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TOWARDS A PROCESS REFERENCE MODEL FOR INFORMATION SUPPLY CHAIN MANAGEMENT

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Abstract

High-quality information is a prerequisite for companies to accomplish business and strategic goals, such as global reporting, customer relationship management or compliance with legal provisions. During the last years, experts in the field of information quality begun to realize that a paradigm shift is needed to solve information quality issues in organizations. Information should be treated as a product and information quality is possible only through the quality management of information supply chains. The paper at hand contributes to this new direction by proposing a process reference model for quality management of information supply chains (Information Product Supply Chain Management, IPSCM) by leveraging the SCOR-Model, a widely accepted standard for supply chain management. The IPSCM-Model enables users to address, improve, and communicate information creation practices within and between all interested parties.

Keywords: Data Quality, Data Quality Management, Information Supply Chains, Process Reference Model

1 INTRODUCTION

1.1 Motivation and Problem Scope

High-quality information is a prerequisite for companies to accomplish business and strategic goals, such as higher quality of decision making (Shankaranarayan & Ziad & Wang 2003, Price & Shanks 2005), efficient customer relationship management (Zahay & Griffin 2003, Reid & Catterall 2005), compliance with legal provisions (Friedman 2006), and supply chain management (Vermeer 2000, Tellkamp & Angerer & Fleisch & Corsten 2004, Kagermann & Österle 2006). Numerous scientific studies follow a preventive approach to information quality management (Wang & Strong 1996, English 1999, Redman 2000, Lee & Pipino & Funk & Wang 2006, Otto & Wende & Schmidt & Osl 2007) which raises the issue of ensuring information quality rather than react on information quality defects. Wang (1998) transferred concepts from resource management to the field of information management and emphasized the need for an information product (IP) approach. Like any process, information product creation should be managed with total-quality principles, emphasizing the quality of the creation process rather than the quality of data components of the information product. The concept of a information supply chain consists of all activities and work associated with the transformation of raw data to the delivery of information products to the end consumer and involves the participation of several actors (Dedeke 2005, p. 87). Managing the information supply chain over the whole life cycle of an information product is a prerequisite to ensure its quality. Furthermore, controlling and monitoring the information supply chain is mandatory for being able to comply with business rules and regulatory provisions relevant in a company's operating business (Gartner 2008, pp. 11-12).

However, many companies, regardless of what industry they are in, see themselves confronted with a multitude of problems, which mainly are caused by ineffective approaches and instruments supposed to provide such control and monitoring of information supply chains. For example, a national European railway network operator has to make sure that its entire infrastructure is accurately kept in an inventory database in order to be able to report to national authorities. The consistent view on infrastructure data is a major challenge, because of the traditional line and staff organization the IT system landscape is heterogeneous. The majority of information creation processes require involvement of virtually all business functions, such as construction planning, timetable planning, asset management, and maintenance. Therefore, many IT systems store and process infrastructure data, and no consistent definitions exist. Actors and processes of the information supply chain are not transparent and ad-hoc managed only. The consequences of such poor data management are far-reaching: As infrastructure inventorization constitutes the basis for the government to decide on co-financing of the infrastructure, insufficient or poor reporting by the company can have substantial negative effects.

Although there is an agreement in the literature on the need to build quality into information supply chains, there is no unanimity on the practice of process management. The definition of process management in the field of information quality is an important issue that is yet to be resolved (Dedeke 2005, p. 91). The aim of the present paper is to close this gap by introducing a process reference model covering all phases of the life cycle of an information product, from its definition to its final termination. This model, which is very much characterized by treating information as a product and which builds on existing scientific approaches and findings, is supposed to constitute a structural and conceptual framework by which further research on the topic can be structured and motivated. The real-world case of a national European railway network operator is used to explain the applicability of the model.

So the central objective of our research lies in identifying design objects needed to construct the model, and in specifying the relations between these design objects. In doing so, our guiding principle is to make sure that both compliance with scientific requirements and applicability of the model in real-world business settings is ensured.

