

A METHODOLOGICAL APPROACH FOR MEASURING B2B INTEGRATION READINESS OF SMES

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Abstract: In the dawn of 21st century, companies are seeking ways to perform transactions efficiently and effectively. Enterprises must tackle B2B integration and adoption challenges in the short term in order to survive in such a competitive business environment of nowadays. However, most enterprises, and especially SMEs, lack the necessary technical and non-technical infrastructure as well the economic potential in order to efficiently adopt a B2B integration framework. This paper presents a methodological approach towards measuring the B2B integration readiness of Enterprises and the development of the software system to support it.

1 INTRODUCTION

In today's competitive business environment, companies are seeking ways to perform transactions efficiently and effectively. The Internet has created a flexible platform for the buying and selling of products and services. As businesses recognize the need for employing efficient methods for the vertical exchange of goods and services, they are considering the adoption of functional business-to-business (B2B) applications and technologies that allow transactions in "real time." (Amoroso, 2006)

Modern B2B technologies, such as XML-based protocols have solved major technical issues of traditional EDI but due to a vast number of non-technical adoption barriers, the efforts for business-to-business integration are still enormous (Gionis, 2007). Although there are some approaches and guidelines available that address the adoption phase, most Enterprises, especially the SMEs, lack the necessary business culture, technical and non-technical infrastructure and economic flexibility in order to efficiently adjust to the environment of a B2B integration framework.

To solve the current issues, we present a comprehensive framework that measures the readiness of an enterprise to adopt a multi-enterprise (B2B) integration approach and, based on the findings, provides thereafter guided support to the SMEs with a view to overcoming the related barriers.

2 METHODOLOGY

2.1 Approach Overview

The proposed methodological approach for measuring B2B Integration Readiness presents a research framework and a web-based platform with an aim to aid the Enterprises, and especially the SMEs transition to a B2B integration environment. This approach will provide insight for the B2B integration adoption phase by:

- Recognizing and classifying common integration patterns and styles
- Identifying key technical and non-technical factors that affect the transition
- Presenting a comprehensive methodology for the assessment of an Enterprise's readiness to integrate with other Enterprises
- Identifying aspects that affect the integration impact
- Developing a "knowledge framework" which can support the enterprises in their brainstorming for B2B integration.

The implementation of the proposed framework involves the following tasks:

- a) Modelling an abstract B2B integration framework
- b) Specification of the assessment indicators
- c) Design and development of the evaluation methodology
- d) Performance Impact estimation design

- e) Design and development of the support software system.

These tasks are described in the following sections.

2.2 Framework’s Methodologies and Design Scheme

2.2.1 Modelling an Abstract B2B Integration Framework

The first step in the conception of the proposed framework is the abstraction of existing and upcoming B2B integration architectures and solutions. The abstraction process involves the study and analysis of the most important both dominant and promising integration technologies, solutions and standards. This analysis will lead to a categorization and classification of the involved patterns based on both technical and non-technical aspects of a B2B integration solution. Then, a generic model will be produced for each possible abstraction of two or more categories.

The output of this procedure will be a set of generic enterprise application integration models covering a broad range of integration styles and technologies. The value of this process is of high importance since, on the one hand, it will provide a generic yet concrete and realistic prototype model based on which the assessment indicators as well as other crucial evaluation elements will be created and maintained, and on the other hand, it will contribute to the sustainable value of the methodology. For the purposes of this analysis we consider five integration levels each with its own specific issue to be addressed (Giachetti, 2004-2005). The enterprise integration types are shown in Figure 1.

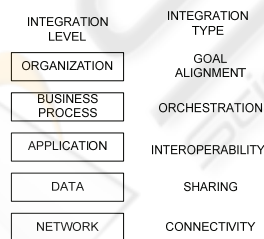


Figure 1: Levels of Enterprise Integration.

Connectivity. At the network level, the integration issue is the physical heterogeneity of the hardware, machines, devices, and their operating systems found in a physical network. The integration goal at the network level is connectivity defined as the linkages between systems, applications, and modules.

