The Hypothesis-Testing Ordering System: A New Competitive Weapon of Japanese Convenience Stores in a New Digital Era

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This study focuses on the store-ordering system practiced by Japanese convenience stores. The article examines (1) the conceptual categorization of such ordering systems, (2) the history of the system development at three major convenience stores, and (3) the characteristics of 7-Eleven's development that led the way toward an innovative ordering system.

Introduction

There is a striking contrast between the impression one receives of a convenience store (CVS) in the United States and that of one in Japan. In the United States, CVS business status is considered to be on the decline due to competition with supermarkets and discount stores. In fact, 7-Eleven, Inc. (formerly Southland Co., Ltd.) one of the leading convenience-store businesses in the United States is struggling to reconstruct its management. In contrast, in Japan, CVS business is a promising business form that has been growing for more than 20 years, outrunning the supermarket, department store, and discount store business forms. For example, compared with department stores, superstores, and supermarkets, CVS's market share in the Japanese retail market exhibited consistently stronger growth (see Table 1). For the 12 years shown in the table, CVS's market share increased from 2.3 percent to 5.8 percent; the superstore increased its market share by only 0.9 percent (from 5.6 percent to 6.5 percent) and the department store reduced its market share by 0.4 percent.

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TABLE 1

CHANGES IN MARKET SHARES AND SALES GROWTH RATES OF DEPARTMENT STORES, SUPERSTORES, SUPERMARKETS, AND CONVENIENCE STORES (1982–1994)

Year	Department Store	Superstore	Supermarket	CVS
1982	7.8	5.6	4.4	2.3
1988	7.9 (101.2)	5.9 (101.3)	4.5 (101.2)	4.4 (231.9)
1994	7.4 (101.2)	6.5 (101.4)	5.4 (101.5)	5.8 (165.8)

SOURCE: Japan Census of Commerce, MITI.
Sales growth rates are in parentheses.

Moreover, 7-Eleven Japan (7-Eleven), the top company in the Japanese CVS business, is attracting attention from various sectors as an exemplary company. In fact, 7-Eleven is currently assisting the American version of the company in its reconstruction. Today, the American CVS sector is striving to revive itself by implementing the "best-practice" method used by its Japanese counterpart. This article focuses on the best-practice method practiced by Japanese convenience stores.

This study focuses on the store-ordering system practiced by convenience stores in Japan. A convenience store is a retail store that supplies consumers with items, such as food, beverages, and household supplies, that typically are used within one hour of purchase. The goal of the store-ordering system is to accomplish streamlined just-in-time inventory, which improves store efficiency by removing "dead" and slow-selling items, replacing these with better-selling items, and providing forms to assist in analysis of data, including data related to dead items, ordering efficiency, and new product sales. This article will clarify and explain the following issues: (1) the conceptual categories of store-ordering systems that exist in the Japanese CVS business; (2) how such systems came to be developed; and (3) the characteristics of development structure from which the innovative CVS store-ordering system arose. In the next section, the research settings and method is explained as well as the development of some categories of store-ordering systems in the Japanese CVS business. Finally, I discuss some characteristics of the development structure that gave birth to the innovative CVS store-ordering system.

Research Settings and Method

Why the CVS Store-Ordering System? There are several reasons for focusing on the CVS store-ordering system. First, one of the reasons

convenience stores in Japan have experienced such growth is the innovation of the store-ordering system. Within limited store space, top-selling products must be efficiently rotated in full cycle and low-selling products must be promptly removed. Thus, respective CVS companies have devised the store-ordering system.

Second, the store-ordering system that was developed by Japanese convenience stores is gathering attention not only in Japan but also in the United States. In Japan, Ogata (1984, 1991), Kunitomo (1986, 1993), Kawabe (1994), and Yahagi (1995) have turned their attention to the Japanese CVS store-ordering system. In addition, ever since 7-Eleven (Japan) started assisting 7-Eleven, Inc. (United States) in its restructuring, U.S. interest in Japanese convenience stores has increased (Kotabe 1995; Bernstein 1996). As will be explained, within the history of the development of the convenience store in Japan is the development of the unique Japanese store-ordering system.

Characteristics of this Study. Numerous studies have paid attention to the Japanese CVS store-ordering systems. This study differs from them in several points. First, this study presents the conceptual categories relating to CVS store-ordering systems. Most previous work related to convenience stores focuses on describing factual situations. In contrast, this article presents the conceptual categories of CVS store-ordering systems based on interviews. Second, by comparing the various CVS store-ordering systems, it illustrates the characteristics of CVS store-ordering systems in Japan. Most of the literature to date focuses on and discusses only 7-Eleven's CVS store-ordering system; this article also describes the trend of other large CVS businesses. In the process of comparing and contrasting different systems, the characteristics of the CVS store-ordering system and the characteristics of the system practiced by 7-Eleven[1] are discussed.

In summary, this study proposes to (1) present a conceptual categorization of the store-ordering systems and (2) present new facts and circumstances surrounding those systems.

Research Method. 34 individuals who were involved in information-system development both in the United States and Japan from June 30, 1995 to August 26, 1997 were interviewed. Most interviews lasted from one to two hours. Most interviews were conducted in person, but some were

[1]The CVS store-ordering systems that I researched are those practiced at 7-Eleven Japan, Lawson, Family Mart, Sunshop Yamazaki, Circle K Japan, Seiko Mart, Sunkus and Associates, and am/pm Japan.

conducted by the telephone.[2] Supplementary communication was achieved via facsimile and e-mail.

Conceptual Categorization of CVS Store-Ordering Systems

Generally, major convenience stores in Japan are managed by a franchise method. In other words, two independent management entities enter into an agreement whereby the franchiser (headquarters) assists the franchisee's (store) management, and in consideration for such assistance, the franchisee pays royalties to the franchiser. Thus, at all times, the store's order-entry rights belong to the franchisee (store). Under the franchise system, convenience stores adopt one of the following three store-ordering systems, which will be described in more detail below: the replenishment-ordering system, the automated-ordering system, and the hypothesis-testing ordering system. Table 2 summarizes the discussion to follow.

Replenishment-Ordering System. First, the employee in charge of store-order entries checks the existing stock of the products he or she plans to order. Then, after checking the stock, if the employee thinks, based on his or her experience, that there is not enough stock, the employee replenishes the stock appropriately. For example, say 20 cans of Coca-Cola are usually stored in the store and that 10 cans have been sold. Under the replenishment-ordering system, a replenishment-order entry of 10 cans would be sufficient. The guidelines for this system are the intuition and experience of the order-entry employee.

