WSR Approach to Evaluation Support for Commercial Integration System [*]

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ABSTRACT

In this paper, we present the application of an oriental *Wu-li Shi-li Ren-li* (WSR) system approach to an evaluation project of commercial automation integration system. In aim to facilitate the healthy development of commercial information system (CIS), the Chinese government invested more than RMB 17 million *yuan* (about US$ 2 million) to foster appropriate development of automation system at retailing stores to set examples around the nation. Among this large project, there is a subproject for the evaluation of the other subprojects and pilot retailing units. Multi-institution, multi-objective and interdisciplinary people made it important to have a harmony coordination within the whole project and also to reflect various evaluation of the commercial automation development projects in China. WSR system approach is applied to building an appropriate framework of evaluation index and coordinating the work with pilot retailing units. Here we discuss how to build conceptual model for CIS evaluation and how to solve the CIS evaluation problem. Problems in practising evaluation are analyzed.

Key Words. *Wu-li Shi-li Ren-li* system approach, information system evaluation, commerce

1 BACKGROUND

Along with the global reforms in commerce and trade brought by advances in computer industry, both commercial institutions and governmental departments invest heavily in information technologies (IT) in China. To avoid large investment waste, to facilitate the effective IT applications and to bridge the gap between IT professionals and commerce people, the State Planning Commission (SPC, before 1998) started a major key project whose focus was on the computer technology integration for commercial automation in 1996. This project was a major large project which was funded more than RMB 17 million *yuan* (up to US$ 2 million) during the national 9th Five-Year Developing Period. At the whole project, one subproject is to study how to achieve comprehensive evaluation of the integrative commercial information systems (CIS) and practice in some pilot units around the country. The principal tasks of this project are: (1) to provide an integrated index framework for synthetic evaluation of commercial automation; (2) to value indices; (3) to select suitable methods for evaluation; (4) to design computer-based evaluation system; and (5) to apply the research result to some pilot commercial stores. The Popularization Center of Commercial Electronic Technology (PCCET) and Institute of Systems Science (ISS), affiliated respectively with Ministry of Internal Trade (MIT, before 1998) and Chinese Academy of Sciences (CAS) undertook the sub-project since 1997. Pilot units were selected according to their business operation

states. Those pilot stores had successful achievements in IT application for their business. To fulfill Task (5), PCEET and ISS people have to cooperate with those pilots closely so as to acquire real data. Table 1 lists the 7 pilot stores and their relevant information system developers, where (a), (b), (c), and (g) represent large and middle scale stores, (d), (e) and (f) belong to chains stores. Such a classification of retailing operation states is a research result by another sub-project of the same large project and is the basis to distinguish any retailing units by their operating state in China.

Table 1 Retailing pilots of information systems and their IS developers

Operating States	Retailing Pilots and their IS Developers
(a) shopping centers	Shanghai No. 6 Department Stores; Shanghai Asia-Pacific Computers Technology Limited Company
(b) department stores	Xidan Department Stores; Xidan Silver Stars Computers Company
(c) hyper market	Beijing Wangfujin Department Stores, China Software and Services Group
(d) supermarket	Duoguan Meijia Super Market Group; JingYue Computers Information Systems Company
(e) specialty stores	Shanghai Kaikai Groups, Shanghai High and New Technology Development Company
(f) convenience stores	Beijing ChaoYang Grocery Group; Beijing University Jade-Bird Commercial Information System Limited Company
(g) fresh and perishable goods stores	Shanghai Baxian Super Market Company; Shanghai High and New Technology Development Company

The complicated organization of this subproject brings different disciplinary practitioners including systems engineering experts, commerce and trade researchers and managers, IT professional, and CIS practitioners together. The differences in disciplines, views about commerce development and IT applications, and roles in practice brought a variety of views about CIS. For comprehensive evaluation of CIS, an oriental *Wu-li Shi-li Ren-li* (WSR) system approach is applied in the project.

