

Towards a Guidance Model for Business Integration Solutions

Andreas Auinger, Dietmar Nedbal
 Department of Electronic Business
 School of Management
 Upper Austrian University of Applied Sciences
 Wehrgrabenweg 1-3, A-4400 Steyr
 Austria
 {andreas.auinger; dietmar.nedbal}@fh-steyr.at

ABSTRACT

The project GuideBIS focuses on the development of efficient, cost- and time-reductive business integration solutions especially for Small and Medium Enterprises (SMEs), which increasingly are forced to implement more effective and efficient exchange of information and goods in value networks due to current business needs. In this project a guidance model containing business integration concepts, approved integration tools in a toolbox, a profound process model for integration implementations, and best practice examples containing successful business integration solutions, is developed. A sound project methodology, which integrates technical analysis, empirical studies, conceptual developments and a pilot phase, guarantees the realization of the project objectives. This paper shows the innovative project methodology and demonstrates the objectives, the different levels and concepts of integration, the process model and the toolbox to be provided for successful business integration solutions. Furthermore, empirical data concerning the need and readiness of SMEs for business integration is discussed.

Keywords: e-business integration, supply chain integration, b2b, e-business readiness

1. Introduction

Effective, cost-reducing interchange and cooperation between companies is a crucial prerequisite to compete successfully and to gain more flexibility in globalized value networks (O'Marah 2007; Trappey et al. 2007). A modern organization – regardless of the size – has the need of integrative cooperation that ensures the effectiveness of data and information flow as well as the flow of goods (Hess 1998; Zhou & Benton 2007; Iskanius & Kilpala 2006).

Business integration for SMEs. Small and Medium Enterprises (SMEs) especially feel the increasing pressure to establish inexpensive technological solutions for data and information interchange (Eikebrokk & Olsen 2007). Since most successful SMEs specialize on their core business, the number of business cooperations to be established in value networks increases. However, recent cross-enterprise business processes in value 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 (cf. Kelle & Akbulut 2004).

Business integration solutions include different technical and organizational levels of single companies. Therefore, they 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 (Vernadat 2007). Currently, SMEs do not receive any methodological and scientific support to select the appropriate concepts, methods, technologies and tools for their business integration intentions. Furthermore, they often do not deploy state-of-the-art technology for business 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 (Ferneley & Bell 2006). But, lacking state-of-the-art technology for business integration solutions confronts SMEs with media disruptions and incompatible digital interfaces in the case of data and information exchange, which leads to inefficient business processes in value networks and competitive disadvantage (Glos, M. 2007). Therefore SMEs are explicitly focused by the project *GuideBIS*, which stands for *Guidance Model for Business Integration Solutions*. Consequently, several different integration scenarios, concluding a methodologically profound set of procedures, concepts, methods,

technologies, standards and tools are needed to bridge this gap and to support SMEs establishing successful business integration solutions in value networks.

Definition of business integration. The term “business integration” is not commonly defined in literature. Huang 2002 defines business integration solution in the context of web services as “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 2003 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)”. Due to Lebender 2003 we see the role of business integration as automated, electronic exchange of data and information of different formats between various, heterogeneous information systems, so that no manual intervention is required. This integration may include multiple levels of integration (data, application, business process, organization) at the same time. The objective of the integration is to ensure a homogeneous view of the various systems. Within an enterprise, integration problems are solved by the means of EAI. Business integration rsp. e-business integration in contrast addresses the integration *between* enterprises. The ways for appropriate integration solutions are manifold. In contrast to EAI, business integration solutions across supply chains often take over some tasks that EAI-middleware has to perform within an organization. Therefore, security matters, organizational disparities, composition of workflow and transactions, management of monitoring and administration and interoperability are significantly important. Within the GuideBIS project, we claim a *holistic approach for business integration* solutions in supply chains, considering the *organizational* and the *technical level*.

The content of this paper is organized as follows: In section 2, the overall project methodology of the GuideBIS project is described. Section 3 briefly shows the single parts of the proposed Guidance Model. Firstly, the objectives of the Guidance Model are described. Secondly, the levels to be considered during business integration solutions and the corresponding concepts are shown. Thirdly, the content of the Toolbox is described, and finally we reveal the process model, how to run through an integration project. Section 4 discusses some empirical data concerning the readiness of SMEs and their need for business integration solutions especially in Europe. Section 5 concludes the paper.

