

A Holistic Approach for B2B Integration at Different Conceptual Levels

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Abstract - *Effective and efficient exchange and cooperation of information and goods between enterprises is a crucial prerequisite to compete successfully in globalized supply networks. Such business-to-business (b2b) integration affecting various partners across the whole supply network is very complex and dynamic by nature and may include multiple levels of integration (like data, application, business process, etc.) at the same time. The paper aims at analyzing concepts for b2b integration at different levels. The methodology comprises a thematic analysis, focusing on b2b models and frameworks in scientific literature, an empirical study to demonstrate the practical relevance, a classification and consolidation of findings in science and practice, and case studies to proof the practical applicability of the proposed concepts.*

Keywords: b2b concepts, b2b framework, b2b integration, guidance model

1 Introduction

The long-term business success of modern organizations crucially depends on the optimal use of synergies along global high-tech supply networks [1]. In particular, Small and Medium Enterprises (SMEs) have to cope with the increasing pressure to establish inexpensive, flexible, short-term cooperation to ensure the effectiveness of data and information flow as well as the flow of goods [2, 3, 4]. Since the most successful SMEs decided to specialize on their core business and to intensify their competitive advantages, consequently the number of business-to-business (b2b) cooperation to be established in supply networks increases. However, recent cross-enterprise business processes in supply networks are often not integrated adequately or supported by appropriate integrative information systems. The main reasons for that are media changes, incompatible digital interfaces or organizational gaps in the information exchange process [5].

B2b integration and cooperation involves different technical and organizational levels of single companies. Therefore, the integration processes are often very complex and dynamic, and rarely consider the size and type of the involved enterprises. Additionally, the existing information systems' infrastructures and architectures, also the instability

of the involved processes and even their human resources need to be taken into account during integration projects [6]. Currently, SMEs do not receive appropriate methodological and scientific support to select the suitable procedure, concept, method, technology, standard and tool for their intended business integration solution. Furthermore, they often do not deploy state-of-the-art information technology (IT) for b2b integration solutions because of increasing complexity and the lack of strategic planning, sparse personal resources, financial bottlenecks or missing know-how in contrast to larger industry [7]. But, lacking state-of-the-art technology for b2b integration confronts SMEs with media disruptions and incompatible digital interfaces in the case of data and information exchange, which leads to inefficient business processes, competitive disadvantage and they risk to be excluded from their supply network [8]. To support SMEs establishing successful and effective b2b integration solutions in supply networks a methodologically profound set of procedures, concepts, methods, technologies, standards and tools is needed. In order to bridge this gap, the project GuideBIS, which stands for Guidance Model for Business Integration Solutions, provides a holistic b2b framework containing integration concepts at different levels, approved integration tools in a toolbox, a profound process model for integration implementations, and case studies containing examples of successful b2b integration solutions.

The objective of this paper is to *identify, classify, consolidate, and proof* one of the core "ingredients" within the holistic GuideBIS b2b framework: *Integration concepts at different levels*. This paper focuses on the methodology and results of how all relevant concepts for b2b integration were scientifically proven and practically verified. First, the authors conducted a literature review on related work, described in section 2 of this paper, followed by an empirical study to identify the demand for b2b integration in practice and to guarantee the practical thematic relevance (section 3). In section 4, the consolidated b2b integration concepts to be considered during integration are presented. Section 5 briefly describes two case studies with reference to the integration concepts affected by the cases to proof the practical applicability of the proposed concepts. Finally, conclusions are drawn in section 6.

2 Literature Review

In order to classify b2b integration concepts at different levels, definitions of “b2b integration” are summed up and related b2b integration models and frameworks with an emphasis on their conceptual levels are discussed now.

