Analysis and Research of Value Stream in Production

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Abstract

This paper first introduces the relevant theory of value stream, especially the detailed introduction of value stream analysis technology and the use of value stream analysis technology to improve the production process of the product, and then analyze the bottleneck process and study it; Production data, drawing a map of the status of the value stream to specifically describe the current state of the production process of the product. Then, according to customer needs, using lean production concept and value flow theory, combined with other basic methods of IE, respectively, the process of eight waste analysis, production process analysis, bottleneck theory analysis of the blanking, based on the analysis of the problem The four principles of ECRS are improved, and the value stream map analysis technology is used to establish an improved future state map of the value stream. Finally, the production process before and after improvement is compared and the benefit is assessed. By using the value stream theory to improve the production process of the product, this paper reduces the process time, shortens the product cycle, eliminates unnecessary waste, reduces the production cost and cycle time of the enterprise, and buffers the bottleneck to achieve process balance.

Keywords

Value stream mapping technology, product cycle, bottleneck theory, production process.

1. Introduction

The core concept of lean production is that behaviors that cannot directly or indirectly bring value to customers should be eliminated. This is to study what can generate added value from the perspective of the customer rather than from the perspective of the company or department; Behavior to determine the supply behavior, production and sales of products in all necessary steps, creating uninterrupted, no waiting, no reflow and timely creation of customer-driven value; continuous elimination of waste, to provide customers with the best value. Therefore, from a value creation perspective, value stream management is a process of systematically acquiring and analyzing data to plan and relate to lean innovation. An enterprise is an organization that creates value for customers. The competition in the market determines that a company must adopt a policy of satisfying customers with products or services, that is, products or services provided by enterprises must have the best value and will have valuable products. And the set of activities that the service provides to the customer constitutes a stream of value. Value stream theory has important research value for enterprise strategic planning, organizational change and resource allocation, and is a new perspective of corporate management thinking. Different from the past based on the function division, value stream management completely breaks the functional division of large-scale production mode. The value stream team manages the whole process of products from supplier to customer, and systematically acquires and analyzes data. Planning, and linked to lean innovation, to achieve effective control of the entire operational system and maximize the value of the entire enterprise.

Value stream management is a new theory for manufacturing companies to implement lean production, process planning and execution plans. It not only makes data collection more convenient, but also improves the level of enterprise value stream operations and improves corporate efficiency goals. Lean production value flow research is based on the theory of lean manufacturing enterprises.

Through the identification and management of the value flow of manufacturing enterprises, using value stream maps to analyze a typical manufacturing enterprise, to explore the key process of value flow, value stream Production cycle calculation method for key processes to achieve production synchronized with demand. The research of this subject provides theoretical basis and method guidance for the current high cost, low efficiency, chaotic production management and slow process of domestic manufacturing, and maximizes the benefits for domestic manufacturers to implement lean production and enhance competition. force.

2. Analysis of the current production status of enterprises

2.1 Process analysis

The desk processing process has nine parts: blanking, drilling, milling and polishing, embossing, sanding, primer, fine sanding, topcoating, assembly and inspection.

(1) Unloading: This process has 5 operations and the cycle time is 43h. The main process is to plan, cut, clear and trim the raw materials. The main waste reasons are shown in Table 1.

Table 1 Cutting production process analysis

Waste of defective products	Worker's operation mistakes
	Measurement error during breakage
Waste of handling	The raw materials are bulky and cumbersome, and the handling is slow
	Equipment is not advanced
	After the material is broken, it is necessary to carry a few distances to place the material.
Waste of action	The labor force is too small, the workers are responsible for a large area, and often walk around
	A piece of wood is broken into several materials and needs to be placed separately
Making too much premature waste	There are more time spent on the board, too much material in the previous process.

In the stock preparation workshop, the production of defective products is a common problem caused by mistakes in the operation and measurement errors during the material breakage. Therefore, many planks are often wasted, which not only delays the production and supply, but also increases the production cost. At the same time, because the raw materials of the wooden board are relatively heavy and heavy, only the trolley can be pushed during the handling process, and the forklift is needed to help. This is mainly because there is no advanced equipment, the regional planning is unstable and unreasonable, and the raw materials are often placed inconveniently. There is too little labor in the preparation workshop, and there are often many problems in the distribution board. As a result, the board cannot be properly arranged in time, so that the post-process is not working. The latter improvement will specifically use the constraint theory to analyze the improvement of the blanking process; The area of responsibility is very large, and the walking distance is too far during processing, which adds a lot of non-value-added activities.

