"Values" Created by IT-FRENS & TRACE Systems

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1. "Data don't lie"

"Data don't lie" —this is the "value" of information systems. We often find that a standard work process, which we take for granted, is completely insignificant after we have introduced an information system or analyzed the data. This is where we start our search for new work processes. Japan Freight Railway Co., Ltd. (JR Freight) uses two main systems to support container transport: "IT-FRENS" for reserving the number of containers that can be sent on a freight train and "TRACE" for tracking the locations of containers. These two systems were first developed in FY 2001 with the objective to save labor. They went into full operation in August 2005. Today, the two systems have created "values" at various levels, ranging from business decision-making to work-process development.

This article takes a retrospective look at the "values" created by "IT-FRENS" and "TRACE"—how these systems have transformed container transport services—and explores the kind of "values" that should be offered in the future.

2. IT-FRENS & TRACE systems

JR Freight began using the host-based "FRENS" system to manage container freight reservation since 2004. However, reservation changes were made manually. "FRENS" had the function to make reservation changes; however, all the containers were booked tentatively and field staff had to work with each other to adjust the reservations. The results were then inputted into the system to complete the reservations. Such practice was common nationwide. It made the use of container freight transport very inconvenient and the adjustment of transport capacity after reservations were canceled very difficult. Oftentimes, this resulted in wastefulness as "reservations were full but the freight trains had spaces of no containers."

JR Freight decided to develop the "IT-FRENS & TRACE" systems based on the concept of "seeking structural reform by using information technology and systems to achieve automation."

The "IT-FRENS & TRACE" have three functions.

(1) Function for reserving freight trains — IT-FRENS

Containers on a freight train can be reserved using the Internet. The system automatically selects the best transport route according to information on the conditions of cargoes registered at reservation. Since the best transport route is automatically selected for the appointed delivery date of cargoes, transport capacity can be adjusted flexibly according to the cargoes' lead time.

(2) Function for managing train locations inside stations — TRACE

"TRACE," a system integrating "wireless ID tag," "high-precision GPS," and "wireless LAN," is installed onboard a forklift. It can track a container's location inside the station and the container's transport information in real time. Since TRACE is linked to the IT-FRENS function for reservation adjustments as well as to the driver's system, it can also transmit the container's cargo information and loading instructions to the forklift operator in real time.

(3) Function for supporting truck operation control — "Driver System"

"Driver System" is a system used by the truck driver for the loading and unloading of containers. It is linked to TRACE and has the functions to navigate the driver to the location of a specific container in the station and indicate the platform at which to carry out the unloading.

Adoption of the IT-FRENS & TRACE systems helped cut cost by several billion yen annually, from the reduction of workforce and the abolition of shipping tags. The systems were designed to create new "values" that would fundamentally change the container handling operation, which had continued for fifty years since the days of the Japanese National Railways.

However, this drastic reform faced a harsh reality—both the development and introduction of the systems were extremely difficult. The development phase turned out to be a year and a half longer than originally planned. The extended development phase resulted in cost overrun, from an estimated investment of 4.1 billion yen at planning to a final price tag of 6.8 billion yen.

When using a system to drastically overhaul an operation, it is important to pay close attention to the steps taken in reforming the work process. This is because changing a work process that has been in use for many years is like "uprooting a tree and causing it to wither," personnel at all levels of the organization may be affected to an extent as to be deprived of the incentive to work. As a result, workers at all levels, including the persons in charge as well as the top management, will develop a dislike for the system and will make consecutive requests to change the system's specifications to such an extent as to jeopardize the concept of reform. The initial development of the IT-FRENS & TRACE was like an overhaul that almost choked the life out of the organization. Indeed, any attempt at systematization without a blue print for reforming the work processes, from making management decision to processing daily businesses, will not generate any "values" no matter how great the effort.

3. Sumidagawa Help Desk

A manual with detailed operation instructions shall be prepared when introducing a system; unfortunately, there was no manual for IT-FRENS & TRACE other than some basic instructions. To include all the functions in a manual, we would probably need to compile several volumes of encyclopedia-like manuals. Even if these formidable volumes were compiled, they would not have been read in many cases. Keeping the manual up-to-date would also take a lot of time and efforts, and caused many troubles, such as update omission and so on.

