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Strategic Business Requirements for Master Data Management Systems

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ABSTRACT

Master Data Management (MDM) is of increasing importance because it is seen as a promising approach in companies to respond to a number of strategic business requirements, such as complying with an increasing number of regulations, supporting internal and external business process integration, and establishing a “360-degree-view on the customer”. As a result, software vendors such as IBM, Oracle, SAP, and TIBCO are offering MDM application systems. However, the user community feels a significant mismatch between their own strategic requirements and the functionality currently offered by the software products. As the Information Systems (IS) research community has remained silent so far regarding this research problem, the research presented in this paper makes intensive use of knowledge from the practitioners’ community in order to design a framework for strategic business requirements to be met by MDM systems. As an outcome of a design-oriented research process, the framework is an artifact which advances the scientific body of knowledge while at the same time providing benefit for practitioners. The framework includes seven design principles which are translated into 23 requirements. The requirements form a baseline for internal and external communication in companies and for the design of concrete MDM systems.

Keywords

Master data management, Business requirements framework, Design research, Researcher-practitioner collaboration.

INTRODUCTION

Motivation and Problem Statement

MDM is a topic of increasing prominence both in the practitioners’ and in the research community. Reasons for that are an increasing number of regulatory and legal provisions companies need to comply with, the need to have a single source of truth for company-wide reporting (McCann 2010; Yen 2004), and the demand for having a 360°-view on the customer (Leser and Naumann 2007; Pula, Stone and Foss 2003).

As a response to that, software vendors have started to offer MDM application systems (in the following referred to as “MDM systems”). Examples are IBM’s InfoSphere Master data Management Server (IBM 2011), Oracle Master Data Management (Oracle 2010), SAP NetWeaver Master Data Management (SAP 2011), and TIBCO’s Collaborative Information Manager (TIBCO 2008). Despite differences with regard to their architectures and to their development history, they offer similar functionality at their core. Basic functionality comprises import, conversion, and export of master data, data storage and distribution, data quality management (such as duplicate checks), search algorithms, and general workflow support for data management activities such as data creation, data update, etc. However, compared to Enterprise Resource Planning (ERP) systems, dedicated MDM systems as the ones mentioned above represent a relatively new class of application systems. As a consequence, the user community is characterized by uncertainty and lack of expertise with regard to the functionality MDM software offers. Exemplary questions discussed at Gartner’s 2008 MDM are (Friedman 2009):

- “What is the proper sequence of activities in support of MDM? Must we have solid data integration and data quality practices and architectures in place before dealing with MDM?”
- “Most of our current data integration requirements are batch-oriented in nature, as we work to physically consolidate silos of master data. What types of packaged data integration tools will be most relevant for our purposes?”
- “Has market consolidation already reached the point where the advantages of single-vendor stacks for MDM outweigh the advantages of a best-of-breed strategy?”

On the other side, user companies have a clear understanding of their business requirements and their expectations regarding MDM software. And they feel misunderstood when talking to MDM software vendors – or, as a leading information

technology (IT) architect at Novartis Pharma put it in a joint workshop with the authors of this paper on February 28th, 2009, in Basel, Switzerland:

“We are flooded by invitations from MDM software vendors to sit together and let them present their solutions, which are always supposed to be the solution to all our problems. When we meet, it’s always the same: They present something we aren’t looking for. Then we tell them our understanding of the world and what our real requirements are – what in return they do not want or cannot share. And in the end, everybody goes his own way, highly frustrated because they couldn’t sell their product, we didn’t get an answer to our problems, and both of us spent time in vain.”

Apparently, there is a mismatch between the expectations in the practitioners’ community regarding the functionality of MDM systems and the offering by software vendors, despite the existence of recommendations from consultancies on MDM system functionality, such as Gartner’s magic quadrants (Radcliffe 2010; White 2010). And the issue has not been taken up so far by the Information Systems (IS) research community, which remains silent when it comes to investigating on current and future functionality of MDM systems. Only few contributions are available. Berson and Dubov (2007, p. 350-363), for example, provide an overview of selected MDM systems. And Kokemüller (2009) provides a market survey directed at the German-speaking community. Neither the practitioners’ nor the scientific community, however, are addressing the issue of strategic business requirements for MDM systems. A general direction is missing which guides the further development of MDM systems, their use in companies, and the collaboration between users and vendors.

