Original Research Article

Research on Enterprise Cost Control Based on Lean Production

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Abstract: Taking the cost control research and improvement process of Chaoyang steering gear production company as an example, this paper studies the enterprise cost control based on lean production. First of all, the problems existing in the production process and organizational structure of enterprises are analyzed. Secondly, the causes of the problem are analyzed. Then, according to the location of the problem, combined with the cause of the problem, it solves the cost control problem of the enterprise from the perspective of lean. Finally. the corresponding improvement results are evaluated and analyzed. This paper combines lean production with cost control, and puts forward another application of lean production, which reflects that lean production is an effective method for enterprises to reduce costs and improve efficiency.

Keywords: Lean production; Cost control; Parts manufacturing.

1. Introduction

Since the reform and opening up, China's economy has made great progress, which is behind the country's progress in various industries, especially in the automotive industry changes and transformations, however, from 1956, China's first car landed in the great new period of the new era, the development of the automotive industry is not easy, and now the face of the competition between joint ventures and foreign brands, parts product upgrades, as well as the entire automotive industry brought about by the pressure to make our business Management and production to be more excellence, in expanding the market and technology research and development at the same time pay more attention to cost planning and control, and strive to make the best goods with the industry's lowest cost.

In today's economic globalization, the market competition is also more and more intense, an enterprise wants to better development must focus on cost control issues. More and more enterprises realize the importance of cost for an enterprise, sometimes the cost may only affect the profit, but sometimes it will decide the survival of an enterprise. The cost control method based on lean production can cover the role of traditional methods in addition to effectively do timely detection of hidden problems in the enterprise, which is conducive to the enterprise's high efficiency, health, and sustainable development. This production method can reduce production costs to achieve competitive advantage, so that the enterprise in the price war to win, further expand market share, improve the survival and development environment, to achieve the purpose of increasing corporate profits.

2. Brief Background of the Subject

Ltd. is located in Chaoyang City, Liaoning Province, was formally established in 1971 with an investment of more than 3 million yuan. Initially, due to the technical constraints of the enterprise, coupled with the limited capital at the initial stage, the enterprise could only process a number of relatively low-tech automotive parts, such as some aluminum parts. After a period of development, the scientific research and manufacturing capacity has been improved to a certain extent, and in the field of steering gear development, in 1973 has been for the central car manufacturing steering gear. Today the technology is mature, but also faces the challenges of a great new era.

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2.1 The Introduction of Product

The enterprise produces circulating ball type power steering gear, circulating ball type steering gear toughness is good, strong and durable, mostly used in a variety of vehicles with large loads, its working principle is the rotation of the steering screw through the guide rail of the steel ball so that the steering nut straight line movement, the steering nut drives the ruler fan movement, the movement of the ruler fan in the transmission to the automobile steering rod, to complete the automobile steering. The main products are CPS11790R, CPS9570, CPS8064GS, CPS8201LL, and the products are shown in Figure 1-Figure 2.

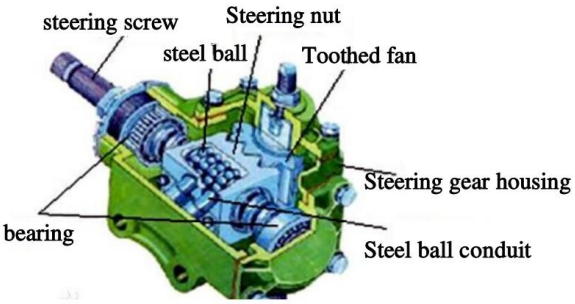

Figure 1 Steering gear product structure diagram.

Name: CPS11790R

Name: CPS9570

Name: CPS8064GS

Name: CPS8201LLL

Figure 2 Product picture show.

2.2 Company's Organization Structure

Figure 3 shows the organizational framework of Sunrise, with a total of seven departments, which are responsible for the company's sales, technology development, quality management, manufacturing, quality and cost promotion, finance, and general security in the order shown in the figure.

