

A Tool for Calculating eReadiness

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Abstract: The search for a fast and standardized method to determine the options for and scope of eBusiness-based solutions for implementation in business processes sparked a cooperation between Siemens in Munich and the Johannes Kepler University in Linz. The extent to which a specific business process is supported by eSolutions determines its eReadiness. We have invented a method and tool (called eBModeller) that can automatically assign eSolutions to business processes. The difference between actually used eSolutions and assignable eSolutions is used to calculate the eReadiness of a business process. Any company, which is interested in assigning eSolutions to its business processes and knowing of the eReadiness of its business processes, can use the eBModeller to get results in a time-saving, defined and traceable way. However, if a company is looking for eSolutions to restructure the whole company, these strategic investment suggestions have to be generated by the management of its company and the eBModeller can support the process.

1. Introduction

The eReadiness of a business process is the degree of its eBusiness-based execution. eReadiness depends on the efficient use of eSolutions. eSolutions are services that support the execution of business processes at any time and any place. eSolutions are typically accomplished through the use of Internet technologies; examples are bulletin board systems, contracting services, eMarketplaces, eBooks and portals.

eSolutions are widely recognized for improving the execution of business processes, and thus many companies are trying to increase the efficiency of their business processes by making them “eBusiness ready”. However, in order to judge and compare the eReadiness of business processes, you need a method for its identification. Until now, methods to identify Readiness could only be found as regard to the eReadiness of a whole country or region [5]. Because of different parameters und requirements, these methods cannot be used to identify the eReadiness of a business process, thus a new standardized method had to be developed.

2. Objectives

We have invented a method and implemented a tool, called eBModeller, to calculate eReadiness and to correctly assign eSolutions to business process activities. This paper will describe this project, which has been privately funded and carried out as a co-operation between two institutes of the Johannes Kepler University of Linz and the corporate technology department of Siemens AG.

The initial motivation for this co-operation project was the industrial partner need for a fast and standardized method which could identify the possibility of an eBusiness-based execution of a business process. As many of the potential users are ISO certificated, the

developed method should also meet the requirements of an ISO 9000 certification. This means that the assignment of eSolutions to business processes has to be defined and traceable.

Before the project started, the standard procedure of the industrial partner was having expert identify the eSolutions for each business process. This was a complex and time-consuming task because this expert had to choose from over 100 eSolutions, and one single business process contained about 180 business process activities. The results varied from expert to expert and didn't meet the requirements of an ISO 9000 certification.

Two questions had been of interest during the project:

1. Which eSolutions can be used to improve the execution of business processes?
2. To what extent is a business process executed through eSolutions, i.e., how high is the eReadiness of the business process?

The method invented and the tool implemented should solve these questions for any company or governmental organisation in a time-saving, defined and traceable manner. Existing or aspired ISO 9000 certifications should be compatible with the invented method and the implemented tool. In order to cover the costs of the project, the financial aim of this project was to patent the invented method.

3. Research Methodology

The development process started with a literary analysis. We searched for literature in the libraries of the Universities of Linz and Vienna, in the Electronic Journals library (an international database of 359 libraries, consortia or research institutes which contains 27.173 titles) and on the Internet with www.google.com. Suggestions for the efficient use of single eSolutions as well as ideas of how to increase the eBusiness usage have been described in the literature, e.g., [1], [2], [3]. However, a method to assign eSolutions to business processes in a defined and traceable way could not be discovered. Methods to identify the eReadiness could only be found for the eReadiness of a country [4], [5] and to evaluate the eReadiness of a supplier [6]. As these methods look at the aspect of eReadiness from another angle and with another aim, most of the criteria used in these methods (e.g. level of competition in telecom industry, political stability, level of censorship... [5]) could not be used to calculate the eReadiness of a business process.

Having the results of the literary analysis, we concluded that it was necessary to invent a new method for the assignment and the identification of the eReadiness of business processes. The method was tested in field studies by the industrial partner. The initial tests showed that the method works, but that it was still time-consuming to manually execute these methods.

Thus the next step was the development of eBModeller, a tool for automated assignment and eReadiness calculation. During and after the development, eBModeller was tested in field tests by the industrial partner as well as by an independent evaluation company. The results of these tests have influenced the further development of eBModeller.