2.1 B2b Integration and derivatives

The term “b2b integration” is not commonly used and defined in literature. Schubert [9] uses “business collaboration” as “support of cross-organizational processes by means of information technology”. Österle et al. [10] do not limit b2b integration to processes and define “business networking” as the “management of IT-enabled relationships between internal and external business partners”. Huang [11] uses a more specific definition of “business integration solution” in the context of web services: “an e-business application that arises from integrating several enterprise applications, data sources, and collaborators (people) by using several execution artifacts including process flows, process logic, and connectivity adapters”. Berlecon Research [12] states that “e-business integration” is the direct or indirect connection between two or more previously existing e-business applications, or stored data with the aim of exchanging business information and business processes. This integration can be fulfilled internally (Enterprise Application Integration), or between enterprises (Business-to-Business Integration). According to Lebender et al. [13], we interpret the role of “business integration” respective “b2b integration” as automated, electronic exchange of data and information of different formats between enterprises and their various, heterogeneous information systems, so that no manual intervention is required. This integration may include multiple levels (like data, application, business process, etc.) at the same time [14]. The main objective of b2b integration is to ensure homogeneity of various systems. Therefore, security matters, organizational disparities, composition of workflow and transactions, management of monitoring and administration, interoperability, varying skills and awareness [15], and resources and motivation [16] are significantly important. For coping with the various dimensions and facets of b2b integration, different models and frameworks can be found in scientific literature. Some relevant work is discussed in the following.

2.2 B2b integration concepts and frameworks

According to the business networking approach of Österle et al. [10], collaborations between enterprises have to be considered on the *strategic*, *business process* and *information system* level. Enterprises are regularly faced with the challenge of implementing strategies to position their enterprise within a supply chain, or to understand the long-term impact of IT on organizational structures. On the information system level enterprises have to deal with the technical integration of their information systems. To bridge the gap between strategies and systems, Österle et al.

introduce the business networking view as the logical result of a consequent process orientation in order to build collaborative processes across various partners.

Rather similar to the business networking approach is the three-level framework for modeling b2b applications of Maamar et al. [17] that consists of the *strategic*, *application* and *resource* level. A b2b application in this context is a set of business processes, modeled as context-aware web services, which engage several organizations in collaboration. The framework itself focuses slightly more on the technical integration than on the process level. The resource level is decomposed into logical (e.g. operating system, database management system) and physical (e.g. server, router) parts. The resources are used by software applications on the application level that implement business processes and fulfill strategic plans and decisions.

Norta [18] proposes a framework for automated b2b collaboration. In this approach workflow management is coupled with service-oriented technologies. The model uses dynamic inter-organizational *business process* management that addresses on the need of organizations for dynamically bringing together a service consumer and a service provider over web-based infrastructures where the service is a business process.

Kajan [19] analyses the maturity of open systems and available component- and framework-standards for b2b integration. The proposed b2b reference framework relies on the hardware, operating system and communication protocol layer. Special attention is given to b2b interactions on the *middleware* layer that ensures uniformity between the underlying layers and the various enterprise information systems. The middleware layer includes two sub-layers that need to be carefully considered depending on the subject of integration: (i) the *content exchange* handling semantics and transport binding; and (ii) the *business processes* handling conversational interactions between partners.

The review of related work carried out several concepts at different levels. It has been shown that there is no common understanding about appropriate levels of b2b integration and that existing approaches concentrate on different aspects of integration. Depending on the focus of the particular framework, the levels envisaged are more technical-operational or more strategic-organizational. In addition, the requirements for using such a model are sometimes set too high, which (unfortunately) often does not apply to SMEs in practice as the model describes the ideal case for integration. Therefore, a holistic b2b framework has to cover all integration levels discussed in this chapter, and should be flexible enough to be applicable for different practical requirements.

3 Empirical Study

Based on the literature research and previous studies on national and international level (cf. [13, 20, 21]) we conducted a survey among Austrian enterprises to identify the demand for b2b integration and to guarantee the practical

local thematic relevance of the overall approach. The survey was pre-tested with experts in personal interviews before it was carried out as an online questionnaire (sample size = 810 companies of varying size and industry, response rate = 6.5%, N = 125). The hypotheses-based survey questionnaire followed the framework of the European Commission's Sectoral e-Business Watch [20] and covered three topics with special attention to b2b integration: *readiness*, *activity* and *impact*. In our survey “readiness” addressed questions whether a company has the ability to adopt and use b2b solutions (e.g. IT infrastructure, in-house know-how, budget for IT, e-business strategy). The identification and analysis of the successful deployment of business integration in an enterprise was addressed by “activity” (e.g. means of communication with customers/suppliers, IT value systems, use of e-business standards, security issues). The topic “impact” contained questions on the outcome of business integrations to the value of the company and questions regarding the objectives and possible barriers of b2b integration.

