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Enhancing ERP to Fit the Business Needs: A Customization Method Selection

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Abstract

Enterprise resource planning and management (ERP) systems is now dominated by systems that are perceived expensive and inflexible. In order to take full advantage of the ERP systems, implementations require drastic structural and cultural changes within the organization including business process reengineering. These changes certainly allowed to do but somewhat difficult to accomplish and organizations continue to struggle with change management of ERP systems. Finding the right fit between ERP systems and the business processes is critical for successful ERP implementation [12]. In this case, the organization can respond by two approaches: ERP system customization or organizational adaptation [6][15]. However, there is also best of breed systems, which are best applied to one or a few functions, facilitating system maintenance. This research proposes a comprehensive ERP system customization selection framework in which the objective hierarchy is constructed and the appropriate criterias are specified to provide detailed guidance for the customization. The analytic hierarchy process (AHP) method [27] is applied for dealing with the ambiguities involved in the assessment of customization alternatives and relative importance weightings of criterias.

Keywords: ERP; Customization; AHP

2. Introduction

Along with the raising of software technology, application makers are competing to produce integrated business management software, that organizations can use to collect, store, manage and interpret the data from many business activities into one enterprise system. This system is called Enterprise Resource Planning (ERP) which has become the dominant strategic platform for supporting enterprise-wide business processes nowadays. ERP is increasingly important in modern business because of its ability to integrate the flow of material, finance, and information and to support organizational strategies [43][42]. A successful ERP project involves managing business process change, selecting an ERP software system and a co-operative vendor, implementing this system, and examining the practicality of the new system. Because of the complexity of the business environment, the limitations in available resources, and the diversity of ERP alternatives, implementation of ERP system is tiring and time consuming. However, given the considerable financial investment and potential risks and benefits, the importance of a pertinent ERP system selection cannot be over emphasized [39].

The implementation of the system often does not fully meet the needs of the organization so frequent changes (customizations) and extensive maintenance are required [21]. Organizations can choose to have custom software built to meet their unique requirements but this imposes additional costs, risks, and implementation delays [5][10]. Existing ERP commercial packages cannot provide a once-for-all business model for every process of all industry. Thus, no single ERP packaged software can meet all organization functionalities or all special business requirements [31][39][12]. Therefore, companies must choose a flexible ERP system and a cooperative vendor that is responsive to customer needs. Achieving fit is a costly proposition. Efforts aimed at ongoing maintenance and enhancements cost approximately $1.5 million annually per ERP implementation [3]. Collectively, U.S.-based organizations are spending $14.5 billion annually on ERP maintenance and enhancements [37]. In a recent survey of U.S. CIOs, 47% cited ERP upgrades and enhancements as key investments for 2006 [14]. Achieving fit is not as easy as simply upgrading to new versions, implementing new modules, or customizing the existing system. It requires the synthesis of knowledge from throughout the
organization. Functional business knowledge must be brought to bear to identify deficiencies in current functionality and anticipated future strategic directions. ERP-technical knowledge must also be tapped to specify the system-level impacts of new functionality. In summary, achieving fit between the ERP as delivered and business needs is a complex organizational issue that is not easily solved. Finding the right fit between ERP systems and the business processes of the target organization is critical for successful ERP implementation [12]. In the case of a misfit between the ERP system and the organization’s established practices, the organization can respond by two approaches: ERP system customization or organizational adaptation [6][15].

This research proposes a comprehensive ERP system customization selection framework in which the objective hierarchy is constructed and the appropriate criteria are specified to provide detailed guidance for the customization. Thus, the research is driven by this research questions: Which is the best methods for ERP system customization to fit the business needs?

The analytic hierarchy process (AHP) method [27] is applied for dealing with the ambiguities involved in the assessment of customization alternatives and relative importance weightings of criteria.

3. The Enterprise Resource Planning (ERP) System

Enterprise Resource Planning is a term used to describe business software that is 1) multifunctional in scope, 2) integrated in nature, and 3) modular in structure. An ERP software solution is appropriate when an organization is seeking the benefits of business process integration and contemporary best practices in its information system, looking for a full range of functionality throughout its organization, and seeking to limit its implementation and ongoing support costs [7]. ERP systems have their origins in Manufacturing Resource Planning (MRP) software with installations traditionally in large scale manufacturing facilities, although recently the trend is to extend installations to industry. The systems are known for their process orientation rather than traditional functional orientation that may enhance an organization’s move toward breaking down departmental boundaries and thinking. The goal of implementing these packages is to reengineer their processes, which in turn will hopefully benefit their bottom line.

