

The Extent of ERP Customization towards User Satisfaction in Daily Operation for Manufacturing Companies

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Abstract—Study to explore the effect of customization towards user satisfaction in the daily operation of ERP system .Study carried out in four manufacturing companies. In-depth interviews and surveys used to measure the user satisfaction in the manufacturing companies. The results reveal that exceeding certain level of customization complexity index would reduce the user satisfaction level towards the ERP system operation.

Index Terms—enterprise resource planning; erp; customization; manufacturing; customization complexity index

I. INTRODUCTION

Enterprise Resource Planning (ERP) has been widely implemented in industry as the key to integrate and optimize business processes in corporations [1]. The ability of ERP to fulfil the need of business process is the result of ERP evolution. In fact, ERP is a packaged software that designed by following the best practice from specific industry to support typical business process in the entire industrial field [2]. It was designed by ERP developer and used by the organizations which implement it. Since the designer and user are two independent entity, misalignment between users need and the software design are often happened [3]. The gap between functionality of the package and the organization's requirement has happened all the time [4].

In order to avoid the gap, organization performs customization, a process that performs modification to the standard rules of ERP package. Customization has become one of the most important steps in implementing

ERP in order to align the system functionality with the user requirement. ERP customization refers to the modification of the ERP package or its functionality, it may include modifications to user interfaces, reports, messages or even program codes [5], [6]. As its importance is recognized, the need of customization has been highlighted by many researchers in ERP implementation research [7-10].

On the other hand, many researchers also suspected that customization is one of the reasons for ERP implementation failure. B.Light [11] reported that the increased customization complexity will amplify maintenance efforts. Customization can also increase the risks and cost of maintenance while it creates difficulties for further development [12] of the ERP system. To ensure the system work properly in longer time horizon researchers [7-10] suggest that customization in an ERP system has to be kept to minimum as possible. A.Yokota and K. Yasuda [9] clarified that the basic version of ERP with no or minimal customization is a category of ERP critical success factors. While M. N. V. Kumar [13] recommended maximum amount of 30% as the limit of customization level to guaranty the success of ERP implementation. However, without an adequate explanation, the extent of customization is still remained unclear.

F. Arif [3] stated that ERP customizations have contradictory implications. From the daily operation perspectives customization must be made in maximum level to satisfy users' need. However, it brings negatives implication regarding the cost, risk of implementation and maintainability of the systems. Therefore, customization can be seen as a tradeoff between the ease of use and its maintainability. Since availability and reliability of the system can be investigated through the user satisfaction about the system, this study tried to

illustrate the extent of customization in relation to the user satisfaction using case studies in four manufacturing companies.

II. LITERATURE REVIEW

A. ERP customization

ERP customization refers to the modification of the ERP package or its functionality, it may include modifications to user interfaces, reports, messages or even program codes [2], [12]. This activity is usually taken in ERP implementation as an effort to align the system with the specific need. Therefore, this activity has been considered within various implementation models.

Past researches in ERP [7-9] highlighted the customization as an integral part of implementation although it was named differently. In the six-stage ERP implementation model [7], customization takes place in adaptation stage. It was clearly stated that organization need to customize their ERP package to suit their specific requirement. In this model, customization was finished when the system are available for the end users.

Five-stage implementation model [9] describes customization as the part of realization whereas technical development and conference room pilot project take places. In this stage, they suggested technical development (modification, interfacing and data conversion) to work concurrently with conference room pilot project (prototyping and final adjustment). Similarly, three-stage implementation model [8] set apart the customization in the stage of realization which they called implementation stage. Nevertheless, at the end they found that customization has to be made minimally to ensure the system will work properly in longer time horizon.

In the real world, organization made various ERP customizations due to different requirement therefore customization then become one of the distinctive parameter to define the ERP implementation characteristics [6], [14]. As an implication, there were various types and amount of customizations have been done. Even though many studies [13-18] suggested the minimum customization to implement ERP successfully, the degree of customization was still unclear.

A.S. Ehsary [2] tried to formulate the customization matrix that can be used in real world practice. Data collected from few companies on modified objects and their development time range. Modified objects were categorised into several types of customization such as reports, interfaces, Extensions, conversions and workflows while development time ranges were classified into three classes as simple, medium and complex to represent their complexities. For each class in every types of customization, the range of development time, average and standard deviation were calculated. Finally, the complexity indices were defined using the average of development time. Entire complexity indices are provided in **Error! Reference source not found.**

TABLE I. CUSTOMIZATION COMPLEXITY MATRIX [2]

Customization types	Complexity			
	Simple	Medium	Complex	Very complex
Reports	0< dt≤ 56	56< dt≤ 84	84< dt ≤ 157	157< dt
	i = 31	i = 66	i = 121	i = 292
Interfaces	0< dt≤ 44	44< dt≤ 166	166< dt	-
	i = 33	i = 66	i = 213	
Extensions	0< dt≤ 44	44< dt≤ 103	103< dt≤ 227	227< dt
	i = 21	i = 65	i = 179	i = 281
Conversions	0< dt≤ 90	90< dt≤ 212	212< dt	-
	i = 56	i = 124	i = 300	
Workflows	0< dt≤ 57	57< dt≤ 71	71< dt	-
	i = 49	i = 64	i = 77	

dt = development time (hour)
i = complexity index

The Degree Of Customization(DOC) or customization complexity index [2] is the sum of all the complexity indices. Suppose that for a system s there are N customizations, the DOC can be calculated as follows:

$$DOC = \sum_{i=1}^N CI_i$$

Where CI_i is the complexity index of the i-th customization.

