TITLE

DEMAND DISPATCH SYSTEM AND METHOD

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to supply chain management, and particularly to a demand dispatch system and method for supply chain management.

Description of the Related Art

In the supply of goods, supply chain encompasses purchase of materials, transformation of these materials into intermediate and finished products, and the distribution of finished products. In the supply chain, customers transmit requests (or demands) that may include a request for a particular quantity of a product by a specific date. The manufacturer plans its schedule according to these received requests to satisfy each customer.

The complexity of the chain may vary greatly from industry to industry and firm to firm. For example, demand and capacity management is critical in integrated circuit (IC) foundries to

reduce inventory and increase productivity, particularly since the manufacturing process of each IC product is complicated, IC products do not use routine materials, and the cost of wafers and capacity is relatively high.

The key issue in supply chain management is fulfillment of customer demands and guarantee of delivery date when the foundry fully loaded. In practice, however, since the foundry is always under loaded, cost management becomes an important issue (for the management of supply chain functions and operations) to strengthen competitive ability.

Since the IC industry is characterized by high variation, wafer and capacity costs are higher. In addition, products are not routine material, that is, the short life cycle, prompt delivery, and quantity management are all critical in reducing costs. Customers endeavor to control delivery date and quantity through planning and forecasting. Wishing to construct a virtual factory to lower the impact of marketing shifts, and reduce the cost of maintaining capacity, customers frequently overestimate demand in order to meet capacity, and the foundry consequently frequently over-commits in order to reduce order

and capacity loss. Since the foundry must prepare capacity and related materials for customer demands in advance, this discrepancy between customer and foundry goals and methods has become a major problem in supply chain management, resulting in impacted cost management.

For a foundry having several fabrications, the best cost management method is to maintain a stable prepared capacity exceeding customer demand for each fabrication. Unfortunately, there is no effective dispatch mechanism provided by current supply chain management applications to smooth loading, and accomplish optimized cost management.

SUMMARY OF THE INVENTION

Accordingly, an aim of the embodiment disclosed herein is to provide a demand dispatch system and method that provides stable fabrication loading.

Another aim of the embodiment disclosed herein is to propose an IC product and manufacturing method thereof.

In a first aspect, there is provided a demand dispatching method, comprising the steps of :

receiving a first demand;

dividing the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate;

determining an expected quantity of a first fabrication; and

dispatching a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand, respectively.

In a second aspect, there is provided a demand dispatch system, comprising:

a risk database recording risk information for a first demand; and

an allocation planning module to receive the first demand,

divide the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate according to the risk information, determine an expected quantity of a first fabrication, and dispatch a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand, respectively.

In a third aspect, there is provided a demand dispatching method in an IC foundry, comprising the steps of:

receiving a first demand for a first IC product;

dividing the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate;

determining an expected quantity of a first fabrication; and

dispatching a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand, respectively.

In a fourth aspect, there is provided a demand dispatch system in an IC foundry, comprising:

a risk database recording risk information for a first demand for a first IC product; and

an allocation planning module to receive the first demand, divide the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate according to the risk information, determine an expected quantity of a first fabrication, and dispatch a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the

second order rate for the low risk demand and the high risk demand respectively.

In a fifth aspect, there is provided a method of IC product manufacturing, comprising the steps of:

receiving a first demand for a first IC product;

dividing the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate;

determining an expected quantity of a first fabrication;

dispatching a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand, respectively;

receiving a purchase order for the first IC product; and

manufacturing the first IC product corresponding to the purchase order in the first fabrication.

In a sixth aspect, there is provided an IC product produced by the process of:

receiving a first demand for the IC product;

dividing the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate;

determining an expected quantity of a first fabrication;

dispatching a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand, respectively;

receiving a purchase order for the IC product; and

manufacturing the IC product corresponding to the purchase order in the first fabrication.

Disclosed herein are novel systems and methods for overcoming

conventional demand dispatch problems. In one embodiment, the demand dispatch system comprises a risk database and an allocation planning module. The risk database records risk information for a first demand. The allocation planning module receives the first demand, and then divides the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate according to the risk information. Then, the allocation planning module determines an expected quantity of a first fabrication, and dispatches a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand respectively.