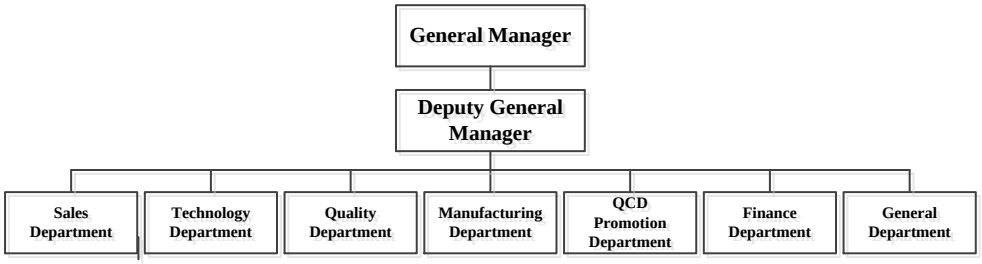

Figure 3 Company's Organization Structure.

3. Brief Background of the Subject

3.1 Status of Cost Control

The existing cost budget of the enterprise is roughly estimated based on the result of multiplying the actual cost data of the previous year by the expected rate. Evaluation and assessment and cost control are mainly implemented through the coordination of rewards, punishments and management methods. There is not enough attention to the variable factors of cost and the impact brought about by the product manufacturing process, resulting in a large discrepancy between the budget and the actual cost, and it is almost impossible to successfully realize the budgeted cost targets. The current system established does not match the cost control methods, which seriously affects the cost control, and the cost remains high and needs to be improved urgently.

3.2 Enterprise Business Processes

The company is a manufacturer of steering gears and produces them on an order basis. The first step of the process is pricing with customers who are interested in purchasing, and once the customer reaches a partnership with the manufacturer, the two sides determine the delivery time to sign a contract. The second step. Production department according to the number of orders to confirm a variety of raw materials, auxiliary materials, machinery and equipment, as well as inventory, after confirming that there is no error in scheduling, if you need to purchase, then notify the purchasing department to purchase. If the production material meets the requirements of the order, the production will start. The production flow chart and the business flow chart are shown in Figure 4 - Figure 5.

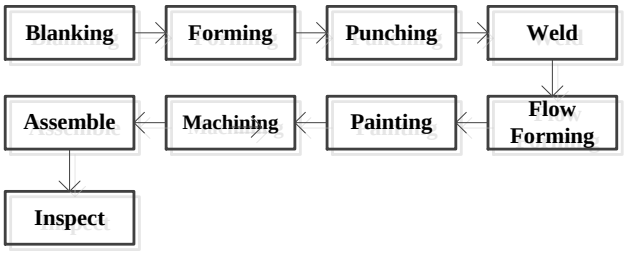

Figure 4 Process of flow chart.

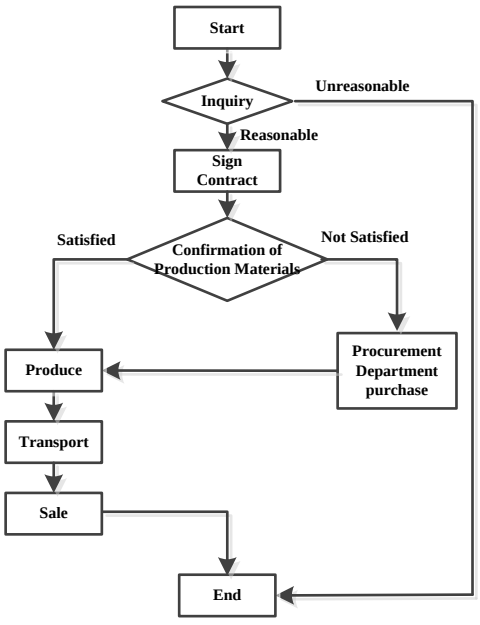

Figure 5 Business flow chart.

2.3 Enterprise Cost Components

Combined with the enterprise business process and multiple surveys know that the enterprise cost is roughly composed of five items, including research and development costs, operating expenses, product costs, management costs and financial costs. Each kind of cost and its specific content, cost composition items such as Table 1.

Table 1 Table of cost components.