Instead of the manual, we established a call center to provide 24-hour support. The center was set up within the development project team in the fall of 2003 when the development and introduction were making progress and the work processes in the field started to change. The development team was working in one corner of Sumidagawa station at the time; therefore, the center was named the "Sumidagawa Help Desk." It handled all

inquiries regarding the operation of the IT-FRENS & TRACE systems. Since there was no detailed manual, the center was bombarded with over 20,000 inquiries a day at the beginning. There were also many complaints but the staff members at the Sumidagawa Help Desk paid special attention to be courteous and informative when answering the inquiries. They would listen to everything the inquirers wanted to do or say and would explain the new work processes. Despite their commitment to advance reform without stifling the operation, this method of introducing the new system was criticized both internally and externally. The reason was, even though the system was introduced, the speed to reform operation was too slow.

However, by operating the call center, the Sumidagawa Help Desk was able to get hints on how to reform the operation. By entering the users' inquiry contents into a database, we were able to understand the actual situation in the field. We realized that even with the same procedure, different offices would perform the task differently. We also found out that "many people were convinced that their methods were correct" since they did not know any other ways. Under such circumstances, if we forcibly pushed for reforms, people in the field would be so turned off as to develop an adverse reaction towards reforms. Overhauling an operation sometimes requires throwing out the procedure that is being accepted by the field staff as commonsense. The way to do it is by showing the correct procedure being implemented elsewhere so as to gain understanding and acceptance.

The Sumidagawa Help Desk made use of the history of inquiries, which were put into a database, as well as the log and data stored by IT-FRENS & TRACE when showing the correct procedures to field offices. Since the history of inquiries contains specific issues and solutions that were used as responses in the past, it became a textbook for standardizing the operation. The skills of the staff giving instructions had improved and the contents of the instructions had persuasiveness. Since logs and data spoke the truth, it was easy to win over the users.

The history of inquiries and the data stored by the IT-FRENS & TRACE became extremely useful in the planning of products and improvement of transport services later on; however, the staff members at the Help Desk at the time were still not aware of the significance of such information.

4. Chuetsu Offshore Earthquake brought realization of the importance of product planning

The Chuetsu Offshore Earthquake, which occurred in July 2007, affected container rail freight tremendously, including an approximately 2-month service interruption between the Kakizaki and Kashiwazaki section of the Shinetsu mainline, which forms part of the Sea of Japan railway network. Because of this disaster, the Sumidagawa Help Desk realized the possibility of using systems for product planning to create new "values."

That is, "container rail freight services will change substantially depending on how the transport routes are set."

When IT-FRENS & TRACE were first developed, there were approximately 400,000 transport routes linking 140 stations in the country. Although only 450 container freight trains were operating nationwide, the various combinations of transport routes and 140 stations resulted in 400,000 transport routes (Fig. 1).

It was believed at the time that the greater the number of transport routes, the more convenient the making of reservations would become. It was better to have many options of the transport routes to enable full utilization of the automatic container adjustment function of the IT-FRENS. However, if all the train routes, including the transfer stations, were set, the number of transport routes reserved for one train would exceed its transport capacity and even the detour and return routes would be reserved. The automatic container adjustment ended up selecting ridiculous detour routes, resulting in not "convenience" but "inconvenience" because of "competing reservations."

The Chuetsu Offshore Earthquake severed the longitudinal route along the Sea of Japan, causing long-term service suspension of about ten round-trips of the mainline train services (Kansai—Hokkaido and Kyushu—Hokkaido). To provide immediate relief to the freight that used to be transported by the ten suspended round-trip services, additional transport routes were added to the Tokaido and Tohoku mainlines on the Pacific coast side, increasing the number of transport routes to as many as 800,000. Although only ten round-trip services were suspended, the transport routes connecting the whole country ended up doubling in number to what it was before.

As a result, the system became overloaded. The increase in transport routes made the system processing more complicated. Immediately after the Chuetsu Offshore Earthquake, the IT-FRENS was in high-load operation day after day. The computer terminals had slow responses and the system was operating to the brink of crash.

To lessen the load on the system, the Sumidagawa Help Desk cut the number of transport routes all at once. Reducing the transport routes meant a reduction in product line-up, which was unthinkable according to the common practice at the time. In fact, there were ample oppositions from the field.

Interestingly, the reduction in transport routes had an unexpected effect. "Competing reservations" declined.