Convenience stores initially adopted the replenishment-ordering system. As explained later, however, they moved toward adopting a different method in the 1980s. Convenience stores must efficiently manage their limited store space or they cannot expect to improve business performance. To achieve this goals, one must strive for a highly accurate store-ordering system.

The first problem with the replenishment-ordering system is that it depends solely on the order-entry employee's intuition and past experience. If a product sells (or doesn't sell) contrary to the employee's judgment, the store cannot promptly respond to the a situation. For example, we instinctively think that ice cream does not sell in the winter. However, we can always comfortably eat ice cream in our own warm

[2]Some interviews were conducted by telephone because I currently live in the United States and as a result interviewing in Japan was limited to a certain time period.

TABLE 2
COMPARISON OF THREE ORDERING SYSTEMS IN THE CVS INDUSTRY

	Replenishment	Automated	Hypothesis-Testing
Problem solver	Store people	Headquarters	Store people
Use of POS data	No	Yes	Yes
Use of intuition & experience	Yes	No	Yes
Required ordering skill of store staff	High	Low	High
Use of local information	Yes	No	Yes
Interaction between stores and headquarters	No	Only through digital data	IT & human based

house. Thus, ice cream sells well even in the middle of winter. As another example, we tend to think that Chinese meat buns sell best in winter. However, facts indicate that they sell best when temperatures drop as summer turns to fall. These facts first became known through implementation of CVS point of sales (POS) data and analysis of the such data.[3] As can be seen, the replenishment-ordering system, relying as it does on an employee's intuition and past experience, cannot adequately respond to trends.

The second problem in the replenishment-ordering system is that there is a tendency to underestimated order entries, a situation leading to products being sold out at time of order entry. For example, let's say that the usually stocked 20 Coca-Cola cans are all sold out. In the replenishment-ordering system, the order entry for that time will be 20 cans. However, the fact that 20 Coca-Cola cans are sold out when it is time to reorder, may mean that there could have been a demand for 30 cans. If summer is approaching, perhaps 40 cans of Coca-Cola will sell the following week. As can be seen, the replenishment-ordering system entails the risk of underestimated order entries.

To avoid such underestimates, one needs data showing that the store places underestimated order entries. Underestimated order entries happen because of the absence of data tracing product demand at the time of placing order entries. Such data should include approximately how much time after delivery the product sold out, how fast Coca-Cola sold last summer, how much Coca-Cola was sold at a nearby store yesterday, etc. When striving for a more accurate order entry, the replenishment-ordering system starts to become inadequate.

[3]Interview with Mr. Kazuyoshi Shiotani, Development Division, am/pm (May 16, 1996).

In the replenishment-ordering system, order entries are based on the responsible employee's intuition and experience. The concept behind this system is to replenish products by the number of products sold. If the product trend is contrary to the responsible employee's intuition and experience, there is no place in this system for modification and, as a result, there is a tendency to place underestimated order entries. In the 1980s, and mainly at 7-Eleven, this problem came to light and led to the innovation of translating records of past order entries and sales records into computerized information. This new information was used when placing order entries. In other words, the CVS industry developed a new type of store-ordering system by making use of information technology.

There are two main methods of utilizing the computerized information about past order entries and sales records: the automated-ordering system and the hypothesis-testing-ordering system. Each will be explained below.

Automated-Ordering System. Under the automated-ordering system, the convenience store is provided with the order-entry volume that the store should order from headquarters. For example, let's say that a store employee suggests to the order-entry employee place an order entry of "10 roast beef sandwiches" for the next day. A computer will then compute this recommended order-entry volume. The computer contains past order-entry records and sales records as computerized information and such data is calculated based on a certain formula. In other words, the data is analyzed by the computer (or headquarters), and the actual convenience store is given only the recommended order-entry volume as computed by the computer. Then the responsible store employee places an order entry making reference to the volume as computed by the computer. Lawson, the second-larges CVS chain, used this order-entry method. American retail stores are also moving in the direction of an automated-ordering system. For example, by utilizing data-mining technology, Wal-Mart is striving toward a store-ordering system that will guide each store with the appropriate order-entry volume in an automated fashion.[4] American retail businesses are developing store-ordering systems whereby headquarters review how to best make use of information technology in managing the stock of each store.

[4] *Nikkei Computer* August 4, 1997:108–13. Comments provided by Mr. Taiki Matsuo of NEC Systems Laboratory, Inc., who has been involved in the information-system development of 7-Eleven, Inc. in the United States, are also used as reference.

The advantage of this automated-ordering system is that it is not especially dependent on the skills of the order-entry employee. Past order-entry records and sales records are used and the same result is obtained independent of the employee who places the order entry. This is an especially advantageous factor in that part-time workers make up the majority of the workforce at convenience stores.

Hypothesis-Testing-Ordering System. The hypothesis-testing-ordering system is similar to the automated-ordering system in that it maintains past order-entry records and sales records as computerized information and such information is used when placing order entries. The difference lies in who analyzes the data and determines the order-entry volume. Under the hypothesis-testing-ordering system, this is done by the employee in charge of making order entries at the store. Headquarters (or the computer thereat) provides support information that allow the responsible employee to place highly accurate order entries. 7-Eleven was the first convenience store to adopt the hypothesis-testing-ordering system.

Under the hypothesis-testing-ordering system, the order-entry employee determines the order-entry volume based on a hypothesis that he or she has formulated. At the time of making order entries, the employee forms a hypothesis based on future trends of the products. For example, ''Summer is approaching so Coca-Cola may start selling.'' Or, ''Since merchandise with 'Sailor Moon' (Japanese cartoon) characters are now 'in,' perhaps sweets incorporating these characters will sell well.''

To come up with such a hypothesis, the employee needs sales records of Coca-Cola for that particular store or sales records of Coca-Cola for another nearby store that entered into an agreement with the same franchiser. Or, with regard to sweets incorporating cartoon characters, the employee needs sales records for other goods that bear the same cartoon characters. To assist the employee, headquarters provides the store with the relevant and available information. In providing the store with this information, computers and a computer network are utilized. Then, based on the information that he or she receives, the order-entry employee creates a hypothesis, determines the order-entry volume, and places an order entry. The sales data will then verify whether the hypothesis was accurate and use this information for the next order entry. This cycle is repeated in the hypothesis-testing-ordering system.