Formally proposed by Gu and Zhu (1995) in the end of 1994, WSR system approach reflects a general thinking in dealing with practical issues based on oriental philosophy. System practice activities are constituted by the dynamic unification of physical world (object of *Wu-li*), system organization (object of *Shi-li*) and humans (object of *Ren-li*). It is better to aim to connect *Wu-li*, *Shi-li* and *Ren-li* in order to get a comprehensive scenario of what is concerned, and then to find a satisfactory and feasible result. When applying WSR approach, we emphasize on **knowing *Wu-li*, sensing *Shi-li*** and **caring *Ren-li*.**

Gu, et al. (1998) had discussed basic ideas of WSR system approach to this project.

After brief review of those ideas, we address the design and technical solution of comprehensive CIS evaluation. Finally, problems in evaluation practice are analyzed.

2 BUILDING CONCEPTUAL MODEL OF CIS

2.1 WSR Approach to the Evaluation Project

Three goals were designed to be achieved in this project by ISS people's proposal. Firstly, to build an integrative index framework for comprehensive CIS evaluation served as a conceptual model of CIS. Secondly, the framework has to be fit for China situation and accepted by both MIT and SPC people. Thirdly, people from pilot units and their CIS developers also can accept such a model.

The working process in this project is taking a variety of surveys, conducting field investigation, formulating the index framework, designing evaluation process and developing a specific computerized system for evaluation tasks. Many indices had been collected by document, experts, Internet surveys and field investigations. Most of those indices are on computer system, only a small part is about the system's users and organizational environments. For example, *throughput* is an important performance index for computer networking system, but it is not on CIS analytical capabilities or problem solving. Only in recent years, attentions began to transferred to CIS quality, human and organizational factors directly relevant to an IS in an organization. Some evaluation index framework had been forwarded and applied (Sage, 1991; DeLone and McLean, 1992; Myers, Kappelman & Prybutok, 1997). Similar considerations had been taken among those conceptual models, such as service quality, individual, work group and organizations impacts, etc. When carrying out the project, we also trace the progress of one subproject which engages in standardization of commercial data at the whole large project. Their results are the indices for data organization in a CIS, which also has to be absorbed into the index framework. We also face-to-face consulted some foreign experts and scolars in Japan, USA and UK on IS evaluations.

In order to achieve three goals, we conduct CATWOE analysis so as to have a right imagine of the whole project and care right *Ren-li*. A mnemonic term formed by Checkland (1981), CATWOE (*customers, actors, transformation, weltanschauung, owners, environmen*t constraints) analysis aims to consider multiple actors and their interaction with the concerned system and the environments, and is helpful to understand different indices and different viewpoints of those interviewees. Here the *owners* of the sub-project were the head people of the whole project, i.e. SPC, MIT and PCCET; the *actors* were the researchers from PCCET and ISS; the *customers* referred to MIT, and those pilot units. As to the *environment* constraints, attentions were given to the trends of interior commerce, such as larger scales marketing, the combination of centralization and distributed operation, store chains trend, e-information popularization, and the operation and management modernization for the sake of global competition, together with the international and national standards. The *transformations* indicated to achieve solutions to an appropriate index framework and appropriate evaluation methods based on current CIS development situations in China, and to keep the solutions feasible, firstly at those pilot stores. Such results could only be achieved with consideration to the global economy trends and the necessities to facing those challenges. Factors, such as e-business trend, socioeconomic development and reforms, were also concerned, which reflected the *weltanschauung* in the sub-project research. Moreover, culture analysis was

in consideration when to build the index framework for operable evaluation, since pilot stores were distributed around the south, east and north regions of China. The aim of *Ren-li* is to facilitate the *actors* to understand the desires of *owners* and *customers*, to encourage the initiative, enthusiasm and participation of the *actors*, *customers* and *owners*, and to explore their potentials through collaborative work.

Opinions from different owners and customers at different levels denoted different concerns. Senior managers usually focused on the benefits brought by investing an CIS, which could be identified as system functions, such as merchandising monitoring, having feedback of solving the problems existed in managerial operation, further analysis of the sales data and the impact to the development of the enterprises, etc. The computer system managers concerned more of the computer network system itself, such as system performance. Usually, managers paid more attentions to the system performance in reflecting their control and operation of the organizations; while IT professionals and computer system end-users cared more technological issues. The gap between them could be strongly sensed at field investigations. How to coordinate those different views was a hard task in formulating the index system for evaluation. Four principles were followed: objectiveness, systemic structure, development constraints, and multiple views.

