

# STUDY ON A MODEL OF THE EQUIPMENT MRO SERVICE INFORMATION SYSTEMS

LIU Huashen<sup>1</sup>    YANG Haicheng<sup>2</sup>    YANG Jianhua<sup>3</sup>    DAI Rong<sup>4</sup>

**Abstract:** The MRO(Maintenance、Repair and Operations) System for the Large Equipment has been becoming a strong support pattern for the agile service support. To build agile service system and identify a portfolio of computer-based integrated applications, a cross-enterprise strategic information systems planning (SISP) is a key concern. An integrated framework for a large equipment support system service chain is analyzed and Strategic information systems planning task is discussed. Integrated the cross-enterprise business process component and inter-organization management policy, the strategic information systems model for a large equipment MRO service support system is proposed.

**Key words:** Strategic information systems, MRO, Service chain

## 1. INTRODUCTION

Both operation managers and information systems executives have viewed improved strategic information systems planning as a key issue. On the one hand, strategic information systems planning can contribute to changes of their organizations model and improvement of operations mode in many ways. For example, it can identify the most desirable information systems applications in which to invest , help an organization use its information systems to carry out its existing business strategies, help it define new business strategies, technology policies, and enterprise architectures, help it align its information systems strategy with its business strategy, and help it deploy information interconnection and share with its suppliers. On the other hand, the failure to carry strategic information systems plans out can cause lost opportunities, duplicated efforts, incompatible systems, lower efficiency, wasted resources, and increased investment. Strategic information systems plan is also a critical issue to a large equipment MRO service chain. MRO service chain management can be particularly challenging for the large equipment users that operate and use the large equipment or clusters of equipment. The term MRO (maintenance, repair, and operating supplies) encompasses any indirect goods and services that are vital

---

<sup>1</sup> Dept. Of Electronics and Mechanics, Northwestern Poly-technical University, Xi'an, P.R. China.

<sup>2</sup> Dept. Of Electronics and Mechanics, Northwestern Poly-technical University, Xi'an, P.R. China.

<sup>3</sup> School of Economic and management, University of Science and Technology Beijing, 100083, P.R. China.

<sup>4</sup> Ny Equipment and Technology Institute, Beijing, 100071, P.R. China.

\* Received 2 April 2008; accepted 5 May 2008

to ongoing operations. The large equipment MRO includes all of the materials and parts needed to maintain the equipment running normally and support the equipment maintenance and operating. The strategic information systems planning for MRO service chain can influence agility of the large equipment logistics, and is difficult to accomplish across many enterprises. Indeed, many researchers have studied strategic information systems planning in a single enterprise. However, few researchers study the strategic information systems planning for MRO service chain. The objective of this paper is to provide an integrated framework of strategic information systems planning for the large equipment MRO service chain.

## 2. SISP AND THE MRO SERVICE CHAIN SYSTEM

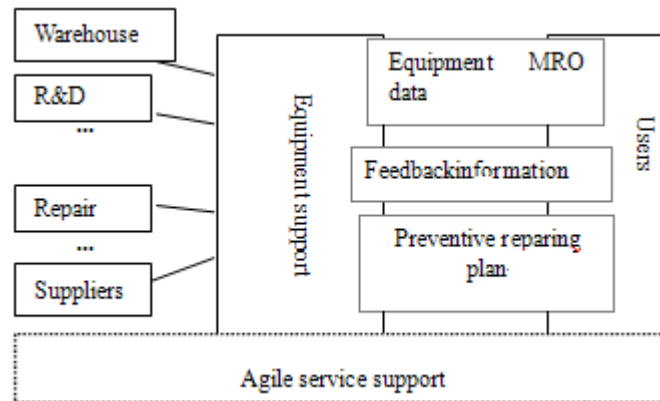
SISP(strategic information systems planning) is the process whereby an organization determines a portfolio of computer-based applications to help it achieve its business objectives. It is an intricate and complex group of specific, interrelated tasks or activities. Comprehensiveness in such planning as SISP has been formally defined as 'the extent to which an organization attempts to be exhaustive or inclusive in making and integrating strategic decisions'. Seven broad behaviors illustrate comprehensiveness in strategic planning in general: (1) the thorough canvassing of many alternatives; (2) the surveying of a full range of objectives; (3) the careful weighing of what is known about the costs and risks of each possible outcome; (4) the intensive searching for new information relevant to alternatives; (5) the considering of any new information or expert judgment; (6) the reexamining of the consequences of all known alternatives before making a final choice; and (7) the making of detailed provisions for implementing the chosen course of action. SISP has also been viewed in terms of five different general approaches, namely business-led, method-driven, administrative, technology, and organizational. These approaches have gained credence from an assessment of the extent of the rationality and adaptability of the planning process. Such assessment demonstrated that SISP comprehensiveness could be viewed in terms of rationality and adaptability.<sup>5</sup> In the large equipment service chain, the inter-enterprise strategic information systems planning have more importance to management and should have rationality and adaptability also.