Therefore, if the hypothesis-testing-ordering system is adopted, headquarters must promptly provide the convenience store with records of past order entries, sales records, and information on sold-out stock. Further-

TABLE 3
COMPARISON OF THE AUTOMATED-ORDERING SYSTEM AND THE TEST-VERIFICATION ORDERING SYSTEM

	Automated-ordering system	Hypothesis-testing-ordering system
Task of the order entry employee	Adjustment of the recommended order-entry volume	Analyze information necessary for setting up a hypothesis Formulating hypothesis Determining the order-entry volume Confirming the hypothesis against sales data
Information provided by headquarters to the order-entry employee	Recommended order-entry volume	Information on new products Product information such as gross margin Past ordering records Sales records Delivery information Customer information

more, headquarters must be able to provide information on product sale trends and new products. This is a striking contrast from the automated-ordering system in which headquarters (or its computer) provides the store only with a recommended order-entry volume (see Table 3).

Another Aspect of the Hypothesis-Testing-Ordering System: Human-Based Communication. The hypothesis-testing-ordering system delegates an immense amount of responsibility for ordering merchandise to store personnel; business performance of the ordering system depends on these employees' ordering skills. As will be shown later, using state-of-the-art information technologies, this system provides the stores with decision-support information such as past order entries, product sales trends, and so on. The hypothesis-testing system uses a technology-based communication system to improve each store's business performance. In addition, the hypothesis-testing-ordering system uses another type of communication system, that is, a human-based communication system. To better understand the hypothesis-testing-ordering system, this other type of communication system also needs to be understood.

The human-based communication system has several characteristics. First, the system emphasizes the importance of person-to-person contact. Every communication is through the person-to-person contact. Second, "field counselors" play an important role in this system. They supervise a

group of stores and go back and forth between the stores and headquarters.[5] The counselors provide stores with advice on ordering and on the use of information systems and information on the portfolio of available items. Also, they convey information, criticisms, and suggestions for improvements from and between store operators, all the way back to headquarters.

7-Eleven believes that the human-based communication system is extremely important to the hypothesis-testing-ordering system. More than one-third (1,000) of 7-Eleven's employees have been Operation Field Counselors (OFC) and they play the role of "field counselors." The OFCs supervise seven to eight stores each and are in close contact with the stores. They are also integrated with headquarters. From all over Japan, all the OFCs gather in Tokyo once a week for a meeting. Those at the next two levels, district and zone managers, also meet in Tokyo once a week. 7-Eleven spends more than $10 million per year on these weekly meetings, the goal of which is to provide headquarters with rapid, distortion-free feedback from stores and make all OFCs aware of the tactics that seem to be working in one group of stores. The OFCs then can disseminate this information rapidly throughout the 7-Eleven network of stores. The OFCs visit each store twice a week; the frequent visits have the effect of motivating the owners and staff of even the small, remote stores because the store clerks receive encouragement and quick feedback on their performance from the counselors.[6]

Advantages of the Hypothesis-Testing-Ordering System. There are several advantages to using the hypothesis-testing-ordering system. First, under this system, order-entry employees are responsible for placing order entries on

[5]With regard to store personnel training, in the major Japanese CVS chains, before starting a new store, the new franchisees (store managers) and their wives are first brought to the central training center for a month and then go through a two-month, on-the-job training period in one of the regular stores. Training helps them understand the corporate policy, the need for high quality of data input, and the importance of daily operation and service quality.

On the other hand, store employees can acquire and improve their skills in ordering only through on-the-job training in each store. In this respect, the field counselors view themselves as coaches. They train the store employees through their visits. For example, the counselors often teach the store employees the importance of placing order entries at at their own initiative and provide them with advice on ordering.

[6]7-Eleven does not use financial rewards to encourage store employees to improve their performance on ordering-related tasks. Not all store employees have ordering responsibilities. Ordering is looked upon as difficult and critical work at CVSs. New part-time workers are not in charge of placing order entries. Experienced employees are charged with the more difficult, sensitive, and important product lines. Thus, part-timers who have order responsibilities for the more difficult and important products take a great pride in their ordering responsibilities.

their own. 7-Eleven, which uses the hypothesis-testing-ordering system considered the following advantages when adopting this system.[7]

Under the automated-ordering system, headquarters recommends the order-entry volume. In other words, in substance, headquarters decides the store's order-entry volume;. the order-entry employee is not part of the process. If the products do not sell, the employee does not consider this to be his or her fault or responsibility, but that of headquarters. 7-Eleven wanted to create a system that allowed the person making the order entry to be responsible for its consequences.

Another advantage is that the hypothesis-testing-ordering system permits the order-entry employee to efficiently use, in an organized fashion, his or her intuition and experience. The replenishment-ordering system is inefficient in that it depends *entirely* on the order-entry employee's intuition and experience, which is not necessarily a problem but there is no real way to verify whether the employee's intuition and experience are in line with current market trends. The hypothesis-testing-ordering system provides the order-entry employee with data against which he or she can check this intuition and experience and determine if it lines up with current market trends. For example, say there is a national highway in front of a convenience store and that passing truck drivers have been frequenting the store for several years. The store manager now knows from experience that these truck drivers often buy canned coffee (with sugar) beverages and so, based on these facts, the store manager remembers not to run out of coffee beverages.

The hypothesis-testing-ordering system allows the order-entry employee to check whether the relationship between the truck drivers and the demand for canned coffee beverages is correct and based on such data, the employee can make an even more accurate order entry. For example, the employee can check data concerning the relationship between "male or female customers in the age range of 30 to 49 years old" *vis-à-vis* sales of canned coffee beverages. As will be explained later, in Japan the POS register allows one to record which people in what age range purchased which items and the time of purchase. By checking the times during which there are many customers, as well as the estimated volume of demand, a more precise order entry can be placed. Furthermore, as a result of each store practicing this method, headquarters can share any useful data obtained with other stores to help them in their order entries.