Considerations of three aspects (*Wu-li, Shi-li* and *Ren-li*) resulted in a comprehensive scenario of CIS and multi-view of the evaluation issue, which could serve as the integrative index framework for evaluating the CISs at pilot stores and providing a satisfactory and feasible result for the sector managers. Next is a simple description of the framework as shown in Figure 1.
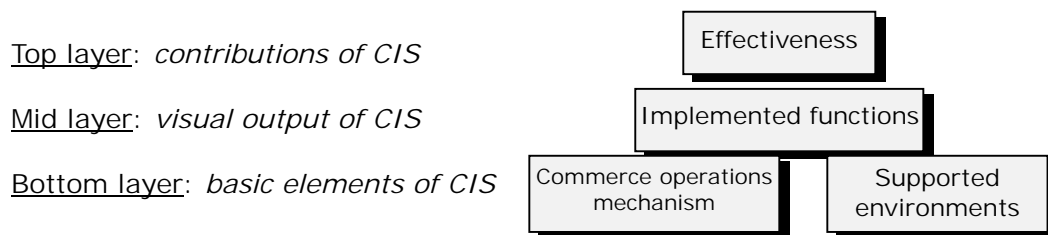
Top layer: *contributions of CIS*

Mid layer: *visual output of CIS*

Bottom layer: *basic elements of CIS*

Figure 1. The outline of index system structure

2.2 The Integrative Index Framework for Evaluation

The basic, functional and developmental elements of a CIS for a commercial organization are placed bottom-up into the framework. Three layers can be also understood as the general considerations of the investment of a CIS, *input*, *output* and *outcome*. W*hat kind of factors will be considered in building a CIS*? *What kind of information a CIS should produce for its final users*? *What kinds of effects and impacts the CIS will be and are having? To what extent*? And so on.

That the bottom layer is often more emphasized during a CIS development indicates the technological view of CIS where commercial characteristics, and impacts to the development of the enterprises, the sector and the society are seldom considered. Top-layer indicators may be achieved technologically, but is difficult to be practically acquired due to environment constraints, especially from governmental and departmental policies. Then trade-off exists in identifying the indicators regarding the technological development and feasibility in China. Figure 2 depicts the logic structure and first-level measures of the index framework after four large revisions.
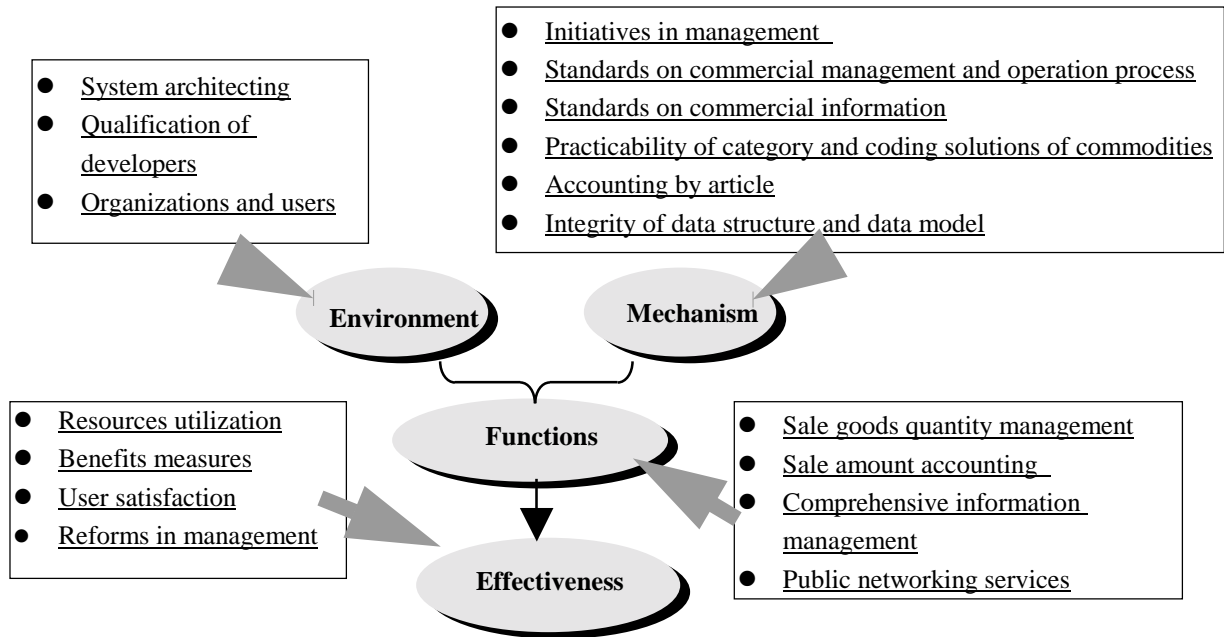
Figure 2. Framework of Evaluation Index for Commercial Information System Evaluation

