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Trends and Prospects for Logistics with Intensified Information Technology

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Here I would like to make a speech on the relationship between logistics and IT (Information Technology), titled "Trends and Prospects Logistics with Intensified Information Technology." The progress in IT is indeed staggering. Logistics has come to the stage where it is generally playing a significant role in the society and logistics surely will achieve rationalization through the advance of IT. This speech is composed of three parts. First of all, the trend of the progress in IT, especially IT effective for logistics, secondly, the actual applications of IT to logistics, and thirdly, the aspects for logistics with intensified information technology.

1. The IT revolution

Currently, in Japan, the term "IT revolution" is gaining popularity. The word itself is, in other words, the latest buzzword within the country. I hear that the term "ICT (the Information Communication Technology) innovation" is being widely used in western nations, or, instead of IT, the term IP (Internet Protocol) is being used. IT is technology, and it is not the objectives but the means of computerization, therefore, the term "innovation" seems more appropriate than the term "revolution." Thus, the phenomenon should be referred to as the "ICT innovation." However, for this speech, the term "IT" will be used as is the practice in Japan.

The IT innovation has been brought forth by the progress in both computers and communication technologies. The computer provides digitized integrated information processing of characters, sounds and graphics. The communication network has expanded through the Internet. The IT innovation can be characterized by its, speedy, network-oriented, open, borderless and cost-less nature.

Through these characteristics, the IT innovation extends the industrialization of information (as in the rise of industries, information communication equipment and information services). The computerization of industries, of the government and of households has also been enhanced by improving the effectiveness in the industries, corporate logistics, in government and municipal services, and in home shopping and home education by means of IT. As a result, not only "digital opportunities" but also a "digital divide" (the economic disparity) has arisen.

2. The trend of IT

In the 1980s, the core of IT was the computer, in the 1990s, it was the communication network, and now for the 21st century it will be the contents.

The computer progressed from general-purpose computers to the PC and to the mobile computer terminal. In the 21st century IT will be fully utilized with information appliances.

The communication network, from the VAN (value added network) which exchanged online data interchange between individual companies, will expand through the current Internet as a global Internet covering almost any field.

Furthermore, with the fusion of computers and communication, computers will become a communication device and the functions of communication will come of age, for instance, word processing and e-mail rather than mere computing. Computing requires communication that consist of NP (Net PC) and ASP (application service providers).

The contents are the information to be processed, accumulated and transmitted through the computer. All types of data will be digitized, integrated, and will become interactive for anyone to utilize at any time or place.

3. The impact of the IT innovation

The IT has great influence on, and brings innovations to industrial structure, business management and consumption behaviors.

For industrial structure, the market will be electronized and exposed to global competition, meaning that the breakup and restructuring of the market will occur. Since industries and consumers will be directly connected, the restructuring of the distribution channels will occur, and new dealers (middleman) will enter the market as agents for procurement and sales.

For corporate commerce will be electronized and there will be a seamless logistics for procurement, production, sales, distribution and recovery. The effectiveness of business itself will be improved by restructuring and business process reengineering through the utilization of the IT. Transactions between clients will be made on a one-to-one basis.

For consumers behaviors, consumers, being able access an abundance of information, will become wiser and will have the initiative in terms of pricing, as in the auction. In other words, corporate management must focus on consumers in order to survive. Home shopping will be very convenient as for consumption, and consumers, as a community, will be able to participate in product development, as in ordering products with exclusive specifications.

4. Forecast on E-Business

E-Business, originally called EC (electronic commerce) or e-Commerce, is frequently referred to as E-Business. It is the electronization of commercial transactions. At the same time, it is the innovation in the business world that utilizes IT. E-Business is able to cover not only the existing commerce but also to create new types of business. For example, business providing electronic sales to consumers, and the creation of an electronic market place among business corporations.

In E-Business, the former is referred to as B-to-C, and the later, B-to-B. Recently, the diversification of E-Business shows the entry of C-to-C (as in auctions), B-to-E (welfare, education and sales to employees), B-to-G (applications to the government), and B-to-L (provision and introduction of local information).

