Critical Success Factors of Integrated System of Production, Sales and Distribution

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Abstract

The market needs have urged the production system to shift from mass production to flexible manufacturing with short period lead time and/or special specification of products. In order to meet these requirements, integrated system of production, sales and distribution is needed. Three critical success factors below are pointed out for the success of this system.

①More elaborate sales planning

Generally, sales is too roughly planned and it causes rough production planning.

②Rapid making and remaking of production planning

Changing of production plan takes much time and it is not easy to coordinate departments.

③Coordination among production, sales and distribution department

As is often the case with coordination among departments, each department has its own way and makes trouble with customers by inconsistent reply.

To cope with these difficulties, following schemes would be useful.

a. Order-made sales forecasting system

Construct elaborate sales planning system using order-made sales forecasting system

b. Production planning system using production planning simulator

Utilizing production planning simulator enables rapid making and remaking of production plan

c. Utilizing production planning simulator and setting up a coordination center

By these, departments can be coordinated rapidly and smoothly

Concepts of these CSFs are stated with case studies.

Key words: Sales Forecast, production Planning, Scheduling System, Simulator

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1. Preface

Recently, market is now under the condition that suppliers capacity overwhelm demand. Suppliers must meet the market needs of various products with small quantity, short period lead time and/or special specification of products, otherwise they will be defeated. Competition among companies require streamed integrated system over different business line from customer to suppliers, which faces following problems.

・Specifying number of product is required in manufacturing, but rare is the case in sales planning. Establishing the total sales amount for the group of products often become the aim of salesperson. Deliberate sales forecast is not severely pursued.

・The real number of inventory often does not coincide with the number in the memory of computer. This would happen if worker forget to make input in computer. This is the fatal problem in utilizing computer.

・There are many manufacturing process disturbing requirement from customer in production planning and rapid making and remaking of production planning is often required.

・Coordination among production, sales and distribution department is difficult. As is often the case with coordination among departments, each department has its own way. Sales department want to meet the user needs however difficult it may be. Manufacturing department, on the contrary, prefers big production size, long term lead time to meet the user needs. Though they have to meet the users' demand finally, they must pursue a best way to coordinate among departments. To succeed in constructing integrated system of production, sales and distribution, there are following three critical success factors (CSF).

①Elaborate sales planning

②Rapid making and remaking of production planning

③Coordination among production, sales and distribution department

In this paper, we examine the background of these CSFs and explain following schemes to overcome these difficulties.

a. Order-made sales forecasting system
b. Production planning system using production planning simulator
c. Utilizing production planning simulator and setting up a coordination center

2. Critical Success Factors of Integrated System of Production, Sales and Distribution

(1) CSF in sales department domain–Elaborate sales planning

There are two ways of manufacturing. One is production by forecast and the other is production by order. Here we assume former case. Needless to say, roughly made production planning may lead to the lack of products or dead stock of products. These cases are often caused by the rough sales planning. Furthermore, sales forecast is rarely done in elaborate manner. Why does this happen?

①There are too many items to forecast for each product sales. There is often the case that they make sales forecast by only calculating the total amount of money for each group of products.

②Salesperson are often evaluated by total sales amount.

③There is often the case that the number of stock is not correct which give arise difficulty in calculating material quantity to supply.

④Even if we can get shipment information, it is hard to get all warehouses' and retail shops' stock number.

⑤Past sales records do not guarantee future sales of similar goods or services.

⑥It seems to be difficult to master forecasting method. We must upgrade forecasting sensitivity at any rate.

(2) CSF in production department domain–Rapid making and remaking of production planning

We have to deal with market needs which change rapidly.
How should we do when following state of affairs happen?

---When urgent order is accepted, how does it make ill effect to the other orders?

---When the working members are not full, how can we maximize production quantity and minimize shipment time delay?

---How can we schedule which minimize the time of exchanging production work tools?

⋮

To cope with these, cunning system will be required.

(3) CSF in departments' combination–Coordination among production, sales and distribution department

Coordination among production, sales and distribution department often arise under the recent market circumstance of flexible manufacturing with short period lead time and/or special specification of products. Coordination among departments must be done smoothly by setting up an appropriate agent. Coordination is required under following conditions.

- Decision support of the choice between production total amount and preferential production of strategic products.
- Re-arrangement of schedule in the case of sudden breakdown of equipment.

3. Means for solution

(1) Order-made sales forecasting system

We found that the following characteristics are in common in many company (especially in Japan).

①Seasonal characteristics

Big deal is done before the end of the year, buddhist summer holidays (there is a soul healing event in the midst of the summer for the dead persons), consecutive holidays in May and it declines greatly on the following days.

