

# Designing Information Governance with a Focus on Competence Management in a Knowledge-Intensive Project Organization

ERKKA NIEMI, Aalto University

SAMI LAINE, Aalto University

Companies can no longer rely on technology alone as a source of competitive advantage. They should treat corporate information as a key strategic asset. Researchers and practitioners have recognized the importance of information governance, but it is still a relatively new research area. In this action design research we contribute to the prescriptive knowledge base on how to design and implement information governance in a real-life organizational context. The research was conducted from 2013 to 2016 in a publicly traded professional services company operating in the technology-consulting field. During the research period, the company implemented information governance practices to support its new competence management system and related competence management organization. According to our experience the implementation of the design principle, “information as an asset,” can lead to significant business benefits.

• Enterprise Computing → Enterprise Data Management • Information Systems → Information systems applications  
 → Enterprise information Systems.

Additional key words and phrases: information governance, data governance, information resource, information asset, master data management, competence management, action design research, enterprise system, systematic literature review.

## 1. INTRODUCTION

Companies should treat corporate information as a key strategic asset in order to achieve competitive advantage [Davenport 2007]. Information-driven decision-making seems to lead to higher productivity and improvements in performance [Brynjolfsson 2011]. Like any other asset, information needs good corporate governance and related quality controls across the entire information life cycle.

Information governance is a relatively new research area. It combines the best practices from many fields such as strategic management, business process management, risk management, and IT governance. In order to present up-to-date understanding about this multidisciplinary topic we conducted a systematic literature review to extend and update the previous one conducted by Otto [2011c]. Although the roots of information governance research are in the early 1980s, today there are still not many papers presenting prescriptive knowledge on how to design and implement information governance in an organizational context. Therefore, we aimed to describe the design, implementation, and organizational impacts of information governance in a real business environment.

In 2013, the rapidly growing Siili Solutions PLC had no formal framework or process to manage, develop, or deploy competence management. The case organization decided to improve its competence management by creating a competence organization and related enterprise system (ES) to support rapid growth [Niemi and Laine 2016a]. However, the first ES releases and competence organization changes in the case organization did not provide the expected benefits due to information quality problems. Therefore, the case organization systematized the information quality approach by setting up information governance practices, standardizing employee master data, and implementing quality controls in the ES. The development was guided by researchers emphasizing information as an asset [Redman 1998] and a product [Wang 1998], and newer research focusing on information governance [Tallon 2013, Otto 2011, Khatri & Brown 2010, Weber et al. 2009].

The structure of this paper is as follows: 1) this introduction, 2) a systematic literature review on information governance, 3) a description of the research methodology and approach, 4) a description of the information governance solution in the case

organization, 5) a discussion regarding the solution's characteristics and the research's impact, and 6) conclusions based on our practice-inspired theoretical findings.

## 2. LITERATURE

Companies can no longer rely on technology alone as a source of competitive advantage [Carr 2003]. They need an enterprise-wide information strategy and information governance in the current information-intensive, knowledge-based economy [Davenport 2007, Castells 2010]. In 1998 Redman [1998] already argued that many enterprises have not achieved the needed awareness of poor data quality, which has adverse effects on the operational, tactical, and strategic levels of business. Nowadays, the leading organizations have learned the lesson that information quality problems are business problems rather than technical IT problems [Lee et al. 2014]. The claim seems justified since, for example, Aiken et al. [2011] have found out that the data management profession is moving from low-level operations towards managerial functions, such as information governance.

The above calls for business-driven information governance have gotten empirical support from a wide set of studies. In the 2000s studies showed evidence that the relationship between information quality and organizational outcomes is systematically measurable and that the measurements of information quality can be used to predict organizational outcomes [Brynjolfsson 2011, Sheng & Mykytyn 2002, Slone 2006]. Moreover, companies that have top-level accountable information owners seem to perform better financially [EIU 2011]. However, several studies [Pierce et al. 2008, EIU 2008, EIU 2011] indicate that only a few companies have enterprise-wide information governance policies in place. There is a clear business need to study how to effectively design and implement information governance in a real business context. In the context of information systems (IS) research the convention seems to be moving towards using the term *information* (e.g., Tallon 2014) rather than *data* (e.g., Otto 2011), so accordingly in this paper we speak about *information governance*. In addition, in this paper *governance* refers to the decisions that must be made and who makes the decisions, whereas *management* involves the making and implementing of decisions [Khatri & Brown 2010, ISO/IEC 2008]. Therefore, we define **information governance** as the formal framework that includes the structure and execution of authority and accountability over information assets, in order to encourage, enforce, and monitor meeting the desired organizational objectives (building on top of the OECD [2015] definition of *corporate governance* and inspired by Thomas [2006], Weber et al. [2009], Khatri & Brown [2010], Otto [2011], Tallon et al. [2013], and Seiner [2014]).

Otto [2011] conducted a systematic literature review of information governance in 2011. In this literature review we revisit his approach and mainly focus on the years 2011 to 2016 in order to find out the latest scientific contributions to this relatively new research area. Our review comprises three steps, as follow.

