

Research on the Lean Process Reengineering Based on Value Stream Mapping for Chinese Enterprises

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Abstract

Under current economic environment, each enterprise faces serious situation. Especially in China, material and labor costs keep increasing for several years and put a great burden on Chinese enterprises. The paper puts forward a set of steps for Chinese enterprises to realize lean value stream so that to reduce costs, increase efficiency and improve product quality. We also propose suggestions for them to implement value stream mapping successfully.

Key words: Chinese enterprises; Value stream mapping; Lean value stream; Process reengineering

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INTRODUCTION

It is well-known that Toyota, Dell and other enterprises got great success in implementing lean production in the product development, production, management and customer service. But unfortunately, many enterprises in China haven't experienced such success even they introduced lean production in the 1980s, because they quickly entered into large-scaled waste eliminated activities after importing the philosophy and methods of lean production without carefully analyzing the whole value stream of a product, which can only improve a small part of the value stream, but results in the problems of the

other part of the flow such as a greater deal of inventory, which increases rather than lowering the cost. If lean is realized in local area, the persistent effect of improvement will be limited and can't achieve the effect as Taiichi Ohno said "reduce waste in the whole process" (Womack & Daniel, 1991), which will result that lean manufacturing implementation can not continue.

The circumstance of an enterprise defers from that of others, so many Chinese enterprises are confused by its complicated background and don't know where and how to implement improvement activities. In this case, we need an effective tool or method to find out the wastes and the reasons, and then to eliminate them, this tool is Value Stream Mapping (VSM).

1. KEY DEFINITIONS AND FUNCTIONS OF VSM

1.1 Key Definitions of VSM

1.1.1 Lean

Lean is a philosophy that shortens the lead time between the customer order and the shipment by eliminating wastes by means of employing various lean tools such as 5S, total production maintenance, error-proofing, setup reduction, standardized work and continuous flow production (Imai, 1986).

1.1.2 Value Stream

Value stream involves all the activities in a business needed to design and produce a product and deliver it to the end customer.

1.1.3 Value Stream Mapping

VSM is a pencil and paper tool that helps people to see and understand the flow of material and information as a product makes its way through the value stream.

1.1.4 Product Family

Generally, total work content for producing one part

should be within 25 to 30 percent of all other different parts in one product family. When deciding if products are in one product family, use formula: (Highest value minus lowest value) divided by highest value.

Example: $(20 - 10) \div 20 \times 100\% = 50\%$ (not belong to one product family)

Example: $(14 - 10) \div 14 \times 100\% = 29\%$ (belong to one product family)

1.2 The Functions of VSM

VSM can create a high-level look at total efficiency, not the independent efficiencies of individual cells or departments, visually show material flow, product flow and information flow to identify improvement opportunities and help identify applicable lean improvement tools and plan for deploying kaizen events. In brief, it can make us understand where we are (current state), where we want to go (future state) and map a route to get there (implementation plan).

2. STEPS OF LEAN PROCESS REENGINEERING BASED ON VSM

When using VSM to improve a process, the first VSM manager should do is to select a typical product family to investigate deeply in order to draw out the current

situation of information flow and physical flow, then compare it with ideal future state to find out problems and opportunities for improvement, and finally put forward and carry out improvement measures.

2.1 Select a Product Family

The first step is to select a product family. VSM means to draw out all production processes of a product family (including both information flow and material flow). When selecting, the VSM team should take following factors into account: size of the product line and share of the business, contribution to the net profit, criticality for the business, market position, technology outlook and potential for gainful growth.

2.2 Draw Current State Map

The second step is to do a quick walk through the whole process to get a sense of the door-to-door flow and begin to draw current state map by hand using general icons defined by a guide book for VSM that is a standard language for all staff involved in lean process reengineering from the process nearest to the customer, and work upstream through the process (Figure 1). The purpose is to show the relationship of work as it flows across major areas. Don't get bogged down in drawing numerous sub-processes but show the "big picture" of the whole process.