Project	Content
Research and development expenditure	Technology development, product development and mold
Product costs	Raw material costs, labor costs, water and electricity, etc
Operating expenses	Logistics, packaging, transportation, after-sales
Administration expense	Benefits, salary, insurance
Financial expense	Procedure expenses, interest, etc., in business activities

3. The Problems of Cost Control in Enterprises

3.1 The Problem of Company Cost Waste

①Long inventory time. Site resources are strained and occupied funds are high as in Table 2.

Table 2 Statistical table of parts inventory area.

Name	Inventory quantity	Days in stock	Number of boards required	Area requirement (m^2)	Logistics area(m^2)	Actual area (m^2)
Steering screw nut	25000	3	160	240.8	115.2	356
Steel ball	100000	3	51	120.4	36.7	157.1
Steel ball conduit	25000	3	178	560.3	128.2	688.5
Steering shell	25000	3	6	56.7	4.3	61
Cubit fan	25000	3	36	300.8	25.9	326.7
Packing material turnover box	25000	3	264	320.1	179.9	500
Total area requirement						**2089.3**

②Mismatch between labor costs and work efficiency. The annual labor cost is paid a lot, but because the human ability to work is limited, so the cost paid by the enterprise can't reach the expected work efficiency. For stacking, the average weight of chassis is 12.11kg, the average stacking height is 2m, and the annual output is 1 million units. The uph of the stacking staff is 200, while the company requires the uph to be 240, which means that the efficiency of human work needs to be improved or replaced by machines. There is a gap between the actual working efficiency and the company's requirement, which will lead to insufficient supply of raw materials to the production line, and if it will lead to production line stoppage when there is insufficient stock, which will greatly waste the production cost.

③The rate of product defective products remains high. The steering gear produced by the enterprise consists of a number of processes such as pressing, punching, welding, machining, assembling, painting, etc., and after the completion of each process, it has to be transferred to the next workshop, and in this process, semi-finished products will be bumped, and the material box is not clearly marked in the production process, and there is often a confusion in the stacking of the materials, which leads to the existence of product quality problems. Figure 6 shows the number of material abnormalities between May 2015 and August 2015 with specific statistics as in Table 3.

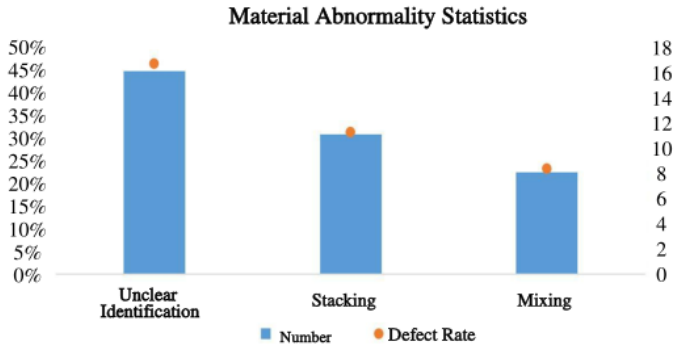

Figure 6 Statistical chart of material anomalies.

Table 3 Statistical table of material anomalies.

Project	The material identification is not clear	Stacking of materials	Mixing of materials
Number of anomalies	16	11	8
Abnormal defect rate	46%	31%	23%

It can be seen that material identification is not clear, material stacking, material mixing can make defective products. Among them, unclear material identification is most likely to lead to unqualified products, which is the focus of our improvement, and the defective rate caused by stacking and mixing of materials should not be ignored, and should be improved as well.

④Enterprises often experience material breaks in the production line during the manufacturing process, resulting in production line downtime, or relying on materials in stock to maintain production line operation.

3.2 Incomplete Company Cost Information

The company's cost control indicators are not designed to be comprehensive enough, and the cost processes reflected are one-sided. The cost inputs for development and after-sales are also not emphasized enough. It is not comprehensive to consider only material, manufacturing cost and labor cost in the cost, especially there are loopholes in the cost control of inventory and scrap, and the consideration is not comprehensive enough. This leads to incomplete cost information and makes it difficult to successfully reach the before designed cost objectives of the enterprise.