4. Assignment of eSolutions

We use attributes and values as a base for our assignment method. The crucial point is that attributes characterize both business process activities and eSolutions. They characterize them and also distinguish them from each other. Examples of attributes are location of participants (values: in-team; in-house; company-spanned; external), form of communication (values: synchronous; asynchronous; direct; indirect), data security (values: input security; access security; theft security; asset security) or artefact (values: documents; appointments; resources).

In a first step, catalogs of attribute values for both business activities and eSolutions have to be created. Attribute values of business activities can be considered as requirements. They specify what is needed for the performance of specific activities. For example, N:M communication may be needed in order to perform a specific business process activity. Attribute values of eSolutions describe properties. For example, an eSolution (e.g., videoconference) may or may not have the property of supporting N:M communication.

Table 1. Conference task with attributes and values

Task	Attribute	Attribute Value
conference	form of communication	synchronous; direct
	communication partners	N:M
	direction of communication flow	bi-directional

An assignment of eSolutions to business process activities is now a simple process of matching requirements of business process activities with properties of eSolutions. The important thing at this point is the fact that both the requirements and the properties are described by the same mechanism, i.e., by attributes and values. To simplify and to speed up assignments, we have additionally introduced tasks. Tasks can be found in several business process activities and have a fixed set of attributes and values. Table 1 shows the task conference with its attributes and values. Attributes and attribute values have to be defined only once for a task and not repeatedly for each business process activity.

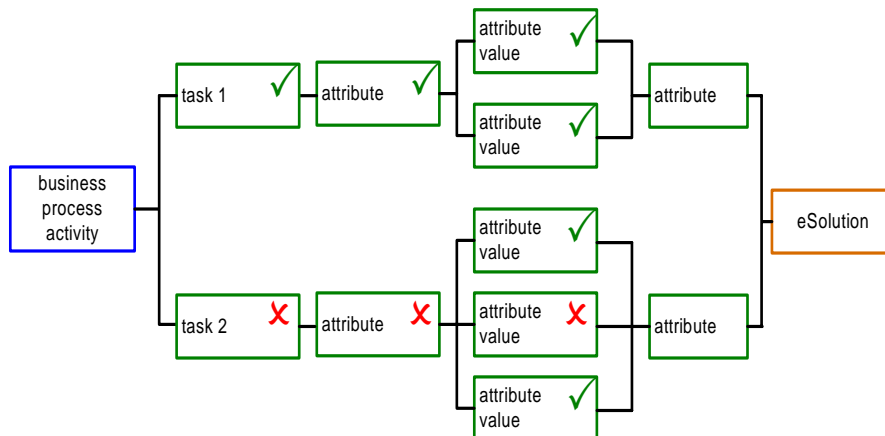


Figure 1. Assignment of an eSolution to a business process activity

Figure 1 shows that an eSolution can only support a business process activity if it has all the required attributes and values. This is the case for task 1. If only one required attribute value is missing, the eSolution cannot be considered because it does not support the execution of the referred task, see task 2 in Figure 1. However, an eSolution can offer additional attributes and/or values, which are not needed by the business process activity.

Table 2 shows the assignment of an eSolution to a task by means of an example. The requirements of the task conference are that the participants can communicate directly, synchronously and bi-directionally. The eSolution videoconference has the properties "form of communication: synchronous, direct", "communication partners: N:M" and "direction of communication flow: bi-directional". Considering the requirements of conference, all listed eSolutions are matched with the required attributes and values. Most of the eSolutions cannot support the task conference, for example the eSolution bulletin board systems only offers indirect communication, i.e., it has the attribute "form of communication: indirect".

Table 2: Assignment of an eSolution to a task

Task	Attribute	Attribute Value	eSolution	Attribute	Attribute Value
conference	form of communication	<i>synchronous; direct</i>	video-conference	form of communication	<i>synchronous; direct</i>
	communication partners	<i>N:M</i>		communication partners	<i>N:M</i>
	direction of communication flow	<i>bi-directional</i>		direction of communication flow	<i>bi-directional</i>

It is both inconvenient and impractical to manually match requirements of business process activities with eSolution properties. The number of available eSolutions is large and the number of activities of business process is typically high. At the moment, we have a list of about 100 eSolutions and about 180 business process activities per business process. The development of appropriate tool support for automated assignment was logical [7]. The tool is based on a relational database model using tasks, attributes and values for the description of properties of eSolutions as well as for the description of requirements of business process activities. This consistent description enables the automation of the process. The result of the automated assignment is a choice of prospective eSolutions to support a business process. The owner of the business process can influence the assignment process, e.g., by giving eSolutions, that are already in use, a higher preference than others.

