP and information disposal to chance as this leads to an ever growing amount of (potentially useless) information associated with increasing information management costs and complexity.

Finally, we believe that our contribution should be of interest to practitioners in firms that are directly involved in managing DP or having DP needs since they are being faced with either providing DP capabilities at reasonable costs or required to rationally justify their need for DP while taking organizational goals and constraints into account. Our findings indicate that formal decision making procedures or taxonomies seem to be an adequate initial step when geared towards the classification of information with regards to their need for long-term availability.

6.2 Limitations and Future Research

The findings of this study should be viewed in the light of its limitations which at the same time indicate directions for future research. First, this paper is based on just three case studies due to the site access restrictions we had to face. We employed a multiple-case design and decided to select three firms from three different industries as our literature review indicated DP needs particularly in the selected industry sectors. Although we gained a rich set of data reaching theoretical saturation [55], [62], this diversification on three different industries might be considered a limitation. Nevertheless, this points towards a starting point for future work, e.g., an analysis of firms within the same industry to subsequently compare DP strategies among them.

A second limitation originates from the fact that we relied on interviews as our primary source of evidence, which poses common problems associated with interviews such as errors in recall, ambiguity of language, lack of trust and interviewee's as well as interviewer's bias [54], [70]. Due to the different roles of our key informants within the three cases, one should especially note the issue of interviewee's bias. Although we tried to encounter this effect by additionally employing secondary data sources, the different levels of experience, job roles and individual objectives of our key informants may influence their perception of DP and as a consequence our interview data. A third limitation of this study is associated with the selected research method. There is a frequent criticism of generalizability (external validity) of the findings which might be limited though it should be acknowledged that case study research is not considered sampling research and that statistical generalizability is considered an inappropriate measure of a case study's quality [54]. However, following the process of generalizing "from empirical statements (as inputs to generalizing) to

theoretical statements (as outputs of generalizing)” [71], we believe that our findings can be generalized beyond the three firms since we could find stable elements across all three cases that are also corroborated by extant research.

As such, this limitation offers another opportunity for future research that could proceed by statistically validating the presented findings and propositions by means of large-scale quantitative studies. This can provide a better understanding of the relationships between the various constructs while further case studies could be conducted to uncover the contingency factors our results suggest.

References

1. Tallon, P.P.: Understanding the Dynamics of Information Management Costs. *Communications of the ACM* 53, 121-125 (2010)
2. Rosenthal, D.S.H.: Keeping Bits Safe: How Hard Can It Be? *Communications of the ACM* 53, 47-55 (2010)
3. SEC: 17 CFR Part 210 - Final Rule: Retention of Records Relevant to Audits and Reviews. U.S. Securities and Exchange Commission (2003)
4. Berman, F.: Got Data?: A Guide to Data Preservation in the Information Age. *Communications of the ACM* 51, 50-56 (2008)
5. Rabinovici-Cohen, S., Baker, M.G., Cummings, R., Fineberg, S., Marberg, J.: Towards SIRF: Self-Contained Information Retention Format. In: 4th Annual International Conference on Systems and Storage (SYSTOR '11), pp. 1-10. ACM (2011)
6. CCSDS: Reference Model for an Open Archival Information System (OAIS), Blue Book. Consultative Committee for Space Data Systems (2002)
7. Volonino, D.L., Sipior, J.C., Ward, B.T.: Managing the Lifecycle of Electronically Stored Information. *Information Systems Management* 24, 231-238 (2007)
8. Factor, M., Naor, D., Rabinovici-Cohen, S., Ramati, L., Reshef, P., Satran, J.: The Need for Preservation Aware Storage: A Position Paper. *ACM SIGOPS Operating Systems Review* 41, 19-23 (2007)
9. Becker, C., Rauber, A., Heydegger, V., Schnasse, J., Thaller, M.: A Generic XML Language for Characterising Objects to Support Digital Preservation. In: *ACM Symposium on Applied Computing 2008 (SAC '08)*, pp. 402-406. ACM (2008)
10. Chen, S.-S.: The Paradox of Digital Preservation. *Computer* 34, 24-28 (2001)
11. Rusbridge, C., Burnhill, P., Ross, S., Buneman, P., Giaretta, D., Lyon, L., Atkinson, M.: The Digital Curation Centre: A Vision for Digital Curation. In: *IEEE International Symposium on Mass Storage Systems and Technology 2005*, pp. 31-41. IEEE (2005)
12. Regli, W.C., Grauer, M., Kopena, J.B.: A Framework for Preservable Geometry-Centric Artifacts. In: *SIAM/ACM Joint Conference on Geometric and Physical Modeling 2009 (SPM '09)*, pp. 67-78. ACM (2009)
13. NSB: Long-Lived Digital Data Collections: Enabling Research and Education in the 21st Century. National Science Board (2005)
14. Barateiro, J., Antunes, G., Freitas, F., Borbinha, J.: Designing Digital Preservation Solutions: A Risk Management-Based Approach. *International Journal of Digital Curation* 5, 4-17 (2010)