(2) Milling type and polishing: mainly to round the workpiece and perform preliminary smoothing on the surface. The main waste reasons are shown in Table 2.

Table 2 Milling and polishing production process analysis

Waste of the process itself	Work instructions are not scientifically regulated
	The personal habits of employees lead to unreasonable movements

Waste of production of defective products	Equipment is not advanced
	Operation error
Waste of handling	Incoming material is heavy and inconvenient to move
	Unreasonable placement leads to long distances for each pick and place of the workpiece
Waste of action	Inadequate technology leads to many processes being redundant
Waiting for waste	Size measurement of the board is required each time polishing is performed

There are still fewer problems in milling and polishing. When the bad appearance occurs, the employees are carelessly placed the wooden board is not placed along the grain direction, and many workpieces are placed; and the thickness of the board is uneven, if not For dimensional measurement, a large number of burrs will appear on the surface of a thick wooden board, and the surface of a thin wooden board will not be thrown away, and it will need to be processed.

2.2 Bottleneck analysis

Using the knowledge of the constraint theory, the time distribution in the production process of the desk is analyzed unevenly, resulting in a large overall time of the process. From the above process, it can be understood that many actions can be decomposed in the blanking process: throwing, breaking, clearing Edge, matching board, imposition, machine sand, these are all blanks, and then shipped to the second workshop for punching.

Survey of the status quo of cutting:

Cutting is the first prerequisite for the completion of the assembly. The speed of the blanking directly affects the advancement of the following processes. According to the constraints of the process and technology, the process and step analysis of the blanking process route and process cards are performed. The working time is measured and the standard working time is set according to the actual situation. The blanking process includes a total of 6 operations. (1 is the production of planing, 2 is the production of broken material, 3 is the production of Qingbian, 4 is the production of the plate, 5 is the production of flat plate, 6 is the production of machine sand)

From the time of the field measurement, the time between the planing and the boarding is high, and the longest working time is different from the shortest working time by 15s. If it is 400s per day, which is 6000s, there is a difference between the first process and the second process. There is a big imbalance. In the second step, there are 6000s of idle time. It is also possible that there are artifacts in process 4 and process 6. How to use the bottleneck identification method to solve the imbalance between processes is also the purpose of this paper.

2.3 Analysis of the causes of the above problems

This section analyzes the reasons for the existence of the current value flow of the desk, mainly from three aspects: planning mode, bottleneck analysis and lean production concept.

(1) Production system adopts push production

The production operation of the enterprise is guided by the planning mode, providing process-oriented functions for production and operation. The current plan is mainly divided into graphic production and pull production. The main difference between the two is that the former uses the demand plan as a production signal to promote the production of each process, while the pull production is the actual demand of the following processes to drive the production of the previous process.

The current production system planning model uses a push production model. According to the customer's order requirements, the production plan decomposes the final product into a raw material demand plan and a production process demand plan through various data calculated by the system.

Eventually, detailed production start time, end production time and production quantity are generated and sent to the workshop supervisor weekly. The production department strictly controls the production according to the production plan and guarantees the completion of the time, quantity and quality required by the production plan. Each process focuses on the production efficiency and quality of the process. Each process is a separate entity, regardless of the actual progress and requirements of the process. After the completion of this process, the semi-finished product is directly transferred to the next process until the final product is completed.

(2) Bottleneck analysis: When the process is assigned, the process is not measured. It does not consider whether the employees can produce on time, on time, and the time used between the processes is uneven. Some processes are too late to complete, not only a large number of products are piled up. Together, it causes a lot of waste, and it affects the processing of the post-process. Reasonable distribution of working hours can also improve the completion cycle of the desk.

(3) Lean production concept was not considered in the design of the production line. At the beginning of the production line investment, the main consideration was given to the processed products, and less consideration was given to the equalization of production, the equalization of process time, and the rapid transition between different processes. Did not follow the lean production concept design. Therefore, the production line does not run, and the value stream is not lean.

3. Bottleneck improvement

Before the implementation of the TOC activities, the enterprises are produced according to the order. In order to deliver on time, they have to work overtime frequently; there is a large accumulation of work in progress between the production lines. In order to solve problems well, companies can implement DBR management.

The following is a DBR implementation for the company's blanking line:

Standard capacity = effective working time / standard time

Capacity = standard capacity * number of operators

Effective working time = 10*3600-2*3600=28800s

The standard time and standard capacity of the process in the blanking area are measured, and the production capacity is compared and the bottleneck process is found. See Table 3 below.