3.3 Inadequate Management of Corporate Cost Control

Enterprises in the application of lean production based on the cost control theory process can often realize the cost of waste in the manufacturing of products, but can not give enough attention to the after-sales cost of this piece, after-sales and production are disconnected. In addition, the cost of coordination and cooperation with customers and suppliers is ignored. There are some companies do use lean production such as JIT and other methods, but due to the lack of planning for pre-production consumption, resulting in enterprises can not be delivered on time, resulting in out-of-stock costs and default costs, which shows that the enterprise only learns some of the skin, but did not touch the essence of the method, but the loss is not worth the gain.

4. The Problems of Cost Control in Enterprises

4.1 Institutional Dysfunction

The enterprise has not studied the implementation and establishment of the cost control system. In the production process, various departments can not coordinate with each other and communicate in time, resulting in slow information flow. Therefore, the establishment of a lean production cost control system is conducive to rapid decision-making and improved efficiency. At the same time, departments should be streamlined,

procedures should be reduced, and the handling time of each link should be shortened, so that production and management can match and promote each other.

4.2 Unreasonable for Human Resource Management

The enterprise does not have the organizational structure and personnel specifically responsible for carrying out lean production activities in the enterprise, the upper level does not have the consciousness of delegating power, the lack of lean production training process, and the lean production awareness of employees and managers is weak.

4.3 Low Level of the Automation

On the one hand, enterprises have to pay high cost of manual handling; on the other hand, the efficiency of manual operation is limited, and sometimes can not meet the needs of enterprises.

The above reasons are the key to solving the problem, and also the obstacles that we must overcome on the road of development of this enterprise.

5. Implementation of Cost Control Based on Lean Production

5.1 Improve Cost Control Based on Lean Manufacturing Conditions

5.1.1 JIT Material Supply System Set Up

The Fulfillment Virtual Hub system is established between enterprises and suppliers to exchange data with suppliers, so that both parties can timely understand each other's needs and ensure the supply of goods in the most correct quantity at the most correct time. The establishment of this system has the most obvious improvement effect on inventory and production line. On the one hand, there is no need to rely on a large amount of inventory to maintain the operation of the production line, and on the other hand, a lot of site area and funds are saved because there is no need for inventory.

5.1.2 Container Standardization

Different materials are loaded with containers of different colors, so that workers can classify materials more easily and pick them up more easily according to the different colors, improve work efficiency and reduce the rate of defective products. In addition, different materials with different shapes of containers, larger parts with larger containers, neatly placed, to prevent bumping, orderly picking and processing, reduce the rate of defective products, improve efficiency. Specific improvement plans are as follows:

①Color standardization. Different kinds of parts are packed in containers of different colors, and different kinds of parts are packed in four colors of black, blue, red and black, as shown in Table 4.

Table 4. Container Standardization Table.

Number	Color recognition	Applicable part
1	Black	Core part
2	Blue	Auxiliary parts
3	Red	Defective products
4	Yellow	Items for repair

②Shape standardization. Different materials are loaded with special containers, so that the parts are stable in the card slot, especially the larger parts, so that they will prevent each other from bumping between the processes and reduce the rate of defective products.

5.1.3 Automatic Introduction

According to the actual situation of stacking, there are three options: pneumatic motor, special rack stacker and robot automation. In the process of scheme selection, we use AHP.

The first step is to build the hierarchical analysis diagram shown in Figure 7.

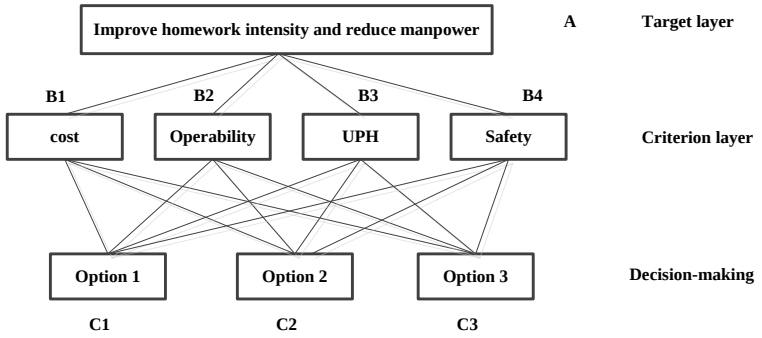

Figure 7 Hierarchy diagram.