15. Storer, M.W., Greenan, K., Miller, E.L.: Long-Term Threats to Secure Archives. In: 2nd Workshop on Storage Security and Survivability, pp. 9-16. ACM (2006)
16. Lee, K.H., Slattery, O., Lu, R., Tang, X., McCrary, V.: The State of the Art and Practice in Digital Preservation. *Journal Of Research Of The National Institute Of Standards And Technology* 107, 93-106 (2002)
17. Levy, D.M.: Heroic Measures: Reflections on the Possibility and Purpose of Digital Preservation. In: 3rd ACM Conference on Digital Libraries (DL '98), pp. 152-161. ACM (1998)
18. Muir, A.: Legal Deposit and Preservation of Digital Publications: A Review of Research and Development Activity. *Journal of Documentation* 57, 652-682 (2001)
19. Lorie, R.A.: A Methodology and System for Preserving Digital Data. In: 2nd ACM/IEEE-CS Joint Conference on Digital Libraries (JCDL '02), pp. 312-319. ACM (2002)
20. Antunes, G., Barateiro, J., Cabral, M., Borbinha, J., Rodrigues, R.: Preserving Digital Data in Heterogeneous Environments. In: 9th ACM/IEEE-CS Joint Conference on Digital Libraries (JCDL '09), pp. 345-348. ACM (2009)
21. Ma, N., Li, C., Jiang, A., Xing, C.: Design and Implementation of Open Source Based Digital Preservation Experimental Platform (THDP). In: 9th International Conference for Young Computer Scientists 2008 (ICYCS 2008), pp. 959-964. (2008)
22. Schmidt, R., Sadilek, C., King, R.: A Service for Data-Intensive Computations on Virtual Clusters. In: First International Conference on Intensive Applications and Services 2009 (INTENSIVE '09), pp. 28-33. IEEE (2009)
23. Gladney, H.M.: Trustworthy 100-Year Digital Objects: Evidence After Every Witness is Dead. *ACM Transactions on Information Systems* 22, 406-436 (2004)
24. Ferreira, M., Baptista, A.A., Ramalho, J.C.: An Intelligent Decision Support System for Digital Preservation. *International Journal on Digital Libraries* 6, 295-304 (2007)
25. Becker, C., Kulovits, H., Rauber, A., Hofman, H.: Plato: A Service Oriented Decision Support System for Preservation Planning. In: 8th ACM/IEEE-CS Joint Conference on Digital Libraries (JCDL '08), pp. 367-370. ACM (2008)
26. Rechert, K., von Suchodoletz, D., Welte, R.: Emulation Based Services in Digital Preservation. In: 10th Annual Joint Conference on Digital Libraries (JCDL '10), pp. 365-368. ACM (2010)
27. Nguyen, Q.L., Lake, A., Huber, M.: Content Server Architecture Pattern for Evolvability and Scalability. In: 5th International Conference on Software Engineering Advances 2010 (ICSEA), pp. 149-154. IEEE (2010)
28. Becker, C., Rauber, A.: Preservation Decisions: Terms and Conditions Apply. In: 11th Annual International ACM/IEEE Joint Conference on Digital Libraries (JCDL '11), pp. 67-76. ACM (2011)
29. Eastwood, T.: Appraising Digital Records for Long-Term Preservation. *Data Science Journal* 3, 202-208 (2004)
30. Antunes, G., Barateiro, J., Becker, C., Borbinha, J., Vieira, R.: Modeling Contextual Concerns in Enterprise Architecture. In: 15th International Enterprise Distributed Object Computing Conference Workshops (EDOCW 2011), pp. 3-10. IEEE (2011)
31. Becker, C., Barateiro, J., Antunes, G., Borbinha, J., Vieira, R.: On the Relevance of Enterprise Architecture and IT Governance for Digital Preservation Electronic Government. In: Janssen, M., Scholl, H., Wimmer, M., Tan, Y.-H. (eds.): Vol. 6846, pp. 332-344. Springer, Berlin/Heidelberg (2011)
32. vom Brocke, J., Seidel, S., Simons, A.: Bridging the Gap Between Enterprise Content Management and Creativity: A Research Framework. In: Proceedings of the 43rd