B. User satisfaction to ERP system

In information system context, quality consists of two different dimensions which are system quality and information quality. ERP is not an exception; it also has inherent quality in it. The success of ERP implementation basically can be measured by assessing its quality. In specific, Z. Zhang [19] explain that ERP quality consists of dimension of flexibility of the system, reliability, ease of use, usefulness of specific function and response time.

Quality is something that user can perceive, quality level can be measured through user perception about the system. In ERP, quality, as one indicator of successful implementation, can be measured by measuring user satisfaction level. According to reference [19] ERP user satisfaction measurement is more appropriate to measure the success of ERP implementation rather than to measure the information system quality. They claimed that in the context of ERP system implementation, the user satisfaction measure concerns overall satisfaction and specifics satisfaction.

Considering ERP customization has contradictory implication to the successful ERP implementation and user satisfaction is an indicator of ERP success, it will be valuable if the relationships are clearly examined. By comparing the level of customization to the level of user satisfaction, it can be expected the proper amount of customization allowed.

III. METHODOLOGY

The purpose of this study is to measure the extent of ERP customization to ensure the high level of user satisfaction. To make it happen, this study conducted two surveys in 4 sample companies. For the confidential reason the name or sample companies are replaced by C1, C2, C3 and C4. The objective of first survey is to assess the level of customization in each company, while the objective of second survey was to measure the level of user satisfaction. The first survey involved the ERP expert and the second survey involved ERP users in each company.

In the first survey, an in depth interview with ERP expert carried out to find out various customizations made. These experts were asked to fill in the questionnaires and asked to explain the customization made in their companies. They were requested to describe and show the evidence of custom reports, interfaces, extensions, conversions, workflows item they developed including their development time. This information were then being measured using ERP customization complexity matrix [2] so that the level of customization in each company is known.

The second surveys were conducted by distributing questionnaires to the ERP user to find out their perception about the ERP system. According to reference [19] user satisfaction consist of:

- Availability of information when it was needed
- The ease of retrieving information when it was needed
- The accuracy of information.

In this study, ERP users were asked to give their perception about the three categories above. This study used 5-scale close-ended questionnaires. ERP users were asked to answer each question with the number 1 until 5, which 1 means very low and 5 means very high.

IV. ERP CUSTOMIZATION

From the surveys, it was found that the studied company did different customization. They modified different items and also different amount of them. C1 only made customization on reports. C2 made customization on reports, interfaces, conversions and workflows. C3 and C4 made customization on reports, interfaces, extension and conversions. To make it clear, the limitation of custom items describe as below:

- Reports here refer to custom developed reports and not the standard report that comes with the packaged software
- An interface defines the data and operations of an application or internal or external component that uses it interact with to applications/components.
- Extension is a modification to the functionality of the packaged software application, beyond what is done via configuration. It is performed by adding or modifying the code of the packaged software
- The conversion of data from the current format to the structure required by the new application. A

conversion can be performed via an automated program or can be completed manually

- Workflow is the sequential flows of task and information in a business process

The complexity of customization can be measured using by summing up the complexity indexes as shown in **Error! Reference source not found.** C1 developed more than 100 custom reports with a development time of more than 158 hours. The customization complexity index for C1 is 292 as shown in Table II.

TABLE II LIST OF CUSTOMIZATION IN C1

Custom Item	Amount	Duration	Index
Report	>100	>158	292
Interface			
Extension			
Conversion			
Workflow			
customization complexity index			292

Custom item list in C2 is shown in Table III, C3 in Table IV, and C4 in Table V.

TABLE III LIST OF CUSTOMIZATION IN C2

Custom Item	Amount	Duration	Index
Report	200	57-84	66
Interface	10	45-166	66
Extension			
Conversion	10	>213	300
Workflow	2	>72	77
customization complexity index			509

TABLE IV LIST OF CUSTOMIZATION IN C3

Custom Item	Amount	Duration	Index
Report	>200	85-157	121
Interface	30	>167	213
Extension			
Conversion		>213	300
Workflow			
customization complexity index			634

TABLE V LIST OF CUSTOMIZATION IN C4

Custom Item	Amount	Duration	Index
Report		85-157	121
Interface		>167	213
Extension		104-227	179
Conversion		91-212	124
Workflow			
customization complexity index			637

The extents of customization in all the studied companies are different from each other. It can be seen from the value of degree of customization in every company. Very few customizations were made in C1 with customization complexity index of 292. A major customization is made by C4 with index of 637. The order of amount of customization for the studied companies from the smallest to largest is C1, C2, C3 and C4 with a customization complexity index of 292, 509,

634 and 637 respectively. Comparison of customization complexity index is shown in Figure 1.