②Month-end half compulsory makers' sales to wholesale

In order to keep monthly sales amount, makers' salesperson often requests wholesalers of stock-keeping purchase.

③Forecast using the sales data of past two or three months

If sales time series have a seasonal characteristics, the last year's same month's sales data are to be watched, but it is not prevailing.

④Several patterns by products characteristics

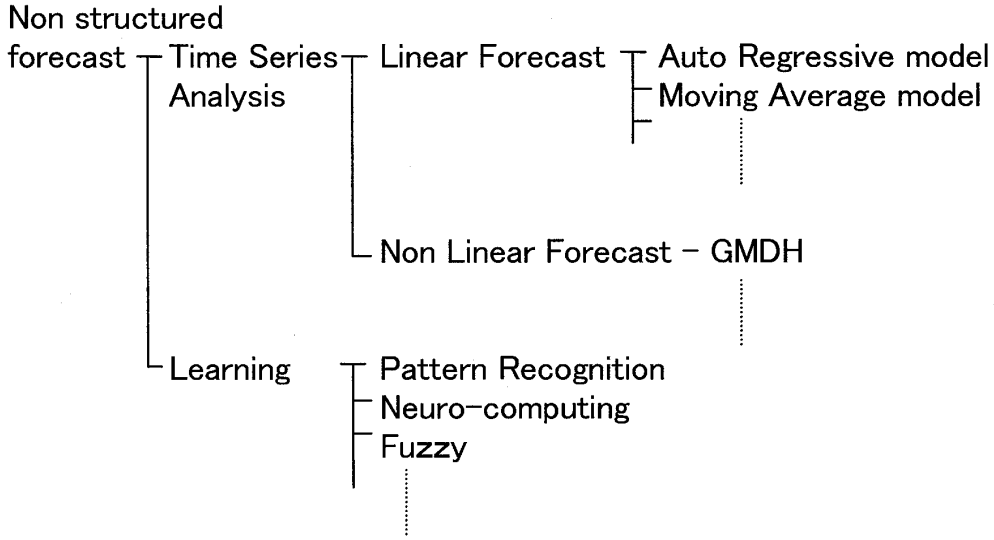
- newly growing products
- long life stable products
- declining products
- big sales change by claim

There are two methods in sales forecast.

One is the method which use structured model, and the other is the method which doesn't use it.

The latter is classified as follows (chart1).

Chart 1: Classification of sales forecast methods



There are many non-structured forecast methods. But simple application of methods does not bear good result. For example, linear forecasting method was successfully used in the past, the present result may not be so good. Because these methods are based on the assumption that the time series are stationary stochastic processes.

Sales data does not always satisfy this assumption. If we want to upgrade forecasting accuracy, we have to eliminate structural noise stated above, and build order-made sales forecasting method considering characteristics of products and customers of each company.

We devised the best fit model for each company. Those examples are summarized at chart2.

Chart 2: Application of sales forecast

Type of industry ・Sales amount	Issues	Improvement	Effect
Manufacture of medical products 15 billion yen	・Eliminate excessive stock ・Defend lack of products ・Increase sales productivity ・Reduce distribution cost	・Regression analysis using moving average sales of quarter year with the effect of decreasing monthly fluctuations. ・Make quarterly forecast by multiplying quarterly index ・Make monthly forecast using the average of past each month's share within the quarter	・Forecast error decreased to within± 20% ・Elimination of excessive stock ・Less lack of products
Manufacture of plastic food vessel 70 billon yen	・Eliminate excessive stock ・Defend lack of products ・Reduce distribution cost	・Method is nearly the same with above method	・Make forecast for every sales office concerning main A rank products ・Forecast error decreased to within± 20% ・Elimination of excessive stock ・Less lack of products
Restaurant chain 22 billion yen	・Support the order making from each shop to center ・Analyze sales trend	・Use week day index and monthly index to count consumption quantity at each shop ・Build analyzing method of shop POS data in the model	・30% of shop's stock was proved to be possibly reduced by simulation ・POS system be reconstructed

(2) Production planning system and production planning simulator

Production planning system is a computer-based system for production planning which include assigning plan of each manufacturing lot to equipment, outsourcing plan, man-machine assignment plan, maintenance plan etc. Production planning simulator determines detail production schedule, and outputs summary or analytic reports. Production planning simulator is used as decision support system.

If we build the model simulating the real manufacturing process and trace the effect caused by the input of urgent order, we can see the influence of the event. This means to build production planning simulator.

