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An Approach to Increase Adaptability in ERP Systems

Zitierhinweis:
An Approach to Increase Adaptability in ERP Systems

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ABSTRACT
The concept of adaptability has been widely recognised as research field in recent years.

Business information systems play a key part in terms of business performance. Adaptability of information systems therefore is a primary goal of vendors and end-users. However, so far concepts that help to determine the adaptability of Information Systems are missing. Based on research results of the project CHANGE1 this contribution presents an integrated process model addressing the problem and a possible solution.

INTRODUCTION
Adaptability as a technical research field has been established in the last decade. Mainly within the focus of factory planning adaptability is considered as goal to develop modular, adaptable factories. [NoKL02, BaWi+01]. Among other factors that enable adaptive behaviour the information technology (IT) of an organisation is considered [Hern02]. However, the exploration of adaptability of enterprise architecture is a complex task. The method presented applies a procedure which combines a criteria and scenario based process.

WHY ERP?
ERP systems are highly standardized systems. ERP systems link all or many business functions and operating locations so all have access to relevant information [Nick01].

ERP systems may be appropriate for some organisations but less for others. ERP systems themselves are limited in the processes they can model. As a result, an organisation is limited to the collection of functions delivered with the ERP system or has to modify either the business processes or the ERP program code.

Thus, currently no single ERP packaged software can meet all company functionalities or all special business requirements. Therefore, companies must choose an adaptive ERP system. [GaGo02]

The general approach of this paper is based on systems theory.

THE CONCEPT OF ADAPTABILITY
Although adaptability is known as a key prerequisite for good business performance [OkGr97], the literature is not consistent in describing or defining the construct of adaptability. A representative sample covering various viewpoints is given below:

1. A factory is adaptable if it is possible to accomplish reactively or pre-actively changes of the transformation objects (personnel, organization, technology) on all structure levels with little efforts [Wien99].
2. Adaptability is the ease with which software satisfies differing system constraints and user needs [Evan87].
3. Adaptability is defined as the ease with which a system or parts of the system may be adapted to the changing requirements [EC96].
4. Adaptability can be defined as a firm’s ability to identify and capitalize emerging market and technology opportunities [Chak92].

All definitions in common describe adaptability as the ability to change or to be changed in order to fit transformed circumstances. In the context of IT systems adaptability means a change in the system to accommodate a change in its environment. More specifically, adaptation of an IT system is caused by change from an old environment to a new environment. It results in a new state of the system that ideally meets the needs of its new environment. Adaptability allows the system to recognize the need for changes and to respond itself with suited alternatives.

ADAPTABILITY ANALYSIS: CRITERIA BASED APPROACH
Adaptability is a multidimensional construct. As the focus is not on mathematical accuracy but on tendencies the scale has to be able to distinguish between high and low "performers".

Despite the fact that adaptability is well recognised as an important factor for business performance as mentioned above, there are no sophisticated and validated measurement scales.

The adaptability construct therefore was operationalized by using pervious measurement items in combination with variables developed for the issue addressed. On one hand the goal is to find all relevant items that fully describe the system, and on the other to ensure the independence of each item from one another. The first criteria set originates from factory planning and comprises scalability, modularity, mobility, and interoperability.

The view on autopoietic systems adds the items self-organisation, self-similarity and redundancy.

HYPOTHETICAL EXAMPLE
On a technological level any ERP system can be assessed using the criteria and applying codes as presented in Figure 1. Four intensities represent a certain degree of fulfilment: strongly positive, positive, negative and strongly negative.

To identify the ERP system characteristics on adaptability the criteria have to be further decomposed. Each criterion is described by a couple of lower-level characteristics. As the code of fulfilment suggests the goal is to start from a high judgement level. The results of an exemplary study of ERP systems are presented in table 1.

Figure 1. Codes for the Degree of Fulfilment

| ++ | Strongly positive - enables adaptability |
| +  | Positive - supports adaptability       |
| -  | Negative - hurts adaptability          |
| -- | Strongly negative - breaks adaptability |
Scalability refers to the permanent state to effectively and efficiently operate at many different scales. An ERP system is described as scalable if it will remain effective when there is a significant increase/decrease in the number of recourses as for instance data in parts lists. Usually the capacity is fixed and resource allocation is not optimized.

Modularity is closely linked with component-based architectures. Modules are implemented so as to hide all the information about them except what is available through its interfaces.

Mobility raises the question on unlimited access to data and functionality- for example via web-browser, terminal-server or a virtual private network, by means of these applications data can be accessed. Some ERP systems do provide a limited access; some are even fully web-based (web-ERP+2). A second dimension represents the platform- independency of applications. This freeness covers for example the used hardware, the operating system, data bases or application servers.