A third advantage of the hypothesis-testing-ordering system is that an employee can freely combine the recorded data and, using that as a

[7]Interview with Mr. Sachio Mizuno, NEC special counsel, and Mr. Hideo Matsumoto, No. 5 C & C System Operations Headquarters, NEC (June 30, 1995).

reference, create a hypothesis. For example, there is a convenience store at which more than 50 percent of the customers are women. The time is February, a few days before Valentine's Day. In Japan, it is the custom for women to give men chocolate on Valentine's Day as an expression of affection and, likewise, men give women chocolate on White Day (March 14). In principle, chocolate sells in February because of Valentine's Day. Generally, it is believed that women buy chocolate for Valentine's Day. The convenience store stocked more chocolate than usual, but the chocolate does not sell as initially anticipated. However, when the order-entry employee stands at the counter, she realizes that men are actually buying chocolate as well. Using the sales data in the computer, the employee checks the relationship between customer type and the sales volume of chocolate. The employee discovers that it is actually mostly male customers who are purchasing chocolate, not female customers. Perhaps female customers were instead purchasing their chocolate at department stores or chocolate boutiques. Based on this discovery, the employee formulates a hypothesis such as "on White Day in March, female customers will buy chocolate at convenience stores, not male customers." Since the store's main customers are women, the employee may place a bigger than usual order for chocolate in anticipation of March 14. By combining direct observations with freely modifiable data analysis, the store can promptly and actively respond to market needs. In comparison, under the automated-ordering system, the kind of data used to compute a product's order-entry volume is already fixed; use of market trends observed by store employees cannot be actively implemented in the order entry.

The final advantage of the hypothesis-testing-ordering system is that the employee can make use of detailed local information when placing an order entry, information not available at headquarters. For example, let us say that there is going to be a marathon at a neighborhood high school. Headquarters would most likely not have this kind of information. Furthermore, assume that the store employees find out that white socks will sell well the day before a marathon. The information that "there is going to be a marathon" is a vital piece of information that can be actively used in the order entry.

The Actual Store-Ordering Systems Used at Convenience Stores

As explained above, there are three types of store-ordering systems used by convenience stores: the replenishment-ordering system, the automated-ordering system, and the hypothesis-testing-ordering system.

Today, most large convenience stores use the hypothesis-testing-ordering system, but the road to its adoption has not been an easy one, especially for 7-Eleven, which was the first to implement it. Its history of systematizing its store-ordering system is one of constant trial and error.

7-Eleven is the leading firm in the Japanese CVS industry. 7-Eleven ranks first among Japanese retailers in terms of ordinary profit ($93.3 million in 1994) and third in terms of net sales ($13,923 million in 1994). 7-Eleven is Japan's largest CVS chain, consisting of almost 6,000 stores in 1994 (see Table 4).

Let us examine how 7-Eleven came to adopt the hypothesis-testing-ordering system and how Lawson and Family Mart, the other two major convenience stores in Japan developed their store-ordering systems by studying 7-Eleven's system development.

7-Eleven's Store-Ordering System. The transformation of 7-Eleven's store-ordering system can be divided into four major periods. The primary system started in 1978, the secondary system in 1982, the third system in 1985, and the fourth system in 1990. Figure 1 shows how the management figures improved in 7-Eleven stores through the implementation and renovation of the four phases. Each system reform contributed to improvement of store efficiency in terms of average stock turnover time, average daily sales, and average gross profit margin.

Primary system. 7-Eleven's systematized store-ordering system was introduced in 1978. Initially. 7-Eleven started by systemizing the replenishment-ordering system. Terminal 7, developed by NEC exclusively for 7-Eleven, assisted this systemization. The replenishment-ordering system worked as follows.

TABLE 4

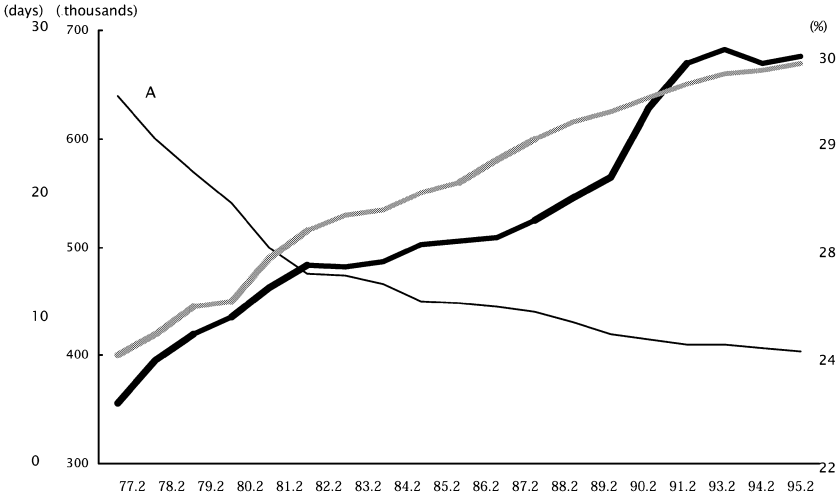
THE 10 LARGEST CVS COMPANIES RANKED BY SALES IN 1994

Rank	CVS company	Sales ($million)	Number of stores
1	7-Eleven Japan	13,923	5,905
2	Lawson	8,214	5,139
3	Family Mart	4,863	2,749
4	Sun Shop Yamazaki	3,532	2,616
5	Circle K Japan	2,571	1,622
6	SunKus and Associates	1,859	1,093
7	Mini-stop	940	603
8	Kasumi Convenience Networks	897	721
9	Kokubu	880	612
10	Seiko Mart	833	529

SOURCE: *Ryutsu Keizai no Tebiki 97* (*Handbook of Distribution Economy 97*, Nihon Keizai Shinbunsya 1996).

FIGURE 1

AVERAGE STOCK TURNOVER TIME, DAILY SALES, AND GROSS PROFIT MARGIN PER STORE



Period ended	77.2	78.2	79.2	80.2	81.2	82.2	83.2	84.2	85.2	86.2	87.2	88.2	89.2	9.02	91.2	92.2	93.2	94.2	95.2
INFORMATION SYSTEM REFORM		Started EOS				Started EOB; POS system introduced				Interactive POS registers introduced				GOT and ST introduced		New POS registers introduced	Started Three-times-a-day combined deliveries of refrigerated items		
DISTRIBUTION SYSTEM REFORM	Reduced number of vendors		Started twice-a-day deliveries of rice products	Started combined deliveries of milk	Started combined deliveries of frozen foods			Started combined Deliveries of retrigerated foods	Computers using color Graphics introduced		Started three-times-a-day deliveries of rice products			Expanded confirmation of items to be delivered	ISDN Put Into operation		Started frozen-food warehouse System for combined deliveries		
A Average stock turnover time. (days)	25.5	22.0	20.1	17.8	14.9	13.0	12.9	12.2	11.1	10.9	10.6	10.0	9.4	8.8	7.9	7.7	7.8	7.7	7.5
B Average daily sales. (.thousands)	356	396	419	435	463	483	482	486	502	506	508	524	545	564	629	669	682	669	676
C Average gross profit Margin. (%)	24.0	24.3	24.9	25.0	25.9	26.4	26.8	26.9	27.2	27.4	27.7	28.0	28.3	28.6	28.8	29.0	29.3	29.4	29.6

.Per store figures.

