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Research on optimization of product value engineering in manufacturing enterprises

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Abstract. Comprehensively strengthen production cost control is the key to improve the competitiveness of China's manufacturing enterprises when facing the crisis of rising cost. This paper designs the application of value engineering theory to the manufacturing industry from dimensions of strategic cost, product cost and function cost based on the theories of value engineering, value chain, product design. And then it verifies thatthe theory of value engineering is highly scientific and applicable for overall optimization of production process and reducing the production cost when applied to enterprise production taking the fastener as an example.

Key words. Product value engineering, strategic cost, product cost, function cost, fastener.

1. Introduction

With the decline of China's demographic dividend, the cost of product manufacturing has been greatly increased as well as the labour costs in China. According to the Boston consulting group reports, the Chinese manufacturing cost was only 5% lower than thatin American in 2013 and it was already flat with America's low-cost regions by 2015, which means the extensive mode of high-input and high-output has encountered a bottleneck in China. Reviewing the experience of Japanese manufacturing enterprises after the World War II when Japan's economy was depressed and

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the competitiveness of manufacturing enterprises plummeted, different from America who occupied the manufacturing competitive advantage applying of the mode of production. However, Japan became the world's manufacturing brand by adopting a new production mode of "lean manufacturing" to reduce production costs and improve product quality.How to reduce the cost of manufacturing industry to maintain the status of world's factory has become an unavoidable problem facing China. Product value engineering was initiated by D. L. Younker[1], and applied in various fields of manufacturing by the America, Japan and other countries. Chinese scholars Shuhua Hu(1987) introduced the value engineering theory to Chinese manufacturing firstly, and pointed out the definition of value engineering: "value engineering was is a technical and economic method, it taken takes a product or a system as the research object, and aimed aims at increasing the value of research objects at the lowest life cycle cost and meeting product functional requirements through functional analysis and program creation. Thus the application range of value engineering extended from the field of physical product research to the physical and non-physical properties. Using the theory of value engineering is helpful to promote transformation of traditional extensive mode to intensive production mode, and improve the Chinese equipment manufacturing industry technical level. However, the application of value engineering is still to be solved. Traditional understanding of the value engineering emphasizes more about the direct link of function and cost, but for products especially when the expansion of their function extension, the products cost understanding of value engineering also needs to be expanded. So, it is worth exploring of how to scientifically evaluate the cost of products and apply the theory of value engineering to the optimization of products development.

The value for product in the manufacturing process is to reduce the manufacturing cost. Ronald W. Hilton (1979) introduced of the variable cost method, and divided the cost into variable cost and fixed cost based on the relations of cost and production [2]. Rajiv P(2014) also proposed that the cost benefit problem is limited by its specific assumptions (linear utility, single cycle level and quadratic cost function). The control of cost is the key to improve the competitiveness of enterprises has become a consensus, and many scholars have proposed ways to reduce costs in different fields[3]. Francesco Malapelle (2017) proposed a set of methods to reduce the generation cost of optical acquisition system focused on the optimization of key links[4]. Jacek Jackiewicz(2017) proposed to use 3D printing technology to reduce production costs[5]. A. Almeida (2017) modified the manufacturing process by ABC cost method [6].Danning Weng (2011) realized low cost operation through supply chain management. However, more and more scholars regard the reduction of products manufacturing cost as a systematic project using the theory of value engineering. Anil Kumar Mukhopadhyaya (2015) believed that value engineering is an indispensable technology that needs to be learned in project management or industrial engineering. In the technology, the optimal output value is achieved through the optimization design of mixing function and cost [7]. Fowler (1997) pointed out that value engineering is no longer a traditional value project. The attention of value engineering had extended from focusing on the team, emphasis on value configuration and complete products and also the implementation to use the customer data, focusing on creativity, champion principle, Gantt charts, loop research, and issued a final value engineering analysis report in the final presentation. Brandon (1999) believed that value engineering pursues high functional level, low cost and high performance, which means it will not meet current market management needs. But if combined with other management techniques, it will become more applicable to provide a means for decision-makers to achieve higher levels of functionality. Tieshan Zhang (2014) used the basic formula of value engineering to analyse China's domestic m-type suvs, and proposed three improvement schemes on the base of comprehensively considering functions and costs. Chinese enterprises are aware that the advantages of product value are the key points in the market in the context of product value orientation, thus the theory of value engineering is getting more and more application into different industries and the focus of enterprise value engineering is transferred to the research of high performance products. As the value engineering object and scale are continuously expanding, the value activity is more and more complex, and the dimension of the exploration value engineering creation project is also gradually increasing. Thus the exploration of the direct relationship between product cost, functional cost and strategic cost of products is helpful to enrich the application field of value engineering.

