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Modeling Collaborative e-Business Processes in SME environments

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Abstract

Introducing process orientation to overcome the functional-oriented organizational structure was the main concern within enterprise during the last decade. The next wave of process-oriented enterprises deals with cross-organization business processes characterized by high automation effort and supported by a wide penetration of e-Business technologies. In this work, we analyze the requirements of modeling collaborative e-Business processes taking into account the specific challenges Small and Medium-sized Enterprises (SMEs) are facing with. A designed analysis framework based on the Balanced Scorecard (BSC) concept structures the indicators in four different perspectives: financial, working process, innovation/ learning and user. The complex interactions of the identified requirements between the perspectives are described in a strategy map highlighting the importance of the actual user in the modeling activities of cross-organizational business processes. According to the designed analysis framework, existing modeling approaches are evaluated. In addition, a case study leverages the findings of the importance focusing on the end-user requirements in context of modeling collaborative e-Business processes in SME environments.

Keyword: Modeling Collaborative e-Business Processes, Small and Medium-sized Enterprises, Analysis Framework, Internet of Services (IoS), GENESIS

Introduction

Concepts of borderless enterprises (Picot, Reichwald & Wigand, 1999) have been discussed for years and highlight the increased relevance of collaboration among enterprises and their business environment. According to the management approach of Business Process Reengineering (Hammer & Champy, 1993), enterprises introduce the internal process concept to overcome the functional-oriented organizational structure. By extending the process-oriented way of doing business across enterprise borders, seamless processes and real-time businesses (Alt & Oesterle, 2004) are the new challenges in adaptive business networks. This next wave of process-oriented enterprises is enabled by a wide penetration of e-Business and rapid technology innovations. By adopting systems that allow for business transaction to be conducted electronically rather than paper-based, enterprises can significantly reduce the effort for data-processing, increase business data accuracy and may even discover new business models or partners (UNO 2006). However, electronic collaboration among Small and Medium-sized Enterprises (SMEs) is currently limited to portal technology on presentation level due to huge technical complexity and missing global accepted e-Business standards (Zhao, Xia, & Shaw, 2005). But the modeling of collaborative e-Business processes will take on a mediating role and binds cross-organization business processes and the underlying IT services.

Existing modeling concepts and approaches are limited on the needs of large enterprises and don't cover the integration of private and public business processes. This article is devoted to a systematic investigation of the requirements of collaborative e-Business process modeling environment focusing on the specific and heterogeneous needs of SMEs - the predominant enterprise form worldwide.

The remainder of the paper is structured as follows. First, we outline specific characteristics of SMEs that fundamentally distinguish SMEs from large enterprises. Chapter three presents a designed analysis framework for collaborative e-Business process modeling approaches focusing on SMEs needs. Identified requirements are presented and a strategy map describes their complex interactions. Chapter 4 evaluates existing modeling approaches according to the analysis framework and leverages the findings building the foundation of a new modeling approach that was developed in frame of the EU-funded research project GENESIS. Finally, chapter five gives a short summary and an overview of future work.

2. Terms and Research Approach

2.1. Small and Medium-Sized Enterprises (SME)

In the European Union - but in most areas of the world as well - SMEs are the predominant form of enterprises. Defined as companies that employ fewer than 250 persons and have an annual turnover not exceeding 50 million Euro and/ or an annual balance sheet total not exceeding 43 million Euro (European Commission 2003), SMEs are not necessarily miniature versions of larger enterprises (Chen & Williams, 1998). Related to their environment, structure, strategy and decision process, and psycho sociological context such as the dominant role of owner-manager, the following characteristics distinguish SMEs from large enterprises:

- **Specialization and Individuality.** First of all, SMEs act on business markets that are not covered by large enterprises. Characterized by a high specialization and individuality many SMEs pursue a segmentation or niche strategy that leads to a certain strength in competition (Porter, 1980).
- **Proximity to markets.** Compared with large enterprises, SMEs are strongly focused on their end-users allowing a high proximity to markets. Instead of focusing on exchangeable products or services for anonymous markets like large enterprises SMEs provide services oriented at the customer's needs.
- **Flexibility.** Quickness to react and reorient themselves on business changes is a major characteristic of SMEs (The Economist Intelligence Unit, 2006). This flexibility in decision making and implementing organizational changes is archived by preferring simplicity and flexibility regarding their processes and organizational structures (European Commission, 2005).
- **Limited resources**. As mentioned before SMEs are limited like all companies by tight resources, especially missing IT literacy and financial resources (The Economist Intelligence Unit, 2006). Missing know-how can be compensated with basis knowledge of many areas due to the fact that employees at SMEs are generally "all-rounders" and are good at multi-tasking.
- Technical heterogeneity. Smaller firms often lack coherent Information and Communication Technology (ICT) strategy or the related skills. For instance, IT landscapes consist of heterogeneous systems, reaching from Enterprise Resource Planning Systems (ERP) to spreadsheet-based island applications for conducting their every-day business transaction (European Commission, 2005).

- **Globalization.** The growing internationalization of markets since one decade affects the strategy of SMEs due to deregulation and liberalisation of former market barriers. The chance of new potential business partners involves an enormous adaptation pressure for SMEs which have less experiences than large enterprises in global electronic business (Ibielski, 2002).

2.2. Collaborative e-Business Processes

Inter-organizational business processes are performed by multiple independent parties. Since organization borders usually represent boundaries for system interactions and information flows, a number of particularities arise in comparison to company-internal (private) business processes. To achieve seamless business processes across enterprise borders the heterogeneity of different terminologies and modeling notations used within the organizations have to be overcome. However, autonomy of the different business partners has to be taken into account meaning that an organization should be able to participate flexibe in business relations. Important contributions to handle these challenges with regard to inter-organizational business processes come from workflow management, e.g. the Public-To-Private Approach (van der Aalst & Weske, 2001) and the Process-View-Model (Shen & Liu, 2001). These approaches distinguish between internal process (private process) and cross-organizational interaction (collaborative process).

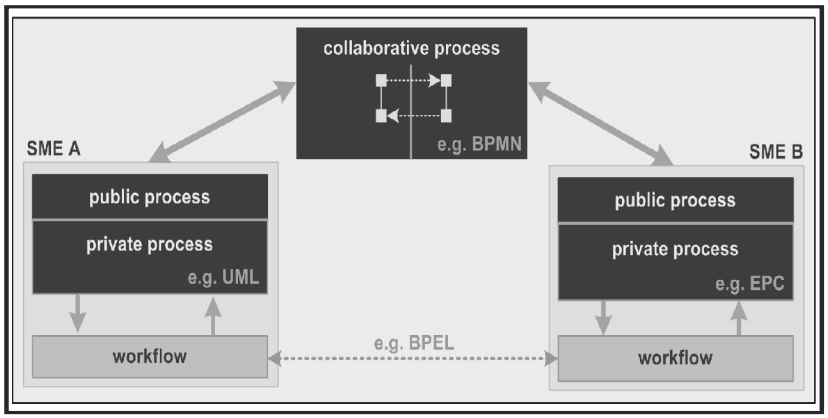

Figure 1: Business Process Modeling Layers

On a **private process level,** organizations model their internal business processes according to a modeling approach or notation that is most suitable for internal demands independently of the modeling methodologies

used by the business partners. As shown in Figure 1, for instance, SME A uses the Unified Modeling Language (UML) for modeling internal processes whereas SME B models with Event-Driven-Process Chains (EPC). A comparison addressing the heterogeneity of business process models can be found in (Mendling, Neumann & Nuettgens, 2004). As a response, abstraction concepts hide details of the internal business process from external business partners on the **public process level**. According to the SOA paradigm (Alonso, Casati, Kuno & Machiraju, 2004) public processes are comparable to the Web Service Definition Language (WSDL) and can be interpreted as a mediator and interface. By hiding the internal process implementation like the specific modeling language and protecting also critical internal information (Parnas, 1972) public processes provided by an organization connect private processes to a **collaborative business process**, the third modeling layer. This level defines the interactions of two or more business entities taking place between the defined public processes. One possible language for modeling collaborative processes could be the Business Process Modeling Notation (BPMN) that consolidates ideas from divergent notations into a single standard notation. Examples of notations or methodologies that were reviewed are: UML Activity Diagram, UML EDOC Business Processes, ebXML Business Process Specification Scheme (BPSS), Activity-Decision Flow (ADF) Diagram, RosettaNet, and EPC (Object Management Group, 2006).