The second step is to construct the judgment matrix of the second layer relative to the first layer and the consistency test, as shown in Table 5.

Table 5 Second layer first layer judgment matrix and consistency test.

A	B_1	B_2	B_3	B_4
B_1	1	5	7	1/3
B_2	1/5	1	3	1/5
B_3	1/7	1/3	1	1/7
B_4	3	5	7	1

The meaning of the value (a_{ij}) in the judgment matrix is shown in Table 6.

Table 6 Numerical meaning table.

Number	Implication
1	The two elements A are equally important compared to B
3	A is slightly more important than B
5	A is significantly more important than B
7	A is more important than B
9	A is more important than B

An example value of 5 indicates that cost is significantly more important than ease of use, and 1/3 indicates that security is slightly more important than cost.

According to the calculation method of AHP theory, the maximum eigenvalue of the judgment matrix is calculated to be 4.2167.

Its corresponding feature vector is $W = \left(0.40\ 0.13\ 0.05\ 0.43\right)^T$ which is used as the weight vector of the evaluation unit.

Then the consistency test of the judgment matrix is carried out CI (consistency index) and CR (consistency ratio) are calculated according to Equation (1) and Equation (2), and the value of RI (random consistency index) can be found according to Table 7. The calculation formula and Table 7 are as follows:

$$CI = \frac{\lambda_{\max}(A) - n}{n-1} \quad \text{(Eq.1)}$$

$$CR = \frac{CI}{RI} \quad \text{(Eq.2)}$$

Table 7 Table of random consistency indicators.

Dimension	1	2	3	4	5	.....	15
RI	0	0	0.52	0.89	1.12	.....	1.59

Where the value of n is the matrix dimension.

$CI = 0.0722$ can be obtained by substituting the above two formulas. $RI = 0.89$; $CR = 0.0811 < 0.10$. Normally, we think that when $CR < 0.10$, the consistency of the matrix is acceptable, that is, the logical ranking of factor importance is reasonable.

The third step constructs the judgment matrix of the third layer elements relative to the second layer elements. The four matrices are shown in Table 8-11.

Table 8 Judgment matrix 1.

B1	**C1**	**C2**	**C3**
C1	1	2	2
C2	1/2	1	1
C3	1/2	1	1

Table 9 Judgment matrix 2.

B2	**C1**	**C2**	**C3**
C1	1	1/3	1/5
C2	3	1	1/3
C3	5	3	1

Table 10 Judgment matrix 3.

B3	**C1**	**C2**	**C3**
C1	1	1/3	1/3
C2	3	1	1
C3	3	1	1

Table 11 Judgment matrix 4.

B4	**C1**	**C2**	**C3**
C1	1	1/3	1/2
C2	3	1	1/2
C3	3	2	1

According to the AHP theory, the calculation process similar to the second step can obtain the calculation results of four judgment matrices, as shown in Table 12.

Table 12 Result table.

B1	$\lambda 1 = 3\ CI = 0\ RI = 0.52\ CR = 0 < 0.10$ $W = (0.5\ 0.25\ 0.25)^T$
B2	$\lambda 2 = 3.10\ CI = 0.03\ RI = 0.52\ CR = 0.05 < 0.1$ $W = (0.10\ 0.30\ 0.61)^T$
B3	$\lambda 3 = 3\ CI = 0\ RI = 0.52\ CR = 0 < 0.10$ $W = (0.20\ 0.20\ 0.60)^T$
B4	$\lambda 4 = 3.10\ CI = 0.04\ RI = 0.58\ CR = 0.06 < 0.1$ $W = (0.14\ 0.37\ 0.50)^T$

By observing the calculations it is clear that the consistency ratios all have CR<0.I0, i.e., the logical

ordering of the third layer elements with respect to the second layer elements is reasonable.

The resulting eigenvector serves as the weight of the third layer elements relative to the second layer factors.

The conclusions of the fifth step are shown in Table 13.