The following hypothesis is of elementary relevance for the presented survey: *SMEs are ranking integration approaches at different levels of integration of lower relevance than large enterprises do*, which leads to the following question: Which of the following concepts for b2b integration are relevant for your enterprise? The respondents were given the choice of classifying the respective integration level at a scale of 1 (“highly relevant”) to 5 (“not relevant”). Table 1 contains the final results of the question organized by the size of the enterprise according to the European Union definition of small (<50 employees), medium-sized (<250 employees) and large enterprises (>250 employees). The number of valid cases varies (columns labeled “N”) as the respondents were also given the choice of “concept not known” to avoid non-reliable responses. As raw data was of ordinal level, the median (columns labeled “Med”) was calculated as location parameter and Kedall’s tau-b as

correlation coefficient (column labeled “r”). The result shows a significant statistical correlation between enterprise size and integration levels: the larger the enterprise, the higher the relevance of the integration concept. This significant correlation could be proven for all except one concept questioned. It can be assumed that b2b integration software is not (yet) used in current practice, as even in large enterprises the median is 4.0. It is also possible that ERP systems undertake the task of b2b integration software and therefore enterprises are not willing or simply do not need to invest in another software product. To sum it up, the survey has shown, that b2b integration is of practical relevance at multiple levels and that especially small enterprises in contrast to large enterprises have little interest in other levels of integration than data integration.

4 Proposed B2b Integration Concepts

The literature review and the survey analysis were followed by an in-depth qualitative analysis that resulted in a profound classification of integration concepts at various levels. To verify the classification of the concepts, case studies were conducted. Those will be discussed in the next chapter.

At this point it is obvious that b2b integration is not limited to the exchange of content by the use of communication standards. Although it may be possible that a basic integration solution between two partners only affects the data level, typically a company has to consider much more aspects when cooperating with others. Strategic plans and decisions have to be made that lead to strategic supply networks exchanging goods and relevant information. Organizational changes are necessary when integrating business processes inter-organizationally. To avoid media disruption, communicative and integrative technologies and services, which need to be supported by state-of-the-art IT, can be used. At the level of information systems, dedicated

Table 1. Which of the following concepts for b2b integration are relevant for your Enterprise?

Integration Level	Small (1-49 employees)		Medium (50-249 employees)		Large (250+ employees)		Total		Correlation of enterprise size and integration level	
	N	Med	N	Med	N	Med	N	Med	r	p
Integration at the level of Enterprise Resource Planning (ERP) systems (e.g.: SAP iDoc)	19	5.0	13	2.0	25	1.0	57	3.0	-.428*	.000
Integration at the level of data (e.g.: XML, EDI)	18	3.5	10	1.5	27	1.0	55	2.0	-.355*	.003
Integration at the level of business processes (e.g.: Outsourcing of processes)	18	5.0	11	3.0	26	2.0	55	3.0	-.357*	.002
Integration by means of communicative technology (e.g.: RFID)	19	5.0	12	2.5	23	3.0	54	3.0	-.308*	.009
Integration through avoidance of media disruption (e.g.: electronic billing or delivery notes)	20	4.0	14	2.0	26	1.0	60	2.0	-.517*	.000
Integration at the level of the supply chain / supply network	19	5.0	14	2.0	26	2.5	59	3.0	-.292*	.009
Integration through business rules at organizational and operational level (e.g.: SAP business rules)	18	5.0	11	4.0	26	3.0	55	4.0	-.390*	.001
Integration through b2b integration software (e.g.: Microsoft BizTalk Server)	17	5.0	11	4.0	23	4.0	51	4.0	-.238	.051
Integration at the level of services (e.g.: Web Services)	19	4.0	13	2.0	26	2.0	58	3.0	-.309*	.006

N = Number of valid cases, Med = Median (scale: 1=“highly relevant” to 5=“not relevant”), r = Correlation coefficient (Kendall’s tau-b), p = Significance level, * Correlation is significant at the 0.01 level (2-tailed).

b2b middleware is available to integrate different data from various heterogeneous systems. Therefore, our proposed holistic approach for b2b integration considers the following six concepts to be crucial [14].

4.1 Supply network integration

The integrated exchange of anticipation and forecast data, respectively supply chain information [16], is of particular interest for b2b integration, as late and ineffective customer-supplier relationships lead to effects like the bull-whip, because traditional supply chains cannot deal with the complexity and dynamic change-, trust- and security issues. Competitive advantage by reducing cycle time, lowering transportation expense and providing event notification [22] is now derived from supply chains competing with other supply chains, not just companies with other companies. Ubiquitous supply networks are the next step in evolution after adaptive supply networks [23] and enable multimodal access (voice, web, and mobile) to decision relevant data anytime and anywhere.