2 RESEARCH DESIGN

The reference model presented and discussed in this paper is an outcome of the Business Engineering (BE HSG[1]) program conducted by the Institute for Information Research (IWI-HSG[2]) of the University of St. Gallen (HSG[3]) since 1989. More specifically, the reference model has been developed by the Competence Center Corporate Data Quality (CC CDQ), which is a consortium research project (Back & von Krogh & Enkel 2007, Österle & Otto 2009) dealing with the development and evaluation of artifacts (e.g. architectures, methods, models) supposed to help solve problems in the area Corporate Data Quality Management (CDQM).

With regard to research methodology, consortium research is characterized by a pluralistic approach, integrating methods both from constructivism and behaviorism (Österle & Otto 2009). Artifacts are mainly constructed following the principles of Design Science Research (DSR, (Hevner & March & Park & Ram 2004)). In order to accomplish rigor and relevance of our research results, our research process follows the concept of iterative phases as defined by Pfeffers et al. (2008):

- *Problem Identification and Motivation:* The specific research problem and the practical relevance has been outlined in the motivation. Based on the scope, we derive the research questions guiding this paper.
- *Definition of Objectives of the Solution:* In Section 2 of the paper, the research objectives, principles, and design decisions concerning the process reference model are derived from the scientific state of the art. Drawing upon the analogies between resource management and the field of information management, the Supply Chain Operations Reference (SCOR) model is chosen to constitute the basis of our process reference model.
- *Design and Development:* Section 3 presents the Information Product Supply Chain Management (IPSCM) model and offers a description of how IPSCM-Model was designed and developed. The real-world case of a national European railway network operator is used to explain the applicability of the model.
- *Evaluation:* In Section 4 the IPSCM-Model is evaluated following the principles defined by Frank (2006).

The results of each phase of the above activities are presented in the remaining parts of the paper. Finally, the last chapter closes with a brief summary, limitations of the conducted research and an outlook to further research.

3 RELATED WORK AND OBJECTIVES OF THE MODEL

3.1 Data and related terms

Pieces of data describe characteristics of objects and processes from the real world. In this sense, data is free of context. When data is used within a context or when data is processed, it turns into information.

Data processes to produce information have many similarities to processes that produce physical products. Therefore, information creation should be viewed as producing high-quality information products for information consumers. Despite the existence of the presented discrimination between information and data, the notion of quality is applied to both terms without much differentiation. Also, there is no unambiguous definition for information quality and data quality, for what quality actually means data or information that are fit for use by these consumers (Redman 2000). Fitness for use involves multiple dimensions like accessibility, relevancy, timeliness, completeness, and accuracy

[1] BE HSG: http://www.iwi.unisg.ch/behsg/

[2] IWI-HSG: http://www.iwi.unisg.ch

[3] HSG: http://www.unisg.ch

(Wang & Strong 1996). The input of a information process may be an atomic data element which cannot be further detailed (e.g. material group codes) or a component data element as a combination of atomic data elements. These data items of a n information product correspond to the bill-of-material of its physical counterpart. A component data element is already semi-processed and therefore is considered as an information product as well (cf. Figure 1). The quality of the information product is dependent from the quality of its data components and from the quality of the process as well.

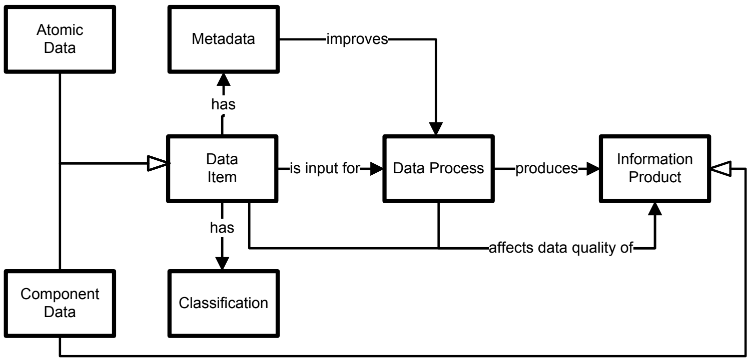

Figure 1. Information process meta model

A common classification for structured data is transactional data, inventory data, and master data. Transactional data represents input and output of business processes, such as purchase orders, invoices, shipping notes etc. Inventory data refers to stock and account levels, e.g. bank account balances or reserved stock of finished goods. Master data, eventually, refers to the features of core business entities within an organization. Typical master data classes are material and product master data, supplier and customer master data. Corporate data is master data that is used across an entire organization. Another type of data is referred to as metadata, generally describing other data in terms of specifying their meaning and properties . Metadata determine important characteristics that need to be known for both database and application engineering and for understanding data within an organization in a semantically unambiguous way. Metadata may be used to guide and improve the information process (cf. Figure 1).