Data Sharing. Data sharing is the ability to exchange data between two enterprises. There are two components of this definition. First, the enterprises must be enabled to exchange data (technical interoperability). Second, the data exchanged must be understood by the receiver (semantic interoperability). This second requirement is harder to satisfy than the first, because semantic differences among enterprises are still prevalent. (Mouzakitis, 2007), (Janner, 2006)

Enterprise Application Interoperability. The application level, describes the systems used by the enterprises. The integration goal is interoperability, which is the ability of one software application to access/use data generated by another software system of another enterprise. Interoperability of software applications is usually achieved by exposing interfaces of a system to the network usually with a service-oriented approach and web services or through application adapters and remote protocol interfaces, with middleware, with Enterprise Service Buses, or with other enterprise application integration (EAI) technologies (Ruh, 2000).

Business Process Orchestration. The business process level describes the tasks, the manner and order in which the business processes are conducted. The problem at this level is that every enterprise has different approaches for conducting their internal or external processes, and even worse in some cases, especially in SMEs there is no formal approach in managing or conducting business processes. Integration in this level is usually achieved with appropriate orchestration and coordination of the business processes between the enterprises that agree on mutual adjustments.

Goal Alignment. The organizational level addresses the way that the three key elements of business strategy, organizational strategy, design strategy and information systems strategy must all be aligned with their B2B integration partners (Venkatraman, 1993).

Since most integration products and standards do not provide end-to-end interoperable solutions, but instead they serve only one integration level, as for example middleware or message broker software, the abstraction task of the methodology will form the abstract B2B integration models, by considering both the individual technologies and their current application in enterprises nowadays in the context of a complete integration framework, taking into consideration all integration levels.

The formulation of the prototype business integration framework will contribute greatly to clarifying the purpose, the merits and the goals of

such a solution, a necessity for the creation of assessment indicators of high quality.

2.2.2 Specification of the Assessment Indicators

In order to specify practical and appropriate evaluation indicators, measurable objectives must be first identified clearly.

Based on the prototype B2B integration framework model, a number of goals can be realized through discourse and negotiation with representative enterprises, such as seamless data exchange in automated transactions between suppliers and partners that is characterized by:

- Maintainability
- Trust and Confidentiality
- Strong Security
- Low Implementation/Integration Cost/Effort
- Low Operational Cost/Effort
- Value-added functionality
- High quality of service aspects, such as speed and availability.

Regardless of the specific B2B integration to be used, the current situational status of an enterprise directly affects one of above mentioned factors (Ranganathan, 2001), (Mouzakitis, 2007). While full integration is not always needed to use some of the exchange's functionality the full value of conducting business on the Internet and sharing information with business partners cannot be realized without integration of exchange technology with production systems. This is not just a technology issue. The cost of integration also includes the redefinition of processes and relationships within the enterprise, and implementation of these new processes, including training in and management of them.

Based on the defined measurable objectives the assessment indicators of the proposed methodological approach can be created in a straightforward way. Still though, the indicators must also be homogeneous and complete. With a view to ensuring these principles the generic enterprise model breaks down to the following two domains:

a) Enterprise Structure

- **Leadership and Strategy:** This section includes business plans, strategies, policies, agreements, ISOs compliance, and Legal compliance.
- **Financial:** Including General Ledger, Cash Management, Accounts Payable, Accounts Receivable, Fixed Assets Projects

- **Internal Management and Support:** This section includes Production Management, Project Management, Human Resources Management and Document Management
- **Supply Chain and Warehouse Management:** Including Inventory, Order Entry, Purchasing, Product Configurator, Supply Chain Planning, Supplier Scheduling, Inspection of goods,
- **Customer Relationship Management:** This section includes Sales and Marketing, Commissions, Service, Customer Contact and Call Center support

b) Resources

- **Basic Infrastructure:** This section includes building infrastructure, network infrastructure (LAN, wireless, VPN) and physical and hardware security.
- **Human Resources.**
- **Documents and Data**
- **Information Technology Systems:** Including operating system, available software (databases, CRM, ERP, CMS, E-procurement, e-business, legacy systems) and hardware (servers, desktops, routers, firewall, etc)

