# Value Stream Mapping Application in Service-Oriented Manufacturing Company A

**Yan Zhao, Rui Miao, Min Ge, Jie-yun Zhang, and Xiao-xu Deng**

**Abstract** This paper mainly introduces value stream mapping (VSM) methodology of lean production, which focuses on the whole process and according to the analysis can eliminate no-value adding parts. In addition, it studies the application of VSM during implementing lean production, which proves the effectiveness and efficiency of the tool in lean production.

**Keywords** Lean production • Value stream mapping

## 1 Introduction

There is an important "Learning to See" tool, Value Stream Mapping (VSM) in lean production system. We use VSM to state current status and future status when implementing lean production. The fact proves that once the enterprise focus its work on the flow and value stream mapping, it can bring excellent results for the enterprise [1, 2]. VSM is a key tool when lean production implement [3]. In the process of implementing lean, we often get confused by the chaotic background of enterprise and do not know how to conduct improvement activities. In this situation, it's necessary to use an effective tool or method which can helps us to find out what is unwanted and then eliminates it directly. VSM is the tool what we need [4]. This paper studies the application of VSM in lean production implementation that can provide a reference for the enterprise when applying implementation of lean production.

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# 2 Concept of VSM

## *2.1 Concept of VSM*

Value stream refers to a product through its whole activities of the production process, including value added activities and non-value added activities [4]. Value Stream Mapping(VSM) is an important tool that helps company to analyze the whole value stream. And we can use it to draw the intricate value stream to a visual current VSM, which can reveal the problems in the production and as a result the non-value adding parts can be eliminated by lean techniques or methods. Taking a value stream perspective means the study must focus on the whole process rather than individual processes. The optimizing must extend to the whole efficiency rather than just one part.

## *2.2 The Origin and Application of VSM*

In the 1980s, Toyota's chief engineer, Taiichi Ohno and sensei Shigeo Shingo pioneered an innovation method of obtaining a competitive advantage by removal production waste; their starting point is to improve production efficiency instead of improving product quality. The reason why they conducted this concept is that they believed the improvement of production efficiency will contribute to the lean production, which can expose deep waste problem in the system and quality issues; can provide a field-based and effective way in implementation of lean production and methods, to help the enterprise in implementation process of the lean manufacturing to better seek out the source of the waste and eliminate it, and then improve the competitiveness of the enterprise The enormous advantages of implementing lean production in the enterprise have been recognized by the world through the great successful implementation in Toyota Motor Corporation in the 1980s, Dell in the 1990s and other companies. More and more enterprises have introduced lean production. However, in the course of pushing lean production many companies only seek and eliminate the large-scale waste without analyzing the whole value stream of the product carefully. Of course the KAIZEN activities may have improved a little of the product's value stream, make it flow more smoothly, but the inventory problem caused by the remained parts would be far more than little, in the end the final result maybe reverse to lower costs. Thus, there will be a big limitation to the persistence of the improve effect, it cannot be achieved in the 'whole process to reduce waste', and will prevent the implementation of lean production from proceeding. Using VSM technology can not only get rid of waste, but also eliminate the root of waste, and banned them from stage a comeback. VSM technology has been accepted and adopted by many companies around the world, and really got a good effect.

# 3 Application of VSM

## *3.1 Starting Point for the Application of VSM*

We should have some prerequisites or plenty of advance preparations to use VSM in the Lean production implement process: First, selecting a product family. Drawing all product flows on one map is too complicated, so it is necessary to analyze the product family and then choose the most appropriate one. We can use a matrix like Fig. 1 to find out the product portfolio with same or similar processes. What your customers care about is their specific products, rather than all the products in your shop floor. So you should not map everything without filtering unrepresentative sorts.

Second, appointing one to personally lead the mapping effort, the person who we called 'Value Stream Manager' should with the capability of being familiar with all the value stream of product family and taking the responsibility for pushing improvement and has enough leadership ability. To ensure his rights to conduct improvement activities, this 'Value Stream Manager' must report to the top manager directly.