The IPSCM-Model aims at the advancement and promotion of quality management of all business activities involved in information creation processes.

3.2 Information Supply Chain

Essential for the information creation processes is the supply with the right data, in the right format, at the right place, and at the right time. Some links can be drawn here to work on the management of information supply chains, which transfers concepts from the supply chain management to the field of information management. Using supply chain management as a metaphor, it aims to create and unify concepts, methods, theories and technologies for information sharing problems. Authors consider the information supply chain to be an information-centric view of physical and virtual supply chains, where each entity adds value to the chain by providing the right information to the right entity at the right time in a secure manner (cf. Sahin & Robinson 2002). Limitations of this analogy due to the different nature of information and physical goods are explained in Klesse (2007, p. 153). Similar to the case in a supply chain, insufficient information supply leads to information deficiency, whereas abundant information may create information overflow. There are different perspectives on how the information supply chain relates to the physical supply chain: Whereas some scholars tightly couple the value of information sharing with the physical coordination of goods flow (Sahin & Robinson 2002), others (Marinos 2005, Sun & Yen 2005) argue that the information supply chain does not coincide with the transactional information flow within a supply chain.

Whereas information has traditionally been considered as a secondary product of a supply chain, the advent of information technology systems in organizations has completely reversed this thinking in many sectors. Actually, in many companies (for example, telecommunications) information is the only product offered. Dedeke (2005, p. 97) states that the quality of information products is possible only through the quality management of its information supply chains. Redman (2000, p. 151) emphasises that the information supply chain must be managed over the whole life cycle of the information product. According to Gartner (2008, p. 9), the life cycle consist of the stages Author, Store, Publish/Subscribe, Enrich, Use, and Archive.

The IPSCM-Model requires to comprise all needed business activities to manage the information supply chain over the whole information product life cycle (since the information supply chain changes along the life cycle of the information product). Since information supply chains is a concept transferred from the field of resource management, it is convenient to analyze process reference models from the domain of supply chain management to leverage the IPSCM-Model.

3.3 Reference Modelling and the SCOR-Model

Fettke and Loos (2004) identified three basic characteristics of reference models. *Best Practices* stands for the capability of reference models to provide recommendations for conducting business. *Universal applicability* means that a certain reference model is not just used for one single organization but represents a complete class of several domains. And *reusability* indicates that reference models provide patterns for the development of information systems. Thus, reference models are conceptual, structural frameworks that can be used in a multitude of information systems projects. Guidelines for modeling (Becker & Rosemann & Schütte 1995), techniques for construction (vom Brocke 2007), and criteria for evaluation of reference models (Frank 2006) have been discussed for some time within the scientific community.

Basically, two ways of constructing a reference model can be distinguished. Either a large number of cases is investigated from which generic elements are derived that constitute a reference model, or an existing reference model is adapted to requirements identified. While the first approach depends on the number of cases, which is a requirement for being able to produce generally valid results that often is not easily met, the latter approach is particularly reasonable if sufficient similarity can be identified between the domain of the basic reference model and the domain of the reference model to be developed.

As information supply chains does have structural and conceptual similarity to classic supply chains (which we have outlined in the previous subsection), the work presented in this paper takes advantage of the second approach, i.e. existing process reference models for supply chain management will be adapted to the domain of information management. Relevant and proven findings from research on information processes will be transferred to the IPSCM-Model that adopt its structures from the Supply Chain Operations References (SCOR) model of the Supply Chain Council (SCC[4]). The SCOR-Model, which has been developed by more than five hundred member organizations and partners and which is broadly disseminated both among scientists and practitioners, is mainly used to facilitate the process of developing integrated supply chains. It defines standardized business processes using three levels of detail, differentiating between suppliers, customers, and the focal organization. However, the model does not attempt to describe every business process or activity within the supply chain. These deliberately excluded components are: Marketing and sales, research and technology development, and product development. This was a main point of criticism regarding the model, since these are determining factors for the supply chain. The SCC reacted to those weaknesses and developed process reference models that seamlessly integrate with the SCOR-Model: Market Chain Operations Reference (MCOR), Design Chain Operations Reference (DCOR), and Customer Chain Operations Reference (CCOR).

