Operations Management Strategy in Fresenius Medical Care*

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Ⅰ. Introduction

In 1996, Fresenius Medical Care was founded from a merger of Fresenius Worldwide Dialysis and National Medical Care, headquartered in Bad Homburg, Germany. As the world's largest provider of kidney dialysis products and services, Fresenius Medical Care provides integrated services and products to chronic kidney disease patients. The Fresenius Medical Care currently has a portfolio of kidney-wide businesses, including hemodialysis, peritoneal dialysis, continuous new replacement therapy and kidney-related medicines, taking up nearly 50 percent of the dialysis market.

With more than 30 years of innovative research experience, advanced technology, and product development, more than 110,000 employees worldwide provide kidney dialysis-related products and services, and they play a leading role in the treatment of kidney disease with excellent technology and quality. Fresenius Medical Care

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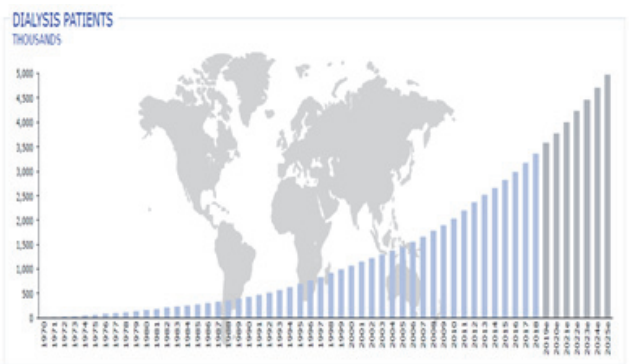
provides dialysis appliances and related consumables to 150 countries, and provide dialysis treatment services directly in the U.S. and Europe through 100% vertical sequencing. One of the two dialysis machines around the world is from the Fresenius Medical Care, and dialysis treatments using devices from the Fresenius Medical Care are being carried out somewhere on Earth every 0.6 seconds.

Ⅱ. Market analysis

The number of patients with chronic kidney disease who receive dialysis services provided by the Fresenius Medical Care increased by about 6% as of 2018, and is on a exponential growth trend worldwide and is expected to continue (Figure 1).

	patient number
Dialysis	3,361,000
HD	2,991,000
PD	370,000
Transplanted	787,000
ESRD total	**4,148,000**
population	7,500,000,000



Source: Global Dialysis Market & Fresenius Medical Care's Market Position

〈Figure 1〉 Global market status

In Korea, the number of patients with chronic kidney disease who receive dialysis services is increasing exponentially every year. According to the Korean Society of Nephrology, average age of patients with chronic kidney disease in Korea is increasing every year. Among many adult diseases, high blood pressure and diabetes often cause kidney damage. Such a rise in the number of chronic kidney disease patients worldwide, including in Korea, is attributed to an increase in the number of elderly people due to an increase in average life span.

〈Table 1〉 Prevalence of Renal Replacement Therapy in Korea

Year	HD		PD		Transplant		Total	
2010	39,509	(768.1)	7,309	(142.1)	12,042	(234.1)	58,860	(1144.4)
2011	42,596	(823.6)	7,694	(148.8)	13,051	(252.4)	63,341	(1224.8)
2012	48,531	(935.4)	7,552	(145.6)	14,128	(272.3)	70,211	(1353.3)
2013	52,378	(1006.1)	7,540	(144.8)	15,124	(290.5)	75,042	(1441.5)
2014	57,256	(1115.3)	7,423	144.6)	15,995	(311.6)	80,674	(1571.5)
2015	62,634	(1215.5)	7,352	(142.7)	17,028	(330.5)	87,014	(1688.6)
2016	68,853	(1331.9)	6,842	(132.4)	18,189	(351.8)	93,884	(1816.1)
2017	73,059	(1411.0)	6,475	(125.1)	19,212	(371.0)	98,746	(1907.1)
2018	77,617	(1497.6)	6,248	(120.6)	20,119	(388.2)	103,984	(2006.4)

( ): Number of patients per million population at the end of 2018.
Source: The Korean Society of Nephrology

Ⅲ. Inventory management

ABC analysis is a method that divides the statistical control target into groups A, B, and C, and first selects group A as an important management target and focuses its management efforts. It begins with a notion that all items should not be handled in the same way. Otherwise, it will take a lot of effort, time, and manpower, which leads to cause excessive cost (Zsolt & Mónika, 2015).

