The Study on Evaluation System and Method of Legacy System

Chao Qi, Fuyang Peng, Bo Deng , Xiaoyan Su

Abstract—In the upgrade process of enterprise information systems, how to deal with and utilize those legacy systems affects the efficiency of construction and development of the new system. We propose an evaluation system, which comprehensively describes the capacity of legacy information systems in five aspects. Then we propose a practical legacy systems evaluation method. Base on the evaluation result, we can determine the current state of legacy system which was evaluated.

Keywords—Legacy Information Systems, Evaluation Index System, Evaluation Method, Evaluation Level

I. INTRODUCTION

AT present, with the rapid development of computer technology, many enterprises need to rebuild their enterprise information systems because of business development and market competition pressure. In the process of upgrading, how to deal with and utilize those legacy systems affects the efficiency of construction and development of the new system.

Legacy system evaluation is the basement of the legacy system transformation, the purpose of the evaluation is to have a comprehensive understanding of the legacy system, the result can be used as a basis for the selection of the legacy system treatment approach.

II. EVALUATION LEVEL OF LEGACY SYSTEM

Evaluation level is divided into two levels, summary level and detailed level. In summary level evaluation, the legacy system is looks as a whole, its ability is evaluated, qualitative methods are usually adopted to determine their level of ability [1]. In Detailed level evaluation, the legacy system is divided into several components, every component's ability is evaluated respectively, the analysis is very time-consuming, and demanding on more experience of the person who evaluates the system [2]. So we choose summary level to evaluate the legacy systems.

III. EVALUATION INDEX SYSTEM

Legacey system is composed of software, hardware, data, personnel, business processes and other factors, it is a man-machine system with social and technical factors[3]. The

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evaluation index system should be a system that can objectively reflect the overall situation and characteristics of the legacy system, and it also should be a collection of indexes, all the indexes in it are intrinsically linked and complementary.

The development of the evaluation indexes depends on the information source which reflects the characteristics and conditions of the legacy system. We can get information sources from the following three aspects:

1)The system itself, including source code, user manuals and operating systems.

2)The system-related experience and the system understanding hold by system users, maintenance personnel and the developers.

3)The error reporting and system maintenance log of the legacy system. Through the analysis of the system maintenance history, we can deepen understanding of the legacy system.

Through high-level summary, we establish a relatively complete evaluation system that can describe the characteristics of legacy systems, shown in Figure 1.

In order to facilitate data collection and analysis, we evaluate legacy systems from the following five aspects :

A. Business Value

Business value of legacy systems show the importance of enterprises business.

B. Hardware support environment

Hardware support environment reflects the quality attributes of the system hardware.

C. Software Support Environment

Software support environment includes: operate system, database, transaction processing program, compilers, networking software, application software development tools, and so on.

D. Application Software

Application software is quite different from support software. Support software is developed by the professional development organization to provide a good environment for the application software. Application software has a wider scope of application. Application software is targeted at the specific needs of businesses in a special territorial.

E. Infrastructure

Infrastructure reflects the state of development, maintenance and operation of the enterprise legacy systems. The result shows the bearing capacity of the enterprise for transplant.

Legacy System Evaluation Index System

Business Value
Match degree of demand
Support ability of information demand
Degree of specialization

Infrastructure
System development approach
Development organizations
Technology maturity of development organization
Training system
Technology Level of support staff

Hardware support environment
System failure rate
System life
Functional maturity
Performance Satisfaction
Support situation of vendor
Maintenance costs

Software support environment
System failure rate
Frequency of the system upgrade
Degree of functional
Performance Satisfaction
Hardware-dependent level
Technology level of support staff
Vendor stability
Maintenance costs