The allocation planning module further dispatches a third quantity of the low risk demand of a second demand dispatched to a second fabrication to the first fabrication if the difference between the expected quantity and the first quantity is exceeding a predetermined ratio of the expected quantity. The allocation planning module further monitors the variation in the first quantity of the low risk demand of the first fabrication,

and dispatches a pilot order to the first fabrication if the variation in the first quantity of the low risk demand shows a downward trend

In another embodiment, a method provides IC product manufacturing. First, a first demand for a first IC product is received. The first demand is divided into a low risk demand having a first order rate and a high risk demand having a second order rate. In addition, an expected quantity of a first fabrication is determined. Thereafter, a first quantity of the low risk demand and a second quantity of the high risk demand are dispatched to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand respectively. Afterward, a purchase order for the first IC product is received, and the first IC product corresponding to the purchase order is manufactured in the first fabrication.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects, features and advantages of this invention will become apparent by referring to the

following detailed description of the preferred embodiment with reference to the accompanying drawings, wherein:

Fig. 1 is a schematic of the demand dispatch system according to the present invention;

Fig. 2 is a schematic of a capacity available support demand (CASD) for a fabrication;

Fig. 3 is a schematic of the CASDs of several fabrications and a buffer fabrication;

Fig. 4 is a schematic of monthly CASDs for a fabrication;

Fig. 5 is a flowchart of a process of the demand dispatching method according to the present invention;

Fig. 6 is a flowchart of a process of short-term demand adjustment according to the present invention; and

Fig. 7 is a flowchart of a process of long-term demand adjustment according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

As summarized above, the present invention is directed to novel systems and methods for overcoming conventional demand dispatch problems.

Fig. 1 illustrates the architecture of the demand dispatch system according to an embodiment of the present invention. Note that IC products in an IC foundry are discussed in the embodiment, but the present invention can be applied to all factories.

The system 100 includes a customer side 110 and a manufacturer side 120. On the customer side 110, the customer 111 forecasts demand plan (demand) 112 and issues purchase order 113. The demand plan 112 and purchase order 113 are transferred to the manufacturer side 120. The demand plan 112 may include a request for a quantity of an IC product to a manufacturer (IC foundry). The purchase order 113 is an actual order that requests the manufacturer to start manufacturing the product.

On the manufacturer side 120, the allocation planning module 121 receives the demand plan 112 from the customer 111, manages the CASD (capacity available support demand) 123 of each fabrication according to the demand dispatching method of the present invention, and generates corresponding allocation plans accordingly. The allocation plan may be the customer support plan for the product, and records rough capacity distribution

(dispatching) and schedule for the product. The details of the demand dispatching of the allocation planning module 121 will be discussed later. The order management module 122 receives the purchase order 113 for the IC product from the customer 111, and arranges the CASD 123 to meet customer demand.

The allocation planning module 121 has a risk database recording risk information for each IC product. It should be noted that the risk information is dependent upon customers 111. Table 1 shows an example of the risk database.

Table 1

Product Name	LRD	HRD	LRD Order Rate	HRD Order Rate
A	70%	30%	90%	40%
B	60	40%	80%	30%

In table 1, the risk database records risk information for products A and B corresponding to a customer. The risk information includes low risk demand (LRD) and high risk demand (HRD) rates indicating the risk of a demand. The LRD represents a part of the demand with low risk and the HRD represents a part of the demand with high risk, that is, the HRD may be

overestimated. In addition, The LRD and HRD have an order rate respectively, and the order rate is the possibility of these becoming actual orders.

In this case, the demand for product A may have 70% LRD and 30% HRD, and the order rates for the LRD and HRD are 90% and 40% respectively. For product B, the demand may have 60% LRD and 40% HRD, and the order rates for the LRD and HRD are 80% and 30% respectively. It should be noted that the risk information can be collected and summarized by analyzing historical information for the demand plans and the purchase orders of each customer.

The allocation planning module 121 divides each received demand into a LRD and a HRD according to its corresponding risk information in the risk database. The allocation planning module 121 also determines an expected quantity of each fabrication. Note that the expected quantity can be determined manually or automatically adjusted to the foundry situation.