Source: Seven-Eleven Japan.

First, a product code was affixed to each product. A bar code indicating the product code was printed in the order book and headquarters distributed these print-outs to the affiliated stores. When placing an order entry, the order-entry employee scanned the bar code corresponding to each product. The employee then input (into the computer) as the order-entry volume the volume per product he or she believed to be short in stock. As the last stage, the employee sent the order-entry data via telephone to headquarters' host computer and vendors.

The introduction of Terminal 7 resulted in a major reduction in clerical order-entry personnel at 7-Eleven headquarters. Previously, order data provided by the stores had to be rekeyed at headquarters. With Terminal 7, all ordering entry data was done at the store level and rekeying was no longer required. This resulted in a major savings in personnel cost at headquarters.

Another important factor of this systemization was that the store's order-entry placement was simplified by the bar code scan. Since there was a wide age range of people working at the store, from high school students to the elderly, a system that permitted anyone to easily place an order entry was necessary. In addition, simultaneous to the transmission of order-entry data via Terminal 7, an order-entry record was made. This avoided a previous problem that had occurred frequently whenever there were discrepancies between the amounts a store said it had ordered and the order the vendor said it received.

Secondary system. The next step in system renovation came in 1982. It was at this time that 7-Eleven began moving toward the hypothesis-testing system. The hardware elements for the system included an electronic order book (EOB), a terminal controller (TC), and a POS register. NEC manufactured the EOB and the TC, and TEC, the top cash-register manufacturer in Japan, customized its standard POS register for 7-Eleven.

The EOB is a portable electronic order book terminal that allows an employee to make order entries while physically checking the stock in the store. Data renewal, sending, and receiving were now handled by the store's computer. This computer was the TC.

There were several reasons for introducing the electronic order book. Since handled goods change rapidly at a convenience store, maintaining an up-to-date order book entailed large printing costs. However, 7-Eleven was more concerned with a problem that arose from use of the paper file order book; order entries for new products came at the end of the order book.[8]

[8]Interview with Mr. Makoto Usui, Information System Division, 7-Eleven (June 12, 1996) and Mr. Toshio Yanagisawa, Distribution/Service System Development Division, NEC (June 7, 1996).

New products have high potential to sell the most, but under the old system, those new products were listed at the end of the order book. Moreover, order entries are usually made in the same order as the book is arranged and it could happen that before reaching the last page of the order book, the store space was filled and thus orders for new products were not placed. 7-Eleven solved this problem by computerizing product information and saving such data on hardware. New products were pulled up on the EOB screen when placing order entries.

In addition, previously, making orders had involved checking the stock of new products in the store and then actually placing order entries using the order book, which was located in the convenience store's office. In other words, the employee had to go back and forth between the store and the office. To avoid such cumbersome routine, a portable EOB was designed so that inputting of order-entry volumes could be made in the store area itself. All data sending, receiving, renewal, saving, etc. was conducted by the TC, which was located in the convenience store office. The EOB and the TC improved store-ordering efficiency.

One month before installation of the EOBs and the TCs, POS registers were installed in 7-Eleven stores. The POS register allowed the employee to input sales record data per product as well as data about the customers. Customers were categorized into one of four groups: (1) children, (2) young adults, (3) women, and (4) other. After a purchase was made, the POS register recorded such data into the appropriate category.[9] The POS register laid the foundation for making use of sales records when making order entries. To summarize, installation of the EOB, TC, and POS register made possible to create a master database on products.

Third system. To respond to changing customer needs, it is important to know what customer change is. To determine what products customers want, and when and where they want them, requires more than a store manager's judgment through his or her experience; scientifically analyzed, up-to-date, usable information from stores is indispensable. As a result of the 1982 system development, the possibility of using customer and sales record analyses per product at the time of placing order entries was in place. The POS system gathered data such as what kinds of customers buy which products at what times, which products are fast sellers, and the times at which products sell out. 7-Eleven believed that the POS system had become

[9]Actually Seiko Mart was the first in the CVS business to categorize customer groups. Interview with Mr. Toshio Yanagisawa, Distribution and Service System Development Division, NEC (June 7 and 17, 1996).

a strong instrument for identifying low-demand items and making detailed analyses of the sales trends of fast-moving goods.

However, until the introduction of the third phase of the system, it was very difficult to utilize the sales data when placing order entries. During the second phase, 7-Eleven printed out and analyzed the sales data obtained through its POS system to determine the appropriate order-entry volume of each product, but the problem was that the volume of paper printed out was phenomenal[10]—each week, data would reach the ceiling. Because headquarters wanted the stores to utilize sales data when placing order entries, headquarters printed out a portion of the data and distributed it to the stores. However, the stack of paper with lines of numbers was difficult to read and, consequently, store employees were not able to utilize the data efficiently.

Therefore, in 1985, 7-Eleven developed an information system that enabled store clerks to analyze past sales information easily using a personal computer with color graphics. The product was developed by the venture business company, Logicsystem International in cooperation with 7-Eleven.

In the third phase, 7-Eleven decided to provide the stores with computerized sales data, rather than printed data, and have store employees analyze the information using a computer terminal. This computer was custom-made, had only 18 keys, and it was easy to operate. The color graphic personal computer was placed in the convenience store office and allowed in-store staff to simply and graphically analyze the POS data.

The display terminal enhanced the speed and efficiency of information analysis considerable compared to the previous method on paper. By using the easy-to-operate graphic personal computer, store clerks did not have to print out sales data. They could look at just the information they required and understand it easily.

7-Eleven's realization of the hypothesis-testing-ordering system was made possible at last by these 1985 developments.[11]

Fourth system. After the introducing the third-generation system, 7-Eleven strove to more fully realize the hypothesis-testing-ordering system.

First, it incorporated graphic analysis of the POS data into the order-entry exercise itself and introduced the hand-held terminal, which enabled clerks to order more quickly and accurately. Second, it created a plan in

[10]Interviews with Mr. Makoto Usui, Information System Division, 7-Eleven (June 12, 1996), Mr. Yoshihiro Nakao, Distribution System Division 1, Nomura Research Institute (June 4, 1996), and Mr. Kazuyoshi Shiotani, Development Division, am/pm (May 16, 1996).