3 SOLVING CIS EVALUATION PROBLEMS

3.1 The Evaluation Process Design

The outlined index structure is just a logic framework into which to put the specific indicators. Indicators can be added as much as possible, especially with special considerations on the different storefronts. Here two concepts, *index base* (IB) and evaluation index *solution* have to be made clear at first. The logic framework is factually an *index base* whose contents (index) can be changed (add, delete, modify, create, etc.). For specific evaluation tasks, specific indices will be selected from IB so as to form a specific scenario about the evaluated CIS dynamically by identification of goals or objectives. Similar ideas have already been seen (Kleiner, 1997). The index selection process undergoes interactively while preferences of customers, actors or owners could be reviewed. As the user ensures the selected indices which is actually the scenario about the evaluated object by his view, the specific index alternative is formulated, or the scenario is established, which is the evaluation index *solution*. The solution not only refers to a template of indices but also includes the methods of measuring and valuing those indices. Different evaluation tasks generate different index solutions, which construct an *index alternative base* or evaluation case base. So relevant indices will be taken from the framework to constitute the specific evaluation index alternative for the specific tasks in practice. Figure 3 shows the basic ideas.
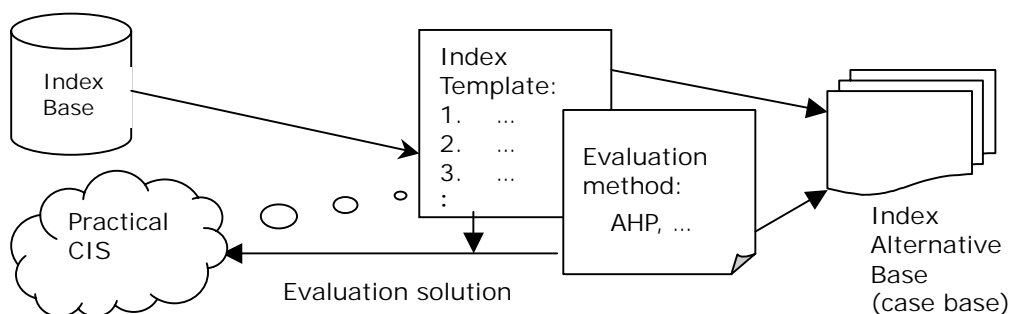

Figure 3. Evaluation Process Design

Next is the computerized interactive evaluation process:

Step 1. Choose an existing (default) index alternative from alternative base according to the evaluation tasks. If there is no proper alternative in the base, select indices directly from IB to form new scenarios and search for new solutions or select an approximate alternative for modification.

Step 2. Give the name, valuation method and operational definition of those newly added indicators.

Step 3. Reassign weights of those items at the same levels where new items added.

Step 4. Confirm the evaluation index solution. If satisfied with the scenario, a solution is reached and also stored in the alternative base. If not, go back to Step 1.

Step 5. Form a questionnaire where lists all checkpoints, their measures and valuation methods. For qualitative index, ask the operator to input a score. For quantitative index, run its computation module.

Step 6. Choose one method of integrative evaluation to produce a synthetic result. More methods can be in trial for comparison.

Step 7. Before really exit, confirm whether to add new indices into IB. If do not exit, go back Step 1.

Explicitly, evaluation index solutions to the CIS for different retailing operation states will be different. The solutions for those stores of State (a) will not be applied to those of State (g). The 7-step working process is an iterative process to find an appropriate solution for evaluation, where the preferences of the users can be reflected by the index solution, and then by the final evaluation result. Furthermore, measures and valuation process of different indices also include individual subjective judgment. The process to a scenario establishment is modeling for imagines (scenarios of the concerned by the human beings), instead for insights of CIS, which are hardly possibly modeled in human activity issues.