4.2 Integration of business processes

Through the outsourcing and insourcing respectively of business processes companies have the ability to focus on their core competencies. This leads to collaborative processes across various partners. Business processes management combined with service-oriented architecture (SOA) provides an abstract view for building agile and interoperable enterprise information systems [6]. Services between partners communicate with each other by exchanging self contained messages, allowing them to make or to respond to requests. Through modifiable business rules, decision flows according to enterprise policies can be described. Business rules, implemented as services, are automating the execution of business processes and saving additional time and money. The concepts that underline the semantic web could be a

candidate solution for intelligent, rules-based services fulfilling complex communication and interoperation requirements of an integrated SOA [24].

4.3 Integration by the use of technologies and services

Media disruptions, e.g. paper invoices and delivery notes, as well as poorly designed electronic interfaces among corporate partners, lead to efficiency losses, slow and confusing processes, and unreliable data in internal processes. Software as a Service (SaaS) for electronic invoices and delivery notes, barcodes and Radio Frequency Identification (RFID) are the key technologies to bridge this gap. SaaS is considered to be an important IT trend with increasing business volume and ongoing growth as especially SMEs are more and more focusing on their core competencies and typically have less IT know-how compared to large companies [25]. Numerous industry and retail companies are currently faced with the challenge of integrating RFID technology with their existing IT landscapes as RFID is said to solve the following business problems: (i) increasing process efficiency of incoming and outgoing goods of a distribution center; (ii) improving the availability of goods on the sales floor of a supermarket; (iii) reducing shrinkage and (iv) product counterfeiting [26].

4.4 Integration through b2b integration middleware

This concept envisages the use of dedicated integration software (e.g. Microsoft BizTalk Server, IBM WebSphere Application Server) as an approach to business integration. Due to business pressure such as margin erosion, channel proliferation, rising customer expectations, time-based competition and faster product commoditization middleware is increasingly required to provide fast, dynamic and flexible integration between various partners [27]. Middleware has to be able to provide appropriate content needed for the integration purpose and to process the electronic data

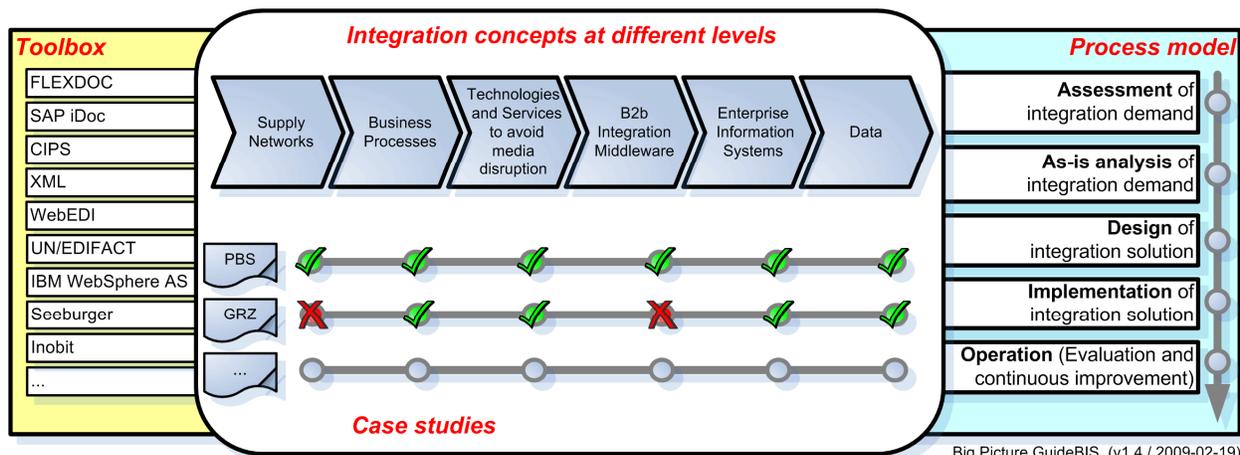


Fig. 1. "Big Picture" of the GuideBIS b2b integration framework covering the proposed integration concepts at different levels, a process model, a toolbox, and case studies. The two case studies described in this paper (PBS and GRZ) are compared and mapped according to the integration concepts. The toolbox contains tools and standards used in the case studies and the process model shows the main steps performed during integration.

automatically and errorless on receipt. All errors have to be caught by the means of exception handling.