In Fig.1, An integrated framework for the large equipment MRO support system service chain is illustrated. Every organization defines MRO a bit differently and the approaches of MRO management process differently. MRO service chain management is a complicated puzzle. It's a world that encompasses hundreds of work orders, thousands of suppliers, and millions of unique SKUs, plus a mystifying parts inventory. Tack on administrative costs, inventory expenses, freight, taxes...and, if not done right, these can be a huge cash drain. Agility and reliability is more important to the defense equipments. An innovative approach and solution to MRO service chain that is not hampered by physical or virtual boundaries should be presented. In the large equipment MRO service chain, equipment support center, as a mediate can improve the ability of rapid response. It integrates MRO warehouses, repairing plant, suppliers and the departments of the large equipment research & development. The warehouse provides timely parts and instruments for repairing in the point of placement. The R&D departments provide guidance for technology, analyze MRO data and failure mode and identify the equipment improvement solutions. The suppliers are responsible for the maintenance, repair, and operating supplies. Repairing plants is responsible for preventive repairing on the assembly base and urgent repairing on the door.

---

<sup>5</sup> Albert L. Lederera, Hannu Salmelab. Toward a theory of strategic information systems planning. *Journal of Strategic Information Systems* 1996,5: 237-253

Grover S. Kearns. The effect of top management support of SISP on strategic IS management: insights from the US electric power industry. *Omega*, 2006,34:236 – 253



**Fig.1 An integrated framework for a large equipment MRO service chain system**

To build inter-enterprise strategic information systems for the large equipment MRO service chain, such streamlined MRO service chain as presented in fig 1 is a needed. These will avoid the service chain inefficiencies such as inventory surplus, decentralized procurement, transaction discrepancies, and poorly managed stockrooms, eliminate excess and obsolete inventory, reduce overall MRO supply costs, and more, View the “big picture” with enterprise-wide MRO-specific data, detailed historical reports and reduce the technology investment.

**Table 1. SISP phases and tasks for MRO service system**

Planning the SIS planning process (i.e. strategic awareness) <ul style="list-style-type: none"> <li>Determining key planning issues</li> <li>Defining mission &amp; objectives</li> <li>Defining the project’s scope and approach</li> <li>Organizing the planning team(s)</li> <li>Obtaining top management commitment</li> </ul>
Analyzing the current environment (i.e. situation analysis) <ul style="list-style-type: none"> <li>Analyzing current operational systems</li> <li>Analyzing current information systems</li> <li>Analyzing the current supply chain mode</li> <li>Defining strategic information system needs</li> <li>Analyzing the current IT architecture</li> </ul>
Conceiving strategy alternatives (i.e. strategy conception) <ul style="list-style-type: none"> <li>Identifying major IT objectives</li> <li>Defining the architecture of required systems</li> <li>Identifying high level IT strategies</li> </ul>
Selecting strategy (i.e. strategy formulation) <ul style="list-style-type: none"> <li>Identifying new business processes</li> <li>Identifying IT architectures</li> <li>Identifying specific new projects</li> <li>Identifying priorities for new projects</li> </ul>
Planning strategy implementation (i.e. strategy implementation planning) <ul style="list-style-type: none"> <li>Defining change management approach</li> <li>Defining action plan</li> <li>Evaluating action plan</li> <li>Defining follow-up and control procedure</li> </ul>