Table 13. Score sheet.

Project	B1	B2	B3	B4	Score
	0.4	**0.13**	**0.05**	**0.43**	
C1	0.5	0.1	0.2	0.14	0.28
C2	0.25	0.3	0.2	0.37	0.3
C3	0.25	0.61	0.6	0.5	0.42

From Table 13 it can be seen that option 3 has the highest score, i.e., the option introduces robotic automation as the best solution. The production system simulation after program selection UPH= 360, which meets the production requirements.

5.2 Set up Lean Production Organization

In order to carry out lean production activities in the enterprise, it is necessary to establish the corresponding organizational departments, improve the organizational structure, the upper leadership decentralization, the lean production department according to the enterprise's situation to carry out strategic arrangements, and gradually promote lean production activities in the enterprise, so the first step should be to set up a lean team, the structure of the diagram in Figure 8 the distribution of functions is shown in Table 14.

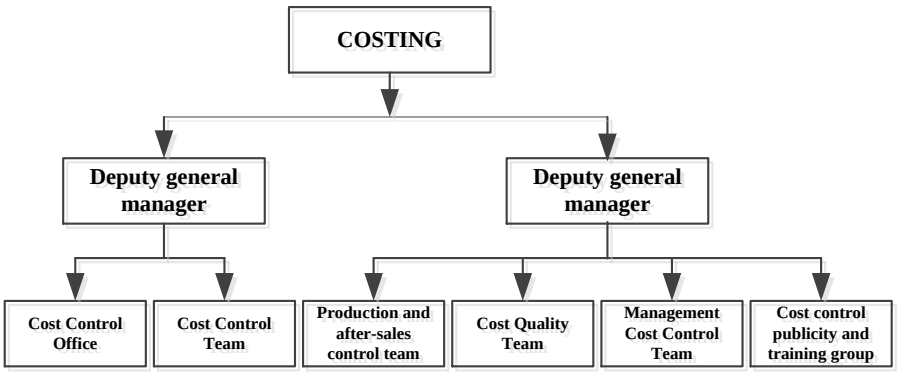

Figure 8 Lean production organization chart.

Table 14 Function distribution table.

Name	Function
Cost control office	According to the company's business situation to develop lean targets, long-term arrangements, decision-making leadership
Cost control team	Responsible for the cost control of all aspects of the enterprise, and make overall specific plans. Supervise various departments
Production and after-sales team	Responsible for production and after-sales costs, implement production and after-sales cost control
Cost quality team	Responsible for product quality cost, implement product quality cost control, make plans
Overhead team	Control the administrative expenses of the enterprise
Cost control publicity team	Mainly responsible for promoting lean production and staff training in the enterprise

5.3 Improve the Cost Control System and System

Enterprises should focus on the implementation and establishment of systems for cost control. Each department in the production process should coordinate with each other, communicate in time, break down the barriers between departments, form a coherent whole team, and communicate and cooperate more in practice, which is the basis of lean production. Therefore, the establishment of lean production cost control system is conducive to rapid decision-making, improve efficiency, while streamlining the department, reduce procedures, shorten the processing time of each link, so that the production and management to match and promote each other.

Take the procurement cost system as an example to set up a cost control system in procurement. Enterprise procurement costs are mainly determined by the market environment, supplier selection, product sales. One of the supplier's supply stability directly affects the normal production operations of enterprises, if the quality of supply or supply time delay, will greatly increase the enterprise's procurement costs, in view of this we can set up a supplier reputation evaluation system, for the supply time and quality of many times unqualified suppliers will be directly terminated the cooperative relationship, in this way, for the supply level of the supplier's supply of the enterprise has a first-hand information to assess, to reduce the cost of procurement. Reduce the procurement cost of enterprises.

In terms of cost control system, continuously improve the cost control system. Embodied in the cost of the budget, implementation, process, accounting, evaluation of five aspects, which the level of an enterprise's budget can best reflect the strength of an enterprise in cost control. Therefore, the cost budget as an example, the study of the budget system. To ensure that the cost budget design budget process as Figure 9.