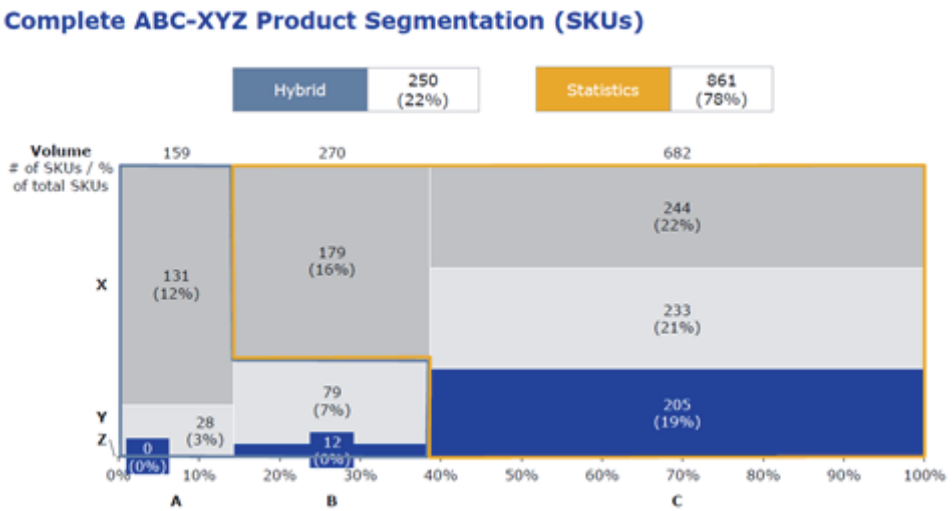
XYZ analysis is a method of investigating ranking based on the standard deviation of the product′s sales, and intended to assess the change in demand or consumption of items in the store. An XYZ analysis is a method of classifying inventory items according to the variability of demand. X items are characterized by steady sale over time, demand of Y items is not steady compared to X items, while demand for Z items show the strongest fluctuation than the others. Therefore, future demand for item X can be reliably predicted, and the demand for item Y is somewhat predictable but not consistent, while it is very difficult to predict the demand for Z items (Pandya & Thakkar, 2016).

The Fresenius Medical Care is managed in nine product lines using ABC/XYZ Analysis technique, which uses both ABC analysis and XYZ analysis together to manage inventory for more than 1,000 products. The ABC/XYZ analysis which categorizes

products into two different groups – "the statistics forecasting product line" and "the hybrid forecasting product line" – and adopt different forecasting strategy for each groups. The use of two demand forecasting techniques by product line increases the accuracy of demand forecasting, which in turn enables efficient inventory management.

Source: Fresenius Medical Care Internal

〈Figure 2〉 Inventory management of Fresenius Medical Care



Source: Fresenius Medical Care Internal

〈Figure 3〉 Product segmentation of Fresenius Medical Care

Based on ABC/XYZ Analysis, 861 products belongs to statistics forecasting products, which accounts for 78% of all products, and 250 products are classified as hybrid

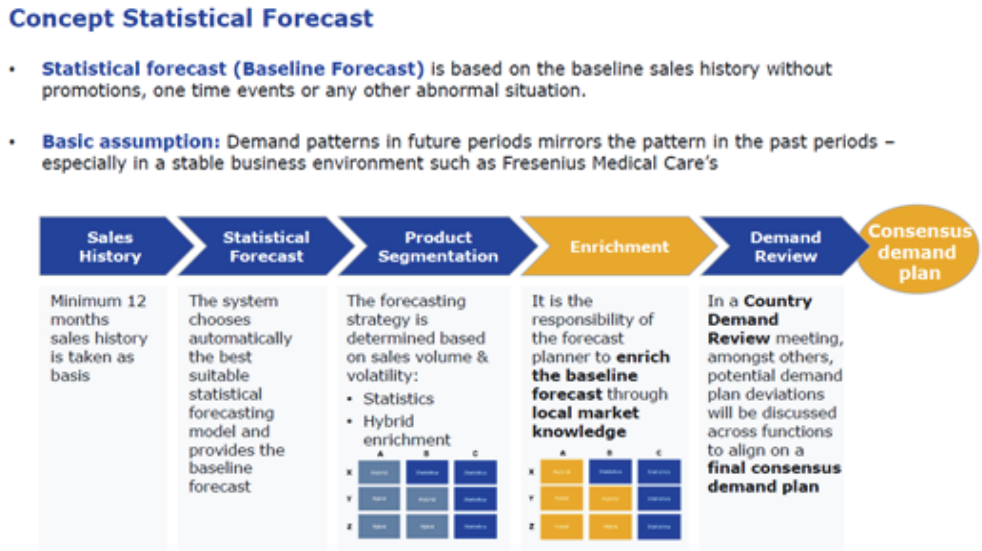
forecasting products, which represents 22% out of total. The hybrid products, around 22% out of total products, were found to account for about 80% of the company's total revenue, and it is confirmed that the Pareto law is in effect.