According to IS planning phases and tasks by Mentzas in 1997 and Andersen Consulting's Method,<sup>6</sup> we summarize the SISP phases and tasks for the large equipment MRO service chain as table 1. The phases and tasks can be used to describe the agile defense logistics' attempts to be comprehensive in its strategic planning process. The establishment of the planning process is essential to set the development of SISP into action. The objective is to get the support of top management, gather a chief project team to carry out the SISP process and to create a formal description of the SISP study. This sub-process can be divided into three stages: the establishment of the joint committee, top management commitment, and establishment of project team.

The joint committee gains top management's commitment by showing the benefits to be obtained from the SISP. After gaining the top management's commitment, the project team for carrying out the overall SISP process is established. A team leader, an executive who will work full time in the study and direct team activities, needs to be selected to communicate with other executives throughout the SISP process (IBM, 1984). The Strategy Conception phase includes identifying major IT objectives, identifying opportunities for improvement, evaluating opportunities for improvement, and identifying high level IT strategies. Based on the analysis of business strategies and IT opportunities, Information systems strategies are established at this stage. The strategies formulated here may be classified into those that are based on the business strategies set in the strategic business planning sub-process and those that are derived from IT opportunities. The new strategies, identified from IT opportunities, will be added to the agile strategies for the defense logistics. Information strategies were established to set the long-range direction of IS development. An information systems strategy was derived, based on the present world environment, and IT enabler. Information strategies can suggest criteria for decision support in the process of constructing and operating target systems.

### **3. STRATEGIC INFORMATION SYSTEMS MODELING**

An abstract view of the strategic information systems for the MRO service chain depicts it as a partially layered architecture that align with across-enterprise processes engineering. Figure 2 depicts a representation of this type of architecture for MRO service chain.

Here is a Strategic information systems model template for MRO service system:

- 1st. Operational management systems (OMS) layer . This consists of existing custom built applications, otherwise called legacy systems, including existing ERP packaged applications, as well as business intelligence applications. The composite layered architecture of MRO service chain can leverage existing systems every enterprises have and integrate them using integration techniques. We should Identification of processes requiring change. The selection process is based on three criteria: the processes critical to accomplishing the critical success factors and strategies, processes that are most problematic, and those that are most likely to be successfully redesigned. At this stage, the current organizational culture also needs to be evaluated in light of the impending change to be brought about by reengineering.
- 2nd. Enterprise components layer. This is the layer of enterprise components that are responsible for realizing functionality. These special components are a managed, governed set of service chain assets that are funded across the enterprise or the business unit level. As inter-enterprise-scale assets, they are responsible for ensuring conformance to service chain center. This layer including: Functional areas supported by this enterprise components; business domains, goals and processes are supported by this enterprise components; Decisions regarding governance and operation functions. Based on the result of the operational analysis and identified information systems strategies, the information architecture is developed, which is the overall

---

<sup>6</sup> Albert L. Lederera, Hannu Salmelab. Toward a theory of strategic information systems planning. *Journal of Strategic Information Systems* 1996,5: 237-253

framework of the IS, providing details such as sub-system areas, information created, controlled and used in each sub-system, relation between the sub-systems and the functions each sub-system is responsible for. The specific components for implementation are identified at this stage to fulfill the IS requirements. Components include specific standards and guidelines for implementation as well as specific products.<sup>7</sup> Equipment services' business processes are encapsulated into distinct, reusable components such as engineering information for the whole life cycle, maintenance planning, service work orders, purchase orders, inventory, reliability management and quality management.