According to the structures of the SCC-Model family, we construct the IPSCM-Model along three structural dimensions: Process area (IP Inventory Chain, IP Design Chain, IP Consumer Chain, and IP Supply Chain), Partner (suppliers, focal Organization, consumer), and Level of detail (top level,

[4] www.supply-chain.org

configuration level, process element level, and implementation level). The reuse of existing and well-known concepts and structures may ease the adoption of the model in the practitioner's community.

4 PROCESS REFERENCE MODEL FOR INFORMATION SUPPLY CHAIN MANAGEMENT (IPSCM-MODEL)

We define the quality management of information supply chains as following:

"Management of Information Supply Chains encompasses the management of all activities involved in defining, collecting, storing and authoring, maintaining, archiving, and all provisioning activities of information products. Importantly, it also includes coordination and collaboration with all participants of the information supply chain which can be (internal or external) suppliers, third-party service or information providers, and (internal or external) consumers. In essence, Management of Information Supply Chain integrates supply and demand management for information products within and across companies."

The structural and conceptual similarity between information production and manufacture of physical goods, as well as the basic transferability of concepts from supply chain management to the domain of information supply chains, allows us to build on SCC-Model family and adapt them to the specific requirements and objectives of information supply chains.

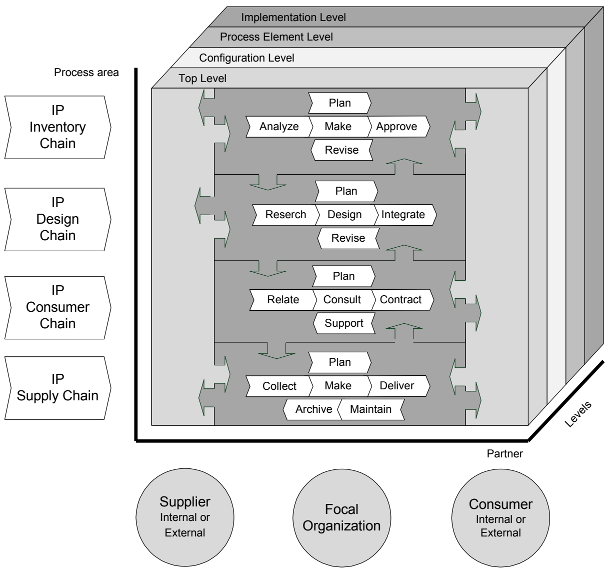

Figure 2. Process Reference Model for Information Supply Chains (IPSCM-Model)

The Information Product Supply Chain Management (IPSCM) model aims at promotion and establishment of quality management of information supply chains in organizations. The scope of the model are information products. Following list summarizes the model requirements as developed in the previous chapter:

- Business orientation in order to create awareness of the relevance of data production processes in the company / in the practitioner community
- Integration of the large scientific body of knowledge regarding data production processes and practitioners „best practices"
- Management of all activities needed along the life cycle of information products

Following the structure of the SCC-Model family, the reference model consists of the following three structural dimensions and their respective values:

- Process areas (IP Inventory Chain, IP Design Chain, IP Consumer Chain, and IP Supply Chain) contain each a set of management processes needed to fulfil a certain task

- Levels (top level, configuration level, and process element level, and implementation level) specify processes and interfaces stepwise (hiding complexity)
- Partner (supplier, focal organization, and consumer) differentiate the groups participating on the information supply chain

Figure 2 shows the IPSCM-Model which covers the whole life cycle of information products from *cradle to grave*.

The IPSCM-Model describes all business activities associated with all phases of satisfying a consumer's demand. Each process area contains a set of the needed management processes. Suppliers provide raw atomic data or pre-processed component data which are collected by the focal organization to provide the produced information product to the final consumers. Focal organization may refer to the organization as a whole, or a single organisational unit or function (for example, the unit responsible for data quality management). The IPSCM-Model contains three level of process detail. Top level defines the process areas and the respective management processes. Configuration level allows to choose between different implementation strategies. For example, process area IP Design Chain differentiates between developing new information products or refining an existing one. Process element level describes the activities in detail. For the paper at hand, we focus on the top level only. IT-based implementation of the information supply chain is out of scope of the paper at hand.