2.3. Research Approach

This section is devoted to the presentation of the research applied. The goal of the research is the analysis of modeling cross-organizational e-Business processes in context of SME's environments. We use the design science framework to structure our research (Hevner et al., 2004) which involves three main activities:

1. First, we design an analysis framework representing a model artifact according to the Design Science research methodology. Based on the four dimensions of the Balanced Scorecard (Kaplan & Norton, 1992), we identify the major requirements by an in-depth literature review.
2. In a second step, we describe the complex interactions between the identified requirements within the four perspectives of the analysis framework by connecting the criteria in explicit transitive cause-and-effect relationships to each other. The detailed modeling experiences taken in the GENESIS project are assimilated in this iterative design process.
3. Finally, the designed artifact is evaluated by analyzing two existing modeling concepts and approaches (ARIS and UMM). In addition, a case study of the GENESIS project highlights the challenges of modeling collaborative e-Business processes in SME.

The results of each of the above activities are presented in the remaining parts of this article.

3. Analysis Framework

3.1. Perspective

In the following chapter, we present the analysis framework for modeling collaborative e-Business processes focused on SMEs. As mentioned in the section above, we structure the indicators according to four perspectives of the Balanced Scorecard concept (Kaplan & Norton, 1992). In contrast to the original perspectives (financial, customer, internal working process and innovation/ learning) the specific importance of collaboration among enterprises leads to four adaptive perspectives that are depicted in Figure 2. This kind of thinking in different perspectives reduces an unbalanced point of view by identifying challenges SMEs are confronted with modeling collaborative e-Business processes. The following paragraphs present these perspectives and their identified indicators in detail.

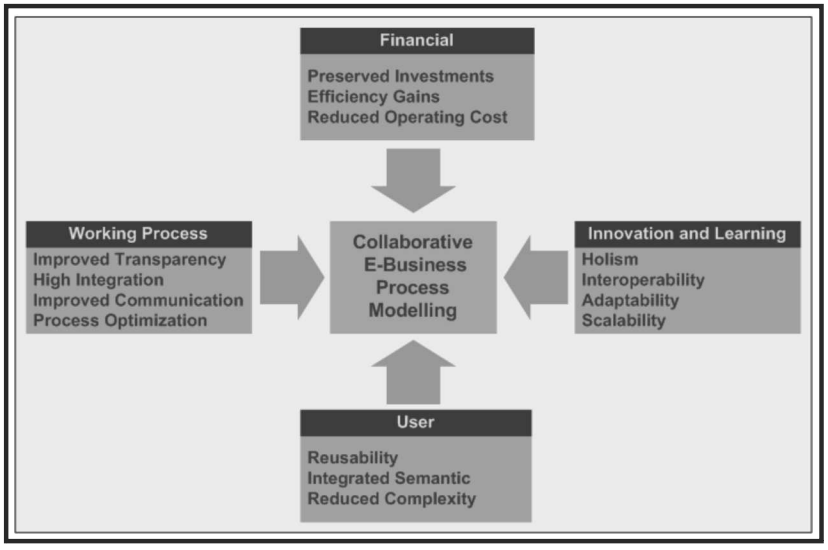

Figure 2: Perspective of the Analysis Framework

3.1.1. User

The first perspective focuses on the actual users who model the collaborative e-Business processes, no matter whether a business or IT specialist is involved. User modeling experiences taken in the GENESIS project have emphasized three major requirements.

First, **reusability** of knowledge compensates the missing modeling know-how of employees at SMEs who are generally characterized as all-rounder or multi-task worker. In contrast to large enterprises employing specialists for modeling business processes SMEs do not have these resources. Therefore by means of templates and best practices the user is relieved from routine modeling activities. Additionally by supporting a new concept transforming the software paradigm Design Pattern (Gamma, Helm, Johnson, & Vlissides, 1994) to collaborative processes it renders assistance to model process transactions among business partners. Besides this so-called business transaction design pattern (UN/CEFACT, 2006) a central repository for process and data building blocks enables a high reusability by adapting, adding or creating collaborative business processes.