The ERP systems are meant to support enterprises in various phases of the business. The application software typically includes warehouse management, material management, production planning and management, people management, purchase management, customer relations management (CRM), and supply chain management (SCM). Figure 1 illustrates the ERP systems as a whole.

![ERP System Diagram](image-url)

Fig. 1. ERP System [33]
In general, ERP differs from older legacy business applications in several distinct ways. First, ERP allows for a single view of the organization by providing an “information portrait” that touches every department and functional area within the enterprise [8][17]. Second, ERP offers the promise of data integration by using a centralized database for business information, such as human resources information, customer information, and business transactions [17]. Third, ERP facilitates increased connectivity among and between business processes via data and process integration [17]. Embedding standard business processes based on “best practice”, ERP systems in many cases will not meet the unique needs of a particular organization. Thus, finding the right fit between ERP systems and the business processes of the target organization is critical for successful ERP implementation [12]. In the case of a misfit between the ERP system and the organization’s established practices, the organization can respond by two approaches: ERP system customization or organizational adaptation [6][15]. An important decision is then the scale of ERP system customization and/or business process change that should be applied.

The ERP literature includes a number of studies exploring the issue of ERP system customization. Many studies recommend that ERP systems should be implemented with minimal customization [35][40], as ERP customization is problematic and may increase costs and limit maintainability [15]. Despite this, a number of studies have documented how ERP system customization may occur [19][25][26]. Reasons identified for this include resistance to change [26], functional misfit [5][19], and cultural differences [34][1].

3.1. ERP system customization

The primary goal of ERP system customization is to achieve a fit between an ERP system and the business processes of the organization [20], to fill the potential gap between ERP functionality and organizational requirements. Different conceptualizations of ERP system customization in former research include related terms such as tailoring [5], modification [26] and functional alignment [12] of the system. For example, based on a review of the ERP literature, and complemented by fieldwork and interviews with ERP vendors and consultants, Brehm [5] developed a framework of ERP tailoring options. The framework distinguishes between 9 different types of ERP package tailoring, ranging from “light” configuration up to “heavy” package code modification. When implementing an ERP system, an organization can choose to modify an ERP system by using almost any combination of the tailoring types [5]. The framework was further modified by Rothenberger [26] who grouped ERP modification options into three areas: configuration / selection, bolt-ons and system change. By selecting appropriate system components and setting parameters, an organization may configure a system to its needs. Since this may not accommodate all existing business needs, an organization may implement bolt-ons (or third-party packages) that supplement the ERP functionality, or build custom features on top of the ERP platform. Lastly, the ERP system code may be modified to fit the business needs [26].

According to an ERP report from Panorama Consulting in 2015 [24], only 7% of organization did not customize any aspect of their ERP system. An overwhelming 63% of organizations had some customization or significant customization.

3.2. Reasons for ERP customization

Minimal ERP customization has been reported as one critical success factor for ERP implementation [22][35][40], and some studies have documented how ERP projects applying customization have failed [11][15]. On the other hand, several studies have reported how ERP system customization has been applied by organizations [18][25][26][34], also documenting positive results from this [7][12]. A frequently mentioned reason for ERP system customization is a functional misfit between the standard ERP system functionality and existing business processes [5][18]. The study by Light [19] discussed further potential reasons for ERP package customization. Besides functional misfit, several reasons for ERP system customization rooted in the influence of diverse social groups were identified. For example, ERP system customization may be performed because of a consultant’s lack of knowledge about a product or its context, insufficient development work from the vendor, or as an act of safeguarding a work position by internal information systems personnel [19].

Zach and Munkvold, [44] identified seven possible reasons leading to ERP system customization, classified according to two phases of the ERP lifecycle (prior to “going-live” and after “going-live”).
The reasons are resistance to change, unique business process, functional misfit, ownership type, motivation for the implementation, stage of growth, and maturity of the ERP system.

3.3. Categories of ERP customization

Gartner, Inc, 2013 [38] defines six categories of customizations to establish a differentiated approach. They are:

- Changes in User Interface (UI)
- Reports, Documents and Forms
- Workflows
- Integration to other applications
- Functionality extension
- Modifications of existing functionality

4. The Analytic Hierarchy Process (AHP)

Thomas Saaty, one of the pioneers of Operations Research, directs the research project for Arms Control and Disarmament Agency in the US State Department. Generous budget allows him to recruit some of the world's leading economists and games and utility theory. However, Saaty disappointed in the result of a team effort. Saaty [29] then remember: Two things stand out in my mind from that experience. The first is that the theories and models scientists are often too general and abstract to adapt to the specific needs tradeoff weapons. Difficult for those who are prepared to enter the US position their diverse concerns ... and to come up with practical answers and sharp. The second is that the US position was prepared by a lawyer who has a great understanding of the legal issues, but [that] is not better than the scientists in accessing the value of a weapon system to be traded off.