The allocation planning module 121 then dispatches the quantity of the LRD and that of the HRD to the fabrication utilizing a dispatching rule as follows:

EQ=FQ*FOR+SQ*SOR, in which EQ is the expected quantity, FQ is the quantity of the LRD, FOR is the LRD order rate, SQ is the quantity of the HRD, and SOR is the HRD order rate. It should be noted that FQ is less than or equal to the amount of the LRD, and SQ is less than or equal to the amount of the HRD. That is, a part or all of the LRD or HRD can be dispatched to the fabrication. Fig. 2 illustrates the CASD 200 for a fabrication using the dispatching rule. In this case, the dispatched CASD 200 includes LRD 202 and HRD 203, and the LRD 202 and HRD 203 can achieve the expected quantity 201 of the fabrication.

In addition, the allocation planning module 121 may select a fabrication as a buffer to bear the risk of demands. The allocation planning module 121 may dispatch remnant HRD to the buffer fabrication. Fig. 3 illustrates the CASDs of several fabrications and the buffer fabrication. In this case, the CASDs (310, 320 and 330) of each fabrication can be dispatched according to the dispatching rule and its corresponding expected quantity (311, 321 and 331). The remnant HRD and LRD (HRD4 and LRD4) can be dispatched to the CASD 340 of the buffer fabrication. The allocation planning module 121 may monitor the

quantity of the LRD of each fabrication, and re-dispatch the LRD (LRD4) of the buffer fabrication to the fabrication if the difference between the expected quantity and the quantity of the LRD of the fabrication is exceeding a predetermined ratio of the expected quantity, such as 20%.

In addition, for long-term planning, the allocation planning module 121 may monitor variation in the LRD of each fabrication, and dispatch pilot orders to the fabrication if the variation in the quantity of the LRD of the fabrication shows a downward trend For example, Fig. 4 illustrates monthly CASDs for a fabrication, in which the CASD 401 of first month has LRD LRD_A, the CASD 402 of second month has LRD LRD_B, the CASD 403 of third month has LRD LRD_C, the CASD 404 of fourth month has LRD LRD_D, and the expected quantity of the fabrication is labeled 400. Since the quantity of LRD decreases successively, the allocation planning module 121 dispatches pilot orders to the fabrication. It should be noted that the pilot orders may be new tape out orders and may become potential orders of the fabrication.

Fig. 5 shows a process of the demand dispatching method according to the present invention.

First, in step S501, the allocation planning module 121 receives at least one demand for an IC product. Then, in step S502, the allocation planning module 121 retrieves the risk information from the risk database according to the IC product of the demand. Afterward, in step S503, the allocation planning module 121 divides the demand into a LRD and a HRD, in which the LRD and HRD have an order rate, respectively. Then, in step S504, the allocation planning module 121 determines an expected quantity for at least one fabrication.

Thereafter, in step S505, the allocation planning module 121 dispatches a first quantity of the LRD and a second quantity of the HRD to the fabrication according to the dispatching rule, the expected quantity, and the corresponding order rates for the LRD and the HRD respectively.

Fig. 6 is a flowchart showing the process of short-term demand adjustment according to the present invention. First, in step S601, the allocation planning module 121 checks whether the difference between the expected quantity and the quantity

of the LRD of the fabrication is exceeding a predetermined ratio of the expected quantity. If so, in step S602, the allocation planning module 121 dispatches the LRD of the buffer fabrication to the fabrication.

Fig. 7 is a flowchart showing the process of long-term demand adjustment according to the present invention. First, in step S701, the allocation planning module 121 may monitor variation in the LRD of the fabrication. Then, in step S702, the allocation planning module 121 checks whether the variation shows a downward trend. If so, in step S703, the allocation planning module 121 dispatches pilot orders to the fabrication.

When the order management module 122 receives a purchase order for the IC product from the customer 111, the production line 124 may prepare a material requirement and manufacture IC products according to the purchase order. Further, after the IC products are manufactured, a delivery unit (not shown in figure) may forward the IC products to the customer 111 or other factories as specified by the customer 111.

As a result, using the demand dispatch system and method according to the present invention, the loading of each

fabrication can be kept stable. Thus, the manufacturer can prepare appropriate capacity to meet customer demands, and improve cost management in supply chain management.