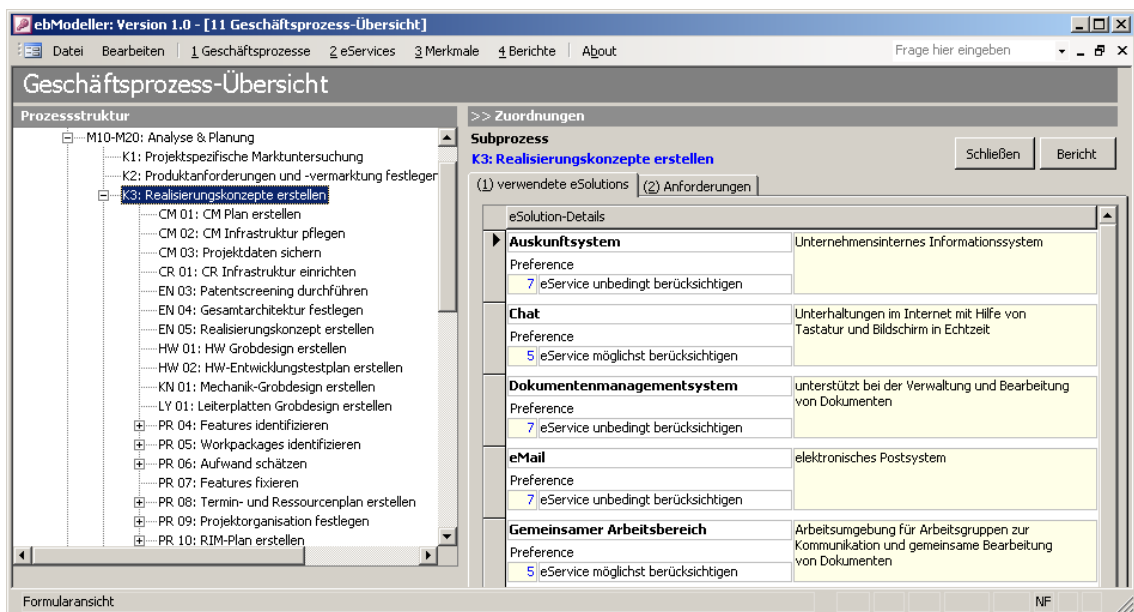


Figure 2. User Interface of the ebModeller

Figure 2 shows a part of the user interface of the ebModeller, which is currently available only with a German interface. On the left side there is the structure of the business process with the business process activities (e.g., CM 01: develop CM plan) on the right side you can see the eSolutions and their preferences that are used in this business process activity.

5. eReadiness

As mentioned before, the eReadiness is the degree of eBusiness-based execution of a business process. To identify the eReadiness of a business process, an analysis of four criteria has to be made:

1. *Technical infrastructure*: The analysis of the technological infrastructure tests if the business process activities can be executed by eSolutions.
2. *Personnel infrastructure*: The analysis of the personnel infrastructure informs about the eBusiness qualifications and the acceptance of eBusiness among the persons working in the business process. It also analyses the management support to use eSolutions.
3. *Economic infrastructure*: The analysis of the economic infrastructure compares the costs and duration of an eSolution-based execution with these of an execution without the use of any eSolutions. This analysis also takes into consideration if the company allocates enough budgets for the service and replacement of eSolutions.
4. *Organizational Infrastructure*: The analysis of the organizational infrastructure takes a look at the customer requirements. It also analyses the integration of eSolutions in the organizational infrastructure and the changes in the business process execution caused by the usage of eSolutions.

The eReadiness of the technical infrastructure can be calculated by comparing the eBusiness utilization with the eBusiness potential. The eBusiness potential is the summation of all possibilities to include eBusiness in the business process. The eBusiness utilization is the day to day use of eBusiness in the business process. The eReadiness results from the difference between the eBusiness potential and the eBusiness utilization. The smaller the difference, the higher is the eReadiness.

The analysis of the technical infrastructure is supported by the eBModeller. It compares the highest possible utilisation of eSolutions (eBusiness potential) with the number of eSolutions used in the business process (eBusiness utilisation). The eReadiness of the technical infrastructure is high if the number of eSolutions used in business process activities is as high as possible. To increase the eReadiness, the eBModeller can produce a list of eSolutions, which can be considered as investment suggestions. Currently, we do not support an analysis of the personnel, economic and organizational infrastructure.