Search criteria combined with a specified context, for instance the country, business partner role or industry, lead to the second requirement of the user perspective, the **integrated semantic**. A common understanding with regard to description of processes and data across enterprise and even department borders is a prerequisite to solve this business dilemma (Stuhec, 2006). A concept handling the accustomed terminology of the different user groups (e.g. a business expert speaks another language than an IT specialist) is required to reduce misunderstandings and potential sources of error. Especially the growing international orientation of SMEs increases this phenomenon due to regional, cultural or language differences as modeling experiences in GENESIS have shown. As a result of this additional information overload the modeling approach has to provide only the relevant information according the users' specific context. Unnecessary information has to be hidden.

Combined with the above presented requirement reusability, an integrated semantic leads to a **reduced complexity**, the third and last requirement of the user perspective (Fricke, Goetz, Renner & Polz, 2006). Different levels of abstraction and granularity as well as different views on business processes provide modeling environments corresponding to the respective user group. In this sense business people see a company as a set of processes that generate and consume different kind of flows and are carried out by resources. From another perspective, IT people interpret a company as a set of information systems or services (Anaya & Ortiz, 2005).

3.1.2. Innovation and Learning

Focused on innovation and learning the second perspective of our holistic analysis framework regards collaborative e-Business processes from a strategic point of view. Due to the fact that business processes are subject to permanent change, the specific SME characteristic of high flexibility to react and adapt to business changes is a major challenge in this perspective. In this context innovation is not interpreted as product innovation but as process innovation. First of all, the widespread thinking in island approaches at SMEs has to be overcome by a **holistic** modeling approach. Derived from the management concept of Continuous Improvement Process that is a never ending effort to adapt and improve processes, modeling of collaborative e-Business processes is a cycle using small steps improvement, rather than implementing one huge radical improvement as proposed by the BPR approach (Hammer & Champy, 1993). In the first phase, SMEs discover potential business partners as well as their provided business processes. Followed by a modelling and design phase where local processes are mapped to collaborative processes, the third phase implements private processes to executable workflows. The fourth and last phase closes the continuous improvement cycle by executing and evaluating collaborative e-Business processes. In addition, an integrated data and process modelling approach has to take into account the traditional strong focus on data interchange in context of e-Business and EDI (Glushko & McGrath, 2005).

This will lead to the second requirement regarding the innovation and learning perspective: **interoperability**, meaning the ability of ICT systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge (European Commission, 2004). Divided into organizational (laws, processes), semantic (data structures, services) and technical (protocols, technical interfaces) interoperability (European Commission, 2004), globally accepted standards are a prerequisite to integrate business partners into the enterprise value chain without a huge effort (Fricke, Goetz, Renner & Polz, 2006). Especially the increased globalization implies a strong focus on extending the integrated semantic approach of the user perspective by linking local and global knowledge as well as combining the technical SOA paradigm with BPM concepts.

Furthermore interoperability fosters the agility to react and reorient on business changes and generates a competitive advantage for the enterprise (The Economist Intelligence Unit, 2006). As a consequence a model-driven approach has to bridge the gap between IT and business to achieve full **adaptability** in the dynamic business environments. According to the ISO Open-EDI reference model (ISO/IEC, 2004) modeled business processes on the so-called Business Operational View are mapped automatically to executable workflows on the Functional Service View with the workflow

patterns of van der Aalst, ter Hofstede, Kiepuszewski and Barros (2003) in mind. Caused by rapid technology innovations technical changes are no longer hurdles for SMEs characterized by their missing know-how in technology issues due to the separation of specification and implementation.

A flexible modeling architecture has to escort the organizational evolution and growth with a huge level of scalability. Open interfaces within a modeling approach support a modular architecture for collaborative e-Business processes (Parnas, 1972) and allow outsourcing of non-core competences according to the Resource-Based View (Hamel & Prahalad, 1990). Especially new concepts like Business Process Outsourcing (BPO) on business level or Software as a Service (SaaS) on technical level have to be taken into account.