Table 3 Cutting process capacity table

Process		Job name	standard Time	Standard capacity	Number of operators	Production capacity
1	Planing	Handling raw materials in the processing area	77s	374.1	1	374
		Run the machine and check				
		Adjust the machine height according to the thickness of the raw material				
		Put the raw materials into the machine until the surface is free of burrs				
2	Blanking	The timber after the planing is transported to the cutting processing area	62s	464.5	1	465
		Then report the wood to the workbench.				
		Cut the corresponding length with the cutter according to the drawing				
3	Clear edge	Handling to the Qingbian processing area	69s	417.4	1	417
		Run the machine and check				
		Now clean the side of the wood				
		Check for bad materials				
		Re-clear the other side of the wood				
4	Fitting plate	Put the wood on the workbench	74s	389.2	2	389
		Flip the wood to find the good side on the surface				

		Put together the color and the similar side of the pattern				
		Draw a pencil on the surface of the board with the pencil				
5	Imposition	Incoming appearance inspection	66s	436.4	1	436
		Flip the prepared wood board and fix it with a tool				
		Apply glue to the fixed side				
		Place it on the machine for pressing				
6	Machine sand	Visual inspection	72s	400	1	400
		Set the machine height (the maximum height of each sand does not exceed 1mm)				
		Until there is no glue on the surface of the board				

(Remarks: The above is the production line under normal circumstances; does not include quality abnormalities, machine abnormal processing time.)

One customer orders 200 sets of F3201 (second generation) desk

The company's production and management personnel will make a work plan based on the delivery date and delivery quantity of the customer's order, and obtain the process capacity/load map:

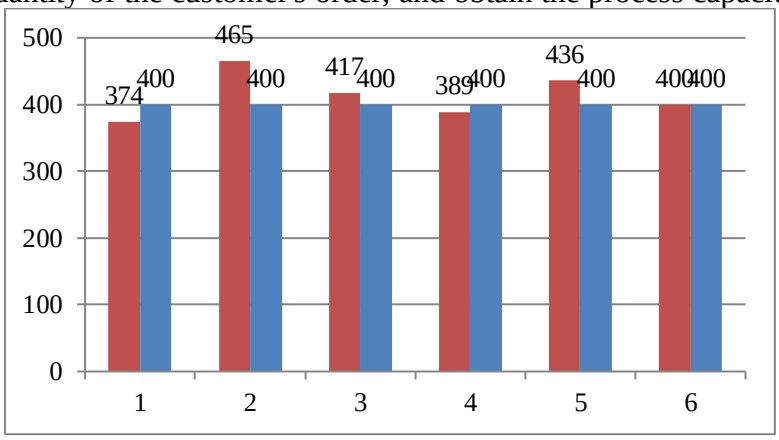

Figure 1 Process capacity/load map

(1) Identify the bottleneck process.

Obviously, the production capacity of the main line process 1 and the process 4, that is, the plate and the sand process cannot meet the load requirement. Considering that the process 4 is the subsequent process of the process 1, its production capacity can meet the output requirement of the process 1, so the main The bottleneck is process 1, and the secondary bottleneck is process 4.

(2) Make full use of the bottleneck process.

After the steps 1 and 4 are designated as the bottleneck process, the steps 1 and 4 are thoroughly utilized and played. Here are a few measures taken:

1. Set the time buffer.

Because process 1 is the first process of the entire work, the time buffer here means that the initial investment of the component is advanced a certain time, which is equivalent to overtime, and needs to be strictly controlled. For the step 4, its buffering time is suitable for the step 1, which is slightly less thn the buffering time of the step 1, that is, depending on the step 1.

2. set in the product buffer.

A certain amount of WIP safety stock is placed in front of Process 1 and Process 4. Allow them to work all the time and make the most of their production capacity.

3. Set the quality inspection link before the bottleneck process.

Especially in the process 1, the quality of the parts that are initially put into use must be strictly controlled to ensure that the processes are doing the right work, that is, the quality-qualified work-in-progress is assembled.

4. Combine the 5S activities promoted by the company to comprehensively organize the accumulation of parts, work-in-progress and finished products on the production line. Make sure everything is intact.

In short, it is necessary to make full use of the production capacity of the bottleneck process, so that the machines and workers of the process 1 and the process 4 are 100% put into work. At the same time, note that its in-process inventory must be kept at the lowest level under the premise of meeting the bottleneck process.

(3) Let the non-bottleneck process be subordinate to the bottleneck process.

Here, the most important thing for non-bottleneck processes is the control of material inputs. The health management personnel will carry out detailed work plan arrangement for each process according to the rough plan of the work in front and the production capacity of the bottleneck process.