4.5 Integration of enterprise information systems

Integration can be explored and managed in various ways in relation to information systems. In the most cases integration at this level is affecting Enterprise Resource Planning (ERP) systems [28]. An ERP system attempts to store all corporate information in one central database, where ERP data (eg. SAP iDoc, www.sap.com) can be retrieved, shared and exchanged. The combination of ERP systems and web technologies offers the opportunity to build interactive relationships [29] between partners and suppliers throughout the whole supply network. Furthermore, ERP systems provide several tools for supply network integration. In [5] the authors identified the two most important ones as the real-time transaction tracking and the internal process integration.

4.6 Integration of data

The concept of data integration between multiple data sources allows data to be exchanged and shared across enterprises. Despite classic Electronic Data Interchange (EDI), data exchange and proprietary text-based data integration scenarios, integration by the use of XML and Web Services are considered to have a high impact on future development for achieving b2b transactions [30]. Web Services promise flexible, cross-platform communication, using the internet to exchange and combine data in new ways, thus enabling on-the-fly business relations to a much greater extent than before [31].

5 Case Studies

To proof the applicability of the proposed concept levels, we conducted case studies covering examples of successful b2b integration of SMEs with other enterprises by means of state-of-the-art IT. The facts were collected by document analysis and semi-structured interviews with experts based on the method “PROMET Business Engineering Case Studies” [32]. In the following, two different studies are presented and discussed concerning used integration concepts.

5.1 Case Study GRZ

Case description. This case deals with an SME that specialized in manufacturing safety boots for trade, industry, construction, authorities, railways, police and rescue organizations. When in early 2007 the person that was responsible for printing, enveloping and dispatching of invoices retired, the management was looking for a way to optimize resources and costs for that business process. In addition, an Austrian enactment of the ministry of finance regulates the abolition of VAT refunds for fax invoices by the end of 2009 [BMF-010219/0183-IV/9/2005]. The SME decided to invest in an electronic billing solution that had to

(i) cover the complete process of invoicing, (ii) provide the possibility to send a printed copy of the invoice as well as an electronic transmission, (iii) be easy-to-use for employees, (iv) integrate seamlessly into the in-house enterprise resource planning (ERP) system, (v) accomplish Austria’s regulatory conditions for electronic billing.

The solution that best met the requirements of the SME was FLEXDOC (by GRZ IT), that offers a fiscally certified electronic document management system for offers, orders, order confirmations, delivery notes, invoices, credit notes and dunning letters. FLEXDOC is offered as Software as a Service (SaaS), as it provides functionalities to a big group of clients over the web with one single instance of software application running on top of a multi-tenancy platform [33]. The service is hosted at the GRZ IT Center in Linz, Austria and is distributed with a software component that serves as printer driver and connector to the FLEXDOC web service. The clients use credentials issued by FLEXDOC to log onto and consume the SaaS services over web through an internet browser. The web portal serves for the purpose of master data administration, workflow and output settings of documents (e.g. client A receives a printed copy, client B a digitally signed electronic invoice per email, client C a digitally signed electronic invoice as SAP iDoc, etc.). In accordance to the client’s individual settings, FLEXDOC not only dispatches electronic documents in various output formats, the fulfillment center of FLEXDOC also provides printing, enveloping and dispatching services. The business model is based on a small setup-fee and costs per use of the service (i.e. “printing” a document via FLEXDOC web service). As the running costs of FLEXDOC are significantly lower for the SME (from 12.6% up to 62%, depending on the output type) the integration resulted in significant savings in resources, time and money.

Mapping the case study to the levels of integration.

The GRZ case study covers the cooperation of an SME and a b2b integration solution provider on SaaS basis. The SME has outsourced the process of billing and added an electronic invoice service for their customers that seamlessly integrates into their in-house ERP system. The case study therefore affected integration at the *business process* level by outsourcing the electronic billing process. This was achieved by using the *software as a service*, which serves as printer driver to communicate with the FLEXDOC web service. Even though there is the possibility of media disruption by sending invoices as printed copies, the b2b integration itself resulted in an electronic processing of all invoices for the SME. The SME did not use dedicated middleware for integration, instead their ERP system served as *enterprise information system* for the integration. The *integration of data* is done by the use of web technology and the content exchange is done by calling web services. In the center part of Fig. 1 the used categories of the GRZ case study are illustrated with reference to the proposed integration concepts of this paper.