Research Question and Contribution

The paper addresses a current gap in the IS community as it aims at finding answers to two research questions:

- What are strategic business requirements to be met by MDM systems?
- How can these requirements be framed to support communication between user companies and software vendors?

Since the topic is of relevance and interest both to the practitioners’ and the scientific community, the work presented in this paper follows a design-oriented research approach. Design Science Research (DSR) aims at delivering research artifacts which advance the scientific body of knowledge and – at the same time – benefit practitioners (Hevner, March, Park and Ram 2004; March and Smith 1995). The research presented in this paper delivers a framework for strategic business requirements for MDM systems. Being an abstraction of an information system that can be used to develop concrete instantiations, the framework represents the artifact class of “models” according to March and Smith (1995).

The paper makes a contribution both to the scientific and the practitioners’ community. Through explication of the research process and the documentation of the framework itself the paper advances the scientific body of knowledge, as it forms the baseline for future research (for example, on the validation of the research process, or on the extension and adaptation of the framework as a response to changing requirements). At the same time, practitioners benefit from the framework because they can use it as a “blueprint” in the development of their individual, strategic planning, and as a reference in their communication with peers and vendors.

THEORETICAL BACKGROUND

Master Data Management (MDM)

Master data specifies the essential business entities a company’s business activities are based on. Such entities are, for example, business partners (customers, suppliers), products, or employees (Smith and McKeen 2008). Basically, master data can be differentiated by three concepts: master data class, master data attribute, and master data object (Loshin 2008). A master data object represents a concrete business object (an automobile manufactured in a certain plant at a certain point in time, for example), and it specifies selected characteristics of this business object (color, features, or price, for example) by means of attributes. Attributes selected for representation of a specific class of business objects (customers or products, for example) constitute a master data class (which usually is specified by a data model). From the perspective of data modeling, a master data object is an instance of a master data class, which is created by assigning data values (a sequence of numbers, for example) to a master data attribute (a phone number of a customer, for example).

MDM comprises all activities for creating, modifying or deleting a master data class, a master data attribute, or a master data object (Smith et al. 2008), i.e. the modeling, provision, quality management, maintenance, and archiving of master data. All these activities aim at providing master data of good quality (i.e. master data that is complete, accurate, timely, and well-structured) for being used in business processes (Karel 2006; Loshin 2008).

Both researchers and practitioners agree that MDM is about establishing a business function rather than implementing a technology. Hence, MDM has implications on a strategic, organizational and information systems level of a company (Otto

and Reichert 2010). Strategic and organizational questions are closely related to Data Governance (Loshin 2008; Sarsfield 2009) and establishment of roles for planning, designing and overseeing MDM activities. Typical roles are, for example, data owner and data steward for master data (Khatri and Brown 2010; Power 2008; Swanton 2005; Weber, Otto and Österle 2009). However, software functionality remains the “necessary condition” for successful MDM, as master data – like data in general – is maintained in software systems.

MDM Systems

Studies on MDM systems mainly focus on three aspects, namely usage scenarios, architecture types, and the vendor market for MDM systems. Regarding (1) usage scenarios, a typical distinction is made between analytical and operational MDM (Dreibelbis, Hechler, Milman, Oberhofer, van Run and Wolfson 2008; Loshin 2008). Analytical MDM refers to the use of MDM systems to establish a “single version of the truth” or a “golden record” by extracting master data from source systems (i.e. from local ERP systems), transforming them, and finally loading them into a system which can then be used for analytical purposes. In contrast, operational MDM refers to master data being distributed from a central system to local systems which use the data to support business processes (or “operations” in general). Identification of usage scenarios is deemed necessary in order to be able to determine an appropriate MDM system architecture.

Researchers and practitioners alike distinguish four different (2) architecture types for MDM systems (Dreibelbis et al. 2008; Kokemüller 2009; Loser, Legner and Gizanis 2004; Loshin 2008; Otto and Schmidt 2010).

- A central system architecture consists of a dedicated MDM system, which consolidates master data from local systems and distributes authorized versions of the data back to these systems.
- A leading system architecture works similar to the central system architecture, but has no dedicated MDM system. Instead, other application systems (often ERP systems) store and provide authorized versions of certain master data classes (e.g. customer data, product data).
- A repository consists of a central system which – in contrast to the central system architecture – does not manage authorized versions of master data, but instead manages references and mappings from data in one local system to data in another.
- A peer-to-peer architecture assumes neither a central system nor central coordination of the data flows between different systems. Instead, it uses standards for definition, description, and exchange of master data. All connections between the different systems are established via a one-to-one relationship.

