Supply Chain Management and Traceability of Food as an Incentive

Supply Chain Management and Traceability of Food as an Incentive

Hiroyuki Shiraishi

1. Introduction

Japanese companies are now forced to grope for a way to survive in the global competition due to the rise of the developing countries where labor cost is quite cheap. In other words, today a pressing need for Japanese companies is to establish a new basis of competitive advantage as companies of developing countries gain competitive capability in production.

An effective long-range strategy for Japan is to convert the basis of competitive advantage from the traditional factors such as capital, equipment, and manual labor into other factors, while SCM is quite effective on optimizing production. Therefore it can safely be said that SCM is the best way to keep competitive advantage of the Japanese companies. Because a manufacturer is facing a difficulty that almost all of the efforts in cost-cutting have reached the limits, it is not too much to say that it is the only breakthrough to keep Japanese corporate competitiveness.

In SCM the effect of optimizing production in quantity has a tendency to become greater as participating retailers increase. So the builder of a network for SCM must persuade as many retailers as possible to take part in it, and needs to ensure proper benefits to all the participants. This study will show that accurate information on the production history and distribution career of goods, especially of food, can be a powerful incentive for the retailers, because securing food safety has been one of the major concerns for many consumers.

But so-called traceability technology whose typical example is RFID (Radio Frequency Identification) is now underdeveloped, that is to say, when a company deploys the technology actually, obstacles exist, including difficulty with accurate tag readings based on the usage environment. In order that the company may use it as the reliable basis of SCM, the manufacturer of the RFID tag must conduct continuous experiments on ratios of the tag read-off in an environment close to actual usage conditions. This paper shows Dai Nippon Printing's trial as a remarkable case of such an attempt.

2. Effect of SCM

To remove possibility of running out of stock and to avoid overstocking are incompatible with each other. It is widely accepted that one of SCM's major objectives is to balance the two conflicting goals of management. Minimizing unnecessary inventory could lead to cost reduction. In its sense SCM is an effective solution to cut cost and to optimize production in quantity.

Today it is difficult for Japanese manufacturers to ensure profits based on so-called economies of scale. They are confronted with a difficulty that almost all of the management strategies to cut every possible production cost have come to a deadlock. Also, they are facing a difficulty of the aging society with a decreasing birthrate.

Therefore it is no exaggeration to say that it is the only breakthrough which keeps Japanese companies' competitiveness and promises their success in the future. The effect of optimizing production quantitatively which SCM produces tends to become greater as participating retailers increase, because production process and market demands should be synchronized in order to reduce inventory (Christopher, 1997 ; Beech, 1999), and the synchronization can never be achieved without a consistent management and commonage of information in the production/distribution chain from top to bottom (GISPRI, 2005). So the builder of a network for SCM has to persuade as many retailers as possible to

take part in it, and needs to ensure proper benefits to all the participants. In other words, providing some incentive is important when the builder invites retailers to join the SCM network, and it is to form a 'win-win relationship' in the supply chain as a result.

3. Traceability of Food

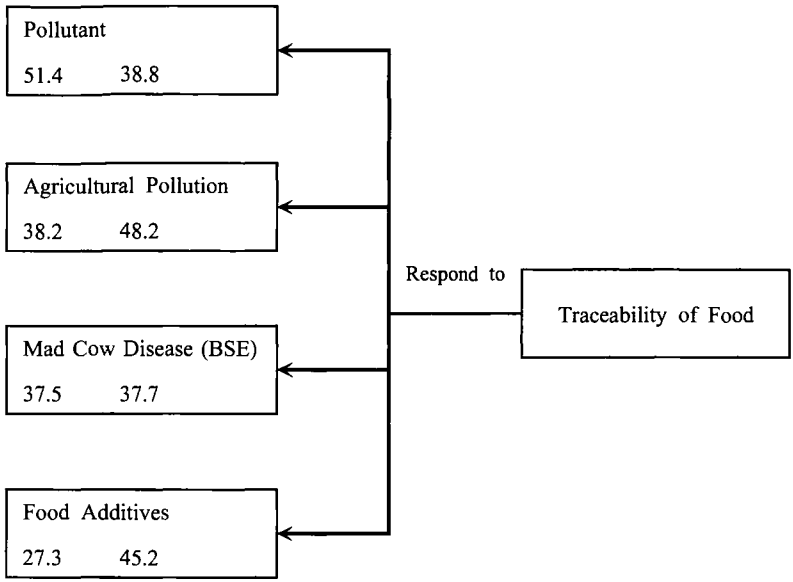
Japanese consumers' faith in the safety of their food has been shaken recently, partly due to the spread of new diseases like BSE and avian flu, which has certainly aroused a kind of social unrest. Securing food safety has been one of the top concerns for many consumers lately in such a context. It is a big change in the environment surrounding logistics and retail business. At present there is a high demand for food traceability that can provide retailers and consumers some accurate information on the production history and distribution career of food (see the figure on the next page).