- Hawaii International Conference on System Sciences HICSS 2010, pp. 1-10. IEEE (2010)
33. Sprague Jr, R.H.: Electronic Document Management: Challenges and Opportunities for Information Systems Managers. *MIS Quarterly* 19, 29-49 (1995)
 34. Munkvold, B.E., Päivärinta, T., Kristine, A.: Contemporary Issues of Enterprise Content Management. *Scandinavian Journal of Information Systems* 18, 69-100 (2006)
 35. vom Brocke, J., Derungs, R., Herbst, A., Novotny, S., Simons, A.: The Drivers Behind Enterprise Content Management: A Process-Oriented Perspective. In: *ECIS 2011 Proceedings*. (2011)
 36. Grahlmann, K., Hilhorst, C., van Amerongen, S., Helms, R., Brinkkemper, S.: Impacts of Implementing Enterprise Content Management Systems. In: *ECIS 2010 Proceedings*. (2010)
 37. vom Brocke, J., Simons, A., Cleven, A.: Towards a Business Process-Oriented Approach to Enterprise Content Management: The ECM-Blueprinting Framework. *Information Systems and E-Business Management* 9, 475-496 (2011)
 38. Zardini, A., Mola, L., vom Brocke, J., Rossignoli, C.: The Shadow of ECM: The Hidden Side of Decision Processes. In: *Proceedings of the 2010 Conference on Bridging the Socio-technical Gap in Decision Support Systems: Challenges for the Next Decade*, pp. 3-12. IOS Press (2010)
 39. Wiltzius, L., Simons, A., Seidel, S.: A Study on the Acceptance of ECM Systems. In: *Wirtschaftsinformatik Proceedings 2011*. (2011)
 40. Nordheim, S., Paivarinta, T.: Customization of Enterprise Content Management Systems: An Exploratory Case Study. In: *Proceedings of the 37th Annual Hawaii International Conference on System Sciences HICSS*. IEEE (2004)
 41. O'Callaghan, R., Smits, M.: A Strategy Development Process for Enterprise Content Management. In: *ECIS 2005 Proceedings*. (2005)
 42. Grahlmann, K., Helms, R.W., Hilhorst, C., Brinkkemper, S., van Amerongen, S.: Reviewing Enterprise Content Management: A Functional Framework. *European Journal of Information Systems* 21, 268-286 (2012)
 43. Tallon, P.P., Scannell, R.: Information Life Cycle Management. *Communications of the ACM* 50, 65-69 (2007)
 44. Khatri, V., Brown, C.V.: Designing Data Governance. *Communications of the ACM* 53, 148-152 (2010)
 45. Gregor, S.: The Nature of Theory in Information Systems. *MIS Quarterly* 30, 611-642 (2006)
 46. Galbraith, J.R.: *Designing Complex Organizations*. Addison-Wesley Publishing (1973)
 47. Fairbank, J.F., Labianca, G.J., Steensma, H.K., Metters, R.: Information Processing Design Choices, Strategy, and Risk Management Performance. *Journal of Management Information Systems* 23, 293-319 (2006)
 48. Goodhue, D.L., Wybo, M.D., Kirsch, L.J.: The Impact of Data Integration on the Costs and Benefits of Information Systems. *MIS Quarterly* 16, 293-311 (1992)
 49. Premkumar, G., Ramamurthy, K., Saunders, C.S.: Information Processing View of Organizations: An Exploratory Examination of Fit in the Context of Interorganizational Relationships. *Journal of Management Information Systems* 22, 257-294 (2005)