Although the present invention has been described in its preferred embodiments, it is not intended to limit the invention to the precise embodiments disclosed herein. Those who are skilled in this technology can still make various alterations and modifications without departing from the scope and spirit of this invention. Therefore, the scope of the present invention shall be defined and protected by the following claims and their equivalents.

What Is Claimed Is:

1. A demand dispatching method, comprising the steps of:

receiving a first demand;

dividing the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate;

determining an expected quantity of a first fabrication; and

dispatching a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand, respectively.

2. The demand dispatching method as claimed in claim 1, wherein the step of dispatching the first quantity of the low risk demand and the second quantity of the high risk demand to the first fabrication utilizes a dispatching rule as follows:

EQ=FQ*FOR+SQ*SOR,

wherein EQ is the expected quantity, FQ is the first quantity, FOR is the first order rate, SQ is the second quantity, and SOR is the second order rate.

3. The demand dispatching method as claimed in claim 1 further comprising dispatching a third quantity of the low risk demand of a second demand dispatched to a second fabrication to the first fabrication if the difference between the expected quantity and the first quantity is exceeding a predetermined ratio of the expected quantity.

4. The demand dispatching method as claimed in claim 3 further comprising dispatching a remnant quantity of the high risk demand of the first demand to the second fabrication.

5. The demand dispatching method as claimed in claim 3 further comprising the steps of:

monitoring the variation in the first quantity of the low risk demand of the first fabrication; and

dispatching a pilot order to the first fabrication if the variation in the first quantity of the low risk demand shows a downward trend.

6. A demand dispatch system, comprising:

a risk database recording risk information for a first demand; and

an allocation planning module to receive the first demand, divide the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate according to the risk information, determine an expected quantity of a first fabrication, and dispatch a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand, respectively.

7. The demand dispatch system as claimed in claim 6, wherein the allocation planning module dispatches the first quantity of the low risk demand and the second quantity of the high risk demand to the first fabrication utilizing a dispatching rule as follows:

EQ=FQ*FOR+SQ*SOR,

wherein EQ is the expected quantity, FQ is the first quantity, FOR is the first order rate, SQ is the second quantity, and SOR is the second order rate.

8. The demand dispatch system as claimed in claim 6, wherein the allocation planning module further dispatches a third quantity of the low risk demand of a second demand dispatched to a second fabrication to the first fabrication if the difference between the expected quantity and the first quantity is exceeding a predetermined ratio of the expected quantity.

9. The demand dispatch system as claimed in claim 8, wherein the allocation planning module further dispatches a remnant quantity of the high risk demand of the first demand to the second fabrication.

10. The demand dispatch system as claimed in claim 6, wherein the allocation planning module further monitors the variation in the first quantity of the low risk demand of the first fabrication, and dispatches a pilot order to the first

fabrication if the variation in the first quantity of the low risk demand shows a downward trend.

11. A demand dispatching method in an IC foundry, comprising the steps of:

receiving a first demand for a first IC product;

dividing the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate;

determining an expected quantity of a first fabrication; and

dispatching a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand, respectively.

12. The demand dispatching method as claimed in claim 11, wherein the step of dispatching the first quantity of the low

risk demand and the second quantity of the high risk demand to the first fabrication utilizes a dispatching rule as follows:

EQ=FQ*FOR+SQ*SOR,

wherein EQ is the expected quantity, FQ is the first quantity, FOR is the first order rate, SQ is the second quantity, and SOR is the second order rate.

13. The demand dispatching method as claimed in claim 11 further comprising dispatching a third quantity of the low risk demand of a second demand for a second IC product dispatched to a second fabrication to the first fabrication if the difference between the expected quantity and the first quantity is exceeding a predetermined ratio of the expected quantity.

14. The demand dispatching method as claimed in claim 13 further comprising dispatching a remnant quantity of the high risk demand of the first demand to the second fabrication.

15. The demand dispatching method as claimed in claim 11 further comprising the steps of:

monitoring the variation in the first quantity of the low risk demand of the first fabrication; and

dispatching a pilot order for a third IC product to the first fabrication if the variation in the first quantity of the low risk demand shows a downward trend.

16. A demand dispatch system in an IC foundry, comprising:

a risk database recording risk information for a first demand for a first IC product; and

an allocation planning module to receive the first demand, divide the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate according to the risk information, determine an expected quantity of a first fabrication, and dispatch a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand respectively.