The Sumidagawa Help Desk immediately reviewed the data to verify the reservation status of each transport route. Competing reservations lower the loading ratio of freight trains. Because the train capacity was fixed, competing reservations caused the freight train's originating station to block the transfer of cargoes from other stations. This blocking behavior triggered unnecessary competition for reservation, resulting in incessant complaints of "not being able to make reservation." It was found that this trend got worse as the number of transport routes increased. The measure meant to bring relief to the severed route after the Chuetsu Offshore Earthquake was causing, instead, competing reservations that blocked the transfer of cargoes. Data from the IT-FRENS shed light on this reality.

The Sumidagawa Help Desk further expanded the scope of data analysis to the whole country. The result revealed that even though the transferred cargoes were blocked at major stations in the country, the trains were actually not fully loaded with cargoes at their originating stations. The data analysis was able to quantify this shocking truth of missed opportunities.

The Sumidagawa Help Desk came to the painful realization that what was important in the formulation of business strategy "was not the number of transport routes but how these transport routes were arranged." It also realized that the data stored in the IT-FRENS & TRACE systems provided the necessary tools for identifying the values of each transport route.

When we analyze the data, we can see the values of the

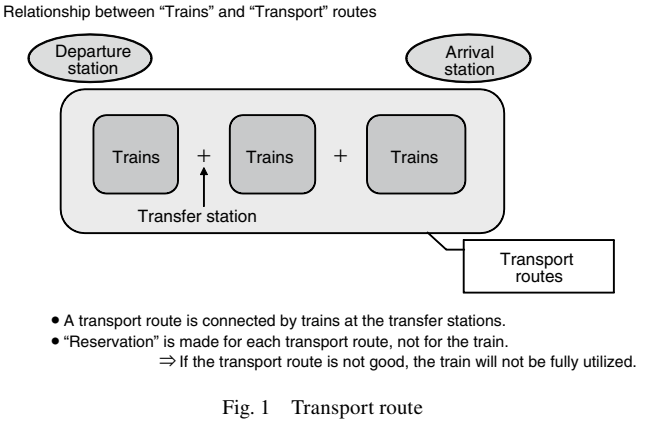

Fig. 1 Transport route

transport routes. Through the data, we see how a transport route designed for bringing in a specific type of cargo was actually not particularly useful and how the transport route was obstructing the transport of other cargoes and so on.

5. I-TEM Center

Since the Sumidagawa Help Desk did not set any limit on the inquiry contents, it received inquiries one after another, covering not only system operation but also various other topics, including container transport procedure, consultation on transport capacity, information on train delays, etc.

As we continued to disclose data showing the values and operation status of the transport routes, we began to receive requests from internal and external users who actively sought the data stored by the IT-FRENS & TRACE systems. This helped the IT-FRENS & TRACE systems to take root and become the impetus for drastic transformation of the operation process.

In March 2008, the Sumidagawa Help Desk was reorganized as the "JR Freight I-TEM Center." From being simply a supporting team of the IT-FRENS & TRACE systems, the I-TEM Center is an organization that utilizes the comments received by the call center and data stored in the systems to find solutions to the

Departure date	Departure station	Arrival station	Train number	Basic number of cars	Basic transport capacity (convert to 12-ft container)	Number of cars dispatched	Actual transport capacity (convert to 12-ft container)	Number of containers (convert to 12-ft container)	Loading ratio
2, 1 (Fri.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	83	83%
2, 2 (Sat.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	85	85%
2, 3 (Sun.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	25	25%
2, 4 (Mon.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	90	90%
2, 5 (Tue.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	85	85%
2, 6 (Wed.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	86	86%
2, 7 (Thu.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	70	70%
2, 8 (Fri.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	90	90%
2, 9 (Sat.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	69	69%
2, 10 (Sun.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	33	33%
2, 11 (Mon.)	Tokyo (T)	Fukuoka (T)	1051	20	100	19	95	36	38%
2, 12 (Tue.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	84	84%
2, 13 (Wed.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	99	99%
2, 14 (Thu.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	76	76%
2, 15 (Fri.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	95	95%
2, 16 (Sat.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	96	96%
2, 17 (Sun.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	26	26%