Both practitioners and researchers provide (3) overviews of the vendor market for MDM systems. Gartner, for example, has come up with a “magic quadrant” for MDM systems for customer data (Radcliffe 2010) and product data (White 2010). Berson and Lubov (2007) provide vendor profiles. And Kokemüller compares different solutions against a number of evaluation criteria (Kokemüller 2009).

With regard to MDM system functionality, both researchers and practitioners have remained rather silent so far. Dreibelbis et al. (2008) give a general functional overview from an Service-oriented Architecture (SOA) perspective, DAMA (2009, pp. 173-192) identifies MDM activities which can be assumed requirements for MDM functionality, and Otto and Hüner (2009) in a working report describe their work toward a functional reference model for master data quality management. No contribution can be found addressing strategic business requirements for MDM systems in particular.

RESEARCH PROCESS

The research process (see Figure 1) in this paper follows the Design Science Research Methodology (DSRM) as proposed by Peffers et al. (2008). The result of the research process is a design artifact, namely the framework for strategic business requirements for MDM systems. The research process consists of four phases. The Analysis phase includes the DSRM activities “Identify Problem & Motivate” and “Define Objectives of a Solution”. The DSRM activities “Design and Development” and “Demonstration” were aggregated in the Design & Demonstration phase. The last two phases, Evaluation and Communication, are kept as proposed by DSRM.

The Analysis phase included two steps:

- In first step, expert interviews (cf. Meuser and Nagel 1994) with three managers working in the field of MDM at Novartis Pharma were used to identify the problem (see also quote in the “Introduction” section).
- The second step, namely the definition of the objectives of the framework, was inspired by the “Future Search Conference” technique (cf. Weisbord 1992). The technique supports collaboration of large heterogeneous groups aiming at innovating around a given problem or at formulating a shared vision of the future in a given context. The technique normally requires

setting up a “conference”, in which people from diverse settings work together in a series of tightly scheduled meetings (2 to 4 days). The research presented in this paper focused on three particular steps of the technique and identified (1) changes in the past, (2) predicted changes in the future (up to five years from present), and (3) desired developments. In the process of applying the technique, the group of professionals from Novartis Pharma and the authors of this paper identified shortcomings in the past regarding MDM systems and developed “innovation profiles” (see Appendix A for two examples) which guided the design of the framework.

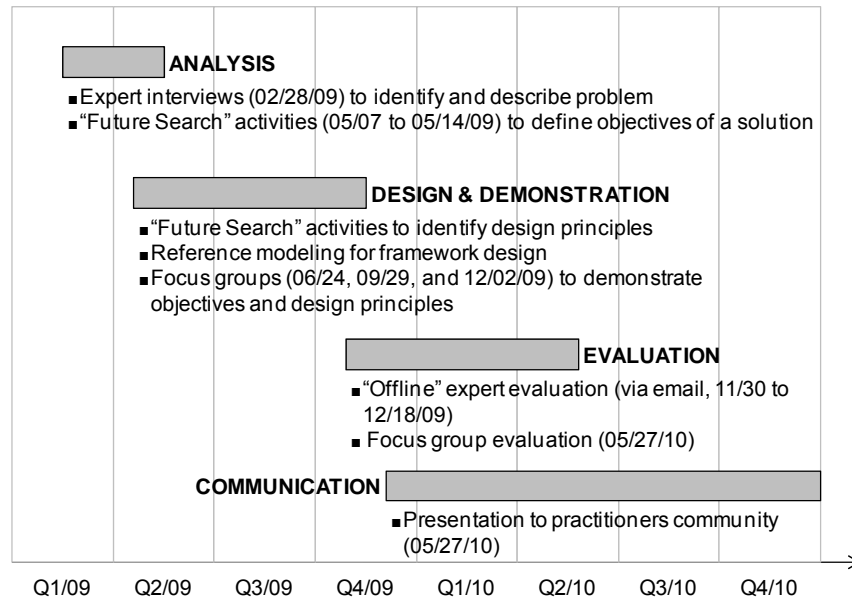


Figure 1: Research Process

The Design & Demonstration phase consisted of three steps:

- In a first step, design principles were developed using the adaption of the Future Search Conference technique described above.
- In a second step reference modeling was applied to design the framework for strategic business requirements for MDM systems. A reference model is defined as the result of a design process performed by a modeler who specifies (at a certain point in time) general elements of a system so that it serves as a reference point in the design of an information system. A reference model represents a class of use cases and can be used for the development of company-specific models (Schütte 1998, pp. 69-74). Fettke and Loos (2004) denote reference models as a “technique of practical utility”, which corresponds very well with the research gap and the practitioners’ demand mentioned above. Reference modeling represents the central design approach used in the Design & Demonstration phase.
- In a third step, focus groups were used to demonstrate preliminary versions of the framework and receive feedback on it from the practitioners’ community. Focus groups are a multilateral form of expert interviews which allow identification and assessment of the level of consensus within a peer group (cf. Morgan and Krueger 1993).

The Evaluation phase included two steps:

- In a first step, an offline, e-mail based expert survey among more than 80 experts from the MDM domain was conducted to evaluate the framework, mainly from a deployment perspective (to determine the framework’s usefulness) and from an engineering perspective (to determine the degree to which the framework meets the requirements mentioned above) (cf. Frank 2007). The participants of the expert survey were selected from the “CC CDQ Community”, an online community on MDM which the researchers run in the social network XING. XING addresses business professionals mainly from the German-speaking parts of Europe. All online community members who represented user companies were addressed by the survey. All of them hold managing roles related to MDM in large companies.
- A second evaluation step was carried out in another focus group. Input to the focus group on 05/27/10 was a version of the framework which already included the evaluation feedback from the offline survey mentioned above.

The Diffusion phases consist of two steps:

- In a first step, the results of the framework design were communicated to the practitioners’ community in mid-2010. This communication is available as a working report (Österle, Otto and Ofner 2010).
- The second step addresses the communication of results to the scientific community through the present paper.

Overall, the research process combines two expert interview workshops with representatives from Novartis Pharma, three focus groups for validating objectives and overall design, an offline expert survey over a period of 18 days among 80 professionals, and two focus groups for artifact evaluation. The intensive collaboration with representatives from the practitioners’ community was deemed necessary given the practical relevance of the topic and the ambition of the research to work toward a reference model. To demonstrate their accordance with its message and content, 27 MDM professionals from twenty organizations co-signed the report (see Appendix B).

The following section of the paper uses “vignettes” to explicate on decisions made during the design process. Following Hevner et al. (2004), the research process was not a unidirectional sequence of design activities, but rather comprised iterations of design, demonstration, and evaluation steps.

FRAMEWORK DESCRIPTION

Framework Overview

The meta-model of the framework for strategic business requirements for MDM systems consists of four components. Two components relate to the business context and two to the framework itself (see Figure 2). The business context is formed by the shortcomings of existing MDM systems on the one hand and strategic MDM use cases on the other. Representing the business rationale, strategic MDM use cases are the starting point for companies to evaluate the use of MDM systems. Shortcomings of current solutions prevent companies from meeting the requirements which can be derived from the strategic use cases.

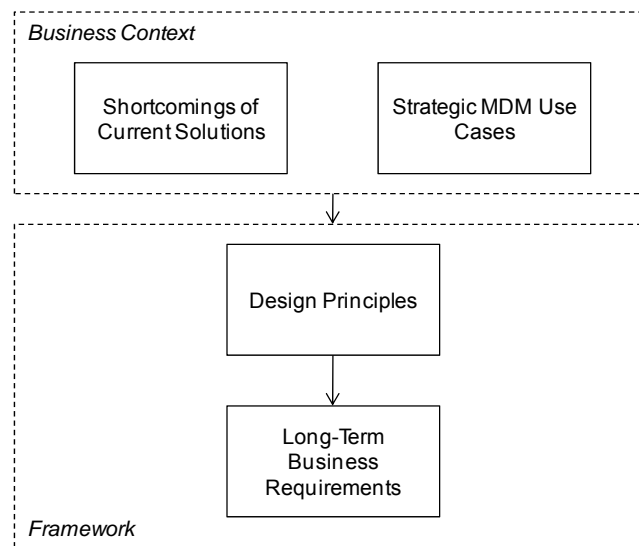


Figure 2: Framework Meta-model

The framework itself consists of design principles derived from the innovation profiles. The design principles do not show the level of detail required for a software realization project. Instead, they represent the strategic vision of what user companies would expect from an MDM system. The design principles were then translated into a set of 23 requirements, which are supposed to be taken up by software vendors. The need for connecting design principles to business requirements was articulated by an MDM expert participating in the design and evaluation activities. The comment received via e-mail reads:

“[In the current framework version] I am missing a link [between requirements] and use cases. How do the latter relate to the requirements? Can’t they be linked [...]?”

