Cost Management of Remanufacturing Products Based on Life Cycle

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ABSTRACT

This paper analyzes remanufacturing life cycle of the various stages of the process and production costs from the product life cycle perspective, and introduces the factors affecting the cost management of remanufacturing in China, puts forward some measures to improve the cost management of China's remanufacturing cost, such as strengthening the fine management, controlling the whole life cycle cost and accumulating the cost data to support the life cycle cost analysis and decision-making from budget, accounting and control analysis.

INTRODUCTION

In recent years, remanufacturing has developed rapidly in China, but the remanufacturing industry is still an emerging industry. Because of the particularity and complexity of the remanufacturing process, the traditional enterprise cost management model cannot meet the development concept of the remanufacturing enterprise. If the enterprise only focuses on the technology and market expansion, enterprise resources, then the enterprise will not be able to fundamentally improve the profitability of enterprises. Cost management is the general name of a series of scientific management activities such as cost planning, cost accounting, cost analysis, cost decision and cost control. Product cost accounting and management is the focus of cost management, and only cost-effective management, in order to business decision-making, cost analysis to provide a reliable basis.

Remanufacturing

Remanufacturing engineering is the general term for a series of activities to repair or upgraded used products with the guidance of product life cycle theory and advanced
technology and industrialization as a means. Remanufacturing product performance is not less than new products, compared with the new energy-saving 60%, 70% of materials and reduce pollutant emissions by more than 80%[1].

Life cycle cost management (LCCM) includes life-cycle cost management and life-cycle cost analysis, which is the cost control of life cycle cost (LCC). LCC is more focused on the value of equipment in the life cycle of the project life cycle, including purchase, depreciation, operation and maintenance expenditure, retirement and other stages, with lower operating costs and increase economic efficiency management content.

The remanufacturing product life cycle

The whole life cycle of a product refers to the whole process of the product from raw material extraction, raw material production, design, manufacture, packaging and storage, use and maintenance, to recycling treatment or reuse. Equipment life cycle refers to the equipment from design until retirement in the whole process. The life cycle cost refers to the total cost paid in the life cycle of the product. The remanufacturing product cost in this paper refers to the sum of the expenses from the beginning of the product recycling to the sales to the customer. From the cost, it involves manufacturer cost, customer cost, and social cost[2].

Remanufacturing equipment life cycle refers to the process of recycling, dismantling, cleaning, testing, remanufacturing, testing, assembling, using and decommissioning of used equipment, as shown in Fig.1.

Figure 1. Product life cycle.

(R&M: Remanufacturing, R&U: Reused, R&C: Recycle, R&S: Resource)
PROBLEMS OF REMANUFACTURING COST MANAGEMENT

Management level

R & D PROCESS SYSTEM

Remanufacturing design process into a one-way flow, lack of information feedback, repeated design, resulting in human, financial, material and other waste, virtually increased the design cost[3]. Second, due to the artificial separation between the various stages, resulting in each stage of the designers focus only on their own cost reduction, while ignoring the upstream and downstream collaboration, design does not take into account manufacturing costs, subsystems do not consider the optimization of a system, raising research and development costs[4].

COST MANAGEMENT FRAMEWORK

Technical personnel engaged only in technology-related work in the cost management, too concerned about the function of the product itself and reliability indicators, the economic importance of the product is not enough, lack of consideration of product costs[5]. In addition, because the financial data is relatively confidential within the enterprise, financial or price data by the financial staff control, once the project personnel can not build a bridge between the design and financial staff to communicate, so designers can not be based on the cost of the product Good to carry out related work.

REMANUFACTURING PROCESS

The skilled worker is bound to the manufacturing equipment, and if the equipment fails or the technician is no longer in place it will directly affect the process. At the same time, individual enterprise technical staff there is a division of labor is not clear, affecting manufacturing efficiency. In addition, the equipment is placed in the classification of equipment characteristics, the lack of waste products for the remanufacturing process, the product turnover time is long, resulting in low production efficiency, cannot effectively control the cost of re-manufacturing[6].

Technical level

KEY TECHNOLOGIES

Key technology and advanced technology system immaturity, did not reach the stage of industrialization. The current high-end product remanufacturing process is still in the stage to catch up with the world's advanced technologies and concepts, such as aircraft engines and more is based on foreign advanced remanufacturing technology, resulting in additional
manufacturing costs. Advanced remanufacturing technology research and development also need to invest a lot of money, and then put into use and the establishment of appropriate equipment to be funded[7].

DESIGN AND REMANUFACTURING MANAGEMENT

The traditional design, after the completion of the design, the technical staff to develop the appropriate technology program, and then carry out a series of activities such as remanufacturing, this approach separates the organic link between design and manufacturing, the original closely linked activities split into Two independent activities, the lack of design and manufacturing synergies. Designers lack the knowledge of process technology, and process personnel on the product design features can not master, resulting in the design of the program design costs are higher.

PROJECT PLANNING

The product of the planning activities of remanufacturing regardless of product testing and verification work (including test methods, test equipment, etc.) in the product design stage. There are uncertain test methods, test items are incomplete or too much In the production of finished products after the completion of test verification, difficult to estimate the difficulty of testing and other issues, resulting in follow-up product verification need to continue to increase the test content, test equipment and test methods uncertain Brought about by repeated test and other issues. At the same time, due to the lack of planning for the pilot project, on one hand caused by a large number of repeated tests, on the other hand caused the test equipment is too complex, thus increasing the cost of the product[8].