By defining these sections the methodology for the creation of the assessment indicators is depicted below:

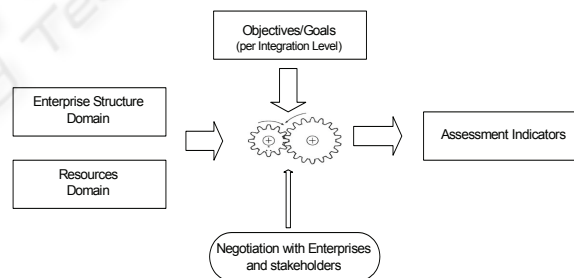


Figure 2: Process for the creation of the assessment indicators.

Many indicators will be created or removed based similar research, standards or implementations, such as e-Business Scorecard applications, the Capability Maturity Model Integration (CMMI) approach for the business process section or the COBIT and the ITIL framework for the indicators of the Information Technology systems section. After producing the basic set of the assessment indicators that apply to a generic model or an enterprise, an extra set of assessment indicators will be created in the same way for each business sector with special requirements.

2.2.3 Design and Development of The Evaluation Methodology

The evaluation methodology will contain questions depending on the business sector of the enterprise. In both cases, questions represent one or more assessment indicators. Since most questions refer to intangible assets, a normalized performance scale must be defined, and all answers (belonging to different measures - percentage, numeric, pre-defined choices) must be transformed to values in the common normalized scale. In order to achieve this, for each question different quality points L_i are defined that have corresponding points to the normalized performance scale. The performance indicators FID are conflated with given weights w_i in a similar way in order to produce a performance value for each Indicator Category.

2.2.4 Performance Impact Estimation Design

Enterprise integration has been found to lead to improved enterprise performance (Armistead,1993), (Frohlich,2001),(Brunnermeier,2003). In the context of the evaluation framework performance impact means that a B2B integration solution when used in the enterprise and interdependencies environment will improve some unit level performance measure. For example, improved efficiency, improved effectiveness, improved quality, or other performance measures are possible. The framework will provide a rough impact estimation that depends closely to a vast number of input parameters provided by the stakeholders in combination with the B2B integration readiness results. These parameters are organized as follows:

- **Macroeconomics:** These parameters deal with the performance, structure, and behavior of national and international economy. B2B integration impact is implicitly affected by the determinants of aggregate trends in an economy, such as national income, unemployment, inflation, investment, international trade and international finance.
- **Legal and Statutory framework:** Current legislation directly affects the performance impact both in time (audit controls, legally required fields, messages, documents or even processes in transactions) and cost (value-added tax, special taxes, regulation compliance cost, etc)
- **Pricing:** Pricing models are not expected to be solidified because many solution providers are struggling to understand the value of the

products they offer. However, in general, pricing structures can include: subscription fees (regular monthly fees); membership dues (typically large, one-time investments intended to help the exchange fund itself); and transaction fees (fees based on a percentage of the business that is transacted on the exchange).

- **Integration Effort:** Integration effort is the difficulty level of achieving integration and is measured in terms of cost, time, and amount of resources that must be used in order to achieve the desired integration. Integration effort includes implementation and operational effort as well as maintenance and support effort. Other integration issues can include: defining integration standards, linking data from the enterprise into the exchange's systems, deciding the data owner, defining the timing of updates and levels of secure access to information, agreeing on decisions that will be made based on the data and by which partner.
- **The Exchange's Technology Vendor Relationships:** The exchange's technology vendor relationships provide insights into its technology strategy, for example, is it using one technology provider or trying to integrate solutions across several providers? (Morrison, 2001) If the B2B integration framework is using one vendor's technology, it may require less effort to integrate, but the enterprise may not be getting the best functionality for specific process areas. Likewise, if the B2B integration framework is working with multiple vendors and taking a best-of-breed approach, integration may be challenging, but functionality is likely to be better.
- **The Exchange's Partnerships and Members:** Many B2B integration solution providers are building partnerships within different functional areas and across process areas in an effort to create a networked end-to-end solution. The number and the quality of potential partners and customers that are members of the provided network can have a significant impact on the enterprise (Ulfelder, 2004).