3.1.3. Working Process

In contrast to the previous perspective focused on strategy challenges our third perspective regards on operational aspects of modeling collaborative e-Business processes. According to the three modeling layers a process step must be mapped **transparently** between the private and public process layer regarding the heterogeneous modeling approaches and notations used on private process level (Fricke, Goetz, Renner, & Polz, 2006). The challenge is an automatic and bidirectional linking without losing information, but providing information hiding simultaneously (Parnas, 1972). As already mentioned before, critical information is not published to all potential business partners. Besides a black or white box approach as provided by BPMN (OMG, 2006) a detailed differentiated grey box approach is required.

Further on, an important barrier for SMEs to invest in e-Business systems is the **integration** into the existing IT landscapes (Fricke, Goetz, Renner & Polz, 2006). In terms of modelling collaborative e-Business processes the Workflow Management Coalition (WfMC)'s workflow reference model (Hollingsworth, 1995) addresses the heterogeneity of Workflow Management Systems (WfMS) by defining five interfaces between different WfMS components. However, relevant in our context is the support of the first interface 'model import/ export' that specifies a process description for transferring the modeled business processes at build time into the run time workflow environment. Thereby workflow languages like Business Process Execution Language (BPEL) focus in general only on the orchestration of activities exposed as Web Services. In addition, process definition typically incorporates people as an additional possible type of participant. A BPEL extension called BPEL4People tries to close the missing integration of human interactions in workflows (Kloppmann, Koenig, Leymann, Pfau, Rickayzen, von Riegen, Schmidt, & Trickovic, 2005).

The third identified requirement in the working process perspective is **improved communication** across department and enterprise borders (Fricke, Goetz, Renner & Polz, 2006). Allowing by the holistic modeling approach with the integration of semantic aspects, communication activities are no longer located on a technical level. Instead of negotiating the technical details business processes establish the communication basis for conducting e-Business processes over the Internet. As a consequence, process models serve as discussion basis and abstract from technically oriented standards.

To measure the related **process optimization** business processes are not only limited to describing the information flow and to assigning organizations units. Also key performance indicators (KPI) have to be included allowing an analysis of business processes. Especially, the increased relevance of BPO and SaaS require an analysis support to validate agreed limit values in the frame of Service Level Agreements (SLA). Besides this post analysis, capabilities for simulation can reduce the learning time for SMEs.

3.1.4. Financial

The fourth and last dimension of our analysis framework is the financial perspective. Characterized by limited financial resources (The Economist Intelligence Unit, 2006), SMEs indicate the **preserved investments** as an important aspect in the context of e-Business (Fricke, Goetz, Renner, & Polz, 2006). In consideration of reuse of already modeled private business processes, existing modeling know-how at SMEs has to be protected meaning a new modeling notation on private process level would implicate additional training session for the employees. For this reason using of well-known modeling languages on private process level is to prefer.

In addition, **efficiency gains** can be achieved by elimination of manual activities during the four modeling phases, such as semi-automatic mapping between public and private processes. One positive side effect of this automation is a gain of time for strategic issues and thus an increase of value-added productivity by error-free processing and reduced sources of error. For that reason, SMEs indicate efficiency gains as the main driver for future IT investments (Fricke, Goetz, Renner & Polz, 2006).

Last but not least, a better operating efficiency influences the **operating costs** (The Economist Intelligence Unit, 2006). By reducing transaction costs SMEs have new liquid resources at one's disposal to strengthen their innovation capability and their growth archiving by minimization of payroll and system costs.

3.2. Strategy Map

After the identification of relevant requirements within the four per-

spectives, in the second step of our research, we analyze the complex interactions of the indicators by connecting the criteria in explicit transitive cause-and-effect relationships to each other (Kaplan & Norton, 1992). By focusing on the important interactions, alignment can be created around the requirements which make a successful implementation easier and represent the heart of our analysis framework. Figure 3 depicts a clear diagram to deeply analyze collaborative e-Business process modeling approaches.