In addition, the retailers generally hope to grasp how widely the damage has been spread, quickly after the cause has been found when a food accident occurs (Ubiquitous ID Center, 2004). Then after grasping it they are to remove the goods from the shelves and withdraw the sold ones from the customers depending on the situation.

Accordingly, if the builder of a network for SCM realizes food traceability there, it will increase the retailers which take part in it. In other words, historical data concerning foods to ensure safety is a powerful incentive for the retailers to join the SCM network.

4. Traceability and RFID

In a ubiquitous network society, as computers automatically identify the locations of various things in the real world and perform processing of information concerning specific items and location data, the function to identify physical



Data
Left: High Concern (%)　Right: Concern (%)
Source: Survey Results for Food Safety Awareness by Food Security Bureau Japan (May 2005)

Figure 1　Food Safety Awareness and Traceability

objects in the real world is considered as a must. For these purposes, the ubiquitous ID technologies give unique numbers, namely, ubiquitous codes (ucodes for short) to every physical object.

If ucodes are given to every single physical object, it will be possible to manage information that is unique to individual objects even of the same product type, such as when they were made and what delivery route they took. In short, it will realize tracing them (YRP Ubiquitous Networking Laboratory, 2005).

To actualize traceability of various goods, a mechanism that links physical objects with ucodes is required. In the ubiquitous ID technologies, a device that gives ucodes to physical objects is called ucode tag.

Currently, RFID tags that support a non-contact communication function and are utilizable as a ucode tag are brought to international attention (Ubiquitous ID Center, *op cit.*). They have a wide range of applications in distribution, tracing goods and reducing inventories (Nagumo, Nakajima & Okano, 2001).

Although the RFID tags are very useful in SCM in this manner, they have not yet attained complete traceability. As for almost all of the goods, clothes, shoes, tableware, and parts of a machine, for instance, even if the tracking rate is not one hundred per cent, if it seems to be high enough, retailers are often satisfied with it. But the traceability of food is another matter. The tracking rate under a hundred per cent is meaningless here. Apart from the other goods, as concerns food retailers and consumers demand faultless read-off strongly. Food traceability is an effective incentive for the retailers to join a SCM network, while the builder of the network is forced to keep perfection in tracing food.

5. Dai Nippon Printing's Trial

In order that a company may use the RFID tags as the reliable basis of SCM, continuous tests on ratios of tag read-off in an environment close to actual usage conditions must be conducted. A remarkable case of such an attempt is Dai Nippon Printing's trial.

Dai Nippon Printing (DNP for short) has one hundred and thirty years of tradition in the printing business (see the attached table). Today their business covers a wide field, and the company's annual turnover amounts to about one trillion and four hundred billion yen.

DNP has developed ACCUWAVE series of original RFID tags. They have functions of tracing the production, processing, and distribution of foods, and multi-sensor tags of them make it possible to monitor the products' storage conditions (Dai Nippon Printing, 2005a).

In addition, DNP opened the "IC Tag SCM Solution Center" in Itabashi-ward in Tokyo. It is an experimental facility for logistics management using the

Corporate Name: Dai Nippon Printing Company Co.,Ltd.
Established in: 1876
Incorporated in: 1894
Headquarters: 1-1-1, Ichigaya Kagacho, Shinjuku Ward, Tokyo
Business Areas: Printing, Packaging Products, Projection Screens, Semiconductor Components, Decorative Materials, etc.
Capital: 114 billion yen
Employee: 35,596
Sales: 1,507 billion yen
Ordinary Profit: 124 billion yen
(As of the end of March, 2006, consolidated)

Table 1　Profile of Dai Nippon Printing

RFID tags.