[11]In addition to the installation of the graphic personal computer, in the third phase of development, the EOB screen indicated sales records per product.

which more time would be spent on the hypothesis-testing order-entry exercise. Third, it formulated a plan so that in addition to delivery information (delivery time, delivery volume), the order-entry volume, and sales records were recorded and that information incorporated in data analysis. The hardware needed for these refinements included a graphic order terminal (GOT), store computer (SC), and the inspection scanner (ST). The GOT, SC, and ST were jointly developed with NEC.

In the third phase, 7-Eleven installed computer terminals with color graphics that allowed clerks to determine the order-entry volume of each product by using the POS data. However, it was not unusual to have order-entry employees place order entries without looking at the information or to have difficulty using the information so that it was reflected in the order entry.

For example, headquarters wanted employees to spend one hour making order entries. In actual practice, that did not happen. Even if data analysis was conducted using the personal computer, this did not necessarily mean that the data could be immediately utilized when making order entries. Because of other routine matters that the employee had to take care of between the time of the data analysis and the time of the order entry (such as the dealing with customers, inspection of products, unpacking the products, shelving and organizing the products in the store, etc.), the employee tended to forget the content of the data analysis when actually making the order entries. As a result, the employee was unable to effectively utilize the data analysis when placing order entries.

To overcome this problem, the order-entry computer terminal was developed into a laptop computer so that the employee could conduct a graphic analysis within the store itself. Moreover, the store-ordering system was designed so order entry could not be completed until the store clerks checked the graph. In other words, graphic analysis was incorporated into the order-entry exercise itself. This method was made possible by the graphic order terminal (GOT), which is a laptop-style computer (the lightest in the world at the time of its development) with a liquid crystal screen that was significantly larger than the EOB (nine inches).[12]

The GOT was a pillar of 7-Eleven's fourth-generation system. It provided improved merchandising data that would assist store clerks in making ordering operations more efficient. The GOT had the ordering capabilities

[12]Of course, complex data analysis could not be conducted with the GOT alone. The SC, which took over the functions of the terminal controller, and the graphic personal computer supplemented the data analysis.

of the EOB, the former hand-held terminal, plus the added function of ordering advice presented as text not merely as a graphic.

Introducing the GOT enabled part-time workers to order more quickly and accurately, further strengthening store performance. However, it is not easy for part-timers to create hypotheses for ordering. To improve their order decision making, the GOT provided store clerks with advice on ordering and helped them create the hypotheses, thus providing a backup to the field consultant communications between store clerks and field counselors. As a result, ordering efficiency was improved.

Installation of the Scanner Terminal. 7-Eleven systematically designed the hypothesis-testing system so that time was not wasted in hypothesis-testing matters. One good example of this is the inspection process. Inspection is conducted for the purpose of checking to see whether the products delivered to the store correspond to actual orders. When the truck carrying the products arrives, inspection is done on the spot. Previously, both the truck driver and the employee conducted the inspection. One of them read off the product name and the order-entry volume from the statement of delivery while the other took the products from boxes and confirmed the order-delivery volume. The inspection ended when it was confirmed that the delivered products matched the order. The time of inspection was simultaneously recorded in the statement of delivery.[13]

At first glance, the above procedure seems simple. In fact, it involved a lot of time and labor. Two people were necessary for the inspection process; one to read from the statement of delivery and another to check and count the number of products. The truck driver could not continue with deliveries until the inspection was completed. Then, in order to check the products, certain knowledge about the products was required. To begin with, rarely were the products taken out of the truck in the order listed in the statement of delivery. For example, in order to check Bandai's "Pokemon de pon" product ("Pokemon" is the name of a cartoon character and "pon" is the sound when one presses something), the employee would have to know that the product is candy. Otherwise, the person would have to search for the product based solely on the "Pokemon de pon" name from a pile of products. Consequently, a considerable amount of time was spent on the inspection task. Convenience stores depend on the part-time labor and new employees do not have much product knowledge. If a new employee was

[13]Interviews with Mr. Makoto Usui (June 12, 1996) and Mr. Takanori Tanaka, Information System Division, 7-Eleven (May 30, 1996), Mr. Tadaaki Kawano, Distribution and Industrial System Headquarters, Nomura Research Institute (May 14, 1996), and Mr. Hideo Matsumoto, the 5th C & C System Operations Headquarters, NEC (June 30, 1996).

used in the inspection process, the time involved could be extensive. Furthermore, if more goods were delivered than actually ordered, or there were defective products, time was needed to take care of those problems. The inspection scanner (ST) was the solution.

Under the new inspection method, all that needs to be done is to have the ST scan the bar code of the delivered products. The product name is then shown on the ST display. By looking at the screen, an employee can tell what the product is and all that is necessary is to confirm that the correct volume has been delivered.

Implementation of ST significantly enhanced efficiency. Inspection with the scanner can be done with one hand, in other words, by one person. As a result, truck drivers can immediately return to making deliveries and the delivery efficiency improves. Also, inspection can be done without knowledge of the product. Even if the inspecting employee does not know what "Pokemon de pon" is, it is no longer necessary to search through all the products. Furthermore, handling of delivery errors has been simplified. Delivery errors are now taken care of by computer. Extra deliveries are considered free deliveries and inadequate deliveries are counted as delivered and sold; sales of the insufficient products are automatically charged to the vendors.

Another function of the ST is recording the product shelving order in the store. With the previously used EOB, products appeared in the recommended order of new products followed by products with high gross margins. The order-entry employee had to search for the product he or she wanted to order in the store, which could be very time consuming.

For example, it is difficult to locate the shelving space of a product that has sold out. Also, with regard to product names, the full name of the product could not be indicated on the small EOB screen. For instance, Morinaga, a Japanese confectionery manufacturer, was abbreviated and indicated as "Morika" on the screen, and boiled mackerel in miso ("saba no miso-ni") was abbreviated and indicated as "saba-miso." Thus, it was necessary for the employee to have certain knowledge about the abbreviated product name in order to find the product. This was a major problem because, as stated before, the majority of convenience store workers are part-timers or temporary and not completely familiar with the store products.

To solve this problem, the ST scans the product bar code in the shelving order when placing order entries so that the product name appears in the shelving order on the order-entry computer terminal screen. This enables even store clerks with little merchandising knowledge to successively place order entries easily and simultaneously eliminates much of the time spent searching for products, as well as alleviating stress-related problems.