2. Methodology

2.1. Nature of the product

Function is the essential requirement of the user, the product is the realization form of function. Through the design and manufacture of products, enterprises can meet the functional needs of users.

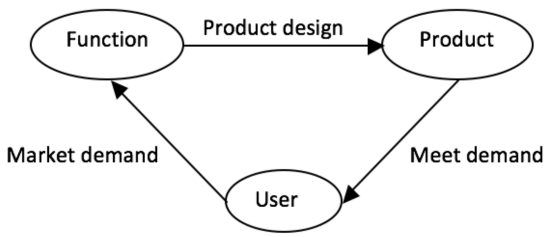

Fig. 1. Nature of the product

2.2. Elements of value engineering

For businesses, as shown in figure 2, the enterprise cost is divided into three-levels.From the outside to the inner core are strategic costs, product costs, and function costs. In the past, the consideration of the product was more about the cost of the product, while the evaluation of the strategic cost and functional cost was neglected.

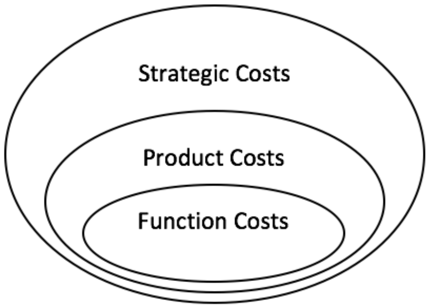

Fig. 2. The composition of enterprise costs

2.2.1. Strategic costs Strategic cost management is formed when the idea of strategic management is introduced into enterprise cost management. It breaks the traditional cost management that focused on the enterprise internal production practice. What can be inferred through detailed analysis of the whole system chain is that the cost-consuming link helps improve the cost of compression and the low cost advantage of the enterprise.

2.2.2. Product costs The product cost is made up of the material cost, the wage cost and the funding costs that including the management cost. The material cost of mechanical products is more than 50% of the total cost, some up to 70% ˜ 80%. The inherent insufficiency in product technology and economy caused by unreasonable design is irreversible in the quality and cost control measures in the production process. As shown in figure 3, the key to reducing costs is in the development design phase.

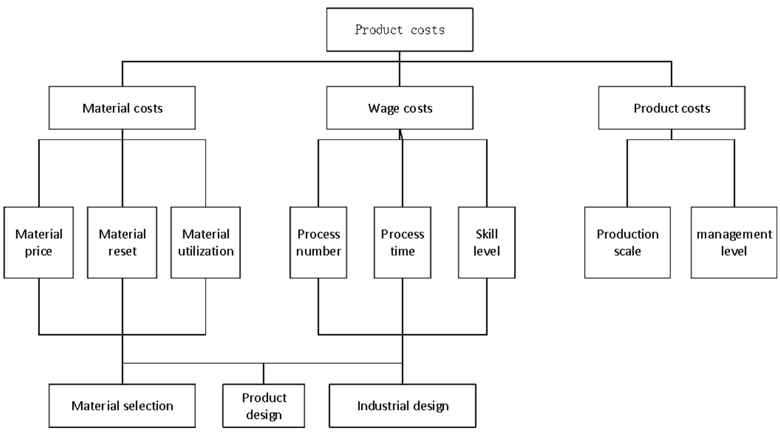

Fig. 3. The composition of product costs

2.2.3. Function costs Functional cost refers to the possible minimum or target cost of realizing a product's function. As shown in figure 4, the product design cost is directly related to its functional parameters and is represented as a function of functional parameters. Research association of costs and parameters, establish their function relation, is beneficial to develop target cost, control of product development and design, is beneficial to optimizing parametric cost analysis, put forward economical and reasonable design plan.