As both shortcomings and MDM use cases are not part of the framework itself, they are described in Appendices C and D. The design principles and strategic business requirements are described in greater detail in the following section.

Design Principles for Future MDM Systems

During the design process seven design principles were identified (see Table 1). They describe fundamental ideas about the practice of good MDM and are assumed to be the basis of any design strategy.

ID	Design Principle	Description
P1	Master Data as a Product	There is an analogy between quality issues in product manufacturing and quality issues in information manufacturing. While product manufacturing can be viewed as a processing system that acts on raw materials to produce physical products, information manufacturing can be viewed as a processing system acting on raw data to produce information products (Wang 1998). Organizations need to understand their customers' (both internal and external) needs with regard to master data. They must appoint a manager to oversee the production of high-quality master data, and they must recognize that master data is not just a by-product but a high-quality product characterized by clear product specifications. The production of master data consumes scarce resources. In this sense, master data needs a price tag just like any other product.
P2	Market for Master Data	Sourcing strategies become more and more important for the MDM domain. Internal and external data providers such as GS1 and D&B need to be identified, evaluated, and selected for the manufacturing of high-quality master data products (cf. Otto and Ofner 2010).
P3	Subsidiarity	Subsidiarity is an organizing principle which says that matters should be handled by the smallest, lowest or least centralized competent authority available. Applied to the MDM domain, subsidiarity means that some rules and standards must strictly be adhered to (with regard to compliance issues, for example), while other rules or standards are just recommendations individuals acting on a local level may follow. Only in case the responsible unit is not able to handle the matter on its own, or if company-wide interests are touched, responsibility for such master data must be assigned to an upper or central level, respectively (cf. Loshin 2008).
P4	Context Awareness	Depending on the lifecycle of master data, the set of mandatory properties forming the nucleus may vary (i.e. different material data lifecycle phases require a different set of mandatory data properties) (cf. White 2008). Moreover, validity of certain properties depends on the business context. For example, the nucleus for product master data contains several properties with a different validity context at the same time, e.g. the current price (for ordering), the planned price (if not yet released), price rebates (to inform the sales force upfront), and the old price (required for potential reimbursements). In other words, certain properties are context-dependending.
P5	"The Nucleus"	The "nucleus" describes the common denominator of mandatory properties of a master data class (e.g. material). This set of properties is unique and binding throughout the entire company (van den Hoven 2003). There might be cases in which the nucleus consists of a unique identifier only (e.g. for reporting purposes). There might be other cases in which the nucleus is formed by a broader set of properties.
P6	Process Quality	Master data quality needs to be ensured throughout the entire data lifecycle (create, read, update, archive, and delete). The sources of master data products ("upstream visibility"), the consumers of master data products ("downstream visibility") (White and Radcliffe 2008), and the manufacturing process of the master data product itself needs to be made explicit. Clear master data ownership needs to be defined and managed (White 2008).
P7	Deep Integration	MDM technology requires sufficient interoperability to seamlessly integrate in existing transactional or legacy systems. A high level of interoperability maximizes flexibility and reusability of the technology. From today's point of view, best integration of MDM technology in any company or group of companies is achieved by using a company-wide data repository to supply high-quality master data to any business function or IT system in the company.

Table 1: Design Principles for Future MDM Systems

Strategic Business Requirements

In the Design & Demonstration phase of the project, the design principles were translated into requirements to be met by MDM systems (see Table 2). The requirements are supposed to be connecting points for software vendors in order to be able to respond to the needs of user companies. In total, 23 requirements were identified.