- 3rd. Services layer. The services the SIS chooses to fund in this layer. They can be discovered or be statically bound and then invoked, or possibly, choreographed into a composite service. This service exposure layer also provides for the mechanism to take enterprise scale components, business unit specific components, and in some cases, project-specific components, and externalizes a subset of their interfaces in the form of service descriptions. Thus, the enterprise components provide service realization at runtime using the functionality provided by their interfaces. The interfaces get exported out as service descriptions in this layer, where they are exposed for use. They can exist in isolation or as a composite service.<sup>8</sup>
- 4th. Access or presentation layer. Web Services and other technologies seek to leverage Web services at the application interface or presentation level. We ultimately need to provide an end-to-end solution from an access channel to a service or composition of services. The service system should provide access interface for the users from the department of Equipment R&D, Equipment Manufacturing, Equipment Maintenance and Operations.

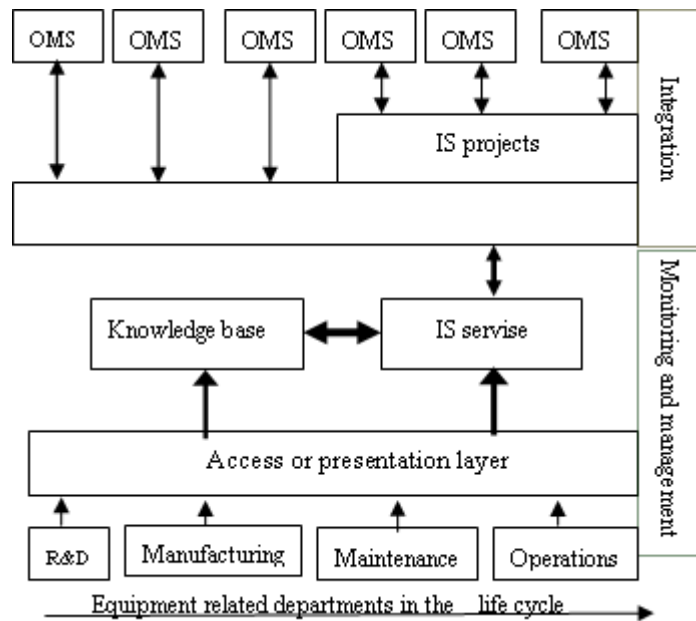


Fig. 2 Strategic information systems model for MRO service system

SIS should provide the capabilities required to monitor, manage, and maintain quality of service such as security, performance, and availability. This is a background process through tools that monitor the health of service chain service applications, including the all important standards implementations.

<sup>7</sup> S.K. Min a, E.H. Suhb, S.Y. Kim b. An integrated approach toward strategic information systems planning. *Journal of Strategic Information Systems*, 1999, 8:373-394

<sup>8</sup> Ali Arsanjani. Service-oriented modeling and architecture. <http://www.ibm.com/developworks/webservices/library>.

Based on the information architecture, solutions for supporting the information systems strategies using current IT are derived. The solutions are derived on three sides: the server side (application specific services such as Administrative applications, intermediate level common solutions such as database management, infrastructure solutions such as security), middleware side (network support services), and client services side.<sup>9</sup>

#### **4. STRATEGIC INFORMATION SYSTEMS MANAGEMENT**

In the strategic IS management for MRO service chain, following point is important.<sup>10</sup>

- 1st. Involving the defense logistics support mediator directly in logistics support planning. The mediator gains knowledge of logistics support objectives and shares knowledge of IS opportunities with management.
- 2nd. Training top management about information technologies and opportunities. Top management acquires IS knowledge which improves agility of defense logistics support so as to become involved in SISP.
- 3rd. Integrating the IS business operation plans with SISP. Cross-domain sharing of knowledge helps to insure that IS strategies. The resultant strategies should have an increased chance of successful implementation
- 4th. Unifying the information systems specification includes deliverables such as information architecture, common IT solutions, and project definition. The project definition compares the target system architecture with current system architecture, and then specifies project requirements for new system development. Priorities of target systems are calculated using weighted average of strategy, importance, difficulty, and urgency.

---

<sup>9</sup> S.K. Min a, E.H. Suhb, S.Y. Kim b. An integrated approach toward strategic information systems planning. *Journal of Strategic Information Systems*, 1999, 8: 373–394

<sup>10</sup> Grover S. Kearns. The effect of top management support of SISP on strategic IS management: insights from the US electric power industry. *Omega*, 2006, 34: 236 – 253