Fresenius Medical Care offers more than 1,000 products, and they range from large, expensive dialysis machines to consumables for dialysis, drugs, disinfectants, and small needles. As a result, it is difficult to proceed all products collectively with regular or quantitative orders, thereby both regular and quantitative order techniques are used depending on the nature of the products. For large and expensive dialysis machines, the company will place regular orders based on demand forecast, while accessories such as medicines, disinfectants, and small needles will be ordered based on quantitative order techniques. In an effort to reduce shipping costs, the company continues to track and manage the optimal inventory to meet the time of the order at regular intervals.

Ⅳ. Demand forecasting

If the quantity of products provided is high, such as in case of Fresenius Medical care, the workload of forecasting demand for each product is very high. The company combines qualitative and data-driven quantitative demand forecasts to reduce workload and predict reliable demand at the same time. Similar to collaborative planning, forecasting, and replenishment(CPFR) techniques, ABC/XYZ analysis is conducted based on historical sales history data, and at the same time, all players from upstream to downstream share information to forecast future demand.

As mentioned earlier, Fresenius Medical Care classifies the product into nine product lines, taking into account the product's sales and sales standard deviations, and the nine product lines are reclassified into hybrid or statistics products – ones with high sales volumes and high standard deviations belongs to the former, while the ones with small sales volumes and small standard deviations belongs to the latter. After the classification, the company proceed actual demand forecasting.



Source: Fresenius Medical Care Internal

〈Figure 4〉 Forecasting strategies of Fresenius Medical Care

The demand forecast process of Fresenius Medical Care is as follows:

① Collect sales history by product for at least 12 months

② Based on the collected Sales History data, the best demand forecast is carried out in a statistical manner.

③ Categorize products into hybrid and statistics product lines with ABC/XYZ analysis.

④ With considering local market conditions, forecast planner performs qualitative demand forecasting for the hybrid product line to improve accuracy of demand forecasts.

⑤ Discussion on demand planning at demand review meeting at each region.

This demand forecasting technique was the first to be applied at the Fresenius Medical Care Poland in 2018, and reliable demand forecasting was possible that only two were outside the demand forecast out of more than 1,000 products. In addition, the Pareto law is identified that 27% of the total products accounts for 80% of total

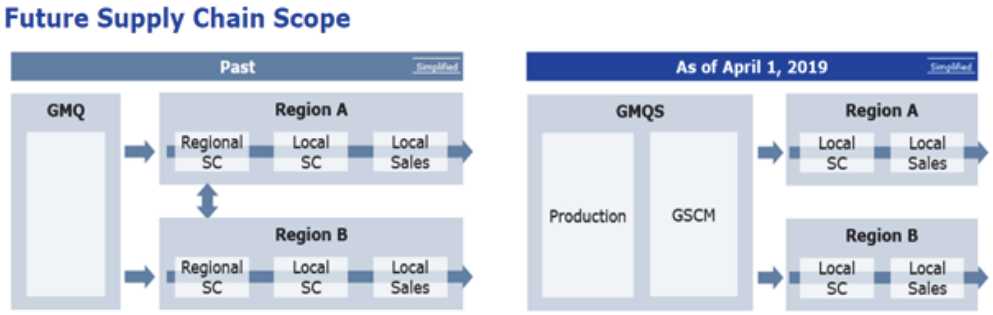
sales. Moreover, 87% of products were found to have no problem with the reliability of demand forecasting only with statistical methods, which reduced the workload and inventory costs.

Ⅴ. Supply chain management

The health care market is less uncertain in demand than in other markets, so it tends to be functional for patient care rather than innovative products. In terms of supply, the supply of materials and parts for medical products is stable compared to other markets. Thus, the health care market focuses on building a supply chain that maximizes efficiency and reduces costs with low demand uncertainty, low supply uncertainty.

The Fresenius Medical Care divides its market as three areas: ① Asia, ② the United States, and ③ Europe, the Middle East, Africa, and South America. In the past, each region operated supply chain(SC) with a total of four stages of structure: Global Manufacturing Quality(GMQ), Regional SC, Local SC, and Local Sales. However, from 2019, the Global Supply Chain Management (GSCM) team was formed by integrating all Regional SC organizations and placing them within the Global Manufacturing Quality Supply (GMQS) organization. This led to organizational changes that reduced the chain′s structure by one step in total three steps. The change and integration of the organization will simplify the structure of the supply chain, and is also expected to reduce the bullwhip effect.

If diverse supply chain in different regions are integrated into single supply chain, a number of synergies such as increase in bargaining power through bulk purchases could be achieved. In addition, by becoming an important customer in the supplier market, a firm may find itself in a more advantageous position in the subsequent purchasing negotiations, and the purchasing process can be simplified to make efficient purchases.