Chart 3: Aims of production planning simulator

① Decrease of the delay of the delivery time
② Decrease the quantity of work in process
③ Appropriate workers' assignment
④ Decrease the time of exchanging production work tools
⑤ Save energy
⑥ Rapid re-arrangement in case of disturbing events

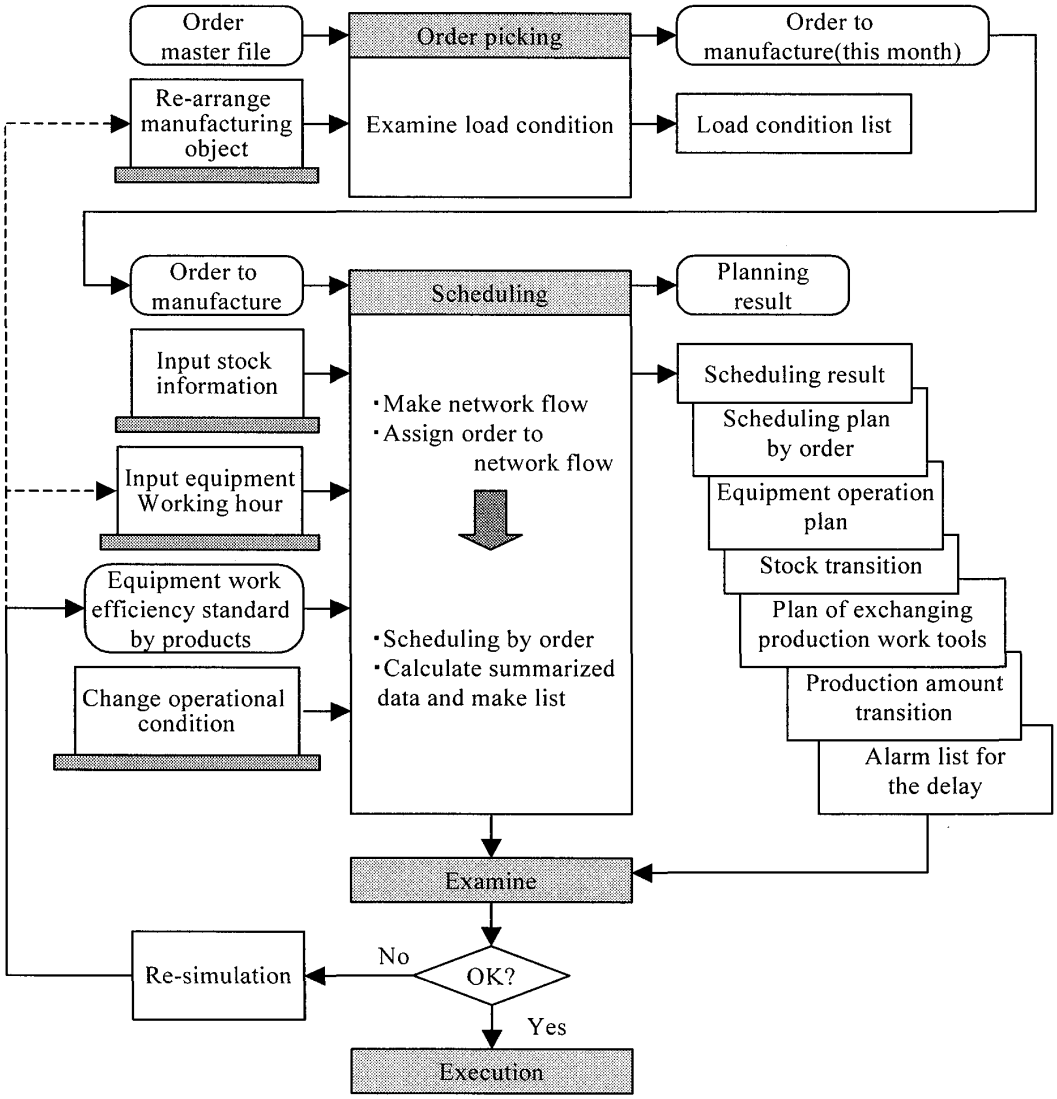
Generally, operational restriction at the factory is so complicated that it is hard to find best theoretical solution. Therefore, production planning simulators using heuristic logic are often be constructed. Recently, constructing the one using AI is also becoming popular. As it is a simulator, user can examine the results under the many varied conditions.

A. The way to use production planning simulator

The example of production planning simulator the author developed before is exhibited in chart 4.

This makes monthly plan by scheduling each manufacturing lot at seamless pipe manufacturing plant of a steel company. If delay of the delivery would arise or many exchange of production work tools would be caused, simulation would be executed again by (for example) changing operational condition. If good result is obtained, the plan is executed. When urgent order comes, simulation is executed. Judging from the influence it makes, manager decide whether they accept it or not.