The diagram shows the forecast of B-to-C and B-to-B in the U.S. and in Japan.

E-Business in Japan is just sprouting. Aside from the absolute values, the facts indicate that it is gradually growing and the rate of EC is showing a steady increase.

5. Examples of E-Business

One good example of E-Business in practice is BIGLOBE by NEC. BIGLOBE covers almost all fields related to the Internet. It not only supports its own E-Business but also the E-Business of other firms.

The business range may be divided into two sections, ISP (Internet Service Provider), the utilization and supportive services for the Internet itself, and ASP (Application Service Provider), support services for various application ranges of the Internet. BIGLOBE has established a layer 3 hosting service, which includes a number of IDC (Internet Data Centers) for its ASP.

In layer 2, various services are provided for B-to-B and B-to-C. Services may be self-provided or in cooperation with other corporations. For example, financial services are provided in cooperation with banks. Sales membership etc., is applied for in layer 1 and new service menus are being developed to gain over 10 million members.

6. IT for logistics

(1) Outline

There are 4 types of physical distributions (PD) in logistics: PD for procurement, PD for production, PD for sales and PD for recovery. Products will be delivered to consumers through a process from raw material, to parts makers, to producers of final goods, and to distributors/ channelers (wholesalers, retailers) in charge of sales. Information on orders, receipts of orders and money will flow the other way around.

IT that contributes to logistics may be classified into 3 groups. Firstly, the network technologies to correspond to the flow of information and money, secondly, the AIDC technology corresponding to the flow of products (identification of products), and thirdly, the technology to support the planning, execution and management of logistics.

Planning, execution and management supportive technologies are the information technologies that support the services provided by logistics. The DWH (data warehouse) and various application packages are concrete examples of such supportive technologies. The ERP (enterprise resource planning) is one example. It is in charge of the SCE (executive) in the SCM range and is called a SCP (planning) package corresponding to the ranges of forecasts in demand and production planning.

7 IT for logistics

(2) Network technology

IT corresponding to the flow of logistics information is called network technology.

The standardization of data interchange between companies is known as EDI (Electronic Data Interchange). The data interchange of physical distribution transactions, is the EDI for physical distribution in Japan and is called JTRN (Japan transport). The global standard is the EDIFACT (EDI for administration commerce and transport), and currently is in the process of integration. Namely, procurement by use of the EDI and Web EDI or XML/ EDI through the Internet is also increasing in Japan.

LANs (Local Area Networks) are set up in warehouses and distribution centers to connect carts and fork lifts with the racks and the warehouse computers.

Satellites are being used for networks between trucks on the road and offices, indicating the real-time location of the trucks. The commercial system, Omnitrucks, a combination of the U.S. GPS system of DOD and the communication satellite of Japan enables identification of the location of trucks. Antennas and vehicle terminals are currently connected to a couple of hundred trucks.

8. IT for logistics

(3) AIDC technology

The subject of logistics is the "goods." It is most desirable that the information about the "goods" is attached to the goods themselves, for instance, what the goods are and to where they should be relocated. AIDC is the name for the global standard of such IT, which identifies the goods.

AIDC includes OMR (Optical Mark Recognition), OCR (Optical Character Recognition), and voice recognition or fingerprint recognition systems. Linear barcodes, two-dimensional codes, and RFID (Radio Frequency Identification) are utilized in logistics. The barcodes may be directly printed on the goods, on labels which are attached to the goods, or electronic tags of the RFID may be embedded in the goods to be identified, to automatize the process and improve the efficiency of physical distribution.

Linear barcodes are often used in tags for door-to-door delivery services and in SCM (shipping carton/container marking) labels. Two-dimensional codes are used in transportation labels printed with the linear barcodes. At present, since the cost of each electronic tag for RFID is rather high, they are often used on reusable pallets, tote boxes and containers.

9. IT and the logistics information system

The logistics information system will be structured based on the various types of IT explained above. 4 patterns will be introduced here.