17. The demand dispatch system as claimed in claim 16, wherein the allocation planning module dispatches the first quantity of the low risk demand and the second quantity of the high risk demand to the first fabrication utilizing a dispatching rule as follows:

EQ=FQ*FOR+SQ*SOR,

wherein EQ is the expected quantity, FQ is the first quantity, FOR is the first order rate, SQ is the second quantity, and SOR is the second order rate.

18. The demand dispatch system as claimed in claim 16, wherein the allocation planning module further dispatches a third quantity of the low risk demand of a second demand for a second IC product dispatched to a second fabrication to the first fabrication if the difference between the expected quantity and the first quantity is exceeding a predetermined ratio of the expected quantity.

19. The demand dispatch system as claimed in claim 18, wherein the allocation planning module further dispatches a

remnant quantity of the high risk demand of the first demand to the second fabrication.

20. The demand dispatch system as claimed in claim 16, wherein the allocation planning module further monitors the variation in the first quantity of the low risk demand of the first fabrication, and dispatches a pilot order for a third IC product to the first fabrication if the variation in the first quantity of the low risk demand shows a downward trend.

21. A method of IC product manufacturing, comprising the steps of:

receiving a first demand for a first IC product;

dividing the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate;

determining an expected quantity of a first fabrication;

dispatching a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for

the low risk demand and the high risk demand, respectively;

receiving a purchase order for the first IC product; and

manufacturing the first IC product corresponding to the purchase order in the first fabrication.

22. The method of IC product manufacturing as claimed in claim 21, wherein the step of dispatching the first quantity of the low risk demand and the second quantity of the high risk demand to the first fabrication utilizes a dispatching rule as follows:

EQ=FQ*FOR+SQ*SOR,

wherein EQ is the expected quantity, FQ is the first quantity, FOR is the first order rate, SQ is the second quantity, and SOR is the second order rate.

23. The method of IC product manufacturing as claimed in claim 21 further comprising dispatching a third quantity of the low risk demand of a second demand for a second IC product dispatched to a second fabrication to the first fabrication if the difference between the expected quantity and the first

quantity is exceeding a predetermined ratio of the expected quantity.

24. The method of IC product manufacturing as claimed in claim 23 further comprising dispatching a remnant quantity of the high risk demand of the first demand to the second fabrication.

25. The method of IC product manufacturing as claimed in claim 21 further comprising the steps of:

monitoring the variation in the first quantity of the low risk demand of the first fabrication; and

dispatching a pilot order for a third IC product to the first fabrication if the variation in the first quantity of the low risk demand shows a downward trend.

26. An IC product produced by the process of:

receiving a first demand for the IC product;

dividing the first demand into a low risk demand having a first order rate and a high risk demand having a second order rate;

determining an expected quantity of a first fabrication;

dispatching a first quantity of the low risk demand and a second quantity of the high risk demand to the first fabrication according to the expected quantity, and the first order rate and the second order rate for the low risk demand and the high risk demand, respectively;

receiving a purchase order for the IC product; and

manufacturing the IC product corresponding to the purchase order in the first fabrication.

27. The IC product as claimed in claim 26, wherein the step of dispatching the first quantity of the low risk demand and the second quantity of the high risk demand to the first fabrication utilizes a dispatching rule as follows:

EQ=FQ*FOR+SQ*SOR,

wherein EQ is the expected quantity, FQ is the first quantity, FOR is the first order rate, SQ is the second quantity, and SOR is the second order rate.

28. The IC product as claimed in claim 26 further comprising dispatching a third quantity of the low risk demand of a second demand for a second IC product dispatched to a second fabrication to the first fabrication if the difference between the expected quantity and the first quantity is exceeding a predetermined ratio of the expected quantity.

29. The IC product as claimed in claim 28 further comprising dispatching a remnant quantity of the high risk demand of the first demand to the second fabrication.

30. The IC product as claimed in claim 21 further comprising the steps of:

monitoring the variation in the first quantity of the low risk demand of the first fabrication; and

dispatching a pilot order for a third IC product to the first fabrication if the variation in the first quantity of the low risk demand shows a downward trend.