

Relevant Research on the Improvement of Supply Chain Management Using EPC System among Chinese Manufacturing Enterprises

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Abstract: This paper deeply discusses the impact of improving manufacturing enterprises supply chain management about EPC system based on a brief introduction component and workflow, analyzes the EPC application status and constraints of Chinese manufacturing enterprises. Meanwhile, puts forward some countermeasures for application of Chinese manufacturing enterprises with EPC system to improve the supply chain management.

Keywords: EPC; manufacturing enterprise; supply chain management

I. Overview

Information coding techniques, automatic identification and data collection technology are the basic information technologies in the supply chain management.

The EPC (Electronic Product Code) system is designed based on the traditional commodity bar code technology combining the advantages of the radio frequency identification and the computer network technologies. The advantage of the radio frequency identification technology is the automatic identification of objects under the conditions of non-contact, long-distance, multi-label even in the fast-moving state. The advanced computer network technology and wide application of Internet make the information transfer faster and easier over the world. The EPC System is developed based on the combination of these two factors and improves each other. Using the advanced coding scheme, the EPC is compatible with the traditional bar code, and on the other hand it greatly expands information capacity. It especially gives a unique code for each object to establish a global standard for single product identification, which builds the connection between the physical things and Internet over the whole world (abbreviation: the "Internet of things").

Manufacturing is a collectively called to industrial sector which including the processing of raw materials or components for assembly. At present, globalization and informationization as two hot spots of the world economy have a profound impact on the traditional manufacturing industry. One hand, effect of the traditional boundaries is increasingly weakening, global Manufacturing has become important in manufacturing industry, China as a global manufacturing center has been a major production base for multinational companies and development and application of

EPC refer to the corporate global supply chain efficiency and enhancement of enterprises competitiveness, therefore, China will inevitably become a major market for EPC; On the other hand, EPC system can improve supply chain response speed, achieve global supply chain collaboration, control total cost, enhance the core competitiveness of manufacturing enterprises and promote the rapid development of automatic identification technology. Its development will bring manufacturing information updates, deeper and more extensive application. Research and application of EPC has become the urgent need of helping the developing countries participate in international competition and blend into economic globalization. Obviously, if China can not follow the world's advanced technology, it's very easy formed technical trade barriers by developed countries.

II. EPC System Overview

The components of EPC System

The EPC system is a very advanced, integrated and complex system. Its ultimate goal is to establish a global identification standard for every single product. It consists of Encoding System of the EPC, radio frequency identification system and information network system including six sub-components as described in Figure 1. and Table 1.

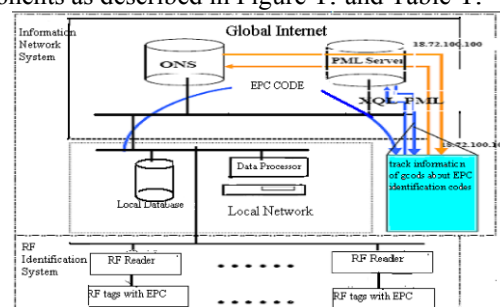


Figure I. Diagram of an EPC system

Table 1. Components of an EPC System

System Construction	Name	Notes
encoding system Of the world's electronic product code	EPC coding standard	identify the target-specific code
RF identification System	EPC tags	attached to the item or embedded in it
	reader	read EPC tag

information Network System	Savant (Neural Network Software)	software support system for EPC system
	Object Naming Service:ONS	
	Physical Markup Language:PML	

Workflow of an EPC System

The reader reads only an information reference (pointer) in EPC system among of EPC tags, readers, Savant servers, Internet, ONS servers, PML server, and a number of databases. The relevant information stored in the Internet can be found from the IP address which is linked to the information reference in Internet and this relevant EPC information is then further processed and managed by Savant software. Since there is only one EPC code on the label so computer needs to know the other information that matches well with the EPC, as a consequence, this requires ONS to provide an automated web-based database services. Savant sends EPC to ONS and then ONS will ask Savant to find the PML server where the product documents are stored. This document can be copied by Savant, so product information can be sent to the supply chain.