ID	Requirement	Supported Design Principle(s)	Shortcomings addressed
R1	Support of Master Data Product Descriptions	P1	Business Semantics Management
R2	Sourcing of Master Data Products	P2	Master Data Service Approach, Predefined Content
R3	Integration of External Master Data Sources	P2	Master Data Service Approach, Predefined Content
R4	Quality Management of Master Data Products and Services	P6	Integrated MDM and DQM
R5	Audit Management of Master Data Products and Services	P6	Regulatory Compliance
R6	Management of Access Rights According to Data Governance Roles	P3	Regulatory Compliance
R7	Escalation Management	P3	Distinction between Global and Local
R8	Support of Usage Monitoring of Master Data Products	P6	Downstream Visibility
R9	Maintenance of Context-Aware Master Data	P4	Master Data Service Approach
R10	Gauging of Master Data Product Consumption	P6	Downstream Visibility
R11	Requirements Engineering for Master Data Products	P1	Business Semantics
R12	Design and Maintenance of Global/Local Master Data Management Processes	P6	Distinction between Global and Local
R13	Internal Customer Support	P1	Master Data Service Approach
R14	Management of Business Rules for Data Standards	P6	Business Rules Management
R15	Support of an End-to-End Master Data Product Lifecycle	P4	Downstream Visibility
R16	Support of Master Data Provenance Tracing	P6	Downstream Visibility
R17	Management of Data Standards	P5	Business Rule Management
R18	Enforcement of Data Standards	P5	Regulatory Compliance
R19	Schema Matching and Mapping Using Heuristics	P5	“On-the-fly“ Matching and Mapping
R20	Delivery of Predefined Content	P5	Predefined Content
R21	Design, Maintenance, and Integration of Global/Local Master Data Models	P5	Distinction between Global and Local
R22	Subscription to Master Data Products or Properties	P7	Downstream Visibility
R23	Support of Interoperability Standards.	P7	Stovepipe Approach

Table 2: Strategic Business Requirements for MDM Systems

Feedback in the Design Process

27 experts from twenty companies participated in the design and evaluation activities by providing their feedback on preliminary versions of the framework. The feedback was – as one can imagine – highly heterogeneous, ranging from simple supportive/disagreeing statements to orthographic and minor comments to major change requests.

An example of a minor change request is the following feedback received via e-mail with regard to R2:

“Data, especially master data, not only need data values but data classification and data transfer rules too, in order to be a valid ‘source’.”

An example of a major contribution is the following feedback received via e-mail with regard to R19:

“Matching and Mapping might be different, matching more content related, e.g. duplication check, mapping is schema related. [...] Would suggest to make two points. Matching and Mapping. [...] Shortcoming for matching is that tools ‘can do’ but do not ‘have’, meaning they are shipped with no content/no sophisticated predefined rules for matching. I’d expect instead of an empty rule set an elaborate set of predefined rules incl. referencing external validation services. These rules can be activated/deactivated/adjusted as required but do not need to be defined from scratch.”

The framework (without the explication of the research process) is available as a working report (Österle et al. 2010) and was distributed within the practitioners’ community. In doing so, the research process follows recommendations for DSR to make research results available both to researchers and to practitioners (Hevner et al. 2004; Peffers et al. 2008).

FRAMEWORK EVALUATION

The framework for strategic business requirements for MDM systems is a reference model. Therefore, artifact evaluation should follow guidelines for evaluation of reference models. Frank (2007) proposes a multidimensional evaluation approach, which the paper at hand follows. He distinguishes four relevant dimensions, namely the (1) economic dimension, (2) the deployment dimension, (3) the engineering dimension, and (4) the epistemological dimension. Table 3 summarizes the evaluation of the framework.

Dimension	Detailed Criteria	Assessment
Economic	Cost caused by the reference model, for training, model acquisition, integration, adaptation, maintenance etc.; business benefits resulting from the reference model; improved communication and knowledge management.	No statement can be made so far regarding the business benefits related to the framework’s use. However, all focus groups evaluated the potential of the framework positive and expected improvement regarding internal and external communication.
Deployment	Appropriateness, comprehensibility, “attitude” (e.g. regarding the “not-invented-here syndrome”).	Both the offline survey and the focus group on 05/27/2010, which included more than 50 participants (among which were Dataflux, IBM, Oracle, SAP, TIBCO, and Trillium as representatives from the software vendor community), confirmed the appropriateness and usefulness of the approach. Asked by the moderator (one of the authors of this paper) whether the initiative should be continued or not, the focus group unanimously voted for continuation.
Engineering	Clarity of definitions, explanations, formalization of language, technical soundness etc.	At present, the written formulation of the framework is still relatively informal in style. This is a result of the intensive input from practitioners, who in general prefer content to formalism. As a consequence, design principles are not free of overlapping and the requirements are “unbalanced” to a certain extent. Apart from that, the representatives from the software vendors participating in the focus group on 05/27/2010 articulated a demand for more specific requirements, as they considered the present version of the framework not ready to be handed to development. They recommended “scenarios” for proof-of-concepts.