3.2 Valuation of Indices

The measures and valuation methods of those indicators about the input, output and outcome of an CIS in the IB should be confirmed before going to Step 5. Table 2 briefly lists some resolutions of the index valuation.

Table 2. Valuation methods of the indices

Index	What do they mean?	Where to collect?	How to value?
Wu-li	(input) technical indices	documents, Internet, pilot storefronts	testing, estimating
Shi-li	(output) system performances	documents, expert survey, pilot stores	testing, calculating
Ren-li	(outcome) user participation, user satisfaction	documents, expert survey, pilot stores	testing, experts' scoring

The valuing process undergoes bottom-up through index framework. For those bottom-layer indicators, the criteria of some technical indicators, especially those on developing a CIS can be provided by suppliers of the computers and networking facilities. The individual performance index of those facilities can also be valued by software testing tools. Then thresholds can be given to those indicators. Results of some other technical indicators of a CIS can be acquired directly or partially through some formulas or mathematical models. For example, throughput of the computer network system is solved by queuing network models. Then thresholds can also be set for those indicators. Indicators on the *Ren-li* aspect usually are qualitative, and expert scoring is useful in practice.

The final evaluation result is the value at the top-level index by synthesizing lower level indicators' values. Many methods can be applied, such as comprehensive scoring approach, visible diagram approach, order number approach, linear allocation approach and so on. In this project, a multiple criteria decision making method, analytical hierarchy process (AHP) is applied (shown in Figure 4).

4 PRACTISING EVALUATION

The project owners approved the index framework in 1998. Then a computerized index system browser has been implemented using Visual FoxPro 5.0 platform. The ideas of index base and evaluation index alternatives will better be exhibited genuinely and effectively by a computerized evaluation support tool for further study. The computer-based evaluation tool will not only facilitate the evaluation of those pilots for current study, but also provide a useful aid to compare evaluation methods, understand actors' desires and improve the index framework. For comprehensive evaluation, it had better to follow such a rule: the simpler the methods are, the more practicable and operable they are.

Figure 4. AHP for Comprehensive Evaluation in CIS Assessment

Tasks (1) to (4) of this subproject had been finished in November of 1998 and appraised by an expert committee organized by SPC and PCEET. The members of the committee include people from MIT, CEOs and CIOs of some large retailing stores. When

applying our index framework and evaluation methods to those pilot stores, we met unforeseen difficulties and now the practice work is in suspension. Here we use CATWOE to analyze the reasons.

Since 1998, great changes happened to governmental administrative system in China. Both SPC and MIT had been changed. SPC transformed into State Development Planning Commission (SDPC), while MIT became the Bureau of Internal Trade (BIT). That the *owners* of the whole project changed not only meant the change of the name, but people who took charge of the project also moved and replaced. The *customers* changed their attitudes towards the whole project and subproject. Even from the start, they were reluctant to provide real data of CIS due to business securities. Field investigations could be taken only with the authorization from PCCET. During the government reforms, PCCET people did not concern much about the framework and its practical applications since they had to concern their own role in BIT. So pilot stores are conditional customers. They even do not need evaluation since they had achieved success in CIS application. The main goal to be involvement into the project is for governmental funds and also for advertisement. *Actors* do not change, but lose objective and administrative right to take any actions, since the pilot stores would not cooperate in data collection without PCCET's authorization. The national administrative system reform is the biggest *environment* constraint. Since 1998, e-business has made such tremendous progress and became such a popular word in IT industry and evolved into a way to change living, heavy investment had been continuously put into electronic business. Then the original goal of this large project had already achieved, i.e. to spread electronic-business ideas and have CIS of most big stores in China up to a level.

Even though there are no practical solutions to any CIS of pilot stores, we still have achieved much in applying WSR system approach to CIS evaluation in China. WSR approach enabled us to manage in provide an integrative index framework, which was the start to depict different scenarios of CIS and its impact on commerce, and then may function actively to a variety of decision making at different managerial levels oriented to specific goals.

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