2. Project Methodology

To fulfill the holistic claim of the project for business integration solutions, a corresponding project methodology was designed. The following phases are performed during the overall project:

- (i) *State-of-the-art analysis:* The project was started with the search and analysis of scientific literature in the subject domain. Furthermore, the search for empirical data of national (eg. Statistik Austria) and international (eg. Eurostat) organizations, previous studies (eg. e-business barometer, it-trends) and literature (eg. Lange et al. 2000, Eikebrokk & Olsen 2007) is part of the state-of-the-art analysis.
- (ii) *Requirements analysis:* The requirements are analyzed by an empirical study with qualitative, semi-structured interviews, followed by a quantitative online survey on the thematic relevance of the various integration levels and the demand of integration. The model questionnaire consists of the following modules (cf. Roberts 2004):
 - a. General information about the use of information and communication technology (ICT).
 - b. ICT security. This module includes questions on security measures in place (e.g. anti-virus software, firewall, secure servers, etc.) and security incidents encountered.
 - c. How companies use ICT in their business operations. This module contains questions covering the use and the barriers of e-business, business processes, SOA, business integration and e-business standards.
 - d. Other information about the company, for example number of employees and annual turnover.
- (iii) *Requirements catalogue:* Extraction of the integration requirements from the results of the empirical study, the integration concepts and best-practice examples from state-of-the-art scientific literature.
- (iv) *Consolidation of concepts:* The inevitable technologically and organizationally relevant concepts were identified during the analysis phase. In this phase, all scientifically proven concepts for integration at all levels are compared to each other and systematically consolidated.
- (v) *Process model:* A compact and adoptable process model, which describes the sequential walk-through for integration projects, is developed. The following steps are considered to be a necessary part of the process model: assessment and analysis of the integration need, followed by the design and implementation of the appropriate integration solution.

- (vi) *Toolbox*: The implementation of technical and also organizational integration solutions requires adequate tools. Therefore, a set of proven tools and standards for the implementation of integration concepts is defined.
- (vii) *Solution Buddy List*: One of the main objectives of the project is, to provide efficient and easy-to-implement solutions especially for SMEs. Assembling a list with contacts of practically experienced local suppliers, which are able to implementing the integration concepts and mappings of tools will fulfill this need.
- (viii) *Guidance Model*: The process model, the toolbox and the integration concepts are integrated in a guidance compendium. This compendium describes the tasks to be carried out on all levels of integration, the tools and partners to be used for business integration solutions and concludes with comprehensive instructions to develop effective business integration solutions.
- (ix) *Pilot phase*: For proof-of-concept, at least two pilot projects for practical testing of the Guidance Model are implemented - this phase starts in parallel with the preparation of the Toolbox and the Guidance Model.

3. The Guidance Model

The proposed result of the GuideBIS project is an effective, efficient, methodologically profound and practically tested guidance model to analyze, plan, design and implement business integration solutions especially for SMEs, which need to be integrated with other SMEs or – in most cases - larger enterprises. This easy-to-use guidance model concludes concepts, methods, technologies, standards and tools, ready-to-use integration solutions, successful best practice examples and a project process model to enable the implementation of successful business integrations within companies. Therefore, the guidance model needs to be planned and constructed in a holistic way.

2.1. A Holistic Approach

Currently, there is a lack of methodologically profound approaches for the implementation of effective business integration solutions for SMEs. Hence, a guidance-model that supports SMEs in this situation has to offer methods, technologies, concepts, standards and tools at the organizational as well as at the technical level of the planned business integration. Subsequently, the development of such a holistic model (Figure 1) that provides the corresponding guidelines has to achieve the following scientific and technological objectives:

- (i) An efficient and cost-sensitive solution for SME business integration needs to be developed.
- (ii) The guidance model should support the business integration on all levels of cooperation, which includes integration of data, business processes, business rules, communication technologies or enterprise resource planning (ERP) systems.
- (iii) The guidance model should provide a structured procedure which shows the single steps that have to be performed and which aspects have to be considered to successfully develop a business integration solution.
- (iv) A state-of-the-art toolbox that provides technologies, standards, tools and partners for business integration of SMEs and/or industries has to be developed.
- (v) The use of the tools should be demonstrated with best-practice examples that show their concrete implementation.
- (vi) The identified methods, technologies, concepts and tools should be incorporated in the process model and interconnected with certain tasks of the process model showing when and how to use them during the business integration process.