Interoperability requires the use of well-established standards that define the behaviour of interfaces. It allows the uncomplicated access and coupling of different data- and processing resources within a workflow or rather the easy coupling of different ERP and information systems.

Self-organization is a basic characteristic of natural systems that adapt automatically to changing conditions. Self-organization of ERP-systems is closely linked with mechanisms of adaptation as customization and handling of updates. It questions for instance the common procedure of periodically given releases as updates are not necessarily capable to handle company specific code modifications. Beyond, systems that automatically create the documentation perform issues of self-organizing.

As an expression of self-similarity a unique design philosophy of applications shall be mentioned resulting in the easier ability to learn and efficiently use the application on different platforms and levels.

Redundancy is a decision factor. As long as systems fail or recourses are considered critical additional components might be deployed for security and scalability reasons [Gron03].

We acknowledge that the notion of “fulfilment” is critical in understanding. The code of satisfaction could be transformed into an x-point scale allowing more differentiation for each criterion.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Items (Example)</th>
<th>System A</th>
<th>System B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalability</td>
<td>Hardware level</td>
<td>n.a</td>
<td>n.a</td>
</tr>
<tr>
<td></td>
<td>Software level</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Score</td>
<td>++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Modularity</td>
<td>Is the ERP system fully component-based?</td>
<td>:</td>
<td>+</td>
</tr>
<tr>
<td>Mobility</td>
<td>Web-browser based access?</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Score</td>
<td>++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Interoperability</td>
<td>Deployment of Standards</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Score</td>
<td></td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Self-organization</td>
<td>Self-documenting</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Score</td>
<td></td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Self-similarity</td>
<td>Unique design philosophy (on every level)</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>User-friendly Interfaces</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Score</td>
<td></td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Redundancy</td>
<td></td>
<td>n.a</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>++</td>
<td>+</td>
</tr>
</tbody>
</table>

Refinement

As mentioned the technical dimension is accompanied by a business dimension as adaptability also depends on the qualities of the company. The terms of deployment do determine to what extend the potential of adaptability may be used or not. The business dimension covers three factors, the factor of structural systems analogy, the business process and the knowledge factor.

For the structural systems analogy the geographical organization and therefore the physical structure of the company deploying the ERP system is important. A decentred organized company requires decentred supported functions – the shape or the architecture respectively of the ERP system has to follow the structure of organisation to locally provide the needed resources. Decentralisation is enabled by certain criteria (e.g. modularity, interoperability). This requirement we see as a constraint when consequently following the cybernetic view on self-organizing systems.

A firm’s adaptability is affected by the nature of its environmental dynamics entailing for instance market and technology-based turbulence factors [TuRa+04]. The deployed technology represents a performance dimension – the more turbulent the environment the more internal dynamism is to be supported. Thus a particular ERP configuration is a good fit for current conditions but may be a bad solution after a process re-engineering. A model for assessing the necessary adaptability of software in relation to a firm’s environmental turbulences was carried out by the CHANGE initiative [AnGro+04].

It can be assumed that personal knowledge is another indicator of adaptability for to instance optimally use the system for process reorganisation we suggest to also consider the factor knowledge about the ERP system.

Integrated Process Model: Overview

While the criteria-based method allows the judgement and filtering of possible ERP system candidates on a technical basis, the business dimension adds the firm’s individual aspects. The handling of the business dimension also involves planning of adaptability for the future. A scenario-based technique fills the methodological gap to cover adaptability areas and deriving the necessary degree of ERP systems adaptability.

Basically each business factor provides a scenario basis. The structural systems analogy requires the ERP logic to cope with structural changes. Projections into the future generate a set of alternatives and should reveal strong and weak points in adapting the ERP system. Scenarios typically follow a phase model. Due to space limitations please refer to [LiBa03] for an in-depth outline of scenario-management.

For instance, a manufacturing company located at one place might be served well with a “monolithic” ERP system actually. However a manufacturing company spread in many small distributed units with different tasks will require a highly modular ERP system providing data and functionality where the transaction occurs.

As for the process factor a company facing an instable external environment may create scenarios to model realigned business processes into the ERP system finding out the degree to which adaptability is reached.

REFERENCES


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[EC96] Adaptability in Object-Oriented Software Development Workshop Report, 10th European Conference on Object-Oriented Programming, July 8-12, 1996, Linz, Austria


ENDNOTES

1 CHANGE Project is available online: http://www.change-project.de

2 Available online: http://web-erp.sourceforge.net