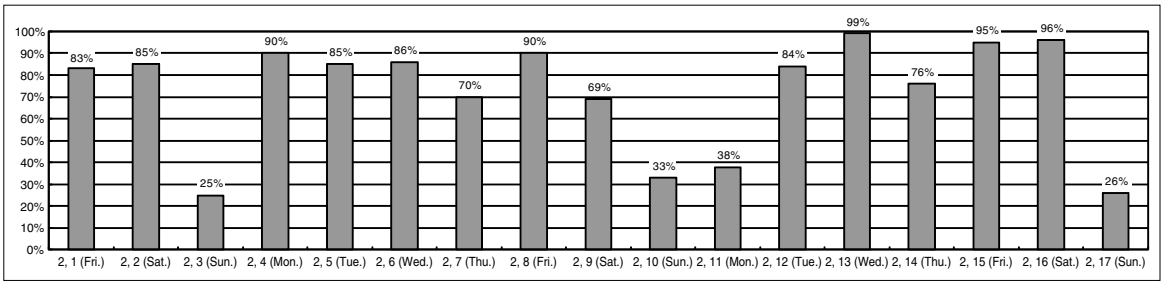

Fig. 2-1 No. 1051 Train departure and arrival records (Tokyo terminal—Fukuoka terminal section) (Feb. 1, 2008~Feb. 17, 2008)

Departure date	Departure station	Arrival station	Train number	Basic number of cars	Basic transport capacity (convert to 12-ft container)	Number of cars dispatched	Actual transport capacity (convert to 12-ft container)	Number of containers (convert to 12-ft container)	Loading ratio
10, 1 (Wed.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	84	84%
10, 2 (Thu.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	83	83%
10, 3 (Fri.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	96	96%
10, 4 (Sat.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	66	66%
10, 5 (Sun.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	80	80%
10, 6 (Mon.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	93	93%
10, 7 (Tue.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	100	100%
10, 8 (Wed.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	99	99%
10, 9 (Thu.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	86	86%
10, 10 (Fri.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	91	91%
10, 11 (Sat.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	78	78%
10, 12 (Sun.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	76	76%
10, 13 (Mon.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	55	55%
10, 14 (Tue.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	94	94%
10, 15 (Wed.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	99	99%
10, 16 (Thu.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	91	91%
10, 17 (Fri.)	Tokyo (T)	Fukuoka (T)	1051	20	100	20	100	97	97%

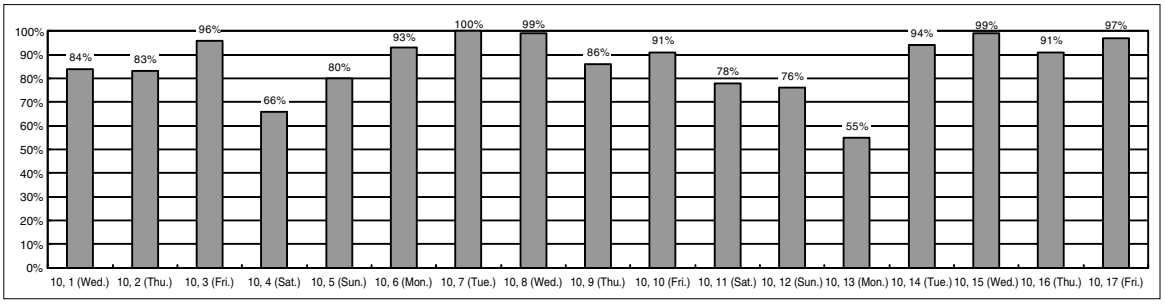

Fig. 2-2 No. 1051 Train departure and arrival records (Tokyo terminal—Fukuoka terminal section) (Oct. 1, 2008~Oct. 17, 2008)

bottlenecks in railway use and to support new product development.

The I-TEM Center not only changed the name board of the Sumidagawa Help Desk, it also took on many different roles. In a way, it functions as a "sweeper" that sweeps up any issues falling through the cracks in a vertical divided organization. In other words, the I-TEM Center is an "amoeba-like problem-solving entity." It continues to use the IT-FRENS & TRACE systems to work on the hot issues of the day, ranging from business management to operation improvement, use data to verify the issues, create new values, and make recommendations.