Internal logistics information systems are systems limited to an in-company range. Any processing after external ordering will be subject to such systems as listed in the following diagrams. Recently, the logistics ABC, the integration of logistics services and the information unification database are being considered.

There are various systems such as the inter-company information system, the EDI for ordering, the system to connect consignees and logistics companies (label and slips issuance), and the inter-company integration system by the SCM (Supply Chain Management).

3PL (third Party Logistics), a new form of business in logistics, requires the information of the consignee.

Global companies have global logistics information systems. The global standard EDIFACT is installed for networking at a global level or database sharing for data interchange.

10. The structure of the logistics information system

The plan execution structure of logistics is as in the diagram given. Network and AIDC technology is contributing at the execution level. Information systems for planning and management levels will be introduced here.

Forecasting and simulations will be made at the level of planning. The CPFR (Collaborative Planning Forecasting and Replenishment) is expanding to enable a higher precision of forecast by sharing sales and inventory data among companies. Furthermore, the reduction of logistics centers is accelerating for the increase in cash flow and the reduction in inventories now in Japan. So, it is necessary to make a simulation for the allocation of logistics centers.

At a managerial level, the sharing and integration of data as well as the one-input, multi-use system is gaining popularity. A collection and analysis of massive amounts of data is increasing with the aim of detailed management. Logistics ABC (Activity Based Costing) is being considered with a view to cost data capture. Through the logistics ABC, distribution cost will be clarified by product, by consumer and by area, which will enhance the improvement in logistics. This therefore, is becoming a driving-force behind the installment of information systems.

11 Logistics information systems in practice

(1) SLP, Standard Logistics Package

The computerization of industries is moving along with the advancement in the IT. However, at the same time, one should not neglect to mention that a "digital divide" is being formed depending on the scale of the companies. It is apparent that computerization has progressed in large companies, and though computers are being installed in smaller and medium enterprises, the range of applications is, as yet, insufficient. This is one of the things hindering the progress in data interchange. The SLP has been prepared to promote the computerization of such smaller and medium enterprises.

SLP is an application package for transportation services and warehouse services. This was funded by the government and developed by the private sector, which is a quite popular case in Japan. This package may be installed at a minimum cost of ¥ 1 million.

The package consists of the common areas and specific areas of the two services. Companies dealing with both areas may install the whole package, whereas companies dealing with only one area may install the necessary parts of the package. Needless to say, since the package is a standard package, there is a customization service to focus on the particular activities of each company. This is expected to contribute to the promotion of the computerization of smaller and medium enterprises.

12. Logistics information systems in practice

(2) Transportation companies

The second case is transportation companies. The example given in the diagram, is a large company which has a distribution center and in which all services are highly computerized utilizing advanced IT. Two of the main systems will be introduced here.

The first is the consignee system. An exclusive terminal machine is installed for data interchange and information processing at shipper. The applications cover the issuance of exclusive vouchers and labels, and inquiry services for the conditions of delivery and

pricing etc. The cargo tracking system, which will be discussed later, must be prepared in order to utilize the delivery condition inquiry service. As for the explanation of the diagram, the cargo will be checked in by the client on the bottom left, the cargo will be delivered from the bottom left to the bottom right which will be handed over to the receiver (customer). The barcode, which is attached to the cargo tag, will be read at each stage to designate the location of the cargo.

The second is the vehicle system. A terminal equipment will be connected to the vehicles, which enables the interchange of data such as work instructions (pick up cargo) or work reports (completion of delivery), and will record the operation history to automatically prepare daily reports, reducing clerical activities. A simple network, the MCA (Multi Channel Access) is used for data interchange between the office and vehicles.

13. Logistics information system in practice

(3) Warehouse companies

The third example is the information system for warehouse companies. A package called the "NEODC" is being used for this system. The term and cost for system structurization has been reduced by utilizing this package.

The package consists of the systems as given in the bottom of the diagram. This package covers from the entry to shipment of the goods and inventory management. The receiving management system is in charge of the receipt of the ASN (Advanced Shipping Notice), the allocation of the storage location of the goods received, and the import and updating of the records of receiving. Shipping management covers various fields such as the delivery schedules, inventory allocation, shipment procedures, creation of shipping slips. The inventory management system creates inventory replenishment lists and corresponds to inventory inquiries.