**Step 1** started with finding the scientific literature related to information governance. We searched in the same five academic online libraries as Otto but added ProQuest and AIS Senior Scholars' Basket of Journals (see Table 1). We used Otto's key words as search terms: "data governance" and "information governance." In addition, we used Google Scholar with the same search terms to find all the relevant material.

Table 1: The online libraries of the literature search

	ACM Digital Library	AIS Electronic Library	CiteSeerX	EBSCO Online	Emerald Insight	ProQuest	Senior Scholars' basket of journals
Website	portal.acm.org	aisel.aisnet.org	citeseerx.ist.psu.edu	ejournals.ebsco.com	emeraldinsight.com	search.proquest.com	site of each journal
Search function	Advanced search in journals, transactions, proceedings.	Advanced search, match any, peer-reviewed only.	Advanced search.	Find academic journals.	Advanced search.	Advanced search, scholarly peer-reviewed only.	Advanced search.
Search options	Search in title, abstract, keywords.	Search in title, abstract, keywords.	Search in title and abstract.	Search in title and abstract.	Search in abstract.	Search in title, abstract.	Search in title, keywords, abstract.
Published since	2011	2011	2011	2011	2011	2011	anytime
Search date	20.3.2016	20.3.2016	20.3.2016	20.3.2016	20.3.2016	20.3.2016	21.3.2016
Nr of articles	12	16	8	37	20	22	24

**Step 2** started with the analysis and categorization of all the search results. We decided to scope out most of the practitioner publications and only included the most cited practitioner information governance frameworks and books. Next we analyzed and categorized all the articles using the criteria “if more than one applies” 1) Does the article focus on designing information governance and prescribing how to implement it? 2) Has the article been published in a journal? 3) Has the article been cited? All the remaining search results were categorized according to their nature (see Table 2).

Table 2: The categorization of the relevant literature

Format	Author(s) & year of publication
Scientific IS Journals	Goodhue et al. (1988), Goodhue et al. (1992), Levitin & Redman (1998), Wang et al. (1998), Weil & Ross (2004), Weil & Ross (2005), Weber et al. (2009), Khatri & Brown (2010), Kooper et al. (2011), Otto (2011a), Otto (2011b), Tallon et al. (2013), Korhonen et al. (2013), Lee et al. (2014).
Scientific IS Conference	Wende (2007), Otto (2011c), Barata & Prado (2015)
Other Scientific Journals	Atkinson (2006), Rosenbaum (2010), Gregory (2010), Tallon (2013), Lajara & Macada (2013), Faria (2013), Felici (2013), Putro et al. (2015), Avery & Cheek (2015), Demarquet (2016), Abbasi et al. (2016).
Practitioner framework	Thomas/DGI (2006), Radcliffe/Gartner (2007), Adler/IBM (2007), DAMA (2009), Soares/IBM (2010), Mike 2.0 (2013).
Practitioner book	Adelman et al. (2005), Russom (2006), Berson & Dubov (2007), Loshin (2008), Redman (2008), Sarsfield (2009), Fisher (2009), Berson & Dubov (2010), Orr (2011), Soares (2011), Soares (2012), Ladley (2012), Seiner (2014).

**Step 3** was the content analysis of the remaining articles. Information governance has its origin in the 1980s and 1990s: the strategic planning of information resources [Goodhue et al. 1988, 1992, Levitin & Redman 1998] and information as a product [Wang et al. 1998]. However, the first attempts to create a framework for information governance were published no earlier than 2006 [Wende 2007, Thomas 2006, Adler 2007, Radcliffe 2007, DAMA 2009], influenced by the IT governance approach [Weil & Ross 2005]. A few years later Weber et al. [2009] and Khatri and Brown [2010] rendered the early scientific definitions of information governance. However, in common with all the approaches was that they focused on single aspects of information governance and this gap in both the scientific and the practical state of the art was the motivation for Otto [2011a, 2011b, 2011c], Kooper et al. [2011], Tallon [2013], and Korhonen et al. [2013]. Still, Lee et al. [2014] reported that data managers used to have a “huge responsibility but no authority” and companies often addressed data problems to the IT department instead of to business leadership.

In addition to IS, the importance of information governance has been recognized in other fields as well. According to Atkinson [2006], the cost of data should be accounted for and to appear on the firm’s balance sheet with other critical assets. Demarquet’s [2016] survey shows that 88% of organizations face issues when closing their books due to a misaligned chart of accounts. Gregory [2010] argues (from a marketing point of view) that many organizations are waking up to the fact that customer data is a valuable corporate asset that needs careful protection and its value needs to be actively managed or “governed.” According to Rosenbaum [2010], health policy is struggling

over access to health information, in particular the conditions under which information should be accessible for research when appropriate privacy protections and security safeguards are in place. Avery and Cheek [2015] argue that organizations are currently implementing advanced analytic capabilities that require additional considerations not addressed by existing governance frameworks. The recent paper of Abbasi et al. [2016] presents varying perspectives on promising big data research topics (including information governance) and highlights some of the challenges.