6. Utilisation

In the field tests the catalogue of attribute values of eSolutions (which contained 94 eSolutions) was matched with the catalogue of attribute values of a business process (which contained the requirements of 146 business process activities). The eBModeller identified 47 eSolutions that could support the business process.

Table 3: Results for the business process activity „develop test plan”

Task	Attributes:	Attribute Values	Result (Preference)
Meeting	form of communication: direction of communication flow: communication partners:	direct/synchronous bi-directional N:M	Session Support System (Pref. 1) or Chat (Pref. 2) or Video-Conference (Pref. 2)
bilateral exchange of information	form of communication: communication partners: frequency:	asynchronous 1:1 daily	eMail (Pref. 1) or Communication Portal (Pref. 2)
time schedule coordination	number of participants: subject: access:	several appointments company participants	Online Calendar (Pref. 1) or Electronic Calendar (Pref. 2)
document coordination	subject: access:	documents team participants	Project Portal (Pref. 1) or Document Management System (Pref. 2)

A simple sample of this field test should demonstrate the eBModeller's utilisation: Table 3 shows four different tasks with their attributes and values. The results, which have been produced by the eBModeller, are already considering the preferences of the business process owner. Thus, meeting can be supported by a Session Support System (Preference

1), Chat (Preference 2) or Video-Conference (Preference 2); bilateral exchange of information can be accomplished by communication Portal (Preference 2) or eMail (Preference 1).

The 47 eSolutions identified by the eBModeller (eBusiness potential) were compared with the 19 eSolutions actually used in the business process (eBusiness utilisation). The result of this comparison is shown in Fig. 3. In short, the main outcome was, that the eReadiness of the technical infrastructure of this business process was medium (40,4) and could be increased by the usage of the identified 28 eSolutions that were not used yet in the business process.

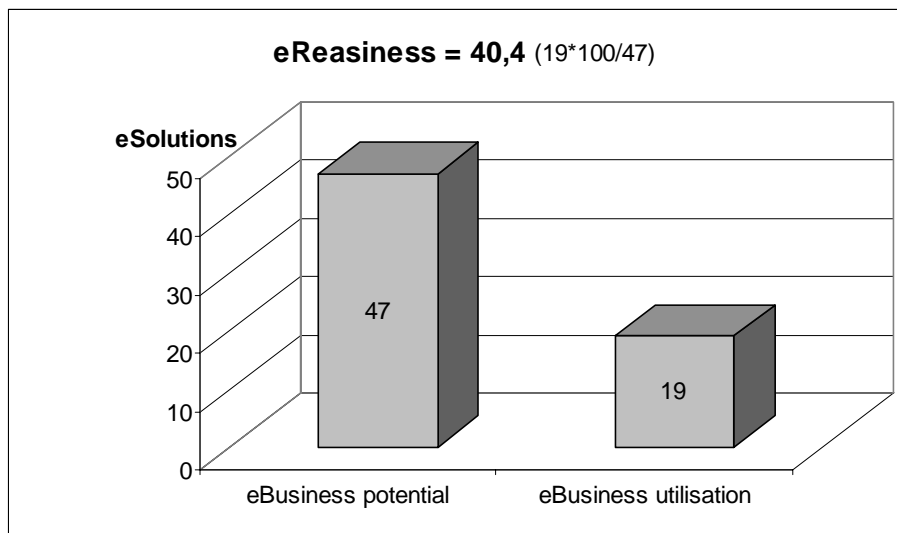


Figure 3. eBusiness potential / eBusiness utilisation / eReadiness

As the eBModeller splits up the business process activities in tasks, it searches for suitable eSolutions at a low level. At this level, the number of requirements is quite small, so it is possible to assign eSolutions to these tasks. To identify suitable eSolutions for a business process, the eBModeller uses a procedure to combine all the eSolutions of the tasks that belong to the business process.

The possibility to identify suitable eSolutions for a whole company by combining the eSolutions of all its business processes is not included in the eBModeller. The reason for this is that strategic investment suggestions, which can restructure the whole company, require the consideration of strategic goals and can only be generated by the management. The eBModeller can support the generation of these strategic investment suggestions by indicating the eSolutions which could support the business processes and therefore should be included in a company wide software solution.