The top of the diagram shows the terminal machine used for inventory management. These are the POT (Portable Terminal) used for inspections and picking, the label printers for printing labels and the printer to issue invoices for transportation services and consignees. The FAX-OCR automatically reads and directly enters the fax data from consignees to the computer and the EDI in which data is entered via the computer.

14. Logistics information system in practice

(4) Convenience Stores

One of the most active retailers in Japan is convenience stores. There are over 37,000 (Feb. 2000) stores in Japan and as many as 10 time-designated trucks deliver merchandize to each store every day.

The sequence of logistics starts from the ordering data sent to the computer center by each store. The ordering data will be transmitted to factories (box lunches), vendors (wholesale), and makers (groceries) and shipping to each distribution center will be delivered.

The distribution center is separated according to 4 temperature ranges, normal temperature (groceries which do not need temperature control), frozen, chilled and constant temperature (box lunches at 20). The merchandize of each temperature range will be delivered in separate trucks. Since the margin for box lunches is relatively high and quality is important, it is delivered three times a day, in the morning, in the afternoon and in the evening.

This refined logistics of convenience stores is supported by the information systems involved with production, distribution systems, ordering and inspection.

15. Logistics and the Internet

The Internet has come to play a significant role in IT and is spreading rapidly in logistics. In Japan, there are approximately 900 companies providing logistics services that have their homepage on the Internet. In the homepages, the introduction of the company, the services available, product news, and recruitment information are all provided and a community page asking for opinions and requests is established.

Furthermore, there are real-time information provision services, such as cargo tracking inquiries, logistics diagnosis (confirming whether inventory and cost management exist and making replies for the corresponding methods), price quotations (freight, moving costs,

storage costs), traffic conditions through fixed point observation and the actual photographs of ports and harbors.

The data which will be interchanged are EDI for physical distribution such as requests for transportation, inventory reports, receipts and ordering data ASN (Advanced Shipping Notice), and management reports. However, arising from concerns in the security of the Internet, the interchange of such data has just begun.

On the other hand, E-Business is on the rise in fields such as online shopping, vehicle and cargo matching systems, escrow services, and ASP. These will be explained later.

16 E-logistics in practice

(1) Cargo tracking system

The Internet applied to logistics is called E-logistics. Here are some examples.

The first case is the Cargo tracking system. The mechanism of the cargo tracking system is as explained in the Transportation companies of the Logistics Information System section. The transportation service provider first started the inquiry service on delivery conditions. In the beginning inquiries were accepted only from the terminal machines of clients, however, at present, the Internet inquiry service is available from the mobile telephones "i-mode" which have spread explosively. The number of i-mode users is said to be over 15 million.

At present, the cargo tracking system updates its data within 15 minutes to 1 hour, and real-time updates are hoped to be possible by fiscal year 2001.

17. E-logistics in practice

(2) Vehicle and cargo matching system

The Vehicle and cargo matching system is a system aiming at enabling higher performance in transportation, and the improvement in the load factor of trucks and arranging cargo for

empty trucks. This type of business did exist, however, has increased tremendously by the utilization of the Internet. Together with conventional services, 10 companies have entered this business in Japan. Not only trucking companies, but also subsidiary of shippers, and information companies have entered either alone or in tie-up.

The Vehicle and cargo matching system is an example of E-Business in the B-to-B market place. This system arranges for the coordination of empty trucks and cargo information. The example given is the service provided by a physical distribution company, which is subsidiary of a food maker. The empty truck information will be entered by the transport service providers. The information consists of, when and where the truck will be empty, the type of truck and the freight. Cargo information will be entered by the consignee. The cargo information consists of the name of the cargo, the units, the date on which it is desired to be loaded, the desired date, time and place of delivery and the pricing. The coordinator will match both pieces of information and will decide and give instructions on which truck will carry which cargo.