### **3. METHODOLOGY**

#### **The Action Design Research Approach**

Action design research (ADR) is practice-inspired research, resulting in a theory-ingrained artifact. According to ADR methodology [Sein et al. 2011], the design consists of four stages: 1) problem formulation, 2) building, intervention, and evaluation (BIE), 3) reflection and learning, and 4) the formalization of learning. In our entire ADR research program we aim at 1) improving competence management as a strategic capability and 2) improving the organizational and technological aspects of ES development, especially in regard to competence management. In this paper we focus on information governance development conducted as a part of larger ADR program. The first author was hired as a director to lead a research and development (R&D) initiative in the case organization in October 2013 and has therefore been actively participating in the design of organizational objectives and implementation projects. The second author has not been participating in these development activities, although in 2015 he joined the same organization. Therefore, the first author is an “involved researcher” and the second author is an “outside researcher” [Walsham 2006].

#### **Case Description**

The case organization, Siili Solutions PLC, conducted an R&D initiative (10/2013–6/2016) aimed to improve competence management in order to meet current and future customer demand. Siili Solutions employs over 400 persons, has an annual revenue that amounted to €42M in 2015 (+42% from 2014), and operates in Finland, Germany, and Poland. During the R&D program, there have been three major organizational changes and four major releases of the competence management system (CMS). The service vision for Siili Solutions’ CMS is founded on the hedgehog concept [Collins 2001], meaning that the company should focus on the intersection of what it can be best at in the world (competence), how its economics work best (customer demand), and what most interests its employees (passion).

#### **The Design Process**

The design process has followed the ADR method [Sein et al. 2011] and implemented the design principles introduced by Lindgren et al. [2004]. The BIE stage, including the four major releases of KnoMe (v.2.0–v.5.0), is visualized in Figure 1. The organizational information governance development was tightly linked to the software development phases. The authors described the design process including the problem formulation stage in more detail in another paper [Niemi & Laine 2016a], the technical KnoMe software in yet another paper [Niemi & Laine 2016b], and describe the formalization of the learning in this paper as well as in a forthcoming paper.

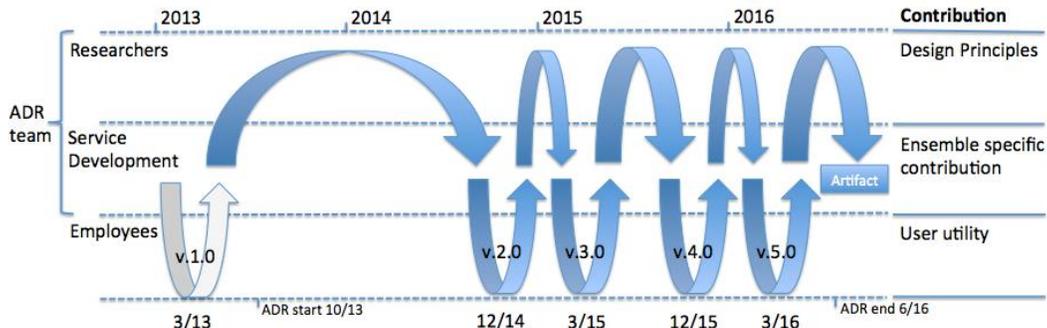


Figure 1: The BIE stage and release versions of the CMS KnoMe at Siili Solutions.

#### 4. THE SOLUTION

The R&D initiative (see Table 3) started from a practice-inspired need in Siili Solutions, which had already launched the first version of the CMS in March 2013 and the first major organizational change in October 2013. During the first year of the formal ADR program we focused on understanding the current and target state, and designed the major version, version 2.0, of the CMS, which went live in December 2014.

Table 3: Organizational and technological events during the ADR program

Date	Organization: data improvement deliverables	Technology: software support deliverables
03/2013		KnoMe v.1.0: .doc CVs to CMS
10/2013	Tribal Network 1.0	
11/2014	Information governance structures: data owners, data standard, target architecture, IT service owners	
12/2014		KnoMe v.2.0: employee master data, solid architecture
01/2015	Tribal Network 2.0: data profiling & cleansing	
02/2015	People MDM process	
03/2015	Person competence data profiling and cleansing	KnoMe v.3.0: competence tribe master data, 3rd party access, reporting
10/2015	Tribal Network 3.0	
12/2015		KnoMe v.4.0: responsive UX
03/2016	Customer & project data profiling and cleansing	KnoMe v.5.0: customer & project master data, API for integrations

Our ADR team understood very soon that, in addition to competence organization and software solution improvement, there was a clear need to focus on improving the governance of information. Therefore, according to our recommendation, the executive management team of Siili Solutions made several decisions on November 19<sup>th</sup>, 2014: 1) They generated an accountable process and appointed information owners (customers: the sales director; projects: the COO; people: the HR director; competence: the R&D director; finance: the CFO), 2) they ratified an enterprise data standard for employee master data (including: name, title, year of birth, career start year, phone number, competence tribe, role, employment type, start date, end date), 3) they approved the target architecture for ES (CRM, CMS, ERP, MDM, DW/BI, and a content and document management system), and 4) they appointed service owners for these systems (e.g., the R&D director was appointed as the owner of the CMS KnoMe).