It should begin from the 'door-to-door' level, so we can clarify the scope of the implementing of VSM. In lean manufacturing, information flow should be treated as much important as material flow. Material and information flow are just like two sides of one coin. You must take both of them into mapping consideration. Thus we can use mapping tool to assist in the implementation of lean production.

| | FAMILY | CODE | Process steps & equipment | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SMT (B) | SMT (T) | M/A | WS | Rtr | B/C | 2nd MA | Pre. FIT | M/W | FA | ICT (G) | ICT (HP) | BST |
| Products | Group A | 1M001D | √ | √ | √ | √ | | √ | | √ | | √ | √ | | |
| | | 1L001A | √ | √ | √ | √ | | √ | | √ | | √ | √ | | |
| | | 1L002B | √ | √ | √ | √ | | √ | | √ | | √ | √ | | |
| | | 1L003A | √ | √ | √ | √ | | √ | | √ | | √ | √ | | |
| | | 1L004A | √ | √ | √ | √ | | √ | | | | √ | √ | | |
| | | 1L005A | √ | √ | | √ | | √ | | √ | | √ | √ | | |
| | | 1M002C | √ | √ | | √ | | | | √ | | √ | √ | | |
| | | 1M003D | √ | √ | | √ | | | | √ | | √ | √ | | |
| | Group B | 2W001A | √ | √ | | | | √ | √ | √ | | | | √ | |
| | | 2W002A | √ | √ | | | | √ | √ | √ | | √ | | √ | |
| | | 2W003A | √ | √ | | | | √ | √ | √ | | √ | | √ | |
| | | 2W004A | | √ | | | | | √ | | | √ | | √ | |
| | | 2W005A | | √ | | | | | | √ | | √ | | √ | |

**Fig. 1** Product matrix

### *3.2 Implementation Steps of VSM*

The specific implementation of VSM can be summarized as the following steps [5, 6]:

1. Draw the current-state map.
2. Find out improvement opportunities on the base of developing and discussing current-state map.
3. Draw the future-state map.
4. Set up Value Stream Plan, and conduct improvement projects to realize the future state-map.
5. Launch a new round of VSM event.

Below will present the application methods of VSM combined with the actual situation of company A:

Step 1: According to above product matrix and product forecast, Group A accounted for 35 % in all products forecast, which is the largest demand in product family. Here we select Group A as the standard product to start VSM analysis, and collect its information to draw current state VSM.

We should pay attention to the following mapping tips:

1. Collecting current-state information while walking the actual material and information flows yourself.
2. Make a sense of whole value stream first, then go back and gather information at each process.
3. Begin at the shipping end and work upstream, and then set the Takt according to the customer demand.
4. Record by yourself with a stopwatch and do not rely on any report forms or information that you did not personally get.
5. Map the whole value stream by a specific person. Several people are allowed to help him to do some preparation work
6. Insist on hand drawing. The rough sketch should begin in the meantime you start to analyze current state, and then revise them step by step.

After gathering information of product Group A, we can organized it into Current State VSM like Fig. 2

Step 2: Discuss in groups, analyze and mark the improvable point based on Current State VSM. The marked flag in Current State VSM is Burst (Fig. 3).

Current state VSM can help us intuitively to find waste in process. All these waste points are what we called Kaizen chances, on which we can push lean production by means of reducing or eliminating wastes in improving activities [4]. It requires everyone to work in team and develop brain storm to find out the waste in process, and then fix the improve point according to the actual condition.

VSM application processes are consisting of four modules; they are customer demand, raw materials logistics, information flow and supportive improvement.