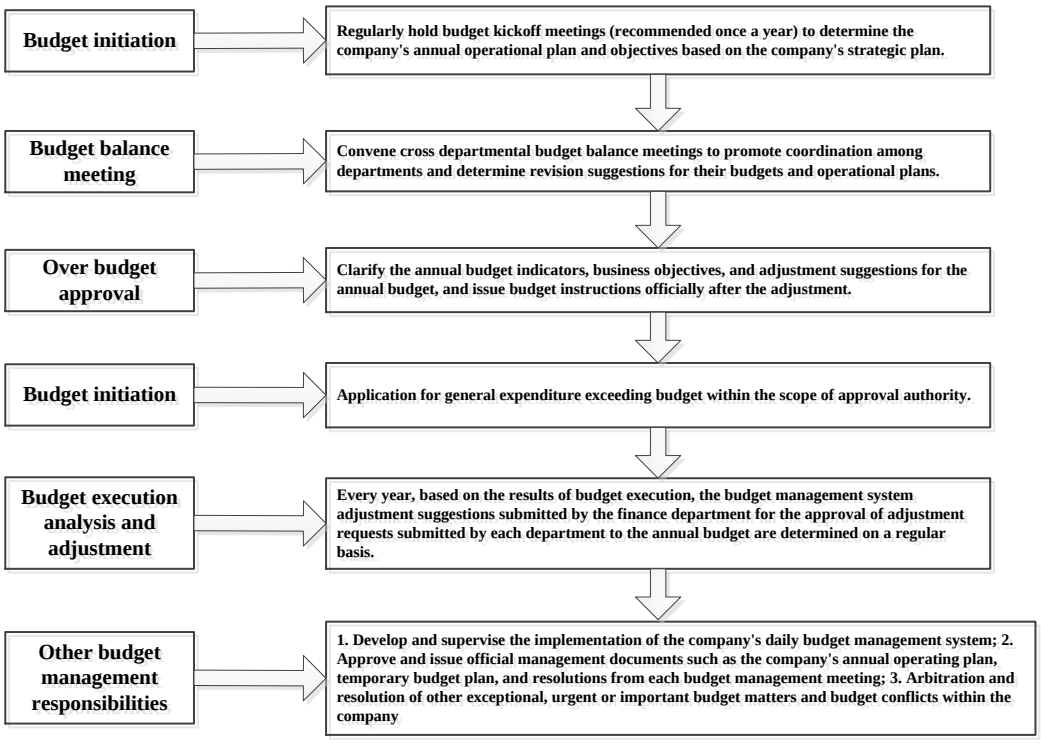

Figure 9 Budget flow chart.

5.4 Create a Lean Atmosphere

People-oriented, excellence and continuous improvement are the core elements of lean thinking, which need to be widely advocated and promoted. Creating a lean atmosphere requires the whole enterprise to be twisted into a rope, each department to make concerted efforts, and the whole enterprise to unify the tone.

As the management of the enterprise relevant departments should start from the actual situation, seriously

study the implementation of methods, rather than copying, not to do face-saving projects, halfway. According to the actual enactment of practical methods. For example, to carry out lean activity month, carry out lean training classroom, the development of appropriate incentives and penalties, in the subtle deepening of the staff lean consciousness, so that it becomes a part of the corporate culture.

As an employee, you should consider yourself as a participant and manager of the enterprise, and strive to contribute to the lean process of the enterprise, especially to find out the methods or suggestions that can strongly control the cost, and actively contribute your own strength.

6. Conclusion

This paper makes a preliminary theoretical application of cost control based on lean production in Sunrise Company and obtains the following main conclusions:

①Through the construction of institutional system can make the enterprise operate efficiently like a machine in the process of cost control, and have justification in dealing with cost control problems, so that the enterprise can accomplish the established cost target.

②By improving the existing production process methods, such as the introduction of automated equipment and the use of JIT and other methods can effectively improve production efficiency and quality, reduce cost waste to achieve cost reduction.

③Each enterprise has its own cost control problems, but must not have fetishism, copying other enterprises method, according to the actual situation of the enterprise to carefully analyze, with enterprise characteristics of the method to solve the problem.

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