After the go-live of KnoMe v.2.0 we evaluated the success and got good feedback on the functionality but realized that there was a need to improve the information quality. We profiled the employee master data in January 2015 and made the following observations: The total headcount of the company was 336 persons; there were 376

employee records in KnoMe; 63 employee records (17%) were missing; 103 records (27%) were obsolete (e.g., departed employees); and a lot of key employee master data attributes were missing or incorrect. We reactively cleansed the master data and noticed that there was an urgent need to establish proactive information production processes because this data had to be up-to-date in real time. Therefore, two management team members, the HR director and the R&D director, approved the People MDM process on February 15<sup>th</sup>, 2015. The data quality was now ensured by a daily HR follow-up, monthly management team meeting reports, and by using the KnoMe headcount as a basis for quarterly bonus payments. After these improvements it was relatively easy to implement and deploy KnoMe versions 3 to 5 between 2015 and 2016.

During the ADR program, data domains were approached in different ways, according to their business characteristics. The employee master data is business critical and challenging due to the rapid growth rate of Siili Solutions. The company needs to know precisely and immediately when employees are starting or leaving. Therefore, the employee data needs to be precise, standardized, structured, and 100% correct continuously. The competence master data, on the other hand, is needed when making allocation decisions regarding customer projects. In this case, we noticed that it could be mostly descriptive free-text with flexible high-level categories in order to provide a full and rich picture of continuously evolving individual employee competences. Modern text mining and search technologies are used to harvest information about employee competencies from rich source material. These contradictory approaches to employee master data and person competence data required business-driven decision-making in order to meet their specific business requirements, characteristic to their related processes, data domains, and even individual attributes.

The Information Governance Research Model was developed to identify causal links between the deployed information governance, its contextual antecedents, and emerging business consequences [Tallon 2013]. In the following table, we describe the original factors that had an impact to the design, composition, and deployment of Siili Solutions' information governance (Table 4). The table also summarizes the most important business decisions guiding the actual composition of the information governance principles, structures, and practices. Finally, the table points out how information governance is linked to Siili Solutions' successful financial performance and growth.

Table 4: The findings according to the Information Governance Research Model [Tallon 2013]

<p>Antecedents: Enablers</p>	<ul style="list-style-type: none"> <li>• Organization strategy: existing corporate value “competence”; a strategy of 20% annual growth builds on top of heavy recruitment (the need for employee master data)</li> <li>• IT strategy: heavy investments in automation</li> <li>• Organizational structure: low hierarchy; centralized decision making</li> <li>• IT structure: centralized; cloud-based solutions</li> <li>• Service complexity: mainly operating in Finland; three main competence areas form the solution</li> <li>• Culture: employees are very knowledgeable about IT; decision-making is based on information</li> <li>• Industry regulation: normal EU privacy legislation allows the storage of employee data</li> <li>• Information growth rate: the annual number of employees incoming is 120 (30%) and leaving is 40 (10%), so the actual numbers are relatively small (though the amount of competence data is relatively big)</li> </ul>
<p>Antecedents: Inhibitors</p>	<ul style="list-style-type: none"> <li>• Organizational structure: multi-site operations hinder the adoption of centralized processes</li> <li>• Culture: the consultants working at customer premises adopt the customers' way of working</li> </ul>

Composition: Structural Practices	<ul style="list-style-type: none"> <li>• The locus of information-based decision-making: the executive management team</li> <li>• Steering committees: each data owner is a management team member and operates his/her own cross-functional working groups in order to prepare decision proposals</li> </ul>
Composition: Procedural Practices	<ul style="list-style-type: none"> <li>• Data principles: transparency is one of the key values; fact-driven decision-making</li> <li>• Data quality: monitored on a daily, monthly, and quarterly basis; regarded as very important</li> <li>• Metadata: the data standards and data models describing the key information needs</li> <li>• Data access: all employees can see all employee and competence data (excluding salaries); there are APIs to make data available for integrations</li> </ul>
Composition: Relational Practices	<ul style="list-style-type: none"> <li>• The education of users: all employees already fill in their KnoMe profiles during the recruitment process and keep on updating them during the employment; there is no other regular education (because the importance of data quality is embedded in the culture)</li> <li>• Business and IT partnership are in very close co-operation; all employees (including business management) are very technology oriented and knowledgeable</li> </ul>
Consequences: Firm Performance	<ul style="list-style-type: none"> <li>• Sales revenue has on average increased 40% annually since 2010 (it rose +42% in 2015)</li> <li>• Sales depend heavily on successful recruitment and competence-based project allocation decisions, making competence information governance a significant contributor to the financial success and an enabler of growth</li> <li>• The majority of the fixed costs (70% in 2015) are employee salaries, which highlights the importance of employee information governance</li> </ul>
Consequences: Risk Mitigation	<ul style="list-style-type: none"> <li>• Understanding the current competences and future development wishes of the employees helps the company to mitigate risks, such as allocating persons to the wrong customer projects—this is expected to increase both customer and employee satisfaction</li> <li>• The company expects to achieve better-quality customer and employee information in order to help in keeping current and acquiring new customers and employees</li> </ul>

The Morphology of Data Governance is a framework that indicates what actually has to be organized by information governance and what information governance may look like [Otto 2011a]. The table below, based on the framework, summarizes the business goals and organizational structures that realize the actual information governance in Siili Solutions PLC (Table 5).