Using the limited capacity planning method, the production schedules of Process 1 and Process 4 are first arranged, and the processes before, during and after the bottleneck process are scheduled according to the bottleneck process, and are carried out according to the pull, process sequence, and push mode, respectively. Must be optimized.

The non-bottleneck process requires that “with a task, use 100% of the ability to complete quickly; if not, do not do extra work”, strictly implement “first in, first out” management.

(4) The ability to improve the process.

For Processes 1 and 4, because companies can't invest in new machines or increase workers for an order, and because overtime can't solve all the problems, it will cause some unnecessary troubles, so companies generally adopt substitutions. Or the practice of sharing work. That is, in the steps 1 and 4, a skilled worker or a worker in the previous process is assisted to assist the workers in the steps 1 and 4 to increase the productivity. The skilled worker's process 1 planer standard time is 73s, and its production capacity is 394 pieces / day, which is very close to the load requirement.

At the same time, in order to solve problems better, companies can use IE improvement methods such as work research to improve the operation of workers and improve efficiency, and perform new cancellation, consolidation, rearrangement, and simplification of each operation between processes. Improvements in the assembly process and slight changes in the location of the work site to facilitate work sharing.

(5) Bottleneck cycle, alert to inertia.

Through the above steps, the production capacity of each process is very close to the load requirements. Work Process 1 and Process 4 may no longer be bottleneck processes. At this time, it is necessary to pay attention to processes in which the other capacities are extremely close to the load. Like the processes 3 and 6, it is necessary to continuously solve the new problems that arise.

The management personnel of the enterprise must pay close attention to the material in-process inventory and the material requirements of the process. Once a large amount of in-process inventory and delay materials are generated, it is necessary to adjust the daily work plan in time to ensure that the products can be delivered on time.

The development of the TOC activities has made the company's production site a good change. In the past, there was a large inventory of work in progress between processes, and most workers often had to work overtime. Now, before the inventory of the product exists only in the bottleneck process, it is only necessary to strengthen the management of the bottleneck process to control the production of the entire production line. At the same time, the number of overtime workers has been reduced.

4. Conclusion

The core concept of lean production to eliminate waste and create value plays an important role in manufacturing enterprises to reduce costs, improve production efficiency and enhance enterprise competitiveness. In recent years, more and more manufacturing companies have introduced lean production methods, and they have verified in practice that lean production is suitable for modern manufacturing enterprises. Value stream graph analysis is also widely used in the practice of lean

production. At present, although there is a large amount of literature on lean production application research, there are still few cases in which furniture companies are the research object.

The innovation of this paper is mainly reflected in two points: Firstly, the value stream analysis method is applied in the field of production and processing, which enriches the case study of the furniture enterprise to realize the lean production plan. Secondly, the specific furniture enterprise is the research object. In terms of finding problems, the application of value stream graph analysis method is a more comprehensive and specific analysis of the production status of the enterprise, and it is found that there are eight waste phenomena such as excessive production in the production process. In solving the problem, by proposing a specific value stream improvement plan and drawing a future value stream map, the company will analyze and improve the bottleneck of the process in the lean production process, and provide a basis for AK company to achieve lean production.

The research in this paper is based on value stream technology, focusing on the improvement of AK enterprises to achieve lean production. Based on the in-depth study of lean production theory and value stream analysis method, this paper conducts field research on the enterprise and identifies the excessive production, unnecessary inventory, handling, waiting and not by the value stream map analysis method. The waste of necessary actions, and the countermeasures for causing these wastes and improving the waste phenomenon have been thoroughly explored and analyzed, and the waste is eliminated as much as possible by improving. In the course of the research, the following results were achieved:

(1) The waste production phenomenon identification and cause analysis were carried out on the actual production process of the company. Based on the value stream technology, the current value stream of the product is described, and the plant is found to have excessive production, unnecessary inventory, handling, waiting and unnecessary actions.

(2) Through the use of value stream map to analyze and improve these wastes, establish inventory supermarkets, reduce the time of raw material transportation, improve the waste of each process, reduce cycle time, enable fast delivery and reduce fatigue degree.

(3) Using the bottleneck theory to improve the bottleneck process, optimize the balance of processes, and improve the efficiency between processes.

In the writing process of this article, due to the limitations of personal ability, time and other conditions, there are inevitably some limitations and deficiencies. Due to actual conditions and time, the improvement plan is still in the planning stage, not implemented, nor The job scheduling model without specific bottleneck resources has yet to be studied.

Acknowledgments

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