4.1 Case RailRoad Inc.

RailRoad Inc. is a national European railway network operator that is part of an international transport and logistics group and is 100 percent state-owned. Among its major business functions are maintenance, repair, and renewal of infrastructure assets, such as tunnels, bridges, and tracks. With more than 42,000 employees, the company generated overall revenue of approximately 4 bn EUR in 2007. A major source of revenue is the leasing of tracks to railway companies.

A new regulation has been introduced that changes the monetary endowment from public authorities for infrastructure maintenance purposes. In the past, the money was approved on a case-by-case basis, whereas nowadays a lump-sum strategy is established practice. Once a year, the public shareholder decides on an overall contribution for maintenance tasks. The amount is granted on the basis of a register that contains the number, age, and maintenance status of the network infrastructure. The company has to create and report the register to the public authority once a year. The basis for this report is infrastructure data – more precisely accurate, consistent, and timely information about national infrastructure assets. There are two major risks involved. First, in the event the report is incorrect, the granted amount might be contrary to expectations. For example, if the reported maintenance status of the infrastructure were too high, the company would have to invest more of its own money for maintenance tasks. Second, if the report quality were unacceptable, i.e., the quality of reported data were too low, the company would risk penalty payments.

RailRoad created a department responsible for managing infrastructure data (IDM) such as tracks and tunnels. IDM is the focal organization that we want to investigate. RailRoad is responsible to generate the infrastructure report (an information product) and identified corporate tunnel data as a mandatory data component. Therefore, IDM is requested by RailRoad to provide high-quality corporate tunnel data (an information product as well) in a form as requested by public shareholders.

In the following subsections we use this case to explain the management processes of each process area and to illustrate how the IPSCM-Model works. In general, planning processes includes the measure and control processes with regard to meeting quantitative requirements and usually occur at regular intervals.

4.2 Information Product (IP) Inventory Chain

To be able to effectively manage the needs of suppliers, the focal organization and consumers an information product manager needs to establish an information product inventory (Pierce 2005, p. 100). The IP inventory is a catalogue of the information products, comparable with a product portfolio, offered by the focal organization and can be used as a basis for identifying and prioritizing those information products that are candidates for quality improvements (or for elimination). Table 1 lists the management processes that have to be established in that particular process area. Furthermore, a well-managed IP inventory will aid the focal organization in reengineering or outsourcing projects because the IP inventory can help identify which information products should continue to be delivered under the new system as well as helping to identify future information needs (Pierce 2005, p. 101)

IDM revises the IP inventory and adds the IP corporate tunnel data. Moreover, IDM analyzes the requirements of the infrastructure report to understand the quality requirements for corporate tunnel data. During development, business-related characteristics were defined which corresponds to the business metadata (general description, data quality requirement, consumers, suppliers, criticality, etc.). For example, timeliness is set to 30 days due the requirements of the infrastructure report, and tunnel length and GPS location data are defined as mandatory attributes. After the IP is technically designed and the supply chain is set up, the IP is finally approved to be used by RailRoad to generate the infrastructure report.

Process	Description
Plan	Different information products and different changes to them will have different impacts, though some possible measures are increased usage, improved consumer satisfaction or, new consumer acquisition.
Analyze	Thoroughly understand the requirements that the information product must satisfy in order to be considered a *quality product*. A quality information product should provide just the right amount of information at just the right time in just the right format so that it aids the consumer in the desired task. This may also include to identify and analyze information products that currently exist in the organization (Pierce 2005, p. 100)
Develop	Develop and determine the characteristics of the information product and specify the data-quality requirements to meet the consumer's needs (Pierce 2005, p. 103). These characteristics correspond to business metadata. This process also integrates with the Design management process of the process area IP Design Chain which specifies the more technically aspects of the IP.
Approval	Once the information product characteristics are fully specified in accordance with the IP Design and Supply Chain, the information product is approved to be finally used by the consumer.
Revise	Review periodically the contents of the IP inventory to see if any changes to the information products have taken place. Like its physical counterpart, it is important to keep the contents of the IP up-to-date (Pierce 2005, p. 110)

Table 1. Management Processes of IP Inventory

4.3 Information Product (IP) Design Chain

The characteristics of an IP are defined at two levels. At a higher level, at the IP Inventory, the IP is conceptionalized in terms of its functionalities for information consumers. IP Design, at a lower level, identifies the IP's basic units and components, along with their relationships. Following management processes are defined in this process area (cf. Table 2).