Table 5: The findings according to the Morphology of Data Governance [Otto 2011]

Goals: Formal	<ul style="list-style-type: none"> <li>• Business: enable recruitment and decision-making; increase operational efficiency; increase data quality; maximize transparency and communications</li> <li>• IT: automation and integrations; in-house development; cloud-computing</li> </ul>
Goals: Functional	<ul style="list-style-type: none"> <li>• Enforce the existing information strategy and data standards</li> <li>• Monitor, report, and correct data quality</li> <li>• Run the operational data stewardship</li> <li>• Ensure the implementation of data life cycle management</li> </ul>
Structure: The locus of control	<ul style="list-style-type: none"> <li>• Functional positioning: business, not IT</li> <li>• Hierarchical positioning: the executive management team</li> </ul>
Structure: Organizational form	<ul style="list-style-type: none"> <li>• Centralized decision-making</li> <li>• Virtual working groups</li> </ul>
Structure:	<ul style="list-style-type: none"> <li>• Sponsor: the chief development officer</li> <li>• Data governance council: the executive management team</li> </ul>

Roles and committees	<ul style="list-style-type: none"> <li>• Data owners: management team members (each per data domain)</li> <li>• Lead data steward: the chief development officer</li> <li>• Business data steward: the HR director</li> <li>• Technical data steward: the KnoMe development team; IT operations</li> </ul>
----------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

## 5. DISCUSSION

The primary objective of Siili Solutions was to design and implement competence management organization and a supporting ES [Niemi & Laine 2016a]. The development was heavily influenced by CMS design principles [Lindgren 2004]. This case study expands them by proposing an additional design principle: information-as-an-asset. In our case, the information assets in the ES are managed with KnoMe [Niemi & Laine 2016b] and the information governance organization described in the previous section. The suggested emphasis on information as a valuable asset [Goodhue 1988, Levitin & Redman 1998, Otto 2015], as well as a managed product itself [Wang 1998], highlighted requirements for competence management from two complementary perspectives: technical software support and organizational information governance.

The technical software development focused on information assets as instantiations of information products [Wang 1998]. Originally, the competence data was physically and semantically fragmented and largely unavailable for business and sales managers (stored as Word documents on a network drive). Therefore, KnoMe aimed to standardize and provide quality control for the collection, manufacturing, and consumption phases of competence information, as suggested by TDQM research [Wang 1998]. Nowadays, KnoMe, as a source of easily available high-quality information assets, has become an everyday tool for business managers, sales managers, and tribal leads in Siili Solutions [Niemi & Laine 2016b]. In fact, usage statistics reveal that there were 239 unique users in March 2016, representing almost 60% of all employees.

In its first two releases KnoMe did not provide high-quality data due to the lack of effective information governance practices. Therefore, the development program began to emphasize a business-driven goal setting and data ownership, as well as explicit organizational roles, across the entire data life cycle (as Otto [2011a] summarized). In practice, the data domain ownership was assigned to the executive management team level, as advocated by many information quality researchers and practitioners. The information governance was structured as a light virtual organization to match the needs of an agile expert organization with light administration. As a result, our research provides evidence of how a light virtual information governance organization with top-level business owners can effectively support continuous information quality improvement in a real business environment. During the development initiative, the quality of employee and competence data has improved significantly in relation to its accuracy, availability, completeness, consistency, and timeliness.

The emphasis on business relevance can also be seen in competence data standardization choices. Rather than forcing overly rigid structuration and fixed ontologies across competence data, employees are allowed to insert their competencies in flexible content categories with self-made abstraction levels. Alternatively, the contents of employee and customer master data objects can be more rigidly standardized to guarantee strict accuracy and compliance requirements. Our case highlights how data standardization and quality control require continuous holistic balancing between pragmatic relevance for business benefits and idealistic goals for perfecting information quality. This view aligns with the previous findings about one size not fitting all [Weber et al. 2009] and the dangers of over-governance [Tallon et al.

2013]. According to our research and practitioner experiences, the balancing decisions should be made by business owners.

### The Research Evaluation

In order to improve the validity of the research it should be guided and evaluated by explicit quality criteria [Sarker 2013]. The following table highlights how our research fulfills the ADR principles [Sein et al. 2011].