18. E-logistics in practice

(3) Logistics service providers

The third case is E-Business for logistics service providers utilizing the Internet. In the U.S., the "Last one mile" has become a common subject of conversation about the B-to-C service. Especially during the Christmas trade war of last year, it is said that more than 25% of cargo was mis-delivered. In Japan, with its time designated deliveries and 24-hour delivery services, logistics service providers are starting to get involved in E-Business.

The diagram is an example of a logistics service provider entering online shopping. The homepage is linked to other virtual shopping malls and the logistics service provider takes over the delivery of the order. The diagram below gives a summary of the services provided by the logistics companies.

The service includes not only the transport of goods, but also the storage of goods subject to virtual shopping, processing, receiving orders and the collection of receivables. The receivables collected will be transferred to the corporations.

19. E-logistics in practice

(4) Convenience stores

Other than the door-to-door delivery services mentioned previously there is one more player which is getting involved in Japan's B-to-C E-Business. Convenience stores, gasoline stands and train stations are starting to be utilized as a place to receive and to make payments for goods ordered through the Internet.

The fourth case is "7dream.com" which has been set up by the largest retailer now in Japan, Seven-Eleven Japan. 8 companies including NEC and Sony have contributed in this project with Seven-Eleven as the center. A homepage listing over 100 thousand items was launched this July and MM (Multi Media) terminals will be sequentially located in the stores. Seven Eleven has over 8,000 stores; the average number of customers per day is 1,000. The MM terminal machine will enable to purchase of the same items as in the homepage. Furthermore, there is also an attempt to enter the banking business and to install ATMs in the stores.

Furthermore, in Japan, several other convenience stores are now starting to enter the E-Business. This business has just started and the performance cannot yet be measured.

20 E-logistics in practice

(5) Escrow service

In Japan, logistics service providers are actively participating in the collection of receivables, which is the other task left for the "Last One Mile" in E-Business. In Japan, there conventionally was a system in which the receivables will be collected on delivery and if collection is not made, the deliverer will make advanced payments.

Two new methods were added for E-Business. One of the new methods started this June in which the driver carries a mobile terminal machine for card payment services (credit card and debit card). The mobile terminal machine was developed by credit card companies, computer makers and transportation companies.

The other case is the Escrow service which Nippon Express recently introduced. The Escrow service stands as a mediator between auction participants, and managing the payments to prevent troubles such as "the item delivered was defective," or "the payment cannot be collected." The case of Nippon Express is supported by the linkage of banks and information service providers (subsidiary of NEC).

21. E-logistics in practice

(6) ASP

The sixth case is ASP, as in "BIGLOBE", for logistics. ASP is a method to provide applications through the Internet. The merits for those utilizing ASP are as follows. There is no need to own a computer. An operation manager is not required. One may use the necessary applications when necessary and for the term necessary. By sharing the computing center, the cost will be kept low. This enables the dispersion of risk against the rapidly changing environments of IT and of business, and is expected as a form of business outsourcing. ASP is good news for the smaller and medium sized companies, and it is also gaining attention from large companies as a form of "management without holding."

The diagram shows the ASP service system in logistics. There are service menus such as the Web warehouse management, cargo tracking systems and vehicle and cargo matching systems in the Internet data center which is the outsourcing center utilized in the warehouses and physical distribution centers of users. This is programmed to be operated by the transport service subsidiary of NEC on BIGLOBE.

22 Aspects of logistics with intensified information technology

(1) Glocalization

IT will keep on developing. IT will unite the whole world beyond time and space. However, it is extremely difficult to unify the mechanism of the flow of goods and information in logistics. It is significant that international coordination in the global standard (ISO) is developed for what should be standardized and what should not. Each

and every nation has its own culture, which makes it impossible to standardize immediately. It is necessary to determine the framework, but to leave some room for flexibility in the details.

Though this may seem to be a rather outspoken view, logistics is very different in each nation. Japan uses the JIT (just-in-time) manufacturing and distribution system, which respects the quality of goods and operations. U.S. uses a more flexible system and pursues low costs. In Europe, the characteristic is that the systems are much more environmentally-aware. Logistics for the 21st century should take the best parts of each of these systems and should be developed to correspond to the circumstances of each nation. Therefore, "Glocalization," a compound of globalization and localization, will be the keyword.