According to our investigation to the DNP's Kansai Department of Packaging and collected materials, the company entered on the gradual introduction of evaluation equipment from 2004, and initiated developing evaluation methodologies for use in specific logistics environments. The company has carried out numerous experiments since that phase, and by building up relevant technologies and know-how has been able to establish simulation test methodologies in a field setting aimed at the introduction of the RFID tags. The foundation of IC Tag SCM Solution Center is the fruit of these efforts.

In Japan, with the amendments to the Radio Law Directives, it has become possible to make full use of UHF band in RFID. The objective of the center is to select tag readers and set up the appropriate environment for their use by mocking up specific logistics environments, and conducting RFID tag reader experiments beginning with UHF bands.

In this experimental facility they intend to develop traceability systems that are tailored to the environments in which individual items are used, such as agricultural, industrial, or marine products. Such equipment as conveyor belts,

palettes and fork lifts are arranged in the center, making it possible to reproduce the major settings involved in any set of logistics operations faithfully.

Making a detailed explanation about the conveyor belts, they use most prevalent forms that comprise belts, rollers, and chains, which allow them to compare the read-off ratios in each different format. The conveyor belts they introduced operate at up to 180 meters per minute, the most rapid of any RFID tag testing facility, making it possible to test various factors including speed of passage past the tag reader, the angle of the reader, the position at which the tag is attached to the goods, and the optimal disposition of goods on the conveyor.

6. Organizational Characteristic of DNP

In order to carry out the experiments stated above, the company should have a great variety of knowledge, that is to say, knowledge of electronic devices, belt conveyor systems, assembly line operations, and so on. The only company that has such knowledge can do the experiments.

DNP respects diversity and creating knowledge through integration of diversity. They make an effort to cultivate an emergent evolutional culture, namely, an organizational climate which stirs up the moral of each employee, activates their individual creativity, and promotes them to fully apply the creativity.

Also, the research facilities of DNP are linked with the technical departments of the various production facilities, the customers (i. e. client companies), and other companies except the customers, so that they can create solutions to resolve issues on the front line of production and logistics (Dai Nippon Printing, 2005b). Actually DNP conducted some of the logistics management tests stated in the former chapter, the tests on tracking containers loaded with beverage-use PET bottles, for instance, cooperating with several soft-drink manufacturers, NTT Comware Corporation, and Sun Microsystems. They take advantage of knowledge and expertise that they have accumulated in this process, by using

it to develop original equipment and systems which allow them to offer increasingly effective manufacturing and logistics technologies.

Thus, based on the corporate philosophy of respecting diversity, under the free, open and dynamic culture, they are trying hard to gather together their various knowledge from the inside and the outside of the company to create the best products, to maximize the synthetic capability.

7. Conclusion

A certain electrical equipment manufacturer announced on a large scale that they succeeded in developing a prototype for the smallest RFID tag in the world (0.3 sq. mm), and that tag production efficiency was dramatically increased by employing a design where the electrodes are deployed on the upper and underside of the tag.

In such a manner, today many manufacturers of RFID tags are very eager to miniaturize them and to improve their production efficiency strategically. Such strategies are important and effective in the development of the other devices, to be sure.

But with regard to the RFID tags, it is extremely doubtful whether such strategies are right or not. To be frank, we cannot help stating they are wrong.

SCM is quite effective on optimizing production quantitatively. Therefore it is no exaggeration to say that SCM is the only way to keep competitive advantage of Japanese companies, while traceability of food will become more and more important hereafter in relation to it. To tell the truth, thinking of food traceability, raising the tracing ratio is a matter of great urgency, and it needs various knowledge.

REFERENCES

Beech, Jeff (1999) 'The Supply-demand Nexus', in Gattorna, John (ed.) *Strategic Supply*

Chain Alignment, Aldershot : Gower.

Christopher, Martine (1997) *Marketing Logistics*, Oxford : Butterworth Heinemann.

Dai Nippon Printing (2005a) *Annual Report : Segment Information.*

Dai Nippon Printing (2005b) *Sustainable Development.*

GISPRI (2005) *Annual Report.*

Nagumo, Toshitada, Nakajima, Hisao & Okano, Yasutake (2001) 'Industrial Change and Corporate Management in the Era of Ubiquitous Networks', *Knowledge Creation and Integration*, 9(8).

Ubiquitous ID Center (2004) *Tronshow 2004.*

YRP Ubiquitous Networking Laboratory (2005) 'Start of Feasibility Study Experiments with the Largest Specialty Men's Clothing Shop, Aoyama Trading, Aiming at the Full-scale Implementation of uID Technology' (press release).