Table 8: The ADR principles used for the evaluation of the research quality [Sein et al. 2011]

1. Practice-inspired research	Research is started due to the need for better organizational and IT support for competence management in the case organization.
2. A theory-ingrained artifact	Information governance development was informed by scientific theories, such as those of Wang and Otto.
3. Reciprocal shaping	The IT artifact and the required organization are analyzed and designed together: small iterations are deployed continuously to the whole organization.
4. Mutually influential roles	The ADR team consisted of researchers and practitioners. The lead designer was a PhD candidate working in the case organization.
5. Authentic & concurrent evaluation	Decisions regarding the design of KnoMe and organizational practices were done continuously as a part of internal development.
6. Guided emergence	Requirements for the artifact are based on the emerging results in the BIE stage.
7. Generalized outcomes	The generalized problem and the created, revised CMS design principles.

**Research significance:** Hevner [2004] argues that design science research differs from routine system design by clearly identifying the scientific contribution. Sein et al. [2011] argue that an ADR project should result in publishing design principles, which belongs to theories of “design and action” [Gregor 2006]. In this research we have utilized the design principles of Lindgren et al. [2004] and propose improvements to them by adding the information-as-an-asset principle. Our findings indicate that a focus on information and its quality will result in a business benefit. The ADR program was implemented successfully a real-life information governance organization to support competence management in a knowledge-intensive project organization. Therefore, the research contributes to the existing set of information governance and master data management case studies. Our findings highlight the positive impacts of these initiatives on information quality in a real business environment.

**Practical significance:** This is practice-inspired research, resulting in a theory-ingrained artifact [Sein et al. 2011]. Kasanen et al. [1993] introduced the concept of market-based validation for constructive research. Our research fulfills the criteria of a “weak market test,” because one company has applied this design and found it useful in a real business environment. Siili Solutions needed a CMS and deployed the KnoMe artifact to all its employees, investing over €2M in the program with four major releases and three organizational changes. During the program Siili Solutions’ annual revenue has grown from €18M to €42M and the stock market value has increased by 243%, which could at least partly be the result of this program. However, the early versions of KnoMe software [Niemi & Laine 2016b] did not provide the expected benefits. After information governance was set up, the quality of competence data has improved significantly. KnoMe has become an everyday tool for the business managers, sales managers, and tribal leaders by improving competence development, recruitment, resource allocation, and sales processes.

## 6. CONCLUSIONS

Previous information governance research has emphasized the business-driven goal setting, information ownership, and management roles across the data life cycle. Our research points out that these functions do not have to be bureaucratic or massive. In our case, a light virtual information governance organization was developed for a very flat, agile, and fast-growing knowledge-intensive project organization. After the information governance organization was set up, information quality improved significantly in relation to its accuracy, availability, completeness, consistency, and timeliness.

In practice, companies must standardize and tightly control information in order to improve its quality. At the same time, standards and controls should not be forced in a too rigid or inflexible way. They should be balanced carefully according to their unique characteristics and business relevance in each use case. Information assets such as competence data can benefit from flexible user-driven content while business critical master data might require more strict control. Business-driven information governance should guide the standardization and quality control decisions.

In summary, our case provides evidence of how the implementation of the design principle of seeing information as an asset can lead to significant business benefits in competence management and other business contexts.

**Appendix:** KnoMe can be accessed at <https://knome.siilicloud.com> and Siili Solutions PLC's website can be found at <http://www.siili.com> Please note that external users (partners and recruits) can only edit their own personal profiles while employees can see the rest of the features and reports.

**Acknowledgments:** We would like to thank all the employees in Siili Solutions PLC for giving their time and sharing their ideas and experiences with us. This study was funded by the Academy of Finland (grant number 259454).