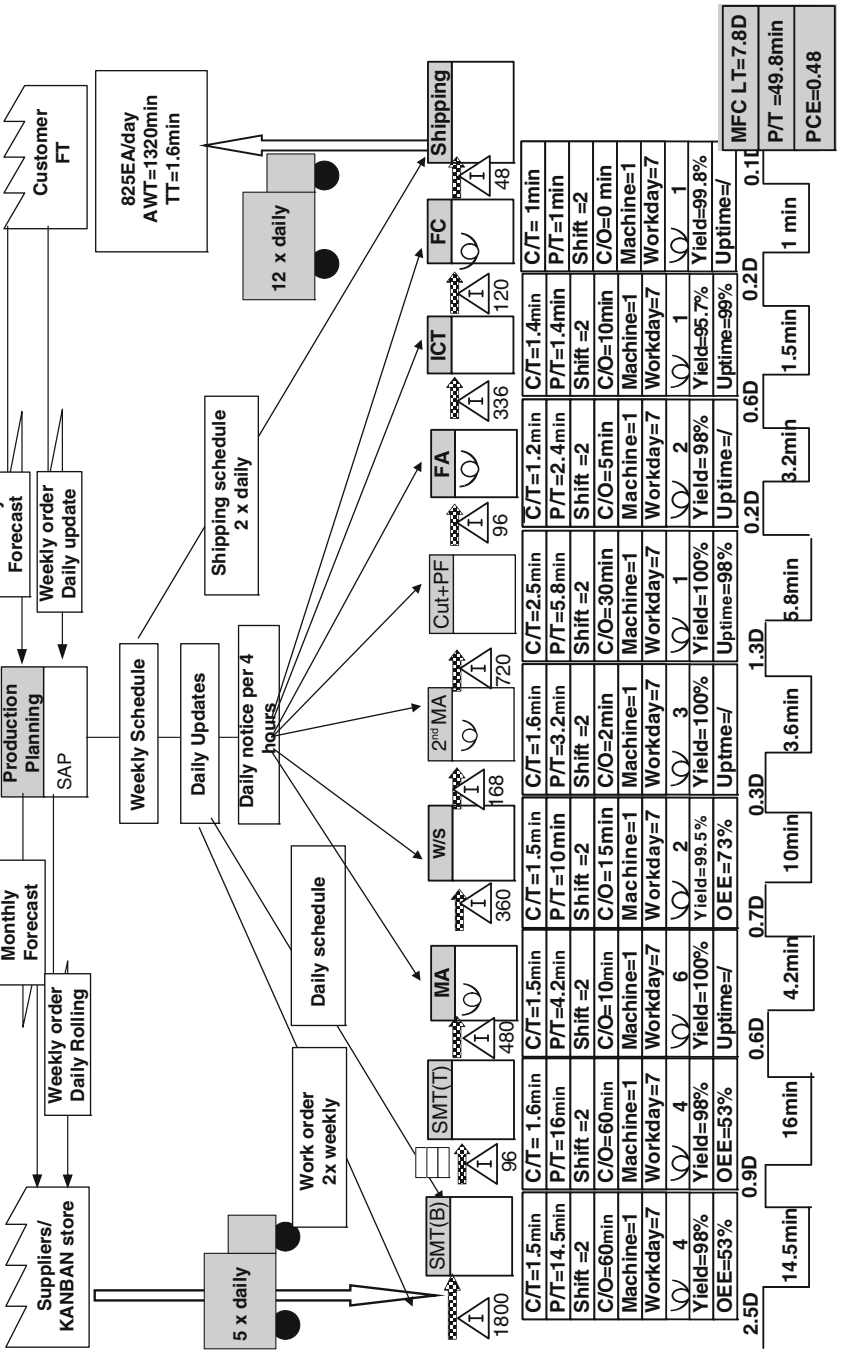


**Fig. 2** Current state VSM

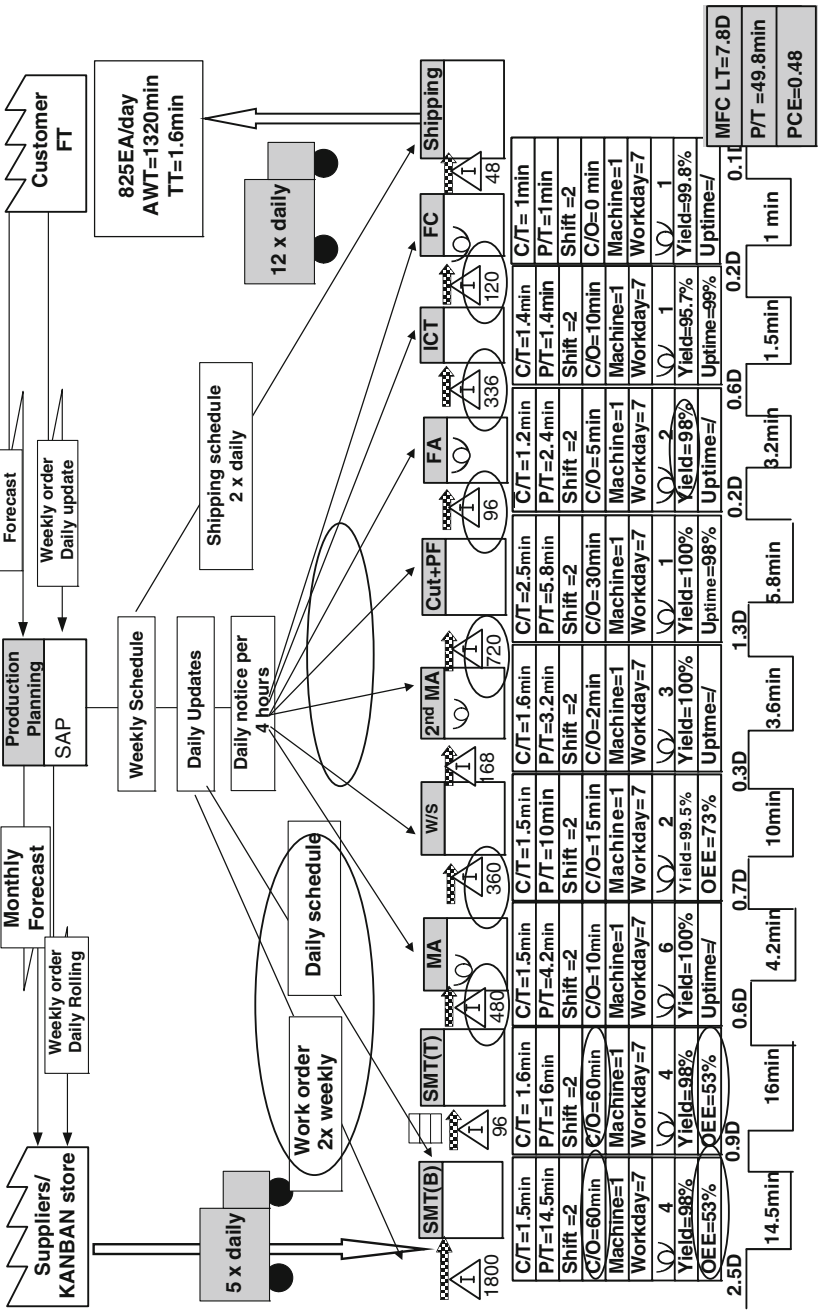


**Fig. 3** Burst in current state VSM

These four modules act as the guiding line in the VSM. It's the most effective way to find improving point along with this guiding line. Answer following questions one by one, then you can find the point need to be improved. Based on your answers to these questions, mark you future-state ideas directly on your current-state map [1, 7].

1. What is Takt time?
2. Build a finished goods supermarket from which customer pulls, or just shopping directly?
3. Where is suitable to set a continuous flow processing?
4. Where is suitable to build a supermarket pull systems to control the production of upstream processes?
5. On which station in the production chain is appropriate to schedule production?
6. How to level the production mix in one pacemaker process?
7. How to calculate the volume for production launch and pick up in the pacemaker process?
8. Which process and facilities are required to get
9. improvement so as to realize the flow of value stream as future-state design specifies?