5.2 Case Study PBS

Case description. In this case study the SME reflected its position on the market as full-range supplier of office equipment, divided into the business areas of office furniture (ranging from planning of the workplace to installation of furniture including accessories) and office supplies. Due to highly competitive and stagnating market concerning office supplies, this business area could not be operated cost-effectively any longer. In order to antagonize a sales collapse in office supplies, the SME identified the following goals: (i) shortening delivery times to within 24 hours; (ii) reducing fixed costs through savings in its own stock and the associated resources by at least 50%; (iii) reducing returns by at least 50% by improving the process quality in deliveries; (iv) improving the marketing activities by a mix of offline and online activities; (v) conducting intense personal sales activities in conjunction with the prior mentioned quality improvement measures. The SME decided not to close down the business area (as this could harm its image and cause an unpredictable loss of customers of business furniture as well) and balanced the remaining alternatives which led to the decision to cooperate with BUEROPROFI Ltd., a 100% subsidiary of the PBS Holding Inc. (in the following "PBS").

For economic and process oriented reasons, the b2b integration with PBS foresees an elimination of duplications in the supply chain (e.g. in terms of logistics, stock, marketing, etc.) by outsourcing key processes and focusing on core competencies. Basis for outsourcing business processes is the technical integration. For technical integration the ERP system "CIPS", which is custom software for the office equipment sector developed by PBS, is available as in-house solution or as application service provider (ASP) solution hosted at PBS. The SME chose an in-house solution which uses WebEDI to communicate with the central system at PBS and which requires a dedicated server PC together with a broadband internet connection. Together with the technical integration the SME was involved in the marketing activities, which includes a personal web shop. Furthermore, newsletter activities, annual catalogs, monthly mailings and invoice inlays were created and dispatched by PBS. As a result of massive cost savings, the SME decided to close down its own stock in favor of directly dispatching goods from the central stock at PBS. The successful rollout of the integration solution and training of the team was followed by an ongoing monitoring and evaluation by PBS regarding process optimization potentials. With more than 100 SMEs using the integration solution, PBS provides training and evaluation opportunities ranging from knowledge exchange, feedback and improvement suggestions (in partner meetings, user groups, seminars and trainings) to personal, quarterly management consulting.

The b2b integration resulted in an integrated electronic process from order to delivery: The consumer places an order via web shop or the classic channels (phone, email or fax). An online order is automatically transferred to the ERP system CIPS and the SME gets informed by email. Orders via

classic channels have to be entered manually. After the SME releases the order, it automatically generates a job in the central IT system of PBS. The "Trader" is used for centralized management of master data, purchasing and product range selection. The second core component at PBS, the "ISA", handles all the logistics and picking of the dealership network. Its main tasks include the creation of the electronic freight list for the carriers, the acceptance of electronic billings from vendors and carriers as well as "track & trace" package tracking. For optimizing the shipment of the ordered goods, a total of 10 employees of various carriers are employed at PBS. Additionally, orders from only one manufacturer can be delivered directly from the manufacturer to the final consumer, saving additional money in shipment and logistics. The b2b integration of all the partners of the supply chain enables a 24 hour delivery of more than 15,000 office products in the standard selection. The solution provided by PBS also significantly increased quality by the use of a standardized numbering system for items, vendors and customers, plausibility checks at processes such as picking, using common e-business standards and eliminating incorrect manual inputs by integrated electronic processes.