7. Current State-of-the-art

To receive more feedback about the usability of the eBModeller, an independent evaluation company has tested the eBModeller. These external field tests have shown that the eBModeller meets the requirements of stable software and that it is reasonable and practical to use the tool when business processes are already defined. The evaluation company annotated that, when (re-)defining their business model or business processes, many of their customers were interested to immediately find out which eSolutions could support their newly defined business process. To provide such a service to customers, the feature for generating results, even if not all attribute values are fixed, was integrated in the eBModeller.

At the moment, all suggestions for improvement from the internal and external field studies are included in the eBModeller. This means that any company could use the

eBModeller in order to find out which eSolutions can be used to improve the execution of business processes and to calculate the eReadiness of the technical infrastructure.

However it has proven to be very complicated to include the calculation of eReadiness of the personnel, economic and organisational infrastructure in the eBModeller. A literary analysis und interviews with experts helped us to define the criteria for those eReadiness aspects. But most of these criteria are qualitative and can therefore hardly be mapped to the rational database model.

It has taken almost half a year to collect all of the necessary information for the calculation of eReadiness of the personnel, economic and organisational infrastructure. As the results of this time-period are not too promising, we decided to concentrate our future research work on the calculation of the eReadiness of the technical infrastructure.

Within the next year we are planning to finalize the development of the eBModeller. We plan to use the eBModeller in at least five more field studies and then integrate the suggestions for improvement into these field studies.

A patent for the invented method is pending. This and the fact, that this project has been privately funded from its beginning, shows, that the project members of the university and the industrial partner believe in the realisation of financial benefits when bringing this product to market.

8. Conclusions and Business Benefits

The eBModeller enables users to automatically assign eSolutions to business processes and to calculate the eReadiness of the technical infrastructure. In order to determine whether the execution of business processes with the support of eSolutions is superior to the execution without eSolutions, the eReadiness of the technical infrastructure must be identified as well as the eReadiness of the personnel, economic and organisational infrastructure. Currently this identification has to be made manually by an expert.

At present, using web service research for the location of these services does not seem plausible enough to support this kind of allocation. Ontologies might improve the eBModeller because we are only using a string matching strategy at the moment. This is why it is not possible to detect data inconsistencies and to autonomously complete missing knowledge by using the available knowledge. An enlargement with ontologies would enable a semantic high-order description of interfaces and service compositions [8] and is considered the next development step.

The main challenge at the beginning of this project was to split up the big problem of assigning eSolutions to business processes and calculating the eReadiness in smaller, less complex problems. We split the business process into business processes activities and these into tasks. We also divided eSolutions into their properties. At this level it was possible to define requirements of tasks, which were matched with the properties of eSolutions. To identify the eSolutions that could support the business process, the eBModeller has a procedure that combines all the eSolutions of the business process activities. The eBModeller is designed to be used on the level of business processes. For strategic investment decisions it can be seen as part of a Decision Support System.

References

- [1] F. Keuper (Eds.), E-Business, M-Business und T-Business, ISBN 3409120262. Gabler, Wiesbaden, 2003.
- [2] A. Hermanns, M. Sauter, Management-Handbuch Electronic Commerce, ISBN 3800626055. 2. Ed., Vahlen, München, 2001.
- [3] M. Meier, H. Stormer, eBusiness & eCommerce, ISBN 3540254269. Springer, Berlin et al., 2005.
- [4] Unesco Bangkok: Assessing eReadiness. 2006. <http://www.unescobkk.org/index.php?id=948>
- [5] Economist Intelligence Unit : The 2006 e-readiness rankings. The Economist Intelligence Unit, London et al., 2006. (also available online: http://graphics.eiu.com/files/ad_pdfs/2006Ereadiness_Ranking_WP.pdf)

- [6] U. Arnold: Wie "e-ready sind Lieferanten?. In: BME (Hrsg.): Beschaffungsmarkt - Das Jahrbuch für den industriellen Einkauf, Stuttgart 2004, S. 15 ff.
- [7] C. Thonabauer, M. Mitko, J. Sametinger, N. Weber: Ein Werkzeug zur Zuordnung von eSolutions zu Geschäftsprozessen, HMD – Praxis der Wirtschaftsinformatik, ISBN 14361011. dpunkt.verlag, Heidelberg, 2005, pp. 77-85.
- [8] J. Cardoso, A. Sheth: Semantic E-Workflow Composition. Journal of Intelligent Information Systems, 21. Vol., 2003, No. 3, pp. 191-225.