Step 3: According to the discussion and the Burst in current state VSM, you can draw a future-state map like Fig. 4.

The future state VSM is a blueprint of our goal of implementing Lean improvement. We need practical improvement programs to achieve it, otherwise, it will not have any significance.

Step 4: Design action plan for the improvement according the burst in current state VSM and the future state VSM. The improvement plan should include improvement purpose, target, action owner, time point and other information [5]. Then Implement the project according the action plan, the action owner should responsible for the project results and the VSM manager should responsible for achieving the future state VSM. The improvement plan such as Table 1.

Regular reviewing of the subprojects in the improvement plan to confirm the progress of the improving actions, to see that there is difficult or not in the implementing process, to provide support to the action owner to reach the target smoothly. Here omit the detail implementation process of the subprojects.

Compare the current state VSM with the future state VSM, from the statistical data we can find exciting results. Greatly reduced the WIP, and vastly improved the productive efficiency. The MFC lead time from 7.8 days reduced to 2.7 days. The contrast table of current state and future state in Company A as Table 2.

Step 5: After achieving the target blueprint of the future state VSM, we finished one VSM cycle. Then should set about the next VSM activity cycle, and the starting line of the improvement activity is the status after the last VSM improvement cycle.

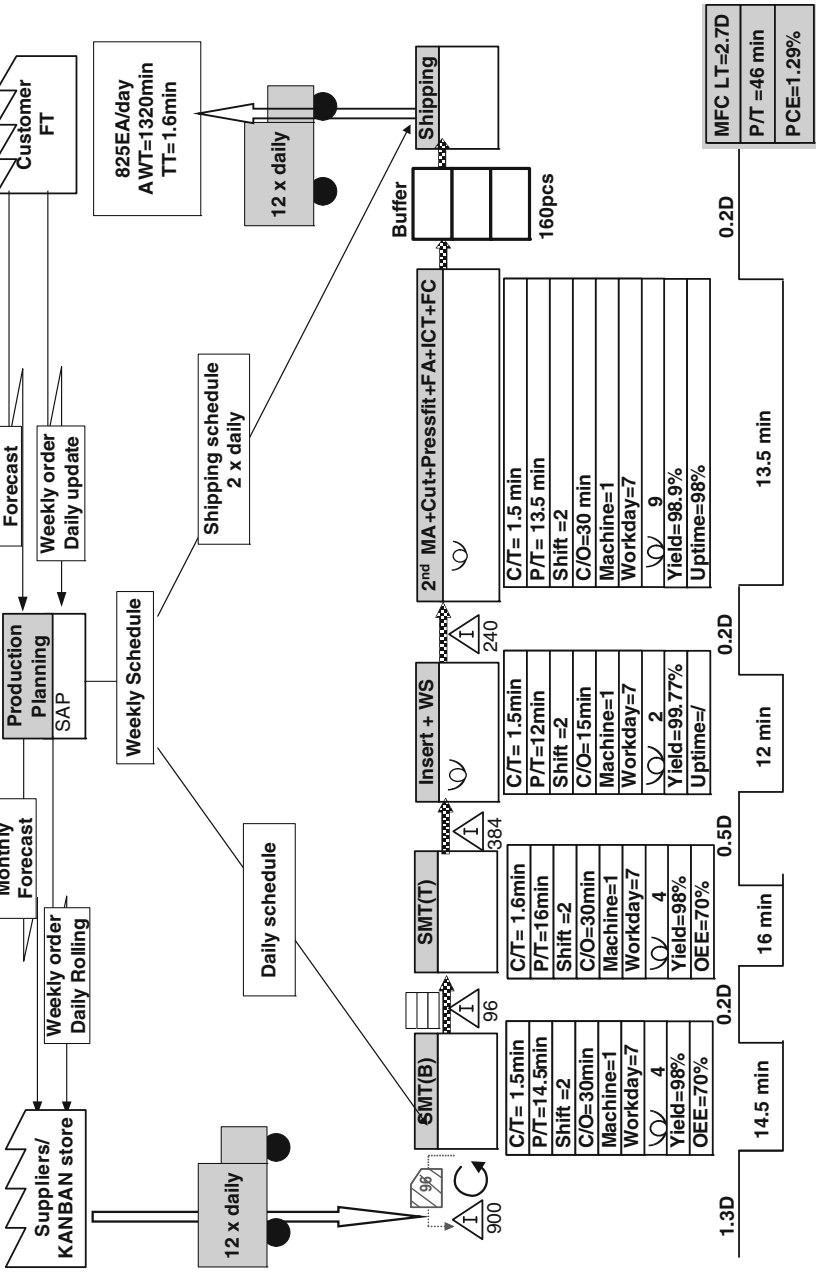


**Fig. 4** Future state VSM

**Table 1** Improvement plan

| Item | Issue | Action | Target | Owner |
|---|---|---|---|---|
| 1 | MA and WS have repetitive motion, routing is complex, more WIP | To redesign production line, combine MA and WS into Inser + WS stream line | LT reduction by 50 % | Sheng |