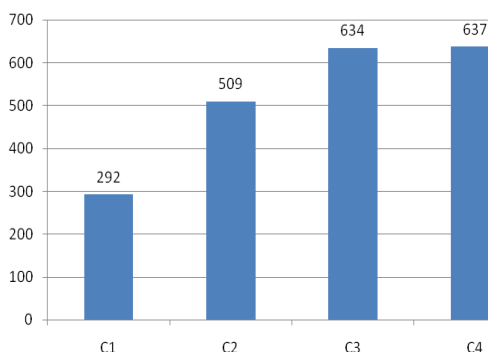


Figure 1 Comparison of customization complexity index in studied companies

C. User Perception to ERP

Beside customization level, this study also assessed the level of user satisfaction on the ERP customization. There are 3 aspects of user perception explored in this study. First, availability of information when it is needed. Second, the ease of retrieving information when it needed and third the accuracy of information. Surveys were conducted among more than 20 ERP users in each company. The result is shown in Table VI.

TABLE VI ERP USERS SATISFACTION

Item	C1	C2	C3	C4	Std dev
Availability of information when it needed	4.3	5.0	4.0	4.5	0.42
The ease of retrieving information when it needed	3.7	4.5	3.6	3.8	0.41
The accuracy of information	2.3	4.0	3.6	3.8	0.75
Overall satisfaction	3.4	4.5	3.8	4.0	0.45

In term of the availability of information, ERP users in C3 recorded to have the lowest availability of information whereas users in C2 were found the highest level of information availability. It means that in C2, users can always get information as they need it. For the ease of information retrieval from system, founded that users in C2 had the highest level while C3 had the lowest level. The results shows that users in C2 can get information easily when they need, while in C3 it is not that easy. For these two aspects, even though the levels are varying, but not too much different. The standard deviation is indicated it.

User satisfaction towards the accuracy of information, is also differ among companies studied. The standard deviation is relatively high compare to the first two aspects. C1 had the lowest level of accuracy. It is indicated that information in C1 is not accurate. Users perceive that they did not get accurate information as their needed.

D. The effect of ERP Customization to User Satisfaction

The studied companies have recorded various level of customization as shown in Figure 1. Similarly, ERP users in these companies also recorded various level of satisfaction as shown in Table VI. Considering that fact, Figure 2 shows the relationship between the user satisfaction and complexity index degree of customization.

As depicted in Figure 2, C1 with a customization complexity index of 292 recorded the lowest satisfaction level in the accuracy of information when it needed. In term of the availability of information and the ease in retrieving information, C3 which recorded a degree of customization index of 634 recorded the lowest level of satisfaction.

It also can be seen in Figure 2, that the customization complexity is not aligned with user satisfaction. Higher level of customization does not resulted in higher level of user satisfaction. To a certain extent, customization can increase user satisfaction. In this study, the customization with index of 509 provides the highest level of all aspects of user satisfaction. However, when the level of customization complexity was increased exceeding the index of 509, the levels of user satisfactions started to decrease.

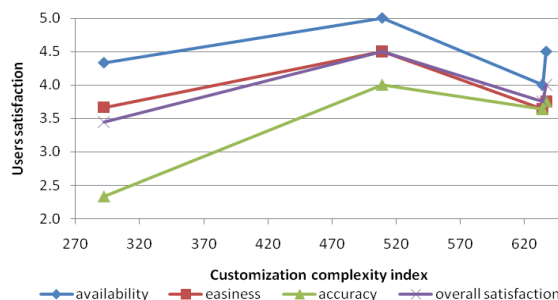


Figure 2 Relationship between customization complexity index and user satisfaction in studied companies

Higher customization can provide better satisfaction to the user but too complex customization can bring negative implication. This study found that in some extent of customization, the availability of system is decreased. It appears that too complex customization needs more frequent maintenance cause the availability of the system to decrease. Too complex customization also made users more difficult to retrieve information that they need from the system.

V. CONCLUSION

Customization as a part of ERP implementation was believed as one of important factor for implementation success. In this study, researcher found that small number of customization resulted low user satisfaction as some of user requirement cannot be covered or fulfilled. However too many customization also cause negative implication in term of system complexity. More complex system needs more frequent maintenance activities that lead to system unavailability. Amount of customization is

a trade off between fulfilment of user requirement and system maintainability.

Even though this study reveals that customization complexity index of 509 give a maximum level of satisfaction, since this study is a snapshot case study, the result cannot be generalized. More comprehensive study with bigger sample number is needed for better generalization.

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