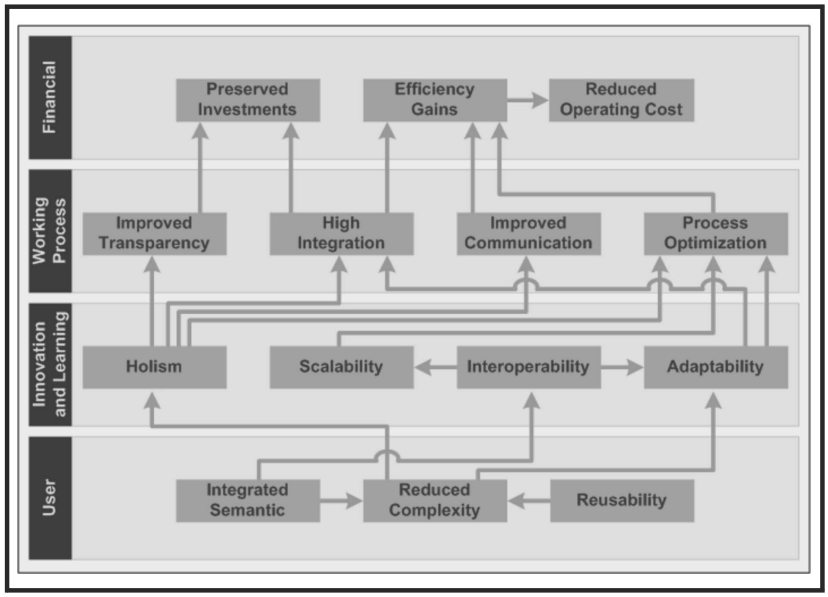

Figure 3: Stategy Map

Starting from the user perspective all criteria can be derived. A reduced complexity supported by a huge degree of knowledge reusability as well as an integrated semantic approach to interpret knowledge across departmental and organizational borders influences directly the adaptability of enterprises. Fast reaction and reorientation on business environment changes are only possible if the complexity is hidden from the user and all modeling phases are covered by a holistic modeling approach. As Figure 3 illustrates by the number of outgoing arrows, holism plays a central role with respect to collaborative e-business processes. In fact, all criteria of the working process perspective are caused by the four identified modeling phases. First, transparent bidirectional mapping between private and public processes combined with information hiding is required to preserve investments by using well-known process languages on private process level. Second, the integration of existing IT landscapes as well as mapping human interactions to workflow

languages like BPEL brides the gap between IT and business supported by a model-driven approach related to the adaptability requirement. Separation of specification and implementation (SOA/ Open-EDI reference model) abstracts from technical interoperability issues and leads to a "Business drives IT" concept located on process level. Third, an improved communication concerning internal and external partners is reachable by a common understanding of different issues beyond all modeling phases. Last of all, process optimization measured by KPI and generated by continuous improvements leads to efficiency gains due to a faster reaction and error-free processing by eliminating manual activities. Hence employees at SMEs can work more on strategic issues associated with a value-added productivity and reduced operating costs.

4. Evaluation

4.1. Existing Modeling approaches

Modeling collaborative e-Business processes are discussed from several perspectives in literature. Many existing approaches are limited to the private process modeling layer like the Zachmann framework (Zachmann, 1987) or the Business Engineering concept (Oesterle, Back & Winter, 2004). A widespread approach is the Architecture for Integrated Information Systems (ARIS) that separates business processes into five views: organization, data, control, function, and service view (Scheer, 1999). To describe the dynamics of the business processes and to link the different views, ARIS uses a modeling language known as Even-Driven-Process Chains (EPC) in the center of the ARIS House of Business Engineering (HOBE). This semi-formal modeling languages combines process and analysis elements and is designed for business aspects like the whole ARIS concept. New research activities divide the ARIS HOBE into a vertical axis of global knowledge (available for all network participants) and a horizontal axis of local knowledge. Also a new modeling language named Process Module Chain is introduced to describe inter-organizational processes (Keller, Scherer, Menzel, Theling, Vanderhaeghen & Loos, 2006). In this sense, ARIS extends its traditional private focus to the cross-organization idea of business processes. Further on, in the last years, the ARIS concept is integrated in enterprise application infrastructure (i.e. SAP, Microsoft, Oracle, etc.) to bridge the gap between business and the underlying IT services. However, modeling of collaborative e-Business processes with the ARIS concepts requires business process expertise which doe not exist in typical SME environments. In addition, an integrated process and data modeling concept is missing. Instead ARIS focuses only on the business processes without any semantic integration.