Mapping the case study to the levels of integration. The key player in the center of the integration in this case study is PBS, which compensates core business processes such as procurement, stocking, picking and delivery of the goods to the consumer for the SME and integrates the major manufacturers of office supplies and carriers for the shipment to ensure efficient deliveries from the manufacturer directly or indirectly to the consumer. Following the proposed integration levels of section 4, this case affected all six levels of integration (cf. center part of Fig. 1). *Supply network integration* is fulfilled by affecting all necessary actors in the supply chain through the exchange of information and goods. The outsourcing of key processes of the SME to PBS leads to integration at the level of *business processes*. In addition, PBS is insourcing manpower of various carriers in order to optimize the process of delivery of the goods. The integration solution uses *technologies and services to avoid media disruption* as the identification of goods, storage of stocked goods and the whole process of picking is done by means of barcodes. Media disruption is also avoided by an automated generation and electronic processing of all relevant documents (purchase order, purchase order response, invoice, delivery note, etc.). The conversion of the various different messages and documents from and to the network partners is achieved by the use of IBM WebSphere Application Server together with additional converters from the companies Seeburger (www.seeburger.de) and Inobit (www.inobit.de), serving as *middleware* for the integration. At the *enterprise information system* level, integration between the SME and PBS is accomplished by the ERP system CIPS. Finally, the *data integration* level is affected by a number of interfaces. The SME is communicating with PBS using CIPS on the basis of WebEDI to send and receive data for orders, customer information, catalog data, customized pricing information, order confirmations and electronic delivery

notes. Depending on the carrier and manufacturer, different converters based on XML, the UN/EDIFACT standard and SAP iDoc are used.

6 Conclusions

This paper proposes a broad approach, how to arrange different conceptual levels of b2b integration within the holistic GuideBIS b2b framework. The GuideBIS b2b framework joins the proposed levels with integration concepts, necessary tools and standards, a process model and case studies, which prove the applicability of the integration levels. Therefore, the different levels of integration were identified, classified, consolidated and proven within this paper.

Whereas the concepts at different levels of integration are considered to be stable, a representative toolbox and a process model, which guides SME's when accomplishing their integration projects, have to be detailed. Further research is planned in order to consolidate and proof the remaining parts of the GuideBIS framework by additional case studies and pilot projects.