| 2 | Assembly process is scattered, routing is complex, more WIP and LT is long | To redesign production line to realize continues flow | WIP reduction by 50 % | Liu/Zhao/Li |
| 3 | SMT OEE is low | To increase SMT OEE | >70 % | Zhang/Liu |
| 4 | ICT first pass rate is low | To increase first pass rate | >98 % | Song/Qu |
| 5 | WS first pass rate is low | To increase first pass rate | 2,700 PPM | Sean |
| 6 | Assembly failure rate is high | To reduce assembly failure rate is high | <1 % | Liu/Li |

**Table 2** Future state vs current state

| Item | Metrics | Current | Future | Improvement rate |
|---|---|---|---|---|
| 1 | MFC LT | 7.8 D | 2.69 D | 65.40 % |
| 2 | WIP | 4224EA | 1780EA | 58.00 % |
| 3 | OEE | 53 % | 72 % | 19 % |

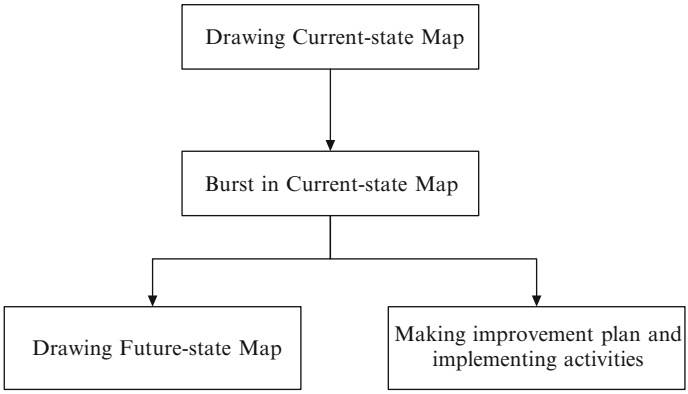


**Fig. 5** Steps of VSM

## *3.3 Summary of the Application of VSM*

In short, the application of VSM can be stated with below chart, Fig. 5 [8]. Below chart indicates the direction of VSM application.

VSM application in A company is very effective, and assist lean production team to find all kinds of waste. It also plays a key role for lean projects development.

## 4 Conclusion

Regardless of our products are tangible goods, services, or both, we have to be responsible for clients, so we must take this cycle improvement as the daily management of the center will continue to implement the lean production. VSM is effective way and method which is based on on-site implementation of lean production [1, 8–10]. This article profiling by Company A value stream mapping applications, the reference value stream analysis for the company's willingness to implement lean manufacturing, careful analysis of their own value stream, and seek for their own company's value stream mapping method. This paper focuses on the application of value stream mapping process, not expatiating on how to draw value stream mapping.

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