While teaching at the Wharton School, years later, Saaty was troubled by the communication difficulties he had observed between the scientists and lawyers and by the apparent lack of a practical systematic approach for priority setting and decision making. Then Saaty was motivated to attempt to develop a simple way to help ordinary people make complex decisions. The result was the Analytic Hierarchy Process (AHP) – a synthesis of existing concepts that attests to Saaty’s genius through its power and simplicity.

Many of the world’s leading information technology companies now use AHP in the form of decision models provided by the Gartner Group’s and Decision Drivers. The American Society for Testing and Materials (ASTM) has adopted AHP as a standard practice for multiattribute decision analysis of investments related to buildings and building systems [2]. The AHP process is taught in numerous Universities and used extensively in organizations such as the Central Intelligence Agency that have carefully investigated AHP’s theoretical underpinnings.

This method directs how to determine the priority of a set of alternatives and the relative importance of attributes in a multiple criteria decision making problem, and has been widely discussed in various aspects. For example, Schniederjans and Wilson [32] utilized the AHP method to determine the relative weights of attributes and applied these weights to a goal programming model for IS selection. Lai [16] conducted a case study to select a multimedia authoring system using the AHP method. Teltumbde [39] proposed a framework based on the Nominal Group Technique and AHP to select an ERP system.

![A simple AHP hierarchy](image)
In this study, a systematic procedure is proposed to construct the objective structure taking into account company strategies and thus extract the associated criteria for evaluating ERP system customization methods. This study uses the analytical framework of AHP to synthesize decision makers tangible and intangible measures with respect to numerous competing objectives inherent in ERP system customization method and facilitates the group decision making process.

4.1. AHP applications

Decision situations to which the AHP can be applied include: [9]
1. Choice: The selection of one alternative from a given set of alternatives, usually where there are multiple decision criteria involved.
2. Ranking: Putting a set of alternatives in order from most to least desirable
3. Prioritization: Determining the relative merit of members of a set of alternatives, as opposed to selecting a single one or merely ranking them
4. Resource allocation: Apportioning resources among a set of alternatives
5. Benchmarking: Comparing the processes in one's own organization with those of other best-of-breed organizations
6. Quality management: Dealing with the multidimensional aspects of quality and quality improvement
7. Conflict resolution: Settling disputes between parties with apparently incompatible goals or positions [30]

4.2. AHP procedures

The procedure for using the AHP can be summarized as [28]:
8. Model the problem as a hierarchy containing the decision goal, the alternatives for reaching it, and the criteria for evaluating the alternatives.
9. Establish priorities among the elements of the hierarchy by making a series of judgments based on pairwise comparisons of the elements. For example, when comparing potential purchases of commercial real estate, the investors might say they prefer location over price and price over timing.
10. Synthesize these judgments to yield a set of overall priorities for the hierarchy. This would combine the investors' judgments about location, price and timing for properties A, B, C, and D into overall priorities for each property.
11. Check the consistency of the judgments.
12. Come to a final decision based on the results of this process.

5. Practical example

The proposed framework was applied to ERP system customization method selection at company XYZ, one of project based company in Indonesia. The main business of this company is delivering System Integration, Managed Services and Data Center. Criteria and values of priorities are based on discussion with Business Process Owner of the ERP in the company. On the one hand, the fragmented modules of the existing ERP system limited the company’s operating efficiency, caused much duplication of effort, and confused the business processes. On the other hand, the need to perform day-to-day operation in the highly dynamic business environment put increasingly heavy pressure on the company. In order to maintain its competitiveness, the top management announced the launch of a series of projects including the adoption of an ERP system and the reengineering of the complex business process to enhance the effectiveness of its businesses. In order to achieve the fit of ERP and business needs, customization of ERP is one of the main agenda. This research will analyze 2 methods of customizations:

- Single Vendor customization inside the ERP itself
  This is the common method used by ERP implementer around the world.
- Multi Vendor customization outside the ERP
  According to James Horne [13], In today’s fast-paced, Web-driven world, the choice is no longer which system to implement, but when to implement each. And, as part of their investment decision process, product-developing companies must consider whether to opt for a single-vendor ERP...
system, or to go with ERP and best-of-breed solutions. Most companies in the apparel industry are finding that combining best-of-breed solutions provides the desired visibility, with greater flexibility, and while encouraging greater excellence of execution. This isn’t a common method, but as the experience of the author, this method was suggested to many organizations.