Source: Fresenius Medical Care Internal

〈Figure 5〉 Supply chain transformation of Fresenius Medical Care

The below are a few examples of positive effects of global procurement by Fresenius Medical Care.

5.1 Global Tender Fistula Needles

There are many companies in Southeast Asia or China that produce products cheaply with low labor cost, and supply them all over the world. However, issues of quality still exist. By contacting the Arterial Vein Fistula (AVF) companies in the countries that produce these low-cost products, the Fresenius Medical Care has increased production capabilities, including the quality of products produced by AVF producers, and more efforts have been made to create products that meet international standards.

5.2 Global Gloves initiative

After analyzing data from the Global perspective on medical glove purchases in each region, Fresenius Medical Care is turned out to be purchasing 1% of the global medical glove use. With this purchasing power, the company was able to reduce purchase costs by making purchases directly through the production company without going through the general distribution process.

Ⅵ. Operations management strategy

A market-driven enterprise refers to a company that can lead the trend with new content or trends. To become a market-driven enterprise, a company should not only aim at treatment but also at improving patient satisfaction and quality of life, as well as providing personalized products. In addition, value-driven medical devices should be prepared that take into account the convenience, social impact and environment of the medical staffs.

6.1 Dialyzer

For chronic kidney disease patients, who are required to receive blood dialysis for life before kidney transplantation, the key to dialysis is the filter and the medical team also chooses the product that brings the best results in treatment. Accordingly, the Fresenius Medical Care has been actively developing a blood filter for artificial kidney machines in a way that is based on value-based health care. The dialyzer of Fresenius Medical Care is an artificial filter contains delicate fine fibres, which replaces the kidneys of renal failure patients. This is the unique design in th industry that has the blue header portion of the blood filler in a lateral direction to reduce the risk of blood line cracking, and the three-dimensional microwave structure's fiber and radial designs have been designed to allow dialysis to be distributed evenly.

6.2 Customized product line-up

Fresenius Medical Care is also the only company in the industry to offer products for children. In particular, the appropriate filters vary depending on blood flow rates, different treatment methods (HD or HDF), age, and so on, and the company has products for all the options. Considering the convenience of the medical staff in charge of the treatment, in addition, the company has been working on simplifying the process of detaching the dialysis machine to reduce the burden on the medical staff and improve usability.

6.3 Forecasting model with AI and big data

Fresenius Medical Care uses its own dialysis clinics and predictive models using artificial intelligence and big data to achieve customized optimal care options. Patients who receive blood dialysis visit the hospital's artificial kidney room at least three times a week, and each dialysis takes three to four hours. As such, each time a patient visits the hospital, extensive data on the effects of dialysis, including pre-dialysis blood pressure and weight changes is collected. Data on individual patients can be analyzed through specific algorithms, guidelines could be suggested for optimal dialysis speed or dosage, and clinics can provide customized treatment services or predict future complications to maximize treatment effectiveness and improve quality of life.

6.4 Environmental-friendly products

Fresenius Medical Care has steadily improved the outer frame material of the blood dialyzer, taking into account not only the patient but also the environmental aspects. As medical waste is becoming a social problem, not just in our country but around the world, the company used materials that can greatly reduce it. The FX Dialzyer's frame material is eco-friendly polypropylene and is up to 50% lighter compared to polycarbonate products, with reducing the average annual waste weight by up to 1,600kg per center.

PVC is a polyvinyl chloride, one of the thermoplastics, and it is one of the most talked about environmental hormone hazards until recently. Fresenius Medical Care has long been interested in environmental issues and introduced products made using Biofine in 1996. Biofine is a PVC-free, plasticizer-free material that does not pose a risk to environmental hormones.

Ⅶ. Conclusion

Reliable demand forecasting is paramount for efficient inventory management. In particular, in order to efficiently manage the inventory of products in a wide variety of cases, such as in the health care market, the method of dividing and separating

products into different characteristics by scientific and statistical techniques will be a way to reduce unnecessary work and improve efficiency.

While awareness of the importance of demand forecasting as the basis for marketing strategy is growing, not many companies are using objective and logical predictive methodologies. It can be achieved by using the right data. In addition, it is important to be able to demonstrate the right management strategy based on demand forecasts.

To prepare for an uncertain future economy, the supply chain must continue to evolve to reflect changing customer expectations and economic realities. One should not seek only his/her own interests in the supply chain, but also work to coexist and develop with other suppliers.

To achieve a successful long-term competitive strategy, the company must carefully review its policies and plans for resource utilization to establish a production operation strategy to become a market-driven company. One should carefully think about what customer's needs are and what it takes to meet them. In addition, sustainable corporate growth requires efforts to achieve eco-friendly production and reduce environmental harmful effect as a member of society.

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