7 References

- [1] P. G. Walters, "Adding value in global b2b supply chains: Strategic directions and the role of the internet as a driver of competitive advantage," *Industrial Marketing Management*, vol. 37, no. 1, pp. 59–68, Jan. 2008.
- [2] T. Hess, *Unternehmensnetzwerke: Abgrenzung, Ausprägung und Entstehung*, A. der Abt. Wirtschaftsinformatik II, Ed. Göttingen: University Göttingen, 1998, vol. 4.
- [3] H. Zhou and W. Benton Jr., "Supply chain practice and information sharing," *Journal of Operations Management*, vol. 25, no. 6, pp. 1348–1365, Nov. 2007.
- [4] P. Iskanius and H. Kilpala, "One step closer towards e-business - the implementation of a supporting ict system," *International Journal of Logistics: Research & Applications*, vol. 9, no. 3, pp. 283–293, 2006.
- [5] P. Kelle and A. Akbulut, "The role of erp tools in supply chain information sharing, cooperation, and cost optimizationz," *International Journal of Production Economics*, vol. 93-94, pp. 41–52, Jan. 2005.
- [6] F. Vernadat, "Interoperable enterprise systems: Principles, concepts, and methods," *Annual Reviews in Control*, vol. 31, no. 1, pp. 137–145, 2007.
- [7] E. Ferneley and F. Bell, "Using bricolage to integrate business and information technology innovation in smes," *Technovation*, vol. 26, no. 2, pp. 232–241, Feb. 2006.
- [8] M. Glos, "ebusiness-standards im mittelstand 2007," www.prozeus.de, 2007.
- [9] P. Schubert, "Business collaboration: Erfahrungen aus der unternehmenspraxis," in *Multikonferenz Wirtschaftsinformatik, MKWI 2008, München, 26.2.2008 - 28.2.2008*, Proceedings. GITO-Verlag, Berlin, 2008.
- [10] H. Österle, E. Fleisch, and R. Alt, *Business Networking - Shaping Collaboration Between Enterprises*, 2nd ed. Springer, 2000.
- [11] Y. Huang and J.-Y. Chung, "A web services-based framework for business integration solutions," *Electronic Commerce Research and Applications*, vol. 2, no. 1, pp. 15–26, 2003.
- [12] J. Quantz and T. Wichmann, "Basisreport integration mit web services - konzept, fallstudien und bewertung," Berlecon Research, Berlecon Research, Tech. Rep., 2003.
- [13] M. Lebender, N. Ondrusch, B. Otto, and T. Renner, *Business Integration Software: Werkzeuge, Anbieter, Lösungen*. media vision expert, 2003. [Online]. Available: http://www.media-vision.iao.fraunhofer.de/business_integration_software.html
- [14] A. Auinger and D. Nedbal, "Towards a guidance model for business integration solution," in *Proceedings of the International Joint Conference on e-Commerce, e-Administration, e-Society and e-Education (e-CASE)*, Bangkok, Thailand, 2008.
- [15] T. Lange, M. Ottens, and A. Taylor, "Smes and barriers to skills development: a scottish perspective," *Journal of European Industrial Training*, vol. 24, pp. 5–11, 2000.
- [16] C. Harland, N. Caldwell, P. Powell, and J. Zheng, "Barriers to supply chain information integration: Smes adrift of elands," *Journal of Operations Management*, vol. 25, no. 6, pp. 1234–1254, Nov. 2007.
- [17] Z. Maamar, P. Thiran, N. C. Narendra, and S. Subramanian, "A framework for modeling b2b applications," in *Proceedings of the 22nd International Conference on Advanced Information Networking and Applications*. IEEE, 2008, pp. 12–19.
- [18] A. Norta, "A conceptual vision for automated business-to-business collaboration," in *Proceedings of the Finnish Computer Science Day 2007*, 2007.
- [19] E. Kajan, "The maturity of open systems for b2b," *ACM SIGEcom Exchanges*, vol. 5, no. 2, pp. 34–44, Nov. 2004.
- [20] European Commission, "The european e-business report 2006/07," 2007. [Online]. Available: http://www.ebusiness-watch.org/key_reports/documents/EBR06.pdf
- [21] S. Roberts, "Oecd work on measuring the information society," 3rd meeting of the Asia Pacific Technical Meeting on ICT Statistics, Wellington, New Zealand, 2004.
- [22] C. Trappey, A. Trappey, G. Lin, and C. Lin, "Business and logistic hub integration to facilitate global supply chain linkage," *Journal of Engineering Manufacture*, vol. 221, pp. 1221–1233, 2007.
- [23] F. Teuteberg, "Realisierung ubiquitärer supply networks auf basis von auto-id- und agenten-technologien - evolution oder revolution?" in *Wirtschaftsinformatik 2005: eEconomy, eGovernment, eSociety*, O. K. Ferstl, E. J. Sinz, S. Eckert, and T. Isselhorst, Eds. Physica-Verlag Heidelberg, 2005, pp. 3–22.
- [24] S. Arroyo, M.-A. Sicilia, and J.-M. Dodero, "Choreography frameworks for business integration: Addressing heterogeneous semantics," *Computers in Industry*, vol. 58, no. 6, pp. 487–503, Aug. 2007.
- [25] P. Buxmann, S. Lehmann, and T. Hess, "Software as a service," *Wirtschaftsinformatik*, vol. 6, pp. 500–503, 2008.
- [26] F. Thiesse and S. Gross, "Integration von rfid in die betriebliche it-landschaft," *Wirtschaftsinformatik*, vol. 3, pp. 178–187, 2006.
- [27] A. Dan, D. Dias, R. Kearney, T. Lau, T. Nguyen, F. Parr, M. Sachs, and H. Shaikh, "Business-to-business integration with tpaml and a business-to-business protocol framework," *Technology*, vol. 40, no. 1, 2001.
- [28] N. Dechow and J. Mouritsen, "Enterprise resource planning systems, management control and the quest for integration," *Accounting, Organizations and Society*, vol. 30, no. 7-8, pp. 691–733, 2005.
- [29] C. G. Ash and J. M. Burn, "A strategic framework for the management of erp enabled e-business change," *European Journal of Operational Research*, vol. 146, no. 2, pp. 374–387, Apr. 2003.
- [30] S. Amer-Yahia and Y. Kotidis, "A web-services architecture for efficient xml data exchange," *Data Engineering, International Conference on*, pp. 523–534, 2004.
- [31] J. Vlachakis, S. Rex, B. Otto, M. Lebender, and T. Fleckstein, *Web-Services: A look into quality and security aspects*. media vision expert, 2003. [Online]. Available: http://www.media-vision.iao.fraunhofer.de/web_services.html
- [32] E. Senger and H. Österle, "Promet business engineering case studies (becs) version 2.0," *Bericht BE HSG / BECS / 1*, Institut für Wirtschaftsinformatik, University St. Gallen, 2004.
- [33] W. Sun, X. Zhang, C. J. Guo, P. Sun, and H. Su, "Software as a service: Configuration and customization perspectives," *Services Part II, IEEE Congress on*, vol. 0, pp. 18–25, 2008.