5.1. Model the problem as a hierarchy

As the decision makers continue with the AHP, they will determine priorities for the methods with respect to each of the decision criteria, and priorities for each of the criteria with respect to their importance in reaching the goal.

The priorities will then be combined throughout the hierarchy to give an overall priority for each method. The method with the highest priority will be the most suitable Alternative, and the ratios of the method's priorities will indicate their relative strengths with respect to the Goal.

The Goal is “Choosing the best method for ERP customization”.

The identified criteria to be used in this research are:

- Commonality of demand: During the consulting process, consultant accepts customization because it is necessary for most enterprises and reflects the actual needs of the market throughout the discussion with customer.
- Complexity of demand: The actual needs of organization, fit with the business needs
- Flexible for future enhancement: The methods should be able to be enhanced, whether by IT Department of organization, or other vendor
- Ease to upgrade ERP System: the ERP should be easy to upgrade in the future
- Cost of customization

![Fig. 3. AHP Hierarchy for choosing the best method in ERP customization](image)

5.2. Establish priorities

Priorities are numbers associated with the nodes of an AHP hierarchy. They represent the relative weights of the nodes in any group.

Like probabilities, priorities are absolute numbers between zero and one, without units or dimensions. A node with priority 0.200 has twice the weight in reaching the goal as one with priority 0.100, ten times the weight of one with priority 0.020, and so forth. While the amount entered in each criteria fields are based on score of alternative methods and scale of importance between 1 and 9.

This AHP steps will compare pairs of methods with respect to each criteria. For each comparison, the Business Process Owner decides which method is the weaker with respect to criteria, giving his experience a weight of 1. Then, using the AHP Fundamental Scale, assign a weight in each criteria of the other method.

The comparisons are summarized below. By processing this matrix mathematically, the AHP derives priorities for the methods with respect to criteria. The priorities are measurements of their relative strengths, derived from the judgments of the decision makers as entered into the matrix. These values can be calculated in many ways, including by hand, or with a spreadsheet program, or by using
specialized AHP software. The author uses BPMSG AHP priority calculator [4], and the results are shown below to the right of the matrix, along with an Inconsistency Factor computed by the specialized AHP software that was used to process the data.

Table 1. Alternatives compared with respect to Commonality demand.

<table>
<thead>
<tr>
<th>Commonality of demand</th>
<th>Single Vendor inside</th>
<th>Multi Vendor outside</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Vendor inside</td>
<td>1</td>
<td>3</td>
<td>0.75</td>
</tr>
<tr>
<td>Multi Vendor outside</td>
<td>1/3</td>
<td>1</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Table 2. Alternatives compared with respect to Complexity of demand.

<table>
<thead>
<tr>
<th>Complexity of demand</th>
<th>Single Vendor inside</th>
<th>Multi Vendor outside</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Vendor inside</td>
<td>1</td>
<td>1/9</td>
<td>0.10</td>
</tr>
<tr>
<td>Multi Vendor outside</td>
<td>9</td>
<td>1</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Table 3. Alternatives compared with respect to Flexibility.

<table>
<thead>
<tr>
<th>Flexibility</th>
<th>Single Vendor inside</th>
<th>Multi Vendor outside</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Vendor inside</td>
<td>1</td>
<td>1/7</td>
<td>0.125</td>
</tr>
<tr>
<td>Multi Vendor outside</td>
<td>7</td>
<td>1</td>
<td>0.875</td>
</tr>
</tbody>
</table>

Table 4. Alternatives compared with respect to Ease of ERP Upgrade.

<table>
<thead>
<tr>
<th>Ease of ERP Upgrade</th>
<th>Single Vendor inside</th>
<th>Multi Vendor outside</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Vendor inside</td>
<td>1</td>
<td>1/9</td>
<td>0.10</td>
</tr>
<tr>
<td>Multi Vendor outside</td>
<td>9</td>
<td>1</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Table 5. Alternatives compared with respect to Cost of customization.