2.2 Business Integration Concepts

The above mentioned objectives make the different dimensions of holistic business integration approaches evident. Figure 1 introduces these dimensions and incorporates the seven levels and concepts of integration.

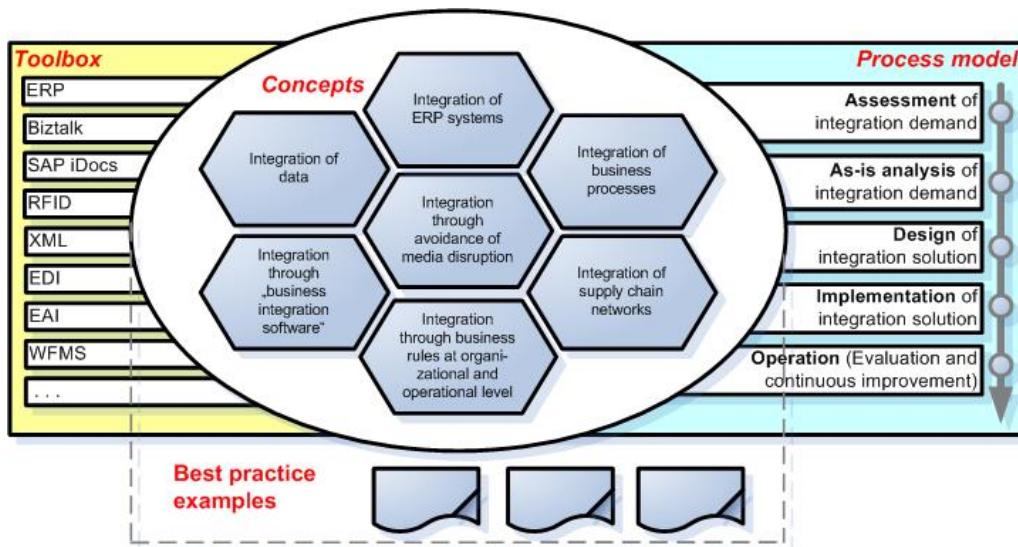


Figure 1: Guidance Model for Business Integration Solutions

The following integration concepts are considered to be crucial for SMEs:

- (i) *Integration of data*: Database integration, the use of XML and Web Services are considered to have a high impact on future development for achieving business transactions (Amer-Yahia 2004). 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 (Vlachakis 2003).
- (ii) *Integration of ERP systems*: Integration can be explored and managed in various ways in relation to Enterprise Resource Planning (ERP) systems (Dechow 2005). An ERP system attempts to store all corporate information in one central database, where ERP data (eg. SAP iDocs) can be retrieved, shared and exchanged. The combination of the technologies ERP and internet offers the opportunity to build interactive relationships (Ash & Burn 2003) between partners and suppliers throughout the whole supply chain. Furthermore ERP systems provide several tools for supply chain integration. Kelle & Akbulut 2005 identified the two most important ones as the real-time transaction tracking and the internal process integration.
- (iii) *Integration through “business integration software”*: This concept envisages the use of dedicated integration software (eg. Microsoft BizTalk) as an approach to business integration. The software solution has to be able to provide appropriate content needed for the integration purpose and to process the electronic data automatically and faultlessly on receipt. All errors have to be caught by the means of Exception Handling.
- (iv) *Integration through avoidance of media disruption*: Media disruptions, eg. 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. Standards in electronic invoices and delivery notes, barcodes and RFID are the key technologies to bridge this gap.
- (v) *Integration at the level of supply chain networks*: The integrated exchange of anticipation and forecast data, respectively supply chain information (Harland et al. 2007), is of particular interest 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 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

- (Ferstl et al. 2005) and enable multimodal access (voice, web, and mobile) to decision relevant data anytime and anywhere.
- (vi) *Integration of business processes:* Business processes management (insourcing vs. outsourcing) paired with service-oriented architecture (SOA) provide an abstract view for building agile and interoperable enterprise systems (Vernadat 2007). Services between partners communicate with each other by exchanging self contained messages, allowing them to make or to respond to requests. The concepts that underline the semantic web could be a candidate solution for the complex communication and interoperation requirements of integrated service architecture (Arroyo et al. 2007).
 - (vii) *Integration through business rules at organizational and operational level:* Lack of skills, awareness (Lange et al. 2000), resources or motivation (Harland et al. 2007) are barriers for successful business integration. Integration has to be accompanied by organizational and operational business rules. This means that technology has to cooperate with business.