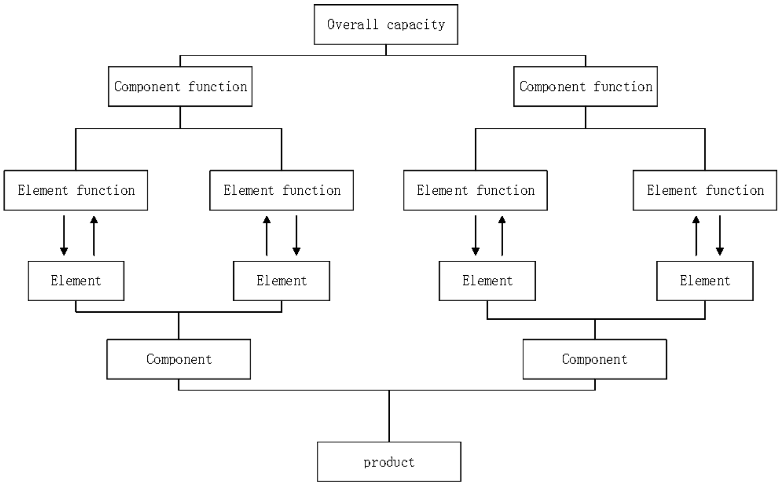

Fig. 4. Function and product

2.3. *The realization method of value engineering optimization.*

2.3.1. The analysis method of strategic cost The value increment analysis of traditional cost management begins with the purchase of raw materials and ends in product sales. The value increment analysis of traditional cost management is focused on the inside of the enterprise, while the value chain analysis takes both inside and outside of the enterprise into account. Value chain analysis sets enterprise in the value system of the whole industry, focusing on three aspects of value chain analysis, namely, the analysis of industry value chain, the analysis of internal value chain, the analysis of competitor value chain.

(1)The analysis of industry value chain

Every enterprise has its specific industry environment. Each industry from raw materials input to the production systemneeds to be done countless value activities to support to make up the industry value chain.As shown in figure 5figure 5, the relations between the enterprise and the value chain upstream and downstream, make full use of existing upstream and downstream value chain advantages, and help to improve the value chain upstream and downstream, to reduce enterprise cost.

(2)The analysis of internal value chain

The enterprise internal value chain is composed of the value chain of each production unit. As shown in figure 6, research and development and design departments,

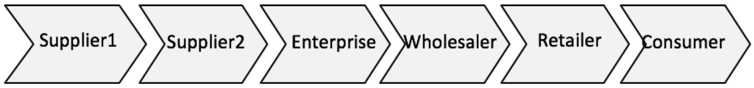

Fig. 5. Industry value chain

production workshops, marketing departments and customer service are closely related and interdependent,whichare also mutually restricted.

Enterprise internal value chain analysis is broken downeach unit of them into smaller work units. At the same time, the importance of the work unit and the cost proportion is considered. The differences between optimizing value-added and non-value added work can be find out by comparing with competitors in the market. So enterprises will improve the efficiency to the greatest extent to reduce costs, reduce the cost of each small operation unit built up the cost reduction of the internal value chain.

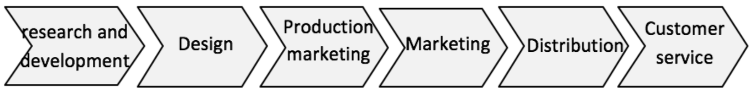

Fig. 6. Enterprise internal value chain

(3)The analysis of competitor value chain

Due to the differences in business strategy, business strategy, competitive strategy and internal operation of different enterprises, causing the differences of the differences of and various activities.Therefore enterprises shouldfind out benchmarking enterprise to spin off of its internal value chain activities, learn its various activities costs, and gradually catch up with the competition.

2.3.2. Analysis method of product cost The cost design and control of modern products should be effectively integrated with CAD/CAPP/CAM under the support of unified product information model, which can run through every link of product development and design (Figure 7). To adapt the feature modellingof advanced manufacturing system, including all content from CAD to CAM research. It includes all plans about manufacturing, testing, assembly and other aspects. It also includes the information for the product design, manufacture, and cost design of management which can be understood by the computer and shared by the various stages of the manufacturing process. The process of product development is using all kinds of knowledge related to design to organize and plan related information according to the intended target, which make the product information model be more and more specific. In the CAD/CAPP system based on feature modelling, the product has taken into account the factors of manufacturing, testing, assembly and other aspects factors in the design stage and has evaluated feasibility of each stage, which make the design of product cost can extract relevant functional parameters and characteristic variables in the model.