6. Using data to improve transport services —measure 1: Use time difference to plan transport routes

Every day the I-TEM Center received over 200 inquiries from transport carriers to find out "if it would be possible to secure adequate number of containers to fulfill the needs of individual cargo shipments." Most of these were complaints that they could not secure "the necessary number of containers." When we analyzed the data of the complaint contents, we found out many facts, ranging from "reserved containers not being used" to "reservations made based on forecast," "competing reservations due to blocking at transfer stations," and so on. Although we were able to resolve some problems by upgrading the reservation system, the core issue still led to the loss of opportunities. New transport routes would usually be created to resolve such phenomenon; however, the solution would only be a means to process complaints.

Verification of complaints with data shed light on the existence of "trains that were surprisingly not being used." In order to utilize these trains, we reviewed from different angles what kind of transport routes should be created in the first place. The value of data lies in such product planning.

Figure 2 (1) shows the actual loads by the day of the week of the No. 1051 train operating between Tokyo Freight terminal and Fukuoka Freight terminal. Although this train was known for being difficult to reserve at all times, we found out that the loads on Sundays were lower that those on the weekdays. Further study of the data indicated that there were few transport routes using the No. 1051 train.

On the weekdays, since the reservations of freight originating from Tokyo Freight terminal were full, adding more transport routes would only lead to more competing reservations. For this reason, only a few transport routes were set up for the No. 1051 train. However, could the same be said for the holidays?

Looking at the sales of the No. 1051 train for the holidays, we

Review the value of Train No. 1077, which leaves Tokyo at 11:16 am

1. Actual result between Tokyo and Kyushu (September 2008)

Train number of train departing Tokyo Terminal		Number of cars	Monthly transport capacity (convert to 12-ft container)	Number of containers transferred in a month (convert to 12-ft container)	Number of containers dispatched (convert to 12-ft container)	Monthly total of containers loaded at Tokyo terminal (convert to 12-ft container)	Loading ratio (Loading total/ monthly transport capacity)	
11:16	Newly added train							···Newly added train departing Tokyo in the morning
17:37	5053	14	2,070	510	1,100	1,610	77.8%	
20:52	5073	11	1,375	522	515	1,037	75.4%	
23:21	7053	21	2,760	499	1,887	2,385	86.4%	
23:55	1051	24	3,480	282	2,705	2,986	85.8%	
02:44	1071	24	2,880	40	1,885	1,925	66.8%	
02:57	7051	22	2,000	803	435	1,238	61.9%	
03:10	5071	26	3,640	590	1,541	2,131	58.5%	
Total of existing trains			18,205	3,245	10,067	13,311	73.1%	

2. Analysis of transferred cargoes

Train number of train departing Tokyo Terminal		Average layover time
17:37	5053	12:04
20:52	5073	7:52
23:21	7053	5:40
23:55	1051	10:41
02:44	1071	7:35
02:57	7051	9:18
03:10	5071	11:02
		8:02

Transferred cargoes that can be shifted to the new train from Tokyo terminal	Transferred cargoes that can be shifted to the new train from Sumidagawa station	Total	
300	24	324	
69	32	101	
148	92	240	
198	23	221	
8	9	17	
257	85	342	
191	56	247	
1,171	321	1,492	···Cargoes that will be available for the new train services (approximately 60 containers/day)

【Conclusion】

(1) The new train service has high product value. Since 60 containers of the cargoes transferring at Tokyo terminal can be shifted every day even under the current transport route system, it can accommodate any increase in transferred cargoes should the transport route plan changes in the future.

(2) Thanks to this, the transfer operation at Tokyo terminal during night time is improved, as pressure from competing reservations and transfer-handling of the 11:00-pm train departing Tokyo terminal is lessened.

Fig. 3 Transport results between Tokyo terminal and Fukuoka terminal

found that it was impossible to gather many cargoes if we just targeted the Tokyo Metropolitan area and its vicinities. There was a train leaving Hokkaido on Friday night and arriving at Tokyo Freight terminal on Sunday morning. By connecting this route with the No. 1051 train to form a Sunday-only transport route, we were able to create "an attractive transport route" that would leave Hokkaido on Friday and arrive at Fukuoka on Monday. This new product planning utilizes chronological order to set transport routes.

Figure 2 (2) shows the actual loads by the day of the week of the No. 1051 train departing on Sunday after it has been connected to the Hokkaido route. It shows that the utility rate of the No. 1051 train has gone up.