2.3. The Toolbox

Electronic exchange of information and data between partners is considered to be a core part of the field e-business. With the emerging of global many-to-many e-business relationships both industry and research organizations have realized the need of standards to minimize adjustment costs and to handle processes faster, more automated and more efficient. Beyond that, the use of e-business standards adds additional value as they (i) uniquely identify data; (ii) clearly structure and describe data; (iii) simplify the transfer of information; (iv) define the format for electronic transmission; (v) normalize and optimize the business process between partners; (vi) simplify internationalization; (vii) improve existing and accomplish new partnerships; (viii) open up new opportunities for partners; (ix) reduce costs (of processes); (x) allow the use of best practices.

Two different types of e-business standards are considered for the Toolbox: *Application oriented* standards used in context of specific application areas at the content level and *technology oriented* standards (eg. SOAP, WSDL, UDDI) used for technical implementation of e-business applications (Lebender et al. 2003). Application oriented standards can be classified as standards for product data classification (eg. eCl@ss, ETIM, Proficl@ss, UNSPSC), standards for exchange of catalogue data (eg. BMEcat, UBL, cXML, UN/EDIFACT), standards for exchange of business documents (eg. openTRANS, UBL, cXML, UN/EDIFACT, OBI) and frameworks (eg. ebXML, RosettaNet, UBL, eCO).

The Toolbox contains standards and a market overview on business integration software for the implementation of different approaches. Every approach provides easier access to the Toolbox for individual companies, especially SMEs.

- (i) “*Standards*” approach: For that approach the company is using existing standards that are supported by tools, so the approach is to search for a tool that supports the standard the company/their industry uses.
- (ii) “*Concepts*” approach: Starting at a business integration concept the company determines the tools that qualifies for the concept.
- (iii) “*Tools*” approach: This approach starts with a tool that is being favorized by a company or being distributed by a software consultant. In this approach the company compares the features of the tool with others at the market.
- (iv) “*Buddy*” approach: The solution buddy list contains a list of contacts for the implementation of the integration concepts (ie. software consultant). The company searches for a consultant in the buddy list and maps the result to the tools they offer.

2.4. The Process Model

The GuideBIS process model describes the process of business integration between the actors. The model has to be compact, adoptable and flexible to be usable by SMEs. The draft of the model (Figure 2) is being tested, refined in the pilot projects and consolidated against best practice examples. The model does not necessarily follow a linear sequence of phases, they can overlap each other and they are cross-linked by feedback (Heinrich et al. 2004). It consists of the following phases:

- (i) *Assessment of the integration demand*: The process model starts with the definition of the integration demand. Therefore GuideBIS provides a qualitative interview or a quick online check to determine the demand. After this phase the integration needs of the SME are explicit, the initial situation and the objectives are defined.
- (ii) *Analysis of the integration demand (As-is analysis)*: This phase determines and analyses the as-is situation of the SME. The technical infrastructure, the organizational conditions and the business processes involved are being analyzed. In the next step a project, time, cost and benefit schedule is created. The output of the analysis phase is a specification document. The SME knows

its current state and has got an e-business strategy. Profound knowledge of the current situation is the prerequisite for the to-be analysis.

- (iii) *Design of the integration solution:* Mostly all input in this project phase is provided by the GuideBIS bundle. The first task is to identify, decompose, prioritize and choose the integration demand. The approach can be top-down, bottom-up or meet-in-the-middle. A top-down procedure is best used when the integration is based on a new development, whereas a bottom-up is recommended when historically developed processes and applications are involved (Berlecon 2003). A meet-in-the-middle approach is often required, because in practice existing systems often constrain modeling choices (Zimmermann et al. 2005). In the next step the GuideBIS' integration concepts are determined that meet the demand. This is followed by the selection of the tools and standards from the GuideBIS Toolbox., If necessary, the GuideBIS Buddy List is used for selecting an appropriate IT partner for the integration. The output of this phase is an adjusted and refined specification including the to-be analysis document.
- (iv) *Implementation of the integration solution:* This phase includes the technical execution of the integration strategy defined on all levels and broken down into sub-tasks. In parallel the organizational tasks like information sharing and education as well as the management of processes and services involved are fulfilled and finally the ready-to-use business integration solution is rolled out and installed. During operation, the results are continuously improved and evaluated, to always ensure a best attuned system.
- (v) Further important accompanying cross-the-phases aspects to consider are: (i) documentation of the results; (ii) testing of all components; (iii) security issues (confidentiality, authorization, integrity, authenticity); (iv) quality (“trusted environment”); (v) availability (“24x7”); (vi) semantics of data (metadata);