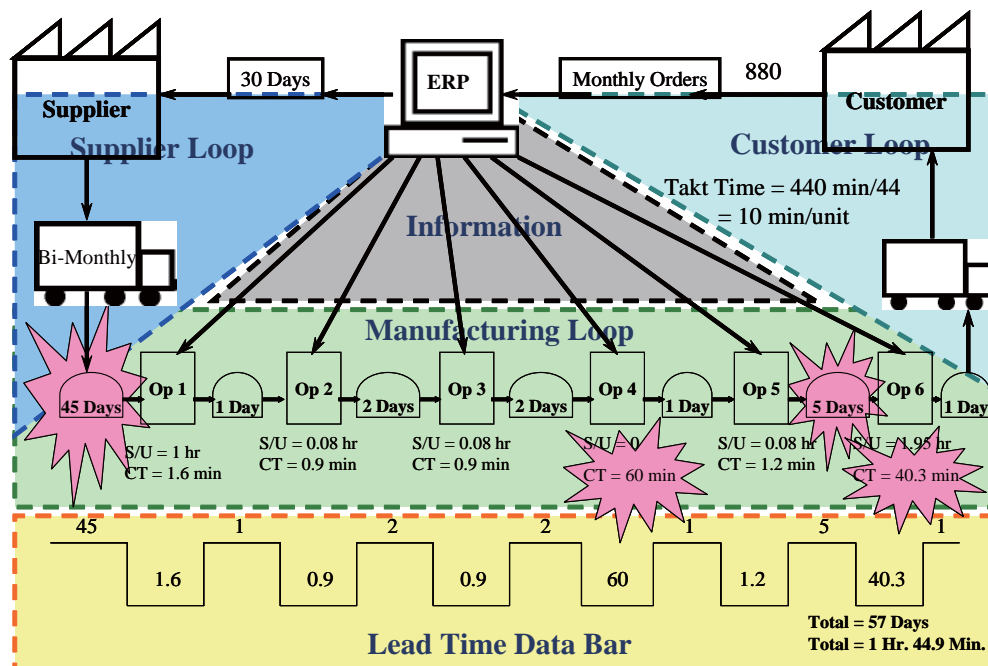


Figure 1 Current State Map

2.3 Mark Problems and Configure Lean Tools

After drawing out current state map, we have a good view on the whole process and mark problems and areas needed improvement by the bursts shown in Figure 1. We

suggest that Chinese enterprises should configure different lean tools according to their actual situation and problems shown in the current state map to realize lean value stream (Table 1).

Table 1
Lean Tools Configuration

Actual situation	Lean tools configuration
Stability phase: stable workplace capable of high quality, consistent production	<ul style="list-style-type: none"> ●5S ●Error proofing
Continuous flow phase :processes flow smoothly through all operations without stopping.	<ul style="list-style-type: none"> ●Setup reduction ●TPM ●Continuous flow manufacturing
Standardized work phase: synchronizing the products' rate of flow with the demand of the customer-TAKT	<ul style="list-style-type: none"> ●Standardized work
Pull production phase: material is replenished by upstream processes at the right place, at the right time and in the right quantity.	<ul style="list-style-type: none"> ●Deploy pull system.

2.4 Draw Future State Map

When drawing a future state map, we should re-design a process that requires participants who can step back and look at the process with a fresh set of eyes. And, ask themselves how they would design this process if it had no restrictions. They need to be visionary, system-level thinkers that can see the total flow as it cuts across functional boundaries. Most often, these are management type, with no direct connection with the current process. Drawing future state map, we divide the future state map into the three process loops (customer, supplier, and manufacturing loops) starting at the end of the processes and move upstream to analyze which steps may be combined or eliminated to reduce cycle time and add a pacemaker process that sets the pace for all upstream processes.

2.4.1 Combine Process Steps

The VSM team needs to question why processes cannot be done in one activity by one person in one place, or even better, at one time with no human intervention. The team should be “reluctant” in adding activities and resources to the process. When you design a process so one person can move through it and efficiently perform all the work elements, it means to design a process that avoids isolated islands of activity, minimizes material and information (documents) between processes, eliminates excessive walking and reduces cycle time.

2.4.2 Build Speed by Continuous Flow Production

Continuous flow production is different from traditional production that means the movement of material from value-added process to value-added process without transport time or storage in buffers, and processes are organized such that one person can build the entire product so as to build speed. If volume increases, additional people are added to match the takt time. FIFO (First-in-first-out) lanes are commonly used (they do not

hold inventory). Lean value stream should do best to realize continuous flow.