Thus, the ST simplified the inspection process and shortened in-store product search time, thus giving order-entry employee more time to spend on generating and testing a hypothesis and placing order entries. The ST was a big step forward in perfecting the hypothesis-testing-ordering system.

By inspecting the product using the ST, delivery data is recorded (quantity and timing of product deliveries). By checking this data with the sales data input from the POS register, the order-entry employee can determine the time that a certain product sold out, the current stock, the turnover ratio of the stock, and so on.

In addition, the ST records product information pertaining to the product shelving order. This allowed the employee to combine and analyze information relating to the product line-up order and the sales data. By doing so, the employee can make use of information on the sales comparison in connection with the product line-up space, gross margin mix, and stock turnover percentage, and so on.

Implementation of the ST allowed employees to record information that would be useful, resulting in more accurate order entries. The development of software that let the employee actually use such information was the next refinement in 7-Eleven's search for the perfect ordering system.

Store-Ordering Systems of Other Companies.[14] Two other major convenience stores developed store-ordering systems built on the foundation of the replenishment-ordering system. In February 1980, Lawson, second largest in the business, commenced an on-line system (EOS) in which one could send order-entry data via the telephone. Oki Denki provided the equipment. Around the same time, in April 1980, Family Mart, third largest in the business, started a similar system using Fujitsu equipment. For the next eight or nine years, neither company significantly changed their store-ordering system. During this time, as explained above, 7-Eleven implemented the computerized order book with the terminal controller and the POS register (in 1982) and moved from the replenishment-ordering system to the hypothesis-testing-ordering system. In 1985, 7-Eleven implemented the graphic personal computer, thus putting itself far ahead of the other companies as regards the hypothesis-testing-ordering system.

[14]Information in this section is based on interviews with the following individuals: Mr. Takehiko Izumi, Information System Division, Lawson (May 17 and June 6, 1996), Ms. Junko Hamao, Public Relations, Family Mart (May 29, 1996), and Mr. Baba, Information System Division, Family Mart (March 26, 1996).

Responding to 7-Eleven's innovations, in September 1988 Lawson renovated its store-ordering system. The system was called the "recommended order entry." The objective behind this new system was to lift the burden from employees when making order entries and have a store-ordering system that maintained a certain level of accuracy regardless of who placed the order. This recommended order entry was similar to the automated-ordering system.

The recommended store-ordering system applies to those goods that are subject to disposal (perishable daily products), that are not sold within 24 hours. The order-entry employee inputs the sales target of that certain time into the computer. The computer, which incorporates a POS register, developed in cooperation with NEC, is located in the store. This permits the order-entry employee to make order entries while he or she is at the store counter.[15] By inputting the sales target into the computer, headquarters can provide the recommended order-entry volume that will serve as a sales target for the store. The order-entry employee then makes order entries using that figure as a reference. If the employee feels that an adjustment needs to be made in the recommended order-entry volume, he or she will do so.

This recommended store-ordering system does not cover the order entries of all the convenience stores. Since the recommended store-ordering system computes a recommended order-entry volume based on past data, the system cannot suggest order-entry volumes for completely new products. Also, in placing order entries for products other than daily goods, information pertaining to customers, and sales data relating to the time of day would be useful. Therefore, when it renovated its system, Lawson developed software such that simple graphic analysis concerning past sales data would be conducted on the POS register screen. In addition, with regard to goods other than daily products, the improved system allowed the employee to input and send order-entry data by using the bar code-printed order book, the portable computer, and the POS register.

Lawson's store-ordering system is a combination of the automated-ordering system and the hypothesis-testing-ordering system. Lawson is not necessarily moving in the direction of the hypothesis-testing system.

At Family Mart, no prominent changes in the store-ordering system were made until September 1989, at which time a significant transformation was made. The new system was developed jointly with TEC and utilizes the electronic order book, store personal computer, and the POS register. This

[15]Other reasons existed for the unification of the POS register; customer service would drop if the already few employees went into the store office to place order entries.

store personal computer can be operated in the store's office and allows graphic representation of data. Basically, Family Mart adopted 7-Eleven's idea of the EOB, TC, POS register, and graphic personal computer. In other words, from around this period, Family Mart moved toward the hypothesis-testing-ordering system.

In September 1990, 7-Eleven installed the graphic order terminal, store computer, and inspection scanner to further improve the hypothesis-testing-ordering system at its stores.

In May 1992, Lawson revamped its system and Family Mart followed suit in April 1994. With NEC, Lawson developed the portable order entry terminal (POT). Family Mart developed and installed the MAT (multi-action terminal) in cooperation with TEC.

By 1992 and 1994, respectively, Lawson and Family Mart had loaded the delivery inspection function into their terminals, a system 7-Eleven had installed back in 1990. At all three companies, now, employees did not need to have knowledge about the products to conduct inspections and could make the inspection alone (only one employee was needed). In the case of Family Mart, by loading the inspection function to the electronic order entry book that had already been installed in 1989, Family Mart terminals were converted into MATs.

Significantly, in making these system conversions, the previously implemented recommended store-ordering system disappeared from Lawson. According to Lawson's employee in charge of the system, the reason for such "disappearance" "was that it was difficult to ascertain as to how much the order entry employees were referring to the recommended order entry volume when placing order entries. And as a result, we couldn't measure the effect of the recommended store ordering system."

Therefore, Lawson renovated the recommended store-ordering system and adopted the following system. First, the computer portion previously located on the register counter was installed into the store's personal computer in the convenience store office (October 1994). This computer was then connected to the POT. By doing so, figures such as past sales records were indicated on the POT screen. In Lawson's order-entry terminal, data supporting an order entry was now shown, rather than a recommended order-entry volume. This function was expanded to cover products other than just perishable products. In addition, more detailed graphic analysis was possible with the office personal computer.

Thus, around this time Lawson began making a full-fledged move toward the hypothesis-testing-ordering system, joining Family Mart and, of course, 7-Eleven.

Table 5 illustrates the transitions made by the three companies.