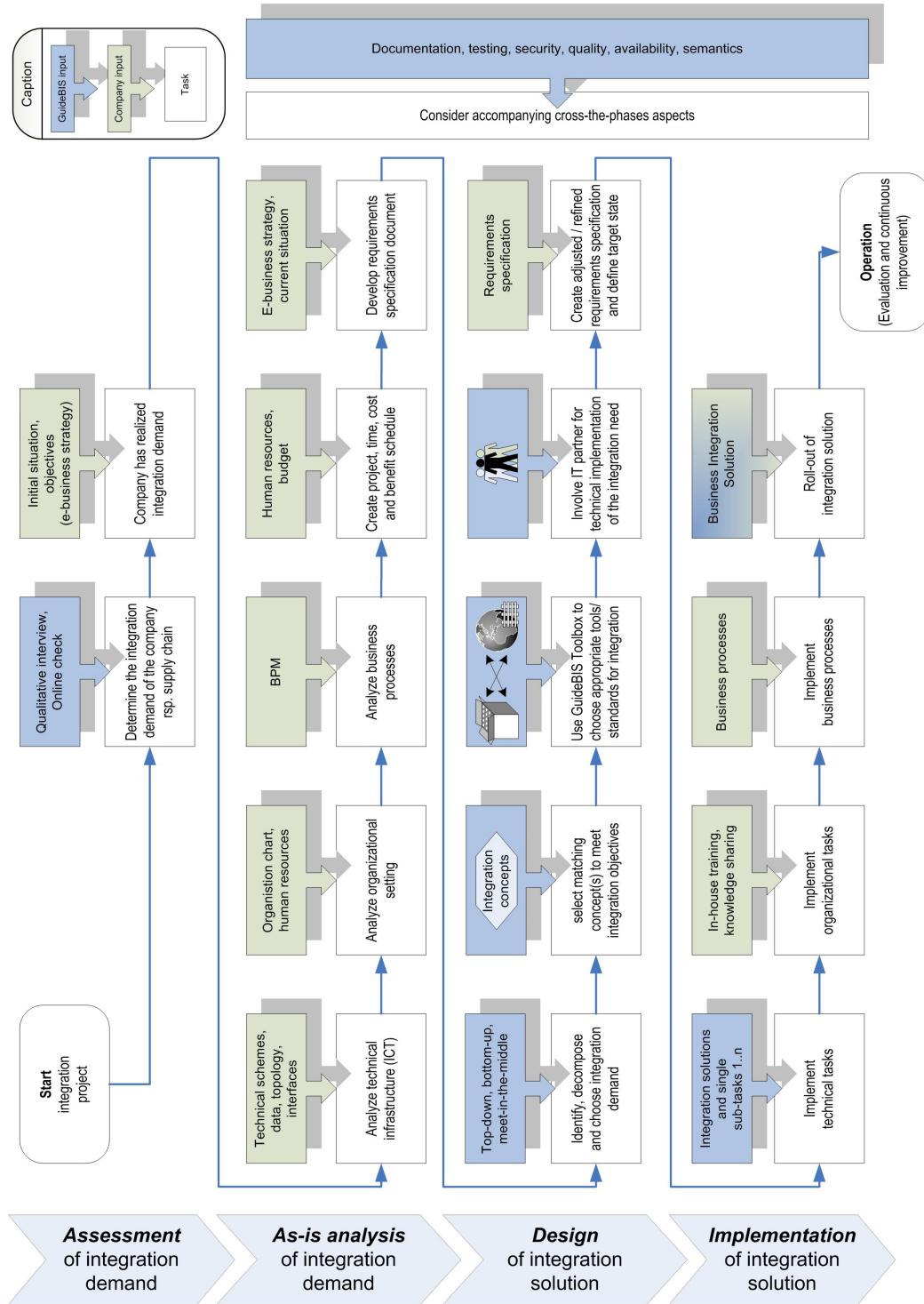


Figure 2: Process model (horizontal format)

4. Business Integration Readiness

To find out, whether European and Austrian SMEs are ready for business integration solutions as proposed in GuideBIS, we scanned recent available empirical data. Introductory information about empirical evidence on international and national level is discussed in the following:

On the international level Eurostat, the statistical arm of the European Commission, has released several programs (eg. eEurope 2002, eEurope 2005 and i2010) to benchmark the usage of Information and Communications Technologies (ICT) in households and enterprises. The concept of the European “information society” is measured by the indicators *connectivity* (networks, internet, and broadband), *e-business*, *e-government* and *e-inclusion*. Internet connectivity of enterprises is the necessary precondition for business integration. The benchmark shows that 89% of SMEs and 99% of larger companies have internet connectivity and that broadband access is continuously growing, but it also carries out that the larger a company is, the more likely it has broadband internet access. The indicator for e-business, the “e-business readiness index” (Castaings & Tarantola 2006), provides a valuable summary measure of the e-business readiness and is made of two core dimensions: *Adoption* of ICT and *usage* of ICT by business. ICT adoption is indicated by the percentage of enterprises using internet, having a homepage, using more than two security facilities, having computers for employees, using broadband connection and having a LAN network. ICT usage is indicated by the percentage of enterprises purchasing products/services via internet, receiving orders via internet, with IT linked with other internal IT, with IT linked with external IT, using internet for banking and selling products via specialized market places. The overall ICT adoption within EU countries is 60,8% (ranging from 75,7% in Sweden to 40% in Latvia) and the overall ICT use is 25% (ranging from 40,3% in Denmark to 12,6% in Hungary). Considering the size of enterprises, during the 2004-2005 period, the gap between large and medium size enterprises has decreased, while it increased between small and medium size companies. More detailed information and analysis with a focus on SMEs is done by the e-Business W@tch project. One key e-business trend observed 2006 was supply chain integration as a key factor in achieving competitive advantage. Whereas in large companies this trend is maturing, many SMEs still cannot cope with the system requirements and risk exclusion from the value network. A positive trend observed for SMEs is that the industry is increasingly addressing the SME market with smaller-sized solutions that can be integrated with the systems of large enterprises.

A study involving almost SAP users entitles that “coincidence is often the inspiration for choosing a vendor” (E-3 2007). Companies are complaining that the IT vendor market is too confusing which results in cost-intensive, hardly predictable projects. 46 percent stated that a market research for solution providers is always a problem and even 31 percent experience troubles in every second project. Not only the search for appropriate solution partners but also the comparison of their products and quality of services are tasks that are difficult to fulfill and time-consuming. In view of the difficult research every second company reported that they met their solution partner by accident. Considering the high amount of investments and the risk of serious consequences due to wrong decisions a profound solution for choosing the right partner is needed.

The “E-Business Barometer 2007/2008”, carried out by several German partners (private organizations, government, research institutes and further associations), found out a correlation between the size of the companies and the importance of business integration. Only 25% of SMEs (in this case these are companies between 50 and 250 employees) are using business integration solutions and half of them stated that these are not relevant, whereas for 43% of enterprises with more than 250 employees business integration is an important issue and only 30% are seeing no relevance. In direct comparison to large enterprises, there is a notable backlog and information demand for SMEs for integrated, holistic e-business technologies and applications. The main barrier for the use of e-business standards is the missing of appropriate standards of the partners. Further problem areas for all enterprises are seen in the choosing of the right standard and the missing of easy-to-use software solutions for implementation of the standard. SMEs have indicated to have more problems with interfaces to their own system (30% of SMEs, but only 15% of large enterprises), a lack of their own know-how and missing information sources for standards.

This brief discussion of empirical data shows, that especially SMEs rely on easy-to-use concepts and reference processes such as provided in the Guidance Model of the GuideBIS project.

5. Conclusions

Since no systematical approach or guideline for SMEs to develop business integration solutions exist, the GuideBIS project includes a number of innovative characteristics, which include: (i) continuous workflows involving different companies of a value network are supported by information systems; (ii) the process model provides a holistic and structured procedure including the necessary steps for a business

integration project that aims to develop a business integration system which goes beyond ad-hoc integration of existing systems and also considers the strategic aspects of the participating companies; (iii) media disruptions and incompatible digital interfaces of the affected business processes are avoided by the use of state-of-the-art technology such as XML and web services. As a result, the integration of these processes and the supporting systems lead to more effective business processes; (iv) business integration is focused on SME's point of view and considers the business relations with the larger industry partners who often initialize business integration projects and force SMEs to adopt certain concepts or tools; (v) the project does not aim to re-invent the wheel concerning technical integration solutions, but builds on existing state-of-the-art technology for business integration and focuses on its effective adoption for the needs of SMEs.

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