According to the parameter variables, doing the parameterized cost estimation

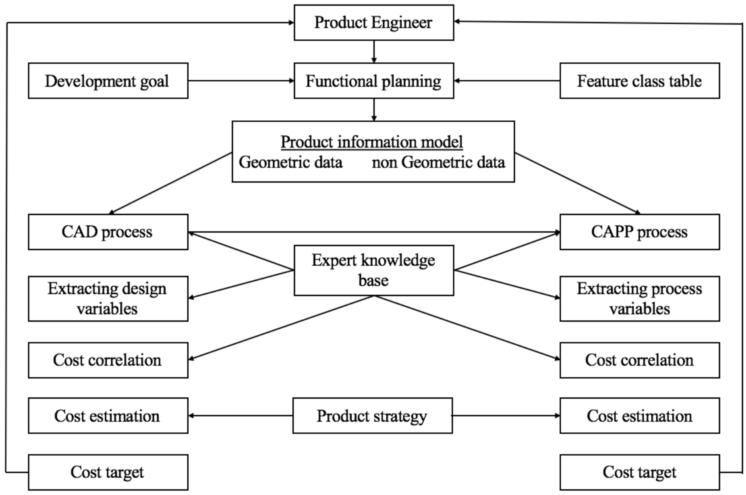

Fig. 7. Realization of product cost optimization

and design by using the data of enterprise management database. At the same time, the results and cost reasons are fed back to the product engineer and CAD/CAP module. Through the necessary further improvement, the optimization design considering the cost is realized. This feature modelling technique provides the basis for the comprehensive integration of CAD/CAP/CAM, and makes it possible to implement cost oriented parallel design.

2.3.3. Analysis method of function cost The establishment of function and cost oriented constraint mechanism is an important content of product cost optimization. As shown in Figure metricconverterProductID8, a8, a functional target system and a cost target system are established.

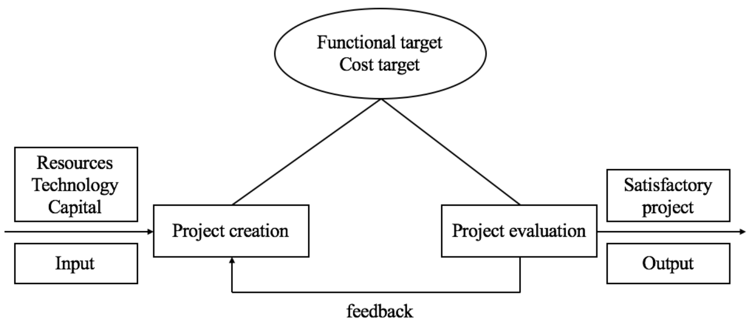

Fig. 8. A functional target system and a cost target system

The calculation of functional cost can be divided into single parameter cost correlation analysis and multi parameter cost correlation analysis according to the single or multiple parameters.

In the case of single parameter, the main function parameter of the product is J, and the cost is C. The correlation function of both can be expressed as:

$$C = f(J) \tag{1}$$

For automobiles, aircraft and other products, not only have many functional parameters, but also the relationship between parameters and cost is complex. The key point of functional cost correlation analysis is to select the main parameters from a large number of functional parameters, and to analyseeach cost item respectively. In the mathematical theory, the correlation analysis is based on the similarity between the curves to determine the correlation between them. When there is a large number of sample data, the correlation coefficient regression method is usually used. In the case of small sample, the grey relational degree model has higher accuracy.

set up reference series: x_0: $x_0 = \{x_0(1), x_0(2), \ldots, x_0(n)\}$

and comparison series x_i: xi = $\{x_i(1)$,xi(2),$\ldots, x_i(n)\}$ i=1,2,...,m

$$\xi_i(k) = \frac{\min\limits_i \min\limits_k |x_o(k) - x_i(k)| + \rho \max\limits_i \max\limits_k |x_o(k) - x_i(k)|}{|x_o(k) - x_i(k)| + \rho \max\limits_i \max\limits_k |x_o(k) - x_i(k)|} \tag{2}$$

Then define ξi(k) as correlation coefficient of curve x_0 and x_i at point K:

Order Δi(k)=|x_0(k)-x_i(k)|as absolute value of the difference between x_0 and x_i at point K

mink|x_0(k)-x_i(k)|is the smallest difference at the first level expressing the smallest absolute value of the difference between point in x_0 curve and corresponding point in x_i.