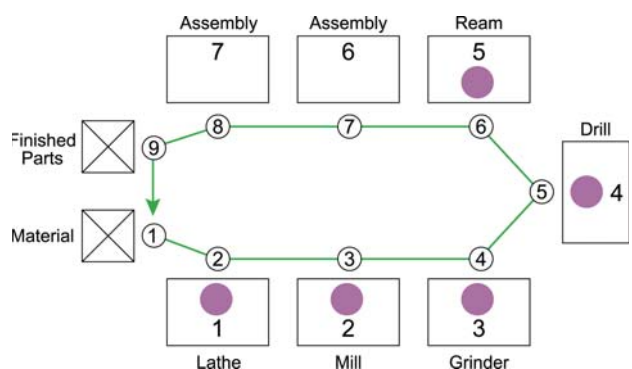


Figure 2
Continuous Flow Production - U-Shape Cell

2.4.3 Add a Pacemaker Loop

Lean rule-of-thumb is to schedule only one point in the value stream. This point is called the pacemaker. Material continuously flows upstream from this most downstream point to finished goods with no supermarkets or pulls. Before the pacemaker we pull from shared resources.

2.5 Put Implementation Plan into Effect

Having a set of maps is pointless if you don't go anywhere. We must make the future state map drawn in previous step come true. We should put implementation plan into effect as following steps: first prioritize the improvement opportunities, then develop a combined kaizen plan for each opportunity according to their priority, develop metrics to measure the performance of reengineering and monitoring the process. If there are too many kaizen opportunities, divide in phases, if appropriate.

3. SUGGESTIONS FOR CHINESE ENTERPRISES TO IMPLEMENT LEAN VALUE PROCESS REENGINEERING

Lean value stream focuses on avoiding overproduction that is significantly different from batch production, which means we only produce products needed for next process, so that to shorten manufacturing cycle, improve product quality and reduce costs. So we propose following suggestions for Chinese enterprises to implement lean value stream according to the practice of lean production in China (Zhou, *et al.*, 2010).

3.1 Develop a Combined Kaizen Plan to Implement Lean Value Stream

Put together all the plans on a time line to form a combined kaizen opportunity plan, including preparations of man, materials, machines and money available for the plan, the announcement and kick-off, monitoring process, communication process, recognition and celebration processes.

3.2 Manage Each Opportunity Plan as a Project

When managing each opportunity plan as a project, the plan are defined by discrete activities related to each other and linked together over the project lifecycle, the plan exists in a constrained resource environment that people, time, money, machines, facilities and materials are coordinated with definite and measurable start and end dates, each section accomplishes its specific work according to the plan and finally produce tangible deliverables according to customer requirements.

3.3 Determine Practical Performance Measures

Performance measuring method is critical for the successful implementation of lean value stream. When determining measures, following concerns should be taken into account: keep measures simple that are understandable for all, link shop-floor measures to the plant-level measures and goals; link measures to all individual's performance measures, results should be communicated regularly and data accessible to all employees. We demonstrate the performance measures of an enterprise that has practiced the method proposed in the paper in Table 2.

Table 2
Performance Measures of an Enterprise

Measure	Current	Future
Cycle time	1Hr. 46 minutes	21.9 minutes
Set up	3.2 hours	0.3 hours
People travel	3600 feet	200 feet
W.I.P.	67 days	16 days
Inventory	RMB 327,000	RMB 65,000
Lead time	67 days	16 days

3.4 Monitoring the Implementation

According to our investigation, Chinese enterprises introduced advanced or popular management tools actively, but many of them lack of monitoring process, as a result, they naturally have a fine start and poor finish (Chen & Meng, 2008). So Chinese enterprises should authorize value stream manager to be in charge of monitoring process and identify a systematic process and structure for reporting progress; who should regularly summarize their plans, accomplishments, hurdles and resource needs, systematically capture the essence of discussions, decisions and resulting action items, publish the meeting minutes promptly to all concerned. And more important, the monitoring process should integrate monitoring with normal business processes such as staff meetings, quality council meetings, daily production meetings, etc., which can twice the result with half the efforts.

CONCLUSION

VSM can make enterprises have a full view on the whole value stream of production process and is proven a useful lean tool for enterprises to realize lean value stream. Although we practice the method in a few of Chinese manufacturing enterprises and get some success, it is a long-term task for most Chinese enterprises since it is an endless process, especially the forming of lean culture, Chinese enterprises have a long way to go, and we hope our suggestions will benefit them in lean process reengineering.

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