Employing the same method, the I-TEM Center used data to identify "trains that were surprisingly underused" and set transport routes to meet new demands. From FY 2008 to FY 2009, the I-TEM Center worked on over 30 plans, accommodating the new demand of over 500 containers per month.

7. Using data to improve transport services —measure 2: Transport routes to fill gaps

When the timetable was revised in March 2009, one new train service leaving Tokyo in the morning for Kyushu was added. This was a "Tokyo-originated morning train," the concept of which had been unthinkable until then. The creation of this train was also the result of data analysis.

Figure 3 shows the actual rail freight transport between Tokyo terminal and Fukuoka terminal. It is noteworthy that about 30% of the loads were transferred cargoes that did not originate from Tokyo terminal and that the layover time for these transferred cargoes at Tokyo terminal was long. Many of the freight trains were direct services between two points—the so-called "overnight trains." However, the intention to make train services more convenient by setting detailed transport routes for transfers inadvertently led to an increase in transferred cargoes that arrived in the morning but had to wait until the night train for transfer. In other words, the transfer stations were filled with layover cargoes during the day because there were no trains for transfer.

There, by adding train services during the day to fill the freight transport gap, we were able to speedup the turnover of transferred cargoes. By loading the transferred cargoes onto daytime trains, we were able to accept and transport time-sensitive cargoes originating from Tokyo terminal by direct freight trains running in the night. Filling the gaps in transport routes seemed like a measure for resolving the issue with transferred cargoes; however, it had the effect of enhancing the convenience of the highly profitable direct freight train services of JR Freight.

8. How to sell a network

One major transport carrier said, "It will be nice if rail freight has a mid-distance fixed-interval timetable. It's difficult to use direct rail freight that only has fixed destination points if the objective is to have a sales strategy that meet changing needs. It's better to use an iron to hit a long hole. It can meet the changing needs and is resilient to external disturbances, such as transport interruption."

Rail freight is a facility industry heavy on fixed cost. There is a limit to boosting profitability by just taking measures to control costs. It is not possible to increase yield without sales promotion measures that can meet the changes in demand and provide a wide range of product options.

If we were to market the trains as we did in the past, the key to providing product options lies in the scheduling of trains. However, what we are selling today is not the trains but the transport routes. Therefore, the key to providing product options lies in the design of transport routes. This is also evident in the two measures for improving transport services shown above as examples. The reason for creating the IT-FRENS & TRACE systems and highly systematized functions, such as automatic container adjustment, is to make the sales of transport routes more effective. This calls for rail freight that can flexibly combine transport routes based on demand. In other words, the higher the frequency of mid-distance trains, the more sales options there are. If we find any transport route that does not match the demand, we can change it immediately. Even though we change the arrangement of the transport route, we do not need to change the train setting right away.

When the demand for a train service assigned for a particular cargo falls, it is extremely difficult to find a way to resell this train service. In the worst case, it will lead to useless discount.

As IT-FRENS & TRACE takes hold, we have had more opportunities to discuss how to "create" and "cultivate" transport routes. With advances in the E&S System (Effective & Speedy Container Handling System) and improvement in station operation thanks to a transport system that no longer requires switching, the demand for transport routes with transfer increased. Looking at the transport needs gathered by the I-TEM Center and the demand data and actual data stored by IT-FRENS, we can see that today's container freight transport sells "a highly sophisticated network of routes." The demand for a mid-distance fixed-interval timetable also makes sense.

9. Using systems to increase profitability

As shown above, when we analyze data and identify potential demand, if we can set up transport routes to meet the demand, we can improve the transport services. However, given today's lingering economic slump and lack of growth in the freight transport volume, any yield boosting measure that does not have a pricing strategy may also run the risk of creating minus "values" in terms of sales; in other words, even if the transport volume increases, profitability may go down.

The keyword is "increasing profitability." Even if the transport volume decreases, we must increase profitability.

In order to formulate a sales strategy for the future, we need to analyze the actual data accumulated for each product and each customer and to set pricing that will match a wide range of customer groups. Then, it is necessary to put in place sales plans to offer products to the customers with the most values so as to maximize profits.

From now on, in addition to controlling the transport routes and conducting demand analysis of the supply volume, it is necessary to draw focus on analyzing demand to determine the timing and pricing of the products offered. To this end, we must proactively utilize information systems while improving the systems at the same time.