A methodology dealing with collaborative processes is the UN/CEFACT Modeling Methodology (UMM). According to the Open-EDI reference model

(ISO/IEC, 2004) it specifies collaborative business processes involving information exchange in a technology-neutral, implementation-independent manner. Based on UML and Rational Unified Process (RUP) UMM is a methodology similar to a software process and supports components to capture business process knowledge. It combines an integrated process (UML) and data (CCTS) modeling approach as well as modeling business collaboration in context (Hofreiter & Huember, 2003). In addition, it encompasses a set of pre-defined patterns, process stereotypes and so-called tagged values and thus fosters reuse of already existing process components. On the basis of these stereotypes, whole business processes can be assembled that comply with the standard, thereby ensuring interoperability between different users. UMM features three views for modeling business processes of which each provides users with a different level of detail: Business Domain View, Business Requirement View and Business Transaction View. The most detailed view (Business Transaction View) can be modeled with the help of UML-based activity graphs representing Business Transactions and Business Collaboration Protocols. Business Transactions can be considered atomic process units and can be selected of six basic patterns: information distribution, notification, query/ response, request/ confirm, request/ response and commercial transaction. They comprise single activities, associated tagged values and determine the sequence flow between the different activities of the requesting and reacting roles.

According to the designed analysis framework, the table above depicts the evaluation results of the two modeling approaches. In the frame of the GENESIS project, we have weighted the identified criteria with a help of a survey. Both approaches are not able to cover all four perspectives adequate. As indicated already before ARIS focuses more on business aspects and on the integration in existing working processes. On the other side, the user perspective regarding the integration of semantics and the usage of reusable building blocks is not addressed at all. Compared to ARIS, UMM provides a good technical foundation regarding the user perspective. But the modeling approach is limited to technical people who are able to handle all complex options (context, rules, semantics, etc.). Further on, the missing integration in the existing IT infrastructure and working processes detain a widespread in SME environments.

Goal Objective	Driver	Weight	ARIS	UMM	GENESIS
Financial Perspective			**2.70**	**1.90**	**2.90**
Preserved Investments	Ratio Reuse of Private Processes	20%	3	1	4
	Ratio Use of well-known Modeling Languages	20%	4	4	4
Efficiency Gains	Degree of Automation	30%	2	2	2
Reduced Operating Costs	Payroll Costs	20%	2	1	2
	System Costs	10%	3	1	3
Working Process Perspective			**2.50**	**1.30**	**2.75**
Improved Transparency	Mapping Private and Public Processes	25%	1	1	3
	Information Hiding	25%	4	1	4
Process Optimization	Analysis Function	5%	4	1	2
	Simulation Function	5%	1	1	1
High Integration	Workflow Management	15%	3	2	2
	Human User Interaction	15%	3	2	3
Improved Communication	Seamless Information flows among department and enterprise borders	10%	1	1	1
Innovation and Learning Perspective			**2.20**	**2.59**	**2.69**
Scalability	Open Interfaces	10%	2	3	3
	Business Process Outsourcing	10%	1	1	1
Holism	Continuous Improvement Process	12%	3	2	2
	Combined Process and Data Modeling	13%	3	5	5
Adaptability	Time Saving/ Quickness	20%	2	2	2
	Model-Driven	10%	2	5	3
Interoperability	Ratio Usage of Standard Modeling Language	15%	3	2	4
	Knowledge Management	10%	1	1	1
User Perspective			**2.00**	**3.70**	**3.15**
Reusability	Process Templates	5%	1	3	3
	Business Transaction Design Pattern	10%	2	4	3
	Repository	20%	1	3	3
Integrated Semantic	Context	30%	1	4	3
	Terminology	10%	1	2	2
	User Group (Role Concept)	5%	3	3	2
Reduced Complexity	Levels of Abstraction (View Concept)	10%	5	5	4
	Levels of Granularity	10%	5	5	5
Total			**9.40**	**9.49**	**11.49**