## REFERENCES

- Abbasi, A., Sarker, S., & Chiang, R. (2016): 'Big Data Research in Information Systems: Toward an Inclusive Research Agenda,' *Journal of the Association for Information Systems*.
- Adelman, S., & Moss, L. (2005): *Data Strategy*, Addison-Wesley Professional.
- Adler, S. (2007): *The IBM data governance council maturity model: building a roadmap for effective data governance*, IBM Corporation, Somers, NY (USA).
- Aiken, P., Gillenson, M., Zhang, X., & Rafner, D. (2011): 'Data Management and Data Administration: Assessing 25 Years of Practice,' *Journal of Database Management*, 22(3), pp. 24–44, July–September.
- Atkinson, K., & McGaughey, R. (2006): 'Accounting for data: a shortcoming in accounting for intangible assets,' *Academy of Accounting and Financial Studies Journal*, 10(2), pp. 85–95.
- Avery, A., & Cheek, K. (2015): 'Analytics Governance: Towards a Definition and Framework,' 21st AMCIS, Puerto Rico.
- Barata, A., & Prado, E. (2015): 'Data Governance in Brazilian Organizations,' *Brazilian Symposium on IS*.
- Berson, A., & Dubov, L. (2010): *Master Data Management and Data Governance*, 2/E. McGraw Hill.
- Berson, A., & Dubov, L. (2007): *Master Data Management and Customer Data Integration for a Global Enterprise*, McGraw-Hill.
- Brynjolfsson, E. (2011): 'Strength in Numbers: How does data-driven decision-making affect firm performance?' *32nd ICIS*, Shanghai 2011.
- Carr, N., G. (2003): 'IT doesn't matter,' *Harvard business review*, (81:5), pp. 41–49.
- Castells, M. (2010): *The Rise of the Network Society*, 2nd edn., Wiley-Blackwell.
- Collins, C. (2001): 'Level 5 Leadership: The Triumph of Humility and Fierce Resolve,' *Harvard Business Review*, (January), pp. 65–76.
- DAMA International (2009): *The DAMA Guide to the Data Management Body of Knowledge*, Technics.
- Davenport, T. (2007): *Competing on Analytics: The New Science of Winning*, Boston, Mass., Harvard Business School Press.
- Demarquet, G (2016): 'Five Key Reasons Enterprise Data Governance Matters to Finance,' *The Journal of Corporate Accounting & Finance*, Jan/Feb, 2016, pp. 47–51.
- Economist Intelligence Unit (2008): *The future of enterprise information governance*, The Economist Intelligence Unit Limited, London (UK).
- Economist Intelligence Unit (2011): *Big data: Harnessing a game-changing asset*, The Economist

- Intelligence Unit Limited, London (UK).
- Faria, F., Macada, A. & Kumar, K. (2013): 'Information Governance in the Banking Industry,' *46th Hawaii International Conference on System Sciences*.
- Felici, M., Koulouris, T., & Pearson, S. (2013): 'Accountability for Data Governance in Cloud Ecosystems,' *2013 IEEE International Conference on Cloud Computing Technology and Science*.
- Fisher, T. (2009): 'The Data Asset: How Smart Companies Govern Their Data For Business Success,' John Wiley, Hoboken, NJ (USA).
- Goodhue, D., Quillard, J., & Rockart, J. (1988): 'Managing the Data Resources: A Contingency Perspective,' *MIS Quarterly* 16(1), pp. 267–274.
- Goodhue, D. L., Kirsch, L. J., Quillard, J. A., & Wybo, M. D. (1992): 'Strategic data planning: lessons from the field,' *MIS Quarterly*, pp. 11–34.
- Gregor, S. (2006): 'The Nature of Theory in Information Systems,' *MIS Quarterly*, 30(3), pp. 611–642.
- Gregory, A. (2010): 'Data Governance – Protecting and unleashing your customer data assets,' *Journal of Direct, Data, and Digital Marketing Practice*, vol. 12, nr. 3, pp. 230–248.
- Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004): 'Design Science in Systems Research,' *MIS Quarterly*, 28 (1), pp. 75–105.
- ISO/IEC (2008): 'ISO/IEC 38500: corporate governance of information technology,' The ISO and IEC.
- Kasanen, E., Lukka, K., & Siitonen, A. (1993): 'The constructive approach in management accounting research,' *Journal of Management Accounting Research*.
- Khatri, V., & Brown, C. V. (2010): 'Designing Data Governance,' *Communications of the ACM*, 53 (1).
- Kooper, M., Maes, R., & Lindgren, E. (2010): 'On the governance of information: Introducing a new concept of governance to support the management of information,' *International Journal of Information Management* 31 (2011).
- Korhonen, J., Melleri, I., Hiekkänen, K., & Helenius, M. (2013): 'Designing Data Governance Structure: An Organizational Perspective,' *GSTF Journal on Computing*, vol. 2, Nr. 4, January 2013.
- Ladley, J. (2012): 'Data Governance: How to Design, Deploy, and Sustain an Effective Program,' Newnes.
- Lajara, T., & Macada, A. (2013): 'Information Governance Framework: The Defense Manufacturing Case Study,' *Proceedings of the 19th AMCIS*, Chicago, Illinois, August 15–17, 2013.
- Lee, Y., Madnick, S., Wang, R., Wang, F., & Zhang, H. (2013): 'A Cubic Framework for the Chief Data Officer: Succeeding in a World of Big Data,' *MIS Quarterly Executive*, March 2014, 13:1.
- Levitin, A., & Redman, T. C. (1998): 'Data as a Resource: Properties, Implications, and Prescriptions,' *Sloan management review*, 40(1), pp. 89–101.
- Lindgren, R., Henfridsson, O., & Schultze, U. (2004): 'Design Principles for Competence Management Systems: A Synthesis of an Action Research Study,' *MIS Quarterly*, 28: 3.
- Lindgren, R., & Henfridsson, O. (2002): 'Using competence systems: adoption barriers and design suggestions,' *Journal of Information & Knowledge Management*, 1.01 (2002), pp. 65–77.
- Loshin, D. (2008): 'Master Data Management,' Elsevier, Burlington, MA (USA).
- MIKE 2.0 (2013): 'Method for an Integrated Knowledge Environment,' The open source standard for Information Management, <http://http://mike2.openmethodology.org/>
- Niemi, E., & Laine S. (2016a): 'Competence Management as a Dynamic Capability: A Strategic Enterprise System for a Knowledge-Intensive Project Organization,' *Hawaii International Conference on System Sciences HICSS-49th*
- Niemi, E., & Laine S. (2016b): 'Designing a Competence Management System “Knome” for a Knowledge-Intensive Project Organization,' *11th Design Science Research Conference in Information Systems and Technologies (DESRIST)*
- OECD (2015): 'G20/OECD Principles of Corporate Governance,' *OECD Publishing*, Paris.
- Orr, J., & Marketing, D. G. (2011): 'Data Governance for the Executive,' Senna Publishing LLC.
- Otto, B. (2015): 'Quality and Value of the Data Resource in Large Enterprises,' *Information Systems Management*, 32: 3, 234–251
- Otto, B. (2011a): 'Organizing Data Governance: Findings from the Telecommunications Industry and Consequences for Large Service Providers,' *Communications of the AIS*, vol. 29, article 3.
- Otto, B. (2011b): 'Data Governance,' *Business & Information Systems Engineering*, 4/2011.
- Otto, B. (2011c): 'A morphology of the organisation of data governance,' *ECIS 2011 Proceedings*.
- Pierce, E., Dismute, W. S., & Yonke, C. L. (2008): 'The State of Information and Data Governance. Understanding How Organizations Govern Their Information and Data Assets.' The International Association for Information and Data Quality and the University of Arkansas at Little Rock.
- Putro, B., Surendro, K., & Herbert (2015): 'Leadership and culture of data governance for the achievement of higher education goals,' *AIP Conference Proceedings* 1708
- Radcliffe, J. (2007): 'The Seven Building Blocks of MDM: A Framework for Success,' *Gartner Research*.
- Redman, T. C. (2008): 'Data driven: profiting from your most important business asset,' Harvard Business.
- Redman, T. C. (1998): 'The impact of poor data quality on the typical enterprise,' *Comms of ACM*, 41(2).
- Rosenbaum, S (2010): 'Data Governance and Stewardship: Designing Data Stewardship Entities and