Process	Description
Plan	Possible measures may be design cycle time, or total design cost. Identified costs may be used in IP Consumer Chain for pricing.
Research	Research prepares all information needed for design decisions in the design management process, like technical capabilities, provided data formats, data transport, etc. of external or internal data suppliers.
Design	Each of the information product characteristics developed in the IP inventory are decomposed into subcomponents. At a lower level, the IP's basic units and data components, along with their relationships are identified. Defining what constitutes a basic unit for an IP is critical, as it dictates the way the IP is produced, utilized, and managed (Lee et al. 2006, p. 7). This corresponds to the IP's technical metadata . Subcomponents of an IP may also be services, like business support. The results of the previous research are used here for design decisions.
Integrate	Ensure the technical readiness of the IP's supply chain and consumer processes.

Refine	Changes in the IP inventory or new consumer requirements/complaints may trigger a refinement of the IP's design.

Table 2. Management Processes of IP Design Chain

The business requirements of the IP corporate tunnel data are decomposed into needed subcomponents. For each subcomponent, the technical requirements are specified (for example, field length, field type, etc). Due to the results of research activities, IDM identified internal suppliers for the tunnel length and GPS data. At the end of the design phase, technical readiness of the information supply chain and the consumer support needs to be set up.

4.4 Information Product (IP) Consumer Chain

This process area is defined as the collection of management processes associated with all phases comprising conversion of stakeholders into contracted consumers. Contracts are expressed in terms of service levels agreements. Furthermore, consumers need to be given assistance to respond to questions and problems in a timely manner and to give feedback on the information products consumed. *Table* 3 lists the management processes that are defined in this process area.

Process	Description
Plan	Planning processes prioritize consultancy activities. Possible measure may be the number of consumer's complaints, number of change requests or stakeholder coverage.
Relate	The process of establishing and maintaining relationships with existing and potential consumers (Redman 2000). This includes obtaining the customer's needs (existing/potential) and establishing the consumer's profile.
Consult	The process of establishing an understanding of the consumer's needs and presenting and/or developing a solution to meet those needs. This includes informing stakeholder of overall consumer requirements and their role in meeting them, for example, with the help of a communication package (Redman, p. 107).
Contract	4.4.1 The process of pricing a solution (containing information products and/or services) and gaining consumer agreement. This includes configuring the service level agreement, pricing the solution and closing the deal.
4.4.2 Support	4.4.3 The process of providing post consultancy support for information products and services provided to the consumer. This includes receiving, logging, assigning support resources and responding to customer inquiries, claims and quality feedback for information products and services. (Thomas 2006) (English 1999, p. 376). This may initiate a redesign of IPs and/or refinement of the IP inventory.

Table 3. Management Processes of IP Consumer Chain

IDM sets up a service level agreement (SLA) that ensures, for example, the timeliness of 30 days for corporate tunnel data. The SLA is accepted by RailRoad. Furthermore, an 24/7 email support is set-up to respond to problems or complaints as fast as possible.

4.5 Information Product (IP) Supply Chain

The established and specified requirements of an IP are deterministic factors for the underlying supply chain. Table 4 describes the needed management processes to finally implement the information creation processes, namely, the information supply chain. Collect, Make, and Deliver also contains data storage.

Process	Description
Plan	Possible measures may be supply chain cycle times.
Collect	The processes to collect data from the data suppliers necessary to produce the information product (Wang 1998, p.4)..
Make	The processes to transform the input data into the information product (Wang 1998, p.4). This includes data transformation and cleansing.
Deliver	The processes to deliver the data to the consumer, for example, store the IP in a database (Gartner 2008).

Maintain	Provide consumers the capabilities to maintain instances of the information product (Redman 2000, p.109)
Archive	Provide consumers the capabilities to archive (or even physically delete) instances of the information product (Redman 2000, p.109)

Table 4. Management Processes of IP Supply Chain

IDM sets up the processes to collect the data components from the internal supplier, transport data, store data, produce the IP, and deliver it to the consumer, the RailRoad Inc. Delivery happens in terms of a subscription to the IDM's centrally corporate data server. In our example, the consumer itself reprocesses the data received and puts up the infrastructure report, the final information product, to be submitted to the public shareholders.