Dimension	Detailed Criteria	Assessment
Epistemological	Theoretical foundation, critical distance, scientific progress.	The scientific body of knowledge regarding MDM is still in its infancy. As a result, the paper makes intensive use of knowledge from the practitioners' community. The research process follows accepted guidelines and combines a variety of research methods.

Table 3: Framework Evaluation

CONCLUSIONS

The paper reports on the design of an IS research artifact, namely a framework for strategic business requirements to be met by MDM systems. The framework is a response to an acute need in the practitioners' community and addresses a topic which has not been investigated in depth by IS research so far. Due to the lack of scientific knowledge, the research presented in the paper makes intensive use of expertise from practitioners who were involved in the research process by means of expert interviews, an offline survey, and a series of focus groups.

Practitioners benefit from the framework because it facilitates internal and external communication and forms a reference for strategic application systems planning for MDM. The paper adds to the scientific body of knowledge since it presents an abstraction of an information system in a quite neglected area of IS research, and since it explicates the research process. This explication allows for future research to validate the framework and to extend and adapt it in order to be able to reflect changing business requirements and technologies.

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APPENDIX

Appendix A: Innovation Profile Examples

Table 4 shows two innovation profiles out of ten in total which were developed in the first phase of the research and which guided the design activities.

ID	2	3
Short title	Master Data as a Service	Data Communities
Description	<ul style="list-style-type: none"> • A model of Master Data deployment whereby a (internal or external) provider licenses Master Data to customers for use as a service on demand. 	<ul style="list-style-type: none"> • Data Communities leverage the strength of a growing community of the best data operations in the world. • Participants benefit from multiple efforts each of the member institution has put into their global business entity database.
Related MDM business potential	<ul style="list-style-type: none"> • Centralized Master Data can improve global quality of information. • Standardized metadata is hashed out for Master Data Sets that are shared. For instance, a zip code is a zip code - no matter where in the world you live. 	<ul style="list-style-type: none"> • High-quality and up-to-date data leads to reduced settlement risk, improved regulatory compliance.
Barriers and risks	<ul style="list-style-type: none"> • Costly for ensuring 24x7 uptime in a global environment • The question of "Who owns the Master Data" comes in to play • Security issues • Requires your business to have metadata already defined for the master data sets 	<ul style="list-style-type: none"> • Concerns regarding potential loss of control over "own" data must be overcome. Fit of externally provided data to requirements of data consumers must be ensured.
Basic technologies used	<ul style="list-style-type: none"> • Web services stack • Service-oriented architectures 	<ul style="list-style-type: none"> • Distributed data architectures, for example Linked Data.

Table 4: Innovation Profile Examples

Appendix B: Co-Signers of the Framework Working Report

The working report which describes the framework in a format appropriate for the practitioners' community was co-signed by 27 MDM professionals from the following companies: Bayer CropScience AG, Beiersdorf AG, Clariant Business Services GmbH, Corning Cable Systems GmbH & Co. KG, Deutsche Telekom AG, DB Netz AG, eCI@ss e.V., Fraunhofer IAO, Geberit International AG, Henkel AG & Co. KG, Nestlé SA, Novartis Pharma AG, Philips Lighting B.V., Robert Bosch GmbH, Roche Diagnostics GmbH, RWE Service GmbH, Sick AG, Siemens Enterprise Communications GmbH & Co. KG, Syngenta Crop Protection AG, TNT Express GmbH, ZF Friedrichshafen AG.

Appendix C: Strategic MDM Use Cases

The analysis phase resulted also in a number of strategic MDM use cases which pose requirements for MDM systems. In the first version of the framework document (before November 2009), the following use cases had been identified: Risk management and compliance, integrated customer management, business process integration and harmonization, reporting,

IT consolidation. Later on, in the process of the offline expert survey, the following use cases were added as a result of the feedback analysis: demand planning, cross-project management, vendor management, product lifecycle management.

Appendix D: Shortcomings of Current MDM Systems

The user companies identified the following shortcomings: No downstream visibility of data, poor business semantics management, MDM and data quality management (DQM) treated as two separate “islands”, “stovepipe” approach for MDM architectures, no consistent master data service approach, no predefined content, no “on-the-fly” mapping and matching, poor support of centralized management of decentralized/federated datasets, no integrated business rules management, poor support of distinction between “global” and “local” data, poor support of compliance issues, insufficient transition management (from one MDM architecture to another).