Application software
System failure rate
Degradation degree of development tools
Well-documented level
External dependence
System Security
Structural complexity of the system
Level of data standardization
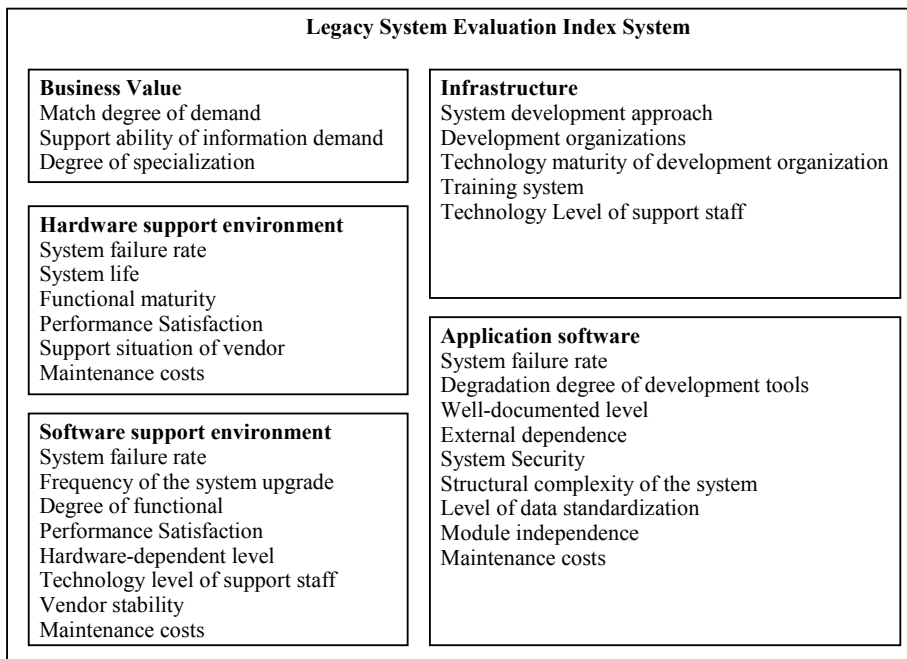Module independence
Maintenance costs

Fig. 1 Legacy System Evaluation Index System

For a legacy system, the final evaluation result is a comprehensive result which is came from the evaluation result of each index. So, in order to determine the overall evaluation results, we accurately evaluate each index, and must carefully examine the relationship among the indexes.

IV. EVALUATION IMPLEMENTATION

A. Hardware Support Environment Evaluation

Through an example, hardware support environment evaluation, the evaluation procedure and method are introduced.

System hardware includes a number of hardware which needs routine maintenance, maybe located in a site, or distributed in a number of sites connected by a network. In general, the legacy system's hardware includes clients, servers, storages, printers and network equipment [4]. Network equipment is usually looked as a kind of auxiliary equipment, and is not included in this evaluation. The contents of hardware support environment includes: clients, servers, storages and printers. The hardware support environment indexes are: system failure rate(SFT), system life(SL), functional maturity level(FM), performance satisfaction level(PS), support situation of vendor(SSV) , maintenance costs(MC). Evaluation level is the outline level.

Specific evaluation method is shown as follows: for a kind of hardware, each indexes is assigned a score (values 1-4), then to work out the score of this hardware, all scores are added together.

Here, for example, we show in details that how to get the score of situation of vendor support. The scores of other indexes in the evaluation index system can get in the same way.

1) If the hardware ventors have closed down, the scor can only take the value 1.

2) If the hardware ventors has closed down, but there are a third-party supporter exists, the score can take value 2.

3) If the vendor still exists, but its future is uncertain, the score can take value 3.

4) If the vendor exists, and its development can be fully guaranteed, the score can take value 4. In this way, we can get hardware support environment evaluation matrix, as shown in Table 1.