Chart 4: Example of production planning simulator



B. Example1

a. In company A which has chemical batch plant, many business works has long been computerized. This company had following difficulties. Production lead time was long and that caused huge stock. Much energy was needed to make production planning and the change of plan was also difficult. Company A decided to build production planning system along with production management system.

b. The aim of developing production planning system was as follows.

- Decrease stock to 2/3 of the present

- Shorten production lead time to 1/2 of the present
- Decrease manpower of production planning to 1/2 of the present
- Rapid re-arrangement when change of the production plan necessary
- Rapid answer to the inquiry for delivery

c. How to build logic was difficult

The production planning process was so complicated. A product was assembled from a set of components that were again composed of parts and materials. A component might be used to make a variety of products. The nest structure of product-component–parts were handled by the computerized Material Resource Planning (MRP) system. However, how many parts and components had been produced in each month was not uniquely determined. That is, the production quantity of parts and components for the specified production of a product had inevitably same flexibility. Theoretically, this problem was deemed to be the case of two patterns (pattern with procedure relation and the one without it) in n job m machine parallel shop problem.

For this problem, a method for obtaining approximate solution with strict constraints attached was proposed, but this method couldn't be applied to the problem. So we developed heuristic logic. For the convenience of maintenance, we developed system such that the logic was controlled by parameter. For example, conditions for priority were set in table.

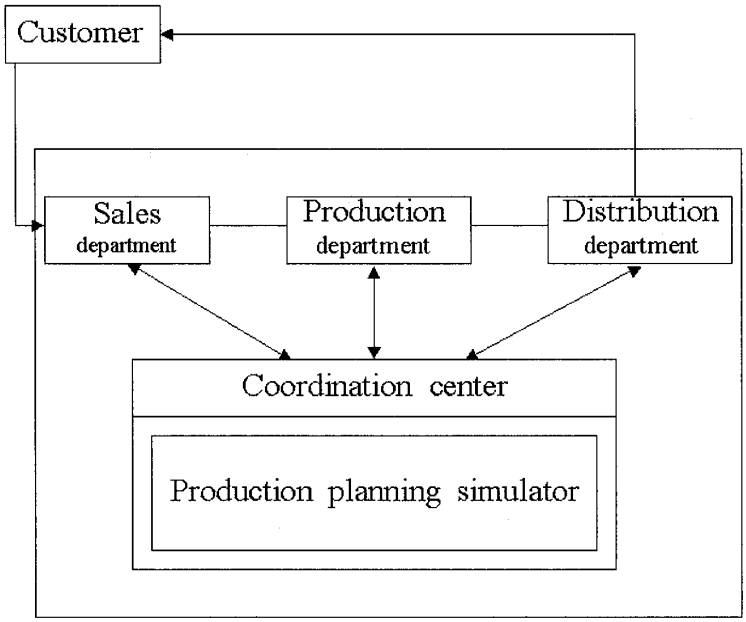
C. Example2

Company B constructed an integrated system of production, sales and distribution to keep competitive edge to another company. Sales forecasting system and production planning system took an important role among them. Production planning had been done by human work, so it took long lead time, and it was hard to change plan quickly. By introducing production planning system and production management system, the lead time was shortened to 3/5 of the before. Stock was also decreased. Formerly, material stock forecast had been done two months before the production, after the introduction of the system, it was shortened to one month before, which improved the accuracy of the material stock forecast a great deal.

(3) Utilizing production planning simulator and setting up a coordination center

Thus, a tremendous improvement of the process management could be realized by utilizing production planning simulator and coordination among departments could be executed easily. Furthermore, setting up a coordination center which coordinate production, sales and distribution department make the simulator function more fully (Chart5).

Chart5: Utilizing production planning simulator and setting up a coordination center



If a short lead time order is brought from sales department, the influence to the production line could be examined utilizing production planning simulator. If it does not bear good result, whether the delivery time can be postponed or not, for example, is sounded to user by salesperson. If these coordination is operated in an organized manner at the coordination center, efficient decision would be made (Chart6).

Chart6: Function of a coordination center

Whenever the change or disturbing events may happen,
coordination center works with the following function.

- Re-Sales forecast
- Re-arrangement of production scheduling
- Coordination among departments such as sales, manufacturing and distribution
- Re-arrangement of delivery time
- Re-arrangement of working person's schedule or work place
- Re-arrangement of procurement

etc.

In the example2, this coordination center was also set and bore stated results.

4. Conclusion

As for the sales forecast which was the base of production planning, the accuracy was improved by separating and analyzing structural characteristics from the original time series. Production control became to be executed rapidly and effectively by developing production planning simulator utilizing practical heuristic logic. Setting up coordination center was effective for the coordination among production, sales and distribution department.

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