50. Bensaou, M., Venkatraman, N.: Configurations of Interorganizational Relationships: A Comparison Between US and Japanese Automakers. *Management Science* 41, 1471-1492 (1995)
51. Gattiker, T.F., Goodhue, D.L.: What Happens After ERP Implementation: Understanding the Impact of Interdependence and Differentiation on Plant-Level Outcomes. *MIS Quarterly* 29, 559-585 (2005)
52. Tushman, M.L., Nadler, D.A.: Information Processing as an Integrating Concept in Organizational Design. *Academy of Management Review* 3, 613-624 (1978)
53. Daft, R.L., Lengel, R.H.: Organizational Information Requirements, Media Richness and Structural Design. *Management Science* 32, 554-571 (1986)
54. Yin, R.K.: *Case Study Research: Design and Methods*. Sage Publications, Thousand Oaks, CA, USA (2009)
55. Pare, G.: Investigating Information Systems with Positivist Case Study Research. *Communications of the Association for Information Systems* 13, 233-264 (2004)
56. Madill, A., Jordan, A., Shirley, C.: Objectivity and Reliability in Qualitative Analysis: Realist, Contextualist and Radical Constructionist Epistemologies. *British Journal of Psychology* 91, 1-20 (2000)
57. Ravishankar, M., Pan, S.L., Leidner, D.E.: Examining the Strategic Alignment and Implementation Success of a KMS: A Subculture-Based Multilevel Analysis. *Information Systems Research* 22, 39-59 (2011)
58. Benbasat, I., Goldstein, D.K., Mead, M.: The Case Research Strategy in Studies of Information Systems. *MIS Quarterly* 11, 369-386 (1987)
59. Dubé, L., Paré, G.: Rigor in Information Systems Positivist Case Research: Current Practices, Trends, and Recommendations. *MIS Quarterly* 27, 597-636 (2003)
60. Klein, H.K., Myers, M.D.: A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly* 23, 67-93 (1999)
61. Walsham, G.: Interpretive Case Studies in IS Research: Nature and Method. *European Journal of Information Systems* 4, 74-81 (1995)
62. Eisenhardt, K.M.: Building Theories from Case Study Research. *Academy of Management Review* 14, 532-550 (1989)
63. Patton, M.Q.: *Qualitative Research and Evaluation Methods*. Sage Publications (2002)
64. Kaplan, B., Duchon, D.: Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study. *MIS Quarterly* 3, 571-586 (1988)
65. Myers, M.D., Newman, M.: The Qualitative Interview in IS Research: Examining the Craft. *Information and Organization* 17, 2-26 (2007)
66. Urquhart, C.: An Encounter with Grounded Theory: Tackling the Practical and Philosophical Issues. In: Trauth, E.M. (ed.) *Qualitative Research in IS: Issues and Trends*, pp. 104-140. IGI Publishing Hershey, PA, USA (2001)
67. Miles, M.B., Huberman, A.M.: *Qualitative Data Analysis: An Expanded Sourcebook*. Sage Publications, Thousand Oaks, CA, USA (1994)
68. Frost, R.O., Steketee, G., Greene, K.A.I.: Cognitive and Behavioral Treatment of Compulsive Hoarding. *Brief Treatment and Crisis Intervention* 3, 323-337 (2003)
69. Grisham, J.R., Barlow, D.H.: Compulsive Hoarding: Current Research and Theory. *Journal of Psychopathology and Behavioral Assessment* 27, 45-52 (2005)
70. Myers, M.D.: Qualitative Research in Information Systems. *MIS Quarterly* 21, 241-242 (1997)
71. Lee, A.S., Baskerville, R.L.: Generalizing Generalizability in Information Systems Research. *Information Systems Research* 14, 221-243 (2003)