- Advancing Data Access,' *HSR: Health Services Research* 45: 5, Part II (October 2010).
- Russom, P. (2006): '*Taking Data Quality to the Enterprise through Data Governance*,' The Data Warehousing Institute, Seattle, WA (USA).
- Sarsfield (2009): '*The Data Governance Imperative: A Business Strategy for Corporate Data*,' IT Governance Publishing, Cambridgeshire (UK).
- Sarker, S., Xiao, X., & Beaulieu, T. (2013): 'Qualitative studies in Information Systems: A Critical Review and some Guiding Principles,' *MIS Quarterly*, 37(4).
- Sheng, Y., & Mykytyn, P. (2002): 'Information technology investment and firm performance: A perspective of data quality,' *Proceedings the 7th ICIQ*, pp. 132–141.
- Sein, Henfridsson, Purao, Rossi, & Lindgren, R. (2011): 'Action Design Research,' *MIS Quarterly*, 35(2).
- Seiner, R. S. (2014): '*Non-invasive Data Governance: The Path of Least Resistance and Greatest Success*,' Technics Publications.
- Soares, S. (2012): '*Big Data Governance*,' Information Asset, LLC.
- Soares, S. (2011): '*Selling information governance to the business*,' MC Press.
- Soares, S. (2010): '*The IBM data governance unified process*,' MC Press, LLC.
- Slone, J. P. (2006): 'Information quality strategy: An empirical investigation of the relationship between information quality improvements and organizational outcomes,' Ph.D. dissertation, Capella University.
- Tallon, P., Ramirez, R., & Short, J. (2013): 'The Information Artifact in IT Governance: Toward a Theory of Information Governance,' *Journal of Management Information Systems*, 30: 3, pp. 141–178.
- Thomas, G. (2006): '*The DGI Data Governance Framework*,' The Data Governance Institute.
- Walsham, G. (2006): 'Doing Interpretive Research,' *European Journal of Information Systems*, 15.
- Wang, R. Y., Lee, Y., Pipino, L., & Strong, D. (1998): 'Manage your information as a product,' *Sloan Management Review*, Summer 1998, pp. 95–106.
- Weber, K., Otto, B., & Österle, H. (2009): 'One Size Does Not Fit All – A Contingency Approach to Data Governance,' *ACM Journal of Data and Information Quality*, 1(1), Art. 4.
- Weil, P., & Ross, J. W. (2005): 'A Matrixed Approach to Designing IT Governance,' *MIT Sloan Management Review*, Winter 2005.
- Weill, P., & Ross, J. (2004): '*IT Governance: How Top Performers Manage IT Decision Rights for Superior Results*,' Harvard Business School Press, Cambridge, MA.
- Wende, K. (2007): 'A Model for Data Governance – Organising Accountabilities for Data Quality Management,' *ACIS 2007 Proceedings*, Paper 80.