Order Δmin=min i min k|x_0(k)-x_i(k)|as the smallest difference at the second level expressing on the basis of finding the minimum difference in each curve. Then, according to i=1, 2,...m,to find the minimum difference in all curves X_i.

Order Δmax=max i max k |x_0(k)-x_i(k)|as maximum difference at the second level. Its significance is similar to the minimum difference at the second level.

So, the correlation coefficient can be expressed as:

$$\xi_i(k) = \frac{\Delta_{\min} + \rho\Delta_{\max}}{\Delta_i(k) + \rho\Delta_{\max}} \tag{3}$$

In the formula, ρ Resolution coefficient,$\rho \in \{0,1\}$

By combining the correlation coefficient of each point, the correlation between the $x_i$curve and the reference curve x_0 can be obtained r_i:

$$r_i = \frac{1}{n}\sum_{k=1}^{n} \xi_i(k) \tag{4}$$

3. Results and discussion

3.1. Introduction of fasteners

Fasteners are spare parts that most widely used parts and the longest working hours is in the general assembly of automobile. Because of the characteristics of fasteners is a wide variety of specifications, the length and the performance is different. But each car total fasteners are formed into the standardization, seriation, universalization, so it can make fasteners convenient to choose the same kind of assembly tool. Therefore, DJH calls it standard parts.

Analysis of the structural analysis of automobile fasteners as shown in Table 1:

Table 1. Structural analysis of automobile fasteners

Fasteners combination length	Fasteners combination width			
	Bolt / stud	screw	Nut	Washer
	Six angle flange bolt	The six flower shaped cylinder head screws	Hexagon flange nuts	Flat washer
	Hexagon headed bolt	Internal six angle cylindrical head screws	Six angle flanged chip nut	Spring washer
	Sixangle combination bolt	Cross groove screw	Six angle combination nut	Conical washer
	Double headed stud	The six flower shaped screws	Six angle lock nut	Ring
	Welded stud	Cross slotted self-tapping screw	Six angle flange locking nut	Heterosexual washer
	Protruding bolt	Cross slotted Combinatorial self-tapping screw	Six angle head nut	
	Special bolt	Self-tapping locking screw	Welding nut	
		Special screw	Special nut	

3.1.1. The design of the head structure and wrench type of the fastener Fastener head structure and wrench type are various. All countries have different standards and specifications, resulting in different head structure and screwing mode of fasteners. The analysis of the head structure and wrench type of the fastener is shown as shown in Table 2.

Table 2. Head structure and wrench type of fastener

Type	Structure	Character	Apply
Outside hexagonal flower shape,The outside twelve angle shape.		Due to the peculiarity of the wrench structure, the torque transmission efficiency is high. So we can exert a large tightening torque on it. The support surface type is flange face, which can increase the friction area and bolt pretension force, making reliable fastening performance.	It's suitable for high fatigue strength connection, such as the cylinder head bolt, main bearing cover bolts, flywheel bolt, chassis and auxiliary frame closing bolt, mounting fixing bolt and so on which belong to safety tightening position.
Outer hexagonal, outer hexagonal flange face.		The external hexagonal wrench structure can make high torque efficiency and low mold cost. The convex table can prevent the destroy of matching surface by hexagonal cutting edge.The combination of flange face and flat gasket can increase the contact area, and can overcome the inhomogeneity of friction coefficient of the phase parts, improving the tightening precision.	The application is wide, which is used at chassis, body mass structure.
Cross groove, inner hexagon pan head type.		It has small head size, and need less space. It has the high cross slot or Allen tighten tools versatility. It's mold production and production process is simple. The tighten cost is low. It's convenient for maintenance and the production and installation efficiency of it high.	It's widely used at the body and electrical parts area with low. When it's at the low strength and torque situation, we can use the cross groove wrench structure. We can choose the internal hexagonal wrench structure to tighten the high accuracy requirement position.

According to the above analysis, in the automobile: at the same time of meeting the design requirements, Design Engineer should analysis fastener manufacturing process, production process quality control and tightening precision to reduce manufacturing cost, improve production quality and tightening accuracy.