<table>
<thead>
<tr>
<th>Cost of customization</th>
<th>Single Vendor inside</th>
<th>Multi Vendor outside</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Vendor inside</td>
<td>1</td>
<td>1/3</td>
<td>0.25</td>
</tr>
<tr>
<td>Multi Vendor outside</td>
<td>3</td>
<td>1</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Table 6. Criteria vs the Goal

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Commonality of demand</th>
<th>Complexity of demand</th>
<th>Flexibility</th>
<th>Ease of ERP Upgrade</th>
<th>Cost of customization</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commonality of demand</td>
<td>1</td>
<td>1/5</td>
<td>1/6</td>
<td>1/4</td>
<td>1/4</td>
<td>0.045</td>
</tr>
<tr>
<td>Complexity of demand</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>1/2</td>
<td>4</td>
<td>0.318</td>
</tr>
<tr>
<td>Flexibility</td>
<td>6</td>
<td>1/3</td>
<td>1</td>
<td>1/2</td>
<td>4</td>
<td>0.211</td>
</tr>
<tr>
<td>Ease of ERP Upgrade</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0.320</td>
</tr>
<tr>
<td>Cost of customization</td>
<td>4</td>
<td>1/4</td>
<td>1/4</td>
<td>1/2</td>
<td>1</td>
<td>0.105</td>
</tr>
</tbody>
</table>

5.3. Synthesizing priorities

The calculations about priorities of alternatives with respect to the goal are as follows. This is a straightforward matter of multiplying and adding, carried out over the whole of the hierarchy.

Table 7. Calculation

<table>
<thead>
<tr>
<th>Criteria</th>
<th>vs Goal</th>
<th>Alternative</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commonality of demand</td>
<td>0.045</td>
<td>Single Vendor Inside</td>
<td>0.75</td>
<td>x</td>
<td>0.045</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multi Vendor Outside</td>
<td>0.25</td>
<td>x</td>
<td>0.045</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity of demand</td>
<td>0.318</td>
<td>Single Vendor Inside</td>
<td>0.10</td>
<td>x</td>
<td>0.318</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multi Vendor Outside</td>
<td>0.90</td>
<td>x</td>
<td>0.318</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Column A shows the priority of this Alternative with respect to these Criteria. Column B shows the priority of these Criteria with respect to the Goal. Column C shows the product of the two, which is the global priority of this Alternative with respect to the Goal. Here are overall priorities for all of the alternatives:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Commonality of demand</th>
<th>Complexity of demand</th>
<th>Flexibility</th>
<th>Ease of ERP Upgrade</th>
<th>Cost of customization</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Vendor Inside</td>
<td>0.033</td>
<td>0.032</td>
<td>0.026</td>
<td>0.032</td>
<td>0.026</td>
<td>0.149</td>
</tr>
<tr>
<td>Multi Vendor Outside</td>
<td>0.012</td>
<td>0.286</td>
<td>0.185</td>
<td>0.288</td>
<td>0.079</td>
<td>0.850</td>
</tr>
<tr>
<td>Total</td>
<td>0.045</td>
<td>0.318</td>
<td>0.211</td>
<td>0.320</td>
<td>0.105</td>
<td>1.000</td>
</tr>
</tbody>
</table>

5.4. Decision

Based on the Business Process Owner's choice of decision criteria, on their judgments about the relative importance of each, and on their judgments about each methods with respect to each of the criteria, Multi Vendor Outside, with a priority of 0.850, is by far the most suitable approach. The organization should choose Multi Vendor Outside as the ERP customization method.

Because the use of the AHP, it is easy to trace criteria and to justify the steps along the way to the decision. If the organization have second thoughts about the final outcome, then it could be revisited the process and make changes if appropriate. And if the organization choose to, it can reveal the details of the process to the consultants and the shareholders, or to anyone else who might be concerned with the decision.

6. Conclusions

This research presents a comprehensive framework for selecting a suitable method for customizing ERP system based on an AHP-based decision analysis process. The proposed procedure allows organizations to identify the criteria of method selection and formulate the fundamental objective hierarchy.

The proposed comprehensive ERP customization method selection framework has the following advantages:

- It ensures that the structure of objectives is consistent with corporate goals and strategies.
- The approach is flexible enough to incorporate extra criteria or decision makers in the evaluation. Notably, the proposed framework can accelerate the reaching of consensus among multiple decision makers.
- The approach systematically assesses organization’s criteria and guidance based on the organization’s goals and strategic development. It can not only reduce costs during the selection phase, but also mitigate the resistance and invisible costs in the future.
- In case of unique business processes in other organizations, the criteria may differ from what this research was chosen. But the framework is easy to use in many kinds of criteria chosen by the organization.

Since the multi vendor customization outside the ERP system itself still less prestige than the big name of single vendor of ERP system, organizations should use this methods if they confident about
the criteria mentioned above. So, let the ERP system remains standard, this will give an advantage when upgrading is needed in the future. According to the research result, this is the most recommended method to get the best choice between the two.

References


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