For instance, even if the size, media and data items of labels are standardized, the notations may differ. For example, from the difference in cultural backgrounds, in Japan, the address will be written in a form of To From, whereas in Europe and the U.S. it will be From To. So, we use the form To From domestically and the form From To internationally. However, in any case, based on the cultural backgrounds, logistics with intensified information technology is to reduce inventories and the transport of goods by the use of IT. The most advanced logistics is the realization of a minimum logistics.

23 Aspects of logistics with intensified information technology

(2) Further IT innovation

It is often said that IT is experiencing dog year progress. This term is used because one year for a dog is equivalent to approximately 7 years for us human beings. New IT is rapidly replacing old IT. It is extremely difficult to foresee the future of IT. However, though it may be difficult to foresee the future of each technology in particular, it is clear that the form of using computers will move to a fusion of C&C as in the diagram. Further innovation of IT and logistics will be introduced here.

Wearable computing is the computer that will be divided into small portions that are wearable. With the CPU on the waist, data entry may be made by the mouth, and the

display may be worn like glasses. This may be helpful for activities in warehouses where one's hands and feet are busy.

Vehicle computing is where the information systems are mounted to transportation devices (vehicle, ships etc.) for a more efficient transport delivery system.

Mobile computing utilizing radio transmission may enable sales people to make decisions and actions without loss.

A high level logistics will be performed due to knowledge computing based on KM (knowledge management) and BI (Business intelligence). Logistics is constantly advancing. Ubiquitous computing is the optimal field.

24 Aspects of logistics with intensified information technology

(3) Logistics information network image for the next generation

Logistics is very complex, manifold and diversified. It will not see completion in one company and it will stride over several companies. Effective logistics may not be realized when the linkage between the companies is not well organized. The mutual linkage is the information network. The various infrastructures involved must be standardized in order to realize a smooth-running information network.

The logistics information network for the next generation will not be formed unless this infrastructure is maintained. The compatibility of the hardware and software must be realized at an industry level, nation level and a global level to reach an agreement on standardization in order to form a network.

The diagram shows the layers of the network, with companies positioned on the top of the classes and the consumers. The information network is structured on top of the infrastructure of communication and information, and finally the logistics information network is formed at company level. A global network will be formed even when partially operating. A globally standardized information network is required when partially operating.

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(4) ALIS development organization

I would like to conclude this speech by introducing the activities of the committee (of which I am a member) established based on the logistics information network for the next generation plan and the "Comprehensive program of logistics policies (CPLP)" announced by the government of Japan in April 1997.

This project is called the ALIS (Advanced Logistics Information System). It started in April 1998 and will end in March 2001. It has been started as one of the main measures in the "CPLP" of computerization to elevate the logistics system.

Computerizations in which the individual companies have been working hard on have been limited to the optimization among individual companies or among companies with transactions. Therefore, computerization was limited to a local network without expandability. The target of this program is to build the base structure for computerization by eliminating any imperfections to realize a highly compatible and open network, taking global standardization into account.

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(5) ALIS utilization plan

ALIS is a system to solve various tasks by unifying the flow of information and goods in logistics. The main theme is to standardize the interface among goods and among information to obtain this unification. The transportation label and the logistics database are the two themes taken up in this project.

In Japan, the labels used in retailers, makers and wholesalers are partially standardized, however, currently, there is no standardization which involves logistics industry. This project is being carried on in accordance with the guidance of the ISO.

For the standardization of the interface of the logistics database, addresses will be indicated by latitude and longitude (not company code), and the delivery plans will be dealt with to realize the most efficient flow of goods. Some large companies have already achieved the GIS (Geographic Information System), however, the smaller and medium sized companies are incapable due to the lack of high price electronic maps. Such tasks will also be worked on.

Finally, though it is easy to talk about logistics with intensified information technology, it will be extremely difficult to make it a reality. We must work on this task step by step. Thank you for listening.