3.1.2. Selecting of the Patterns of Fasteners tip Usually fasteners are chamfered in the manufacture to improve assembly efficiency, and quickly engaged with the internal thread to prevent damage to the internal thread; also, it is good for the thread forming, preventing damage to the roll mold in the process of rolling (no chamfer easily lead to the roll mold collapsing teeth). Tightening assembly on the vehicle assembly line, the different pattern of fastener tip have a greater impact on the efficiency of tightening and the quality of fastener itself and opponent pieces. The analysis on the patterns of fastener tip is shown in Table 3:

Table 3. The Patterns of Fastener Tip

Patterns	Types of Construction	Features	Application
Milling Tip		After cold forming process, the tip of fasteners is not chamfered. It can be simply made at low cost, but lacking of guidance and the installation is not convenient.	The application of this pattern is less, only for the small screws in non-critical parts such as M6 and below.
Chamfering Tip		In the process of cold forming, fasteners are chamfered by chamfering mold and it is easy to install	This pattern is widely used in most screws and bolts.
Spherical Tip		The Spherical tip of fasteners is convenient for installation and good for protecting the end of the thread, but it is slightly hard to make.	This pattern is applied to connect two assemblies and play a role in positioning, such as studs.
Truncated Cone Tip		The truncated cone tip needs machining at high cost, but it has great guiding function. It is used to set and tighten screw. It needs to make pit eyes in the top surface and put the truncated cone tip into the pit to increase the ability to pass load.	This pattern is generally used for chassis and system connection parts of cars, which have requirements on guidance.
Cylindrical Tip		The Cylindrical tip needs cold forming, the end cylinder protects the end of the thread from damage during disassembly.	This pattern is mainly used for internal port thread or tight bolts.
Scraping Tip		The scraping tip is made by machining at high cost and has the function of scraping. It can scraper painting in the process of screwing in opponent pieces and improve the quality of fasteners	This pattern is applied in less part, commonly used in internal thread with electrophoresis paint and welding slag.
Truncated Cone Guiding Tip		This tip has great guidance, it can be achieved with opponent pieces automatically, reducing the risk of damaging the bolt and the internal thread, improving the efficiency of assembly.	This pattern is widely used in chassis and important parts of cars, as well as the parts with high requirements on the guidance.

3.2. *Product Value Optimization for DJH Auto Parts Company*

3.2.1. Strategic Cost Analysis and Optimization (1)Analysis on Suppliers

The raw material of company's fasteners are the cold-rolled coil wire, domestic and international procurement of electroplating drugs and the high-grade alloy steel wire and semi-finished products. Among them, the steel wires are mainly supplied by Nanjing Baorui and Posco, both of which account for more than 90% of the total supply of steel wires. The washers are mainly supplied by Hangzhou Daihatsu and Han-Yi Metal, accounting for more than 75% of the total supply; electroplating syrup mainly relies on imports, CHEMICAL and NOF accounted for 70%. In addition, due to the inability of some fastener companies to manufacture their products on time, it is necessary to purchase semi-finished products from external suppliers for processing and the major suppliers are Wuxi MOBIS and South Korea. The main raw materials for Class B products are parts for brake fittings, which mainly depend on imports from Korea. It can be seen DJH company's main raw material supply channels are more centralized and easy to manage.As it shown in Table 4.

Table 4. Statistics of DHJ Auto Parts Company's Major Supplier

Raw Material Variety	Name of The Supplier	Annual Supply
Alloy-Steel Wire	Nanjing Baorui,	17 tons
Washer	Hangzhou TEFA	800 million
Electroplating Drugs	CHEMICAL??NOF	2 thousand tons
Screw	JINHAP??WUXI MOBIS	3 billion
Brake Union	Nanjing FaGui	80 million

(2)Major Client

At present, DHJ auto parts company's products are mainly sold to Korean-funded auto companies in China, mainly Beijing Hyundai, Wuxi Mobis, Jiangsu Jinhe, and bearing international trade, Beijing Mobis and other vehicle companies and spare parts Companies, accounting for 25.3%, 21.3%, 15.5%, 8.9% and 8.5% of the company's sales respectively, the top five customers accounted for 79.5% of the company sales, as shown in Figure metricconverterProductID9. In9. In addition, the company's customers include KIA, Beijing Nissin Motor, South Korea GLOVIS and so on.