TABLE I
HARDWARE SUPPORT ENVIRONMENT EVALUATION MATRIX

	SFT	SL	FM	PS	SSV	MC
clients	A11	A12	A13	A14	A15	A16
servers	A21	A22	A23	A24	A25	A26
storages	A31	A32	A33	A34	A35	A36
printers	A41	A42	A43	A44	A45	A46

The total score of hardware support environment is worked out as follows:

$$ORH = \sum_{i=1}^{n} P_i \sum_{j=1}^{m} A_{ij} \qquad (1)$$

In equation (1), n is the number of hardware evaluated_items, m is the number of indexes of each hardware, $1 \leq A_{ij} \leq 4$ is the score of index i, item j, P_i is the weight coefficient of index i.

$$ORH_i \sum_{j=1}^{m} A_{ij} \qquad (2)$$

Equation (2) is the total score of evaluated item i. If the score of an evaluated item is less than m * 4 / 2, it shows that the evaluated item need to be upgraded or modified.

The evaluation matrixes of Business value, software support environment, application software, infrastructure can be created as the same as hardware support environment evaluation matrix, all the indexes of them are described in Table 1. The value and the weight of each index dependents on the actual situation of the legacy systems.

B. Evaluation Result

The scores get by the evaluation matrix of hardware support environment, software support environment, software applications and infrastructure reflect the technical factors in current state, the weighted average of the matrixes represents the technical level of the legacy system. The equation is as follows:

$$OR = \frac{P_1 * ORH + P_2 ORS + P_3 * ORA + P_4 OAF}{4} \quad (3)$$

In equation (3), ORH is the evaluation value of hardware support environment, ORS is evaluation value of software support environment, ORA is evaluation value of application software, OAF is evaluation value infrastructure, P_i ($1 \leq i \leq 4$) are their weights respectively.

Comparing the score of the technology level to the score of business value, we can get the comprehensive evaluation results of the legacy system. Based on the relative size of the scores get from technical level and business value, we divided the space into four areas, and the results of the legacy software evaluation is divided into four categories [5], shown in Figure 2.
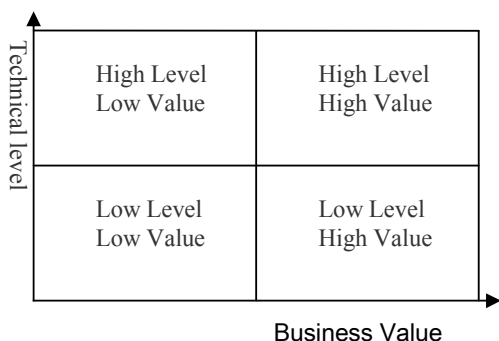

Fig. 2 Analysis of Evaluation Result

Based on score of technical level and business value, we can determine the location of the legacy system:

1) "Low Value, Low Level" area. Operation cost of the legacy system is high, but the return is low.

2) "High Value, Low Level" area. The business value of the legacy system is high, but the functionality or performance is poor.

3) "Low Value, High Level" area. Business contribution of the legacy system is small, and the maintenance cost is low.

4) "High Value, High Level" area. The legacy system is well-functioning.

V. SUMMARY AND FUTURE WORK

The evaluation index system and evaluation method of legacy system have been studied. We propose a practical evaluation index system, in which the capacity of a legacy information system is comprehensively described. It is a universal evaluation index system. The evaluation does not involve technical details, so the evaluation system applies to both stand-alone mode legacy systems and distributed legacy systems. It also applies to the SOA legacy systems. Data processing of each index is easier. By analyzing the data, we can develop value grade and uniform calculation method for each index.

Then we propose a practical evaluation method for legacy systems. It can evaluate each index in the evaluation index system, and then calculate the final score which can show the current state of legacy systems. For summary evaluation level of legacy systems, this evaluation method is easy to operate. The weight coefficients obtained mainly by Delphi method and Analytic Hierarchy Process[6].

Our future work will be the transplant strategies and methods based on the evaluation result of legacy information systems, especially the evolution of the legacy systems that is located in "High Value, Low Level" area and "Low Value, High Level" area.

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