III. The Improvement of a Manufacturing Enterprise's Supply Chain Management Using EPC

The application of EPC system in the manufacturing supply chain

(i) Production

The EPC system can improve the operation of automated production lines by identifying and tracking of the raw materials, components, semi-product and product in the whole production line. It can also reduce labor costs and avoid constant errors caused by human errors and further improve efficiency and increase profit; It not only can locate raw materials and parts quickly from all kinds of inventory by the electronic tag, but also help managers to adjust replenishment information timely according to production schedule to achieve a balanced and steady production line and provide an effective platform for quality control and track.

(ii) Storage

The EPC system can accomplish auto operations such as inventory and pickup; it can reduce the number of personals doing stock-taking as well as inventory. It is even more useful for managers to quickly identify and correct the inefficient situation in the operation according to the accurate information about inventory that provided by EPC system, thus, achieving rapid supply and minimizing storage costs.

(iii) Transport

The EPC system can provide information of the goods in transit and track transport timely; It allow enterprises to

track a particular stock keeping unit in the supply chain, even to locate a specific container commodity during transport. ; It also can achieve the automatic toll of highway and traffic management

(iv) Distribution / Distribution links

The EPC system can accelerate the speed of delivery and improve the efficiency and accuracy of selecting and distributing, so the labor and distribution costs will be reduced. By ensuring the accurate inventory control, people can easily identify any kind of goods on the tray and to make fast and accurate delivery.

The analysis of EPC system in improving the manufacturing enterprise supply chain management

(i) Quality Control

Workers will work more efficiently, the machine's utilization rate would be more reasonable and company's profits will increase by using the EPC technology. More importantly, a company would have its own brand and worldwide reputation.

(ii) Product tracking and related information

EPC technology can be used to record related data in each step of manufacturing. It can also record the date of production, product properties, product lot numbers as well as product status. Even the EPC technology can track components of raw materials and processing information in each step of the manufacturing process.

(iii) Inventory control

The EPC technology can be used to identify goods to the warehouse, as well as containers, so that the out of libraries, warehousing operations and stock efficiency will be greatly enhanced. Furthermore, EPC enables manufacturers to automatically realize synchronized compression and buffer through real-time track so as to enhance response time and inventory management.

(iv) Assets management

EPC can provide effective automated data collection technology. With RFID technology, an important event of equipment (installation, usage, events, damage, repair, overhaul, non-use) can be obtained.

IV. The Analysis of the EPC Application Status and Constraints of Chinese Manufacturing Enterprises

The EPC application of manufacturing enterprises in China

(i) The EPC application of domestic manufacturing industries concentrated in the high-profit industries

To EPC, costs are still an important bottleneck in Chinese market. The pressure of high cost makes many managers of profits manufacturers to give up EPC System and turn to other low-cost solutions. But the cost issue can be tolerated in the high value-added areas of manufacturing industry and

actual costs of EPC System can be accepted.

(ii) Closed-loop application of EPC in most of domestic manufactures

The EPC System is divided into two levels, one is applied in the closed-loop system and the other is in the open system. At present, the domestic EPC System is mainly applied in the closed-loop system (Such as business or company), using a separated set of equipment, frequency, process and coding standards system.

(iii) The dominant role of government in the promotion of EPC

The notable feature in the application of Chinese EPC System is that government projects have huge advantages than the private ones. Many successful cases were led mostly by the government with strong and active promotions. Achieving a win-win to EPC industry chain is not an easy thing if it is only used in power of enterprise. So, combining with our national situations and make full use of the government's power will be a shortcut to the development of EPC system.

Limitation factors of EPC System used widely in Chinese manufacturing enterprises

(i) The issues on hardware cost

It is a large one-time investment as EPC System needs IT systems, RFID tags, readers and other hardware facilities. If we add computers, local area networks, application software, system integration and other expenses, the majority of small and medium enterprises are no doubt balk at the idea.