3.2.2. Analysis on product costs Divide the cost of DHJ auto parts company into two major parts of production cost and period expense (as shown in Table 5.

Table 5. DJH Auto Parts Company's Main Cost and Expense Constitution

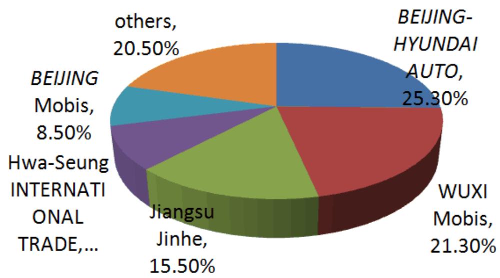

Fig. 9. Major Clients of DHJ Automotive Company

Cost Factor	Period				
	2012	2013	2014	2015	2016
Production Cost	48,625.63	53,897.40	71,541.17	77,899.36	75,267.41
Period Expense	4,539.43	6,121.95	8,483.98	8,338.93	8,967.61

It can be seen from Table 5 that the major cost of DJH auto parts company lies in the production cost, which accounts for about 90% of the total cost, higher than the industry average and indicating that the company focuses its main operating costs on the production processes and takes great control on the period expense of other non-value-creation.

(1)The Constitution of Production Cost

As shown in the Table 6, the direct material costs, direct labourcosts and manufacturing costs of DJH Auto Parts Company are all on the rise. During this period, the company's production scale has not significantly expanded, which reflects the rise of raw material prices.labour costs and other factors have a greater impact on the company's production costs. Specifically, the main reason for the rapid rise in direct material costs is the increase in the total amount of purchased semi-finished products. The cost of purchased semi-finished products in 2016 increased nearly RMB 150 million over that in 2012; followed by the increase in cost of major raw materials, compared with 2012, it increased 31 million yuan in 2016, an increase of nearly 30%; while the cost of supporting raw materials and packaging materials is rising less or almost did not rise

Table 6. Various Proportions of DJH Auto Parts Company's Production Costs

	2012	2013	2014	2015	2016
Proportion of Direct Material Costs	68.7%	70.1%	71.6%	71.1%	68.2%
Proportion of Direct Labour Costs	5.5%	6.7%	6.8%	7.2%	8.2%
Proportion of Manufacturing Costs	29.7%	28.0%	26.6%	26.9%	29.4%

In terms of the composition of production costs (Table 6), after two years of increase in 2013-2014, the proportion of direct material costs declined, accounting for only 68.2% in 2016, slightly lower than 2012. At the same time, the proportion of direct labour costs has kept an upward trend, rising continuously from 5.5% (2012) to 8.2%(2016), which shows that with the increasing shortage of skilled workers in China, labour prices will most likely continue to rise, leading to the rise of labour costs. The proportion of manufacturing costs showed a trend of first decreasing and then increasing. Manufacturing costs accounted for 29.4% in 2016, slightly lower than 2012. It can be seen that under the premise that the direct labour costs can't be reduced in the future, the labour costs can be reduced only by improving the level of automation and reducing the total amount of employment, meanwhile, the manufacturing cost may be increased.

(2)The Constitution of Period Expense

First of all, it can be seen from Table 7, DJH Auto Parts Company's R&DExpenditure has the most rapid growth in indirect expenses. In 2016, R&D expenses have reached 33 million from metricconverterProductID0 in0 in 2012, but this expenditure is strategic, and particularly important for maintaining the market competitiveness of the Company's products and has a high profitability in the future. Secondly, the growth of the management expenses is also fast. Management expenses in 2012 are about 10 million yuan and it is up to 20 million yuan in 2016, an increase of nearly doubled. Specifically, the growth mainly comes from the growth of tax revenue, depreciation charges, management staff salaries and other administrative expenses, reflecting the changes in the tax environment, the demand of equipment renewal and the rise of labour cost are the main reasons for the increase in management expenses. Selling expenses have always been the largest part of overhead expenses, showing an annual fluctuation trend, but the overall growth rate is not large, and the financial expenses also show a lower total volatility, which has a small impact on the total cost of the company.