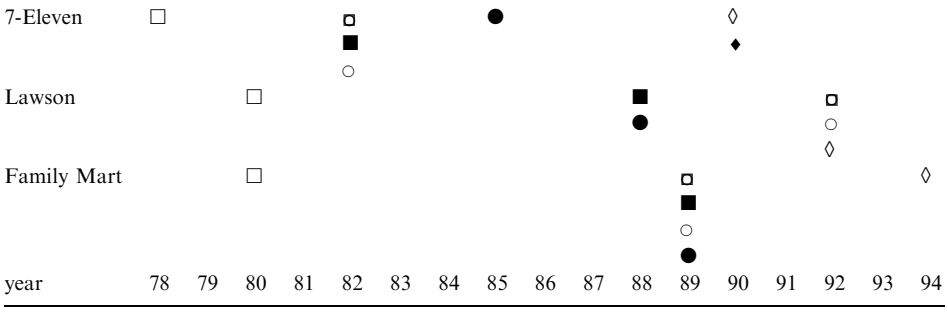
Characteristics of 7-Eleven's System-Development Organization

To this point, I have looked at the categorizations of store-ordering systems at convenience stores and how the three major CVS companies developed and implemented their respective store-ordering systems. One of the more notable findings is that CVS store-ordering systems were developed by incorporating information technology. I have identified three kinds of store-ordering systems: the replenishment-ordering system, the automated-ordering system, and the hypothesis-testing-ordering system. The hypothesis-testing-ordering system, as developed by 7-Eleven, is dominant in convenience stores in Japan today.

This leads to the question of how 7-Eleven developed and implemented such an innovative store ordering system. The key to answering this question lies in comparing the development structures of major convenience stores and paying attention to the characteristics found only in 7-Eleven's development structure. This section explores the characteristics unique to 7-Eleven's system development that became evident from interviews conducted.

TABLE 5

DEVELOPMENT OF THE STORE-ORDERING SYSTEM AT THREE MAJOR CONVENIENCE STORE CHAINS



□: On-line service of sending and receiving orders (EOS)
■: Management of point of sales information (POS)
○: Computerization of order book
●: Implementation of graphic analysis
◇: Efficiency of inspection task
◆: Graphic analysis at the store
◘: Transition to the hypothesis-testing-ordering system
The implementation period is not all-storewide, but refers to the implementation commencement period of a store as of December 1994.
Source: Seven-Eleven Japan.

The first unique characteristic of 7-Eleven is its CEO, Mr. Toshifumi Suzuki. Mr. Suzuki was a major force in developing the store ordering system. He repeatedly and continuously emphasized the importance of managing the products per item, the danger of underestimated order entries, and the significance of the hypothesis-testing exercise.

Second, those in charge of system development attend weekly meetings at which they discuss various issues that have arisen in the course of daily work. As mentioned before, at 7-Eleven, weekly discussion meetings about business issues are held at headquarters. This means that every week, on-site local employees gather together from all over Japan. The system-development employees regularly attend these meetings and provide input about business issues and share information as to how to resolve the issues. Mr. Usui, responsible for 7-Eleven's information-system development for many years, says that his "job is to provide solutions to the problems that arise at the convenience-store; our job is not necessarily to develop the system itself." In this way, it is extremely important that the system-development employees attend meetings with the on-site employees to get a feel of what is actually happening at the stores. Other major convenience stores do not hold weekly discussions at which on-site employees gather together at the headquarters to discuss various issues. At other companies, on-site employees gather at headquarters once or twice a month, if at all and system-development employees do not regularly attend meetings with on-site employees.

Third, at the above-described 7-Eleven meetings, when an information-system-related problem comes up at the meeting, it is the practice to resolve such problem during the meeting and record the matter. Since these meetings are held every week, the routine of raising an issue followed by its solution is exercised on a weekly basis. At other convenience stores, information-system-related issues are reviewed and resolved all together after a certain amount of time has elapsed. For example, at one convenience store, problems are reviewed and resolved at quarterly intervals. During the nonreview period, usually one renovation proposal per week is submitted by a store and, apparently, there is approximately one year's worth of unresolved issues. Also, no records are taken as to when a certain action was taken against a problem and how the matter was resolved. Thus, employees never know whether a certain issue has been taken care of, which issues remain unresolved, and what kind of approach was taken in the past to tackle an issue and how effective such an approach was. As a result, proposals on improving the store-ordering system remain untouched and are eventually forgotten. Therefore, the method of resolving issues one by

one each time, and recording these facts, proves meaningful in more ways than anticipated.

The fourth characteristic relates to 7-Eleven's position toward technology. 7-Eleven actively collects information pertaining to store-ordering system technology. Specifically, 7-Eleven communicates with manufacturers' research centers and the factory engineers who develop and provide their system. If 7-Eleven learns about a technology that may be related to the store-ordering system, 7-Eleven invites the company and its employees to 7-Eleven and interviews them about the new technology. In describing 7-Eleven's positive attitude, an NEC engineer said that "Seven-Eleven's development structure is not one in which it selects the best from among the existing technology, but rather it adopts and develops the upcoming next technology." Mr. Usui of 7-Eleven stated:[16]

> It takes about three to four years to develop a system. By doing so, by the time a system is completed, the then-existing technology is already obsolete. So we try to use new technology as much as possible. Also, the then-existing technology often is not capable of realizing the functions that we seek. Thus, we try to speak with people from manufacturers' research centers and ask them about what kind of technology will be developed in the future, and what kind of things that technology would permit us to do.

This kind of active position toward information technology is not seen at other convenience stores.

As has been described, development of the CVS store-ordering system could not have happened without making use of the information technology. It is obvious that 7-Eleven's position toward information technology played a vital role in the development of its store-ordering system.

Conclusion

This article has discussed the store-ordering systems practiced by convenience stores in Japan. Store-ordering systems in Japanese convenience stores have been created by incorporating information technology, leading to the hypothesis-testing-ordering system. This study examined (1) the conceptual categorization of CVS store-ordering systems, (2) the history of store-ordering system development at three major convenience-stores, and (3) the characteristics of 7-Eleven's development that led the way

[16]Interview with Mr. Makoto Usui, Information System Division, 7-Eleven (June 12, 1996).

toward an innovative store-ordering system. On the basis of the facts elucidated in this research, the next research agenda could compare store-ordering systems among different business conditions and an international comparison of CVS store-ordering systems.[17]

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[17]So far, it seems that the hypothesis-testing-ordering system is working well in U.S. convenience stores. For example, 7-Eleven Hawaii has employed the hypothesis-ordering system since 1992 and improved its business performance in areas such as profit margin, daily sales, and stock turnover time per store every year (see Ogawa 2000). Also, 7-Eleven Inc. introduced the hypothesis-testing system in 1995 and has showed a significant sales increase (see *Retailtech* March 2000:36).