The performance impact estimation methodology is depicted in figure 3.

Provided that an enterprise has completed the readiness evaluation, the proposed framework can approximately calculate the performance impact of moving to a B2B environment by identifying the new values of performance measures, such as required time and cost per transaction, Business Process Interoperability (BPI), quality of service delivery, availability, etc. In order to achieve this, a

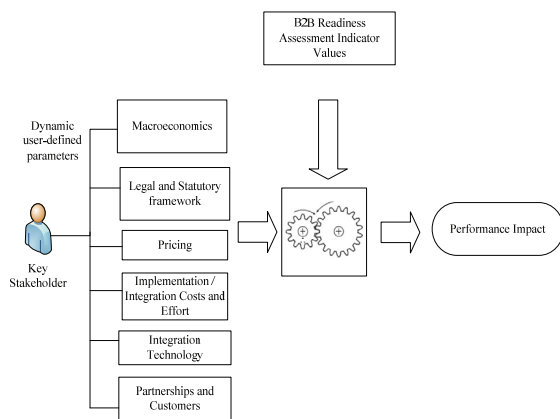


Figure 3: Performance impact estimation.

number of crucial parameters have to manually be inputted by a stakeholder, such as the pricing cost of the B2B integration solution, the number of columns and length of documents. Thus, the limitation of this methodology is that its effectiveness heavily depends on the accuracy and quality of the user input. Nevertheless, most of these parameters are usually objective (e.g. price) so the input task is usually straightforward. Moreover, applications of the framework are possible where some of these parameters can be provided by a neutral and trusted authority.

2.2.5 Design and Development of the Support Software System

In the context of the proposed approach, a modern technological platform is developed to support the application of the methodology in a cost-effective and easy manner. This platform is an intelligent web based system which will evaluate the situational status of a member Enterprise. It will then provide:

- The level of readiness to adopt a B2B integration solution or to participate in a collaborative B2B network
- Detailed analysis of the evaluation results
- In depth examination of the weak points that diminish the worth of the B2B integration
- A practical toolkit that measures the expected impact based on user input and the evaluation results.

The system's evaluation engine is responsible for calculating performance indicators by transforming and combining the values of the answers of the questionnaire as instructed by the evaluation algorithm. Based on the administrators' predefined weights, the indicators FID are conflated to produce a performance value for each indicator category. The evaluation algorithms are expected to be different

for each indicator category. After the evaluation is over, Entrepreneurs can review the associated comprehensive evaluation reports and identify their weaknesses. Moreover, Entrepreneurs can investigate further the assessment results by providing their own weights per indicator (subjective evaluation). Furthermore, a practical toolkit is available for making an estimation of the integration impact.

3 CONCLUSIONS AND FUTURE WORK

The primary contribution of this paper was to propose a research methodology that evaluates the readiness of an enterprise to adopt a B2B integration solution and identifies important technical and non-technical factors that are expected to affect the impact of the integration technology. The results of the evaluation can be used in impact assessment of the integration solution, based on additional user input.

The methodology, presented in this paper, can assist enterprises in identifying their weaknesses and can serve as a guide for establishing an effective integration strategy. In this way, this approach can contribute to achieving the full potential of the multi-enterprise integration. Furthermore, on the other side, B2B technology vendors and standardization bodies can benefit from the knowledge base that is developed around such a framework, by focusing more on the alignment to the organizations' business needs, than technological excellence.

Future work includes collecting the complete set of the assessment indicators, adjusting the evaluation method and proving the framework's merits by collecting data and performing statistical analysis to validate each of the proposed methodologies. Work is going forward on using the research framework to understand SMEs B2B integration in the Greece. Additional findings and results are expected during the support system's pilot operation that will be circulated through further dissemination activities.

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