Table 7. Various Proportions of DJH Auto Parts Company's Period Expense

	2012	2013	2014	2015	2016
Proportion of Management Expenses	21.3%	25.4%	17.5%	22.9%	21.7%
Proportion of Financial Expenses	4.0%	-0.5%	3.2%	-2.1%	2.2%
Proportion of Selling Expenses	74.7%	44.1%	48.1%	39.2%	38.5%
Proportion of R&D Expenditure	0.0%	31.0%	31.2%	40.1%	37.6%

3.2.3. Analysis and optimization of functional cost Fasteners of different types and positions are used differently and require different functions. This section analysesthe choice of fastener surface processing link to reflect the application conditions of fastener industry to use product value engineering.Automotive fasteners commonly used surface treatment: non electrolytic zinc flake coatings (zincaluminiumcoatings), galvanized, nickel alloy, phosphating, oxidation (black). The selection process of anticorrosion design for fastener surface treatment is shown in Figure 10.

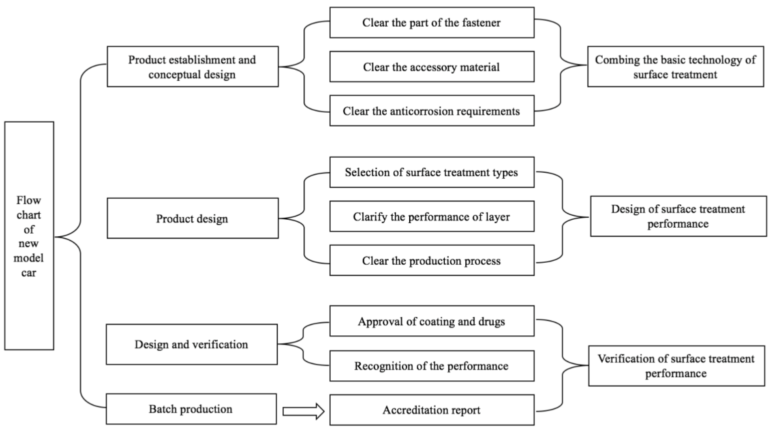

Fig. 10. Selection process of anticorrosion design for surface treatment

Taking suspension and suspension fasteners as an example, surface treatment is selected and analysed. The suspension and suspension fasteners belong to the secondary appearance parts of the chassis, which belong to the requirements of moderate corrosion or severe corrosion. The neutral salt spray test time is greater than 480 hours. Combined with the analysis of all kinds of surface treatment technology of fasteners, the non-electrolytic zinc coating (chrome free zincaluminium coating) is preferred. After determining the surface coating of fasteners, the surface treatment coating validation items need to be identified. The general verification items are shown in Table 8.

Table 8. Non-electrolytic zinc coating verification project for fasteners

Number	Verification projects	Requirements
1	Appearance	have no bad defects
2	Coating thickness	5 m(Micro)
3	Salt spray corrosion time	corrosion will not appear in 480 hours.
4	Adhesion strength	Coating will not be peeled and exposed.
5	Resistance of damp and hot corrosion	Neutral salt spray is tested after placing at the temperature of 150 for 3 hours.
6	Resistance of heat	The coating has no defects.
7	Resistance of water	The adhesive strength is tested after placing in the deionized water for 360 hours
8	Hardness	8H
9	Friction coefficient	0.12??0.18

When clearing the coating verification project, this paper verifies it one by one. Through the above analysis and design, the anticorrosive performance of parts can be effectively guaranteed at the beginning of the fastener design, and reasonable coating should be selected at lower cost.

4. Conclusion

The concept of enterprise cost control is obsolete and the problem of technology and economy is disjointed seriously. Due to the relatively long history of manufacturing industry and the maturity of production and cost control theory, it is difficult to improve greatly. But the systematic manufacturing links are relatively weak, and the space for improvement is relatively large. In view of the above problems, a new theoretical value project is introduced into the enterprise cost control. It is a scientific way of thinking combined with economy and technology. It takes account of the relationship and connection between strategic cost, product cost and functional cost. It provides theoretical basis for systematized optimization of enterprise value engineering by analyzing the relationship between them. In this way, the theory of value engineering with the cost control of production and manufacturing are combined. In some extend, it widens the research perspective of manufacturing cost control in manufacturing industry. The value engineering theory is applied to systematically consider the strategic cost, product cost and functional cost of production, so as to help the cost control project carry out targeted and in-depth value analysis. Finally, this paper takes the fastener products of auto parts enterprises as an example to analysed the weakness of production cost and suggestions for the selection and optimization of production process are put forward.

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