Table 1: Evaluation Modeling Approaches

4.2. Case Study - GENESIS project

In the frame of the EU-funded GENESIS[1] project, a consortium of several partners from across Europe proposes an architecture for performing seamless Business-to-Business (B2B) and Business-to-Government (B2G) processes focused on the business environment of SMEs in Eastern Europe. A critical success factor for the novel modeling method is taking into account the SME modelers heterogeneous modeling and analysis skills as discussed in chapter two. This led to the development of a project specific modeling method that should enable the modelers to quickly become familiar with the modeling technique. Two existing notations (ADONIS BPMS 3.81 and BPMN 1.0) that already offer intuitive features for linking processes and documents have been leveraged as the foundation of the modeling technique. However, both notations do not provide CCTS-compliant decomposition of business documents into information entities, so that we needed to develop appropriate extension. For the representation of CCTS compliant documents, UML class diagrams as proposed in UMM have turned out to be an inadequate choice: we identified two major weakness of the UML notations: the documentation of contexts is not possible and the graphical presentation of data building blocks (so called Aggregated Business Information Entities, ABIEs) is not user friendly. Thus we develop a specific technique, which is rather close to CCTS (Schroth, Pemptroad & Janner, 2007). The figure below depicts the integrated process (BPMN) and data (CCTS) modeling environment on the basis of ADONIS©. In addition, the actual end-users are able to reuse existing data building blocks (i.e. address, contact, period, etc.) from the GENESIS common repository.

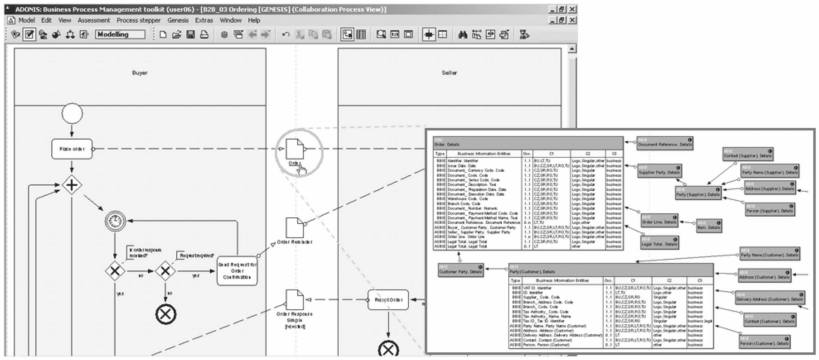

Figure 4: GENESIS Modeling Tool in ADONIS©

[1] http://www.genesis-ist.eu

In frame of the GENESIS project, several B2B and B2G processes were modeled. Especially the usage of templates reduces the modeling complexity and provides a common semantic regarding the individual process steps and the related exchanged data documents. Also the business oriented BPMN notation enables business users without detailed processes expertise to model collaborative e-Business processes.

5. Conclusion and Further Work

In the frame of this work, we have presented a framework that identifies the challenges SMEs are facing with regard to modeling collaborative e-Business processes, the next wave of conducting business in a process-oriented inter-organizational way. Following the management concept Balanced Scorecard the requirements are considered from different viewpoints and generate a holistic understanding. Based on the identified criteria, existing approaches are analyzed and the findings are highlighted. By consideration the existing modeling approaches (i.e., ARIS on private process level and UMM on collaborative process level), a novel modeling methodology was developed in frame of the GENESIS project addressing the specific needs of SMEs.

Further work will deal with a semi-automatic generation of executable BPEL scripts which can be deployed seamless on the GENESIS platform. By integrating different Enterprise Resource Planning (ERP) systems via adapters, legacy SME applications will be connected with each other. As identified in our research, modeling of collaborative e-Business processes is not only limited on design time aspects. Instead a semi-automatic deployment and analysis process is also part towards the vision of seamless business transaction in SME environments which are currently implemented in the GENESIS project.

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