5 EVALUATION

Frank (2006) presents an approach that is aimed at fostering a differentiated and balanced judgment of reference models using different perspectives. The process accompanying the evaluation contains five major stages: define the aim of the evaluation, specify model requirements, select relevant perspectives, evaluate selected perspectives, and balance the perspective-specific evaluations.

The evaluation aims at observing and measuring how well the developed IPSCM-Model supports a solution to the problems outlined in order to establish information supply chains in companies. Derived from the specified model requirements in Section 3, all four perspectives are selected for evaluation. Table 5 shows the results of the evaluation.

Perspective	Criteria	Evaluation
Economic	Costs, Benefits, Coordination	Criteria like costs for using the model (training or adaptation, for example) and benefits (reduced costs) may not be evaluated yet due to the lack of cases the IPSCM-Model has been instantiated in. Regarding communication, the model was discussed in workshops and focus groups of the consortial research approach (cf. Section 1) and helped to foster the communication between different stakeholders (with different professional background) regarding information products, related processes and the information product supply chain.
Deployment	Understandability, Appropriateness	Discussions in the workshops and in the focus groups proved the understandability of the structure and elements of the model. Due to the similarity to the SCOR-Model, which is a well-known reference model both in scientific and practitioner communities, intuitive access to the contents has been approved. The appropriate level of abstraction is guaranteed through the derivation of the SCOR-Model structure as well, using three levels of process abstraction. A limitation can be seen in the incompleteness of the models of levels 2 and 3.
Engineering	Definition, Explanation	Requirements have been made explicit in a comprehensive and precise way (cf. Section 2 and 3). Section 3 also assigned requirements to model elements as well as substantiated major design decisions.
Epistemological	Evaluation of Theories, Scientific Progress	The underlying principles and theories of the IPSCM-Model are the information product approach and information product supply chain. The model does not extend the body of knowledge here, but applies process management to information supply chains. The model fills the research gap by defining process management in the field of information quality and thereby contributes to scientific progress.

Table 5. Evaluation of the IPSCM-Model

During discussion with our research partners, we used the model as a guidance to identify the as-is situation regarding information creation processes at the user sites (as shown in Section 3). The model helped to guide the discussion and, hence, answered following questions: What are the participants in the information supply chain? What information products are actually used? What are the users and consumers of information product? What are the requirements the customers have on IPs? Where do the raw data used in a IPs come from? How can information supply chains be designed in order to meet requirements and needs of all participants (including regulatory authorities)? Although the evaluation achieves promising results in some criteria, the need for instantiation and application of the model seems evident. Further research aims at populating the model completely and to evaluate the applicability in practice by means of case studies.

6 CONCLUSION

The aim of this paper is the development of a process reference model for the quality management of information supply chains to apply process management to the field of information quality. In order to achieve this we followed the design science approach using reference modelling as a concrete procedure. We presented a process reference model by leveraging the SCOR-Model, a well-established and well-used process reference model by both scientists and practitioners. Thereby, we took advantage of the analogy of information products to physical products and the similarities of supply chain management and information supply chain management. Partner, process areas and management processes needed for a quality management of information supply chains were modelled and described. The Information Product Supply Chain Management (IPSCM) model enables users to address, improve, and communicate information supply chain practices within and between all interested parties. By describing inventory, design, consumer support, and supply of information products using standard process building blocks, the model can be used to describe chains that are very simple or very complex, using a common set of definitions. As a result, disparate partner can be linked to describe the depth and breadth of virtually any information supply chain. By means of a multi-faceted evaluation, we illustrated the potential ability of the model to support the establishment of quality management of information supply chains in organizations.

The evaluation also identified the limitations of the research conducted. What is still missing is the application of the model in real-world scenarios to prove the use of the model to solve instances of the problems presented. Also, the IPSCM-Model refers only to the top level view to understand the management processes needed to establish quality management of information supply chains. A complete population of the model on all levels of detail is needed. Further research also aims to complete the evaluation (for example criteria applicability in practice) by means of case studies.

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