(ii) the complexity of RF technology

The key technology that used by EPC System is RF technology. However, it has many kinds of support technologies. For instance, a simple automatic sale involves the manufacturing of radio frequency identification systems, wireless data communications and networks, data encryption, automatic data collection and data mining techniques. In order to use a credit card to defray, you must install the POS payment system and the issue bank clearing systems; A new powerful software system is needed if you want to hang the marketing system, enterprise resource planning (ERP) and warehouse management systems (WMS) together to achieve the automation of the entire supply chain management. The most important thing is that all of these technologies and systems must be seamlessly connected where system integration is a great challenge.

(iii) Unification of standards

In the aspect of frequency standards, each country has got certain differences in the allocation of radio spectrum's purpose, so the radio frequency identification system may face resource constraints. These situations will lead to more complex technology. The needs to design a variety of tags and readers result in higher costs.

(iv) Privacy protection and security issues.

The EPC security issues are mainly on individual user's privacy protection and business users of commercial secrets protection as well as avoiding attack on the RFID systems

and making use of RFID technology in many aspects such as safety and prevention.

(v) Existed issues of EPC application in China comparing with foreign countries

So far, application of EPC in the large-scale domestic enterprises in China is far more behind the developed countries. There are three objective reasons: first of all, the level of Chinese industrial automation is relatively low. Secondly, Chinese labor cost is very low, while the EPC System is largely to help companies save on labor costs and this is why the Western developed countries with relatively high labor costs actively promote the EPC. However, China are at an advantage in human resources and labor costs have less pressure on the enterprises. Therefore, there will be less enthusiast of the application of the EPC System for domestic enterprises than those of Western developed countries. Finally, the economic strength of domestic enterprises has also hindered the widespread application of the EPC System. Overall, Chinese manufacturing competitiveness is low, there is not a strong financial capability to support enterprises EPC System test applications. Moreover The major reason is that domestic enterprises decision-maker's awareness about this new technology is very limited, in particular, it need to spend a lot of money and human to buy such a system and their attitudes also impede the EPC System's development.

V. The Countermeasures for Application of Chinese Manufacturing Enterprises with EPC System to Improve the Supply Chain Management

Utilizing different strategies for each different enterprises

For some small and medium enterprises If barcode can improve their logistics and supply chain, then it is not necessary to build high-cost RFID and EPC System, so the only requirement for them is to follow up the EPC technology in the development and application in the industry, and it doesn't need to invest heavily in the acquisition of infrastructure and the establishment of EPC Systems.

For the large enterprises which have highly sensitive production and operation business information, especially for those foreign trade enterprises, they must be pay close attention to the latest progress of the EPC including the latest research results, relevant standards developed and implemented, pilot application effect, promotion of the same industry and measures to other peer companies, etc. in order to respond to the challenges that may arise.

A small number of powerful large-scale enterprises can involve in EPC global standard development work and pilot experiments so that Chinese enterprises can have a place in the EPC international arena.

Follow the EPC system, enterprise-class applications, methods and steps

(i) Enterprise-class application method

Enterprise-class enterprises must do feasible analysis, valuation and risk analysis.

Feasibility analysis: Confirmed that able to resolve key issues affecting the application under the existing technical conditions and business environment.

Valuation analysis: As an independent economy body, the input-output on EPC program for enterprise must be considered carefully. Whether EPC technology can improve productivity and create benefits for the enterprise is important.

Risk analysis: Enterprise risk is inevitable when they use EPC technology. Technical risk, operational risk and policy risk are needed to consider carefully.

(ii) Application of EPC System should follow the following steps

According to enterprise's own situation, (a) choose more independent with capacities to embody the best technical advantage of business for EPC applications; (b) choose the right time to carry out projects and do feasibility analysis, valuation analysis and risk analysis; (c) make sure the total solution and deployment configuration model; carry out testing program and modify the deployment configuration model; (d) start a comprehensive implementation of the project and the deployment of work;(e) do the related business systems integration work.

(iii) Achieve the integration of existing information systems with the EPC system

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