ANALYSIS OF INFLUENCING FACTORS OF COST MANAGEMENT

The cost management of remanufacturing is influenced by many factors, such as cost management and cost management. There are many factors influencing cost management, including internal and external factors[9]. These factors affect the enterprise cost management of the enterprise development is also a twofold: on the one hand these factors provide a good opportunity for the development of enterprises, but also the development of the enterprise caused some risks, as shown in Fig1[10].
Economic factor

The economic factors are the primary influencing factors of cost management in remanufacturing enterprises. Changes in the economic environment directly affect the enterprise remanufacturing program development and implementation. Remanufacturing enterprises to analyze and study the changes in economic factors, the development of suitable for the development of remanufacturing enterprise production and sales routes, and in a timely manner in accordance with the economic environment changes to make adjustments. The change of the economic environment is cyclical. This cyclical economic change affects the business activities and development of each enterprise. But different types of remanufacturing enterprises by economic factors change is not the same.

Technical factor

Innovations in remanufacturing technology can give companies many opportunities to repair new products and new markets. If companies cannot quickly grasp and use of new technologies, enterprises may have been eliminated for a long time. Therefore, the mastery of new technologies and the ability to use is an expression of the competitiveness of enterprises[11]. Different remanufacturing enterprises are affected by different technologies, and the high-tech remanufacturing industry is greatly affected by the technology update. Enterprises in order to long-term development is inseparable from the technical innovation, the replacement of the original product, which are closely linked with the enterprise cost management.

Competitive factor

The traditional market competition tends to compete with the quantity and quality of the products. Under the modern market economic system, the competitiveness also includes the cost-saving competition, and the cost competitiveness is bigger. Cost competition is mainly manifested in the enterprise through cost management to reduce the use of resources, the use of funds and dependence on manpower, with the minimum cost to produce inexpensive products, thereby increasing the economic efficiency of enterprises[12]. But for enterprises,
competition not only bring development and opportunities to enterprises, but also bring challenges.

Management factor
Cost management system is a subsystem of enterprise management, cost management by the impact of enterprise management, while cost management is to rely on business management and development. Therefore, the enterprise management environment directly affects all aspects of cost management, such as enterprise management structure, content and methods. The quality of enterprise management also has a direct impact on the effect of cost management.

COST MANAGEMENT PROGRAM DESIGN

Cost Management Objectives
Life cycle cost management is the goal of optimizing and minimizing the total cost of the entire life cycle of a remanufacturing project. The whole life cycle cost management is mainly from the feasibility of the program to select the best option, so as to effectively use the resources of the project program for a systematic analysis. Life cycle cost management aims to achieve the most economic cost of the project, through the life cycle cost and all kinds of cost estimates of the project, in-depth comparison of sub-clever, in all stages of the project life cycle to make A Systematic Approach to Decision Making.

Cost management system
Remanufacturing management and traditional new product manufacturing in technology management from the above discussion we can see, there are different in the aspects, and because the remanufacturing market and by technology, management and other costs caused by reasons, remanufacturing management in the enterprise in the application is not ideal. It makes the remanufacturing management for China's current economic restructuring and sustainable development is difficult to give full play to the significance. In a sense, the remanufacturing industry depends on the development of the government, society and enterprises in many aspects of the joint efforts. Therefore, in order to achieve the goal of remanufacturing management, we believe that the establishment of remanufacturing operation system should include management, technology and standards in three aspects, as shown in Figure 3.
Management foundation

Remanufacturing management is based on the whole life cycle theory, remanufacturing evaluation theory, decision-making and optimization theory, to solve the equipment maintenance decision-making, enterprise remanufacturing production decision and benefit evaluation.

The life cycle cost refers to the total cost paid in the life cycle of the product. The remanufacturing product cost in this paper refers to the sum of the expenses from the beginning of the product recycling to the sales to the customer. From the cost, it involves manufacturer cost, customer cost, and social cost. According to the current product remanufacturing system, the cost of the remanufacturing product can be further decomposed into the cost of the old parts, the construction cost, the remanufacturing and processing cost, and other management expenses, as shown in Figure 3.
Cost prediction

The choice of estimation method should take full account of the characteristics of each estimation method and the need to select the estimated object, according to the actual situation and flexible selection, the following is a commonly used estimation method. Combined with the equipment life cycle of the actual situation, the various stages of the estimation methods are summarized in Table 1. Choose the more suitable estimation method, at the same time meet the remanufacturing characteristics and cost structure.

<table>
<thead>
<tr>
<th>Stage Estimation method</th>
<th>Design phase</th>
<th>Production phase</th>
<th>Maintenance support phase</th>
<th>Processing stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter estimation</td>
<td>Applicable</td>
<td>Not applicable</td>
<td>Applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Analogy estimation</td>
<td>More applicable</td>
<td>Not applicable</td>
<td>More applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Trend extrapolation</td>
<td>Not applicable</td>
<td>Applicable</td>
<td>Applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Gray system estimation</td>
<td>Applicable</td>
<td>Not applicable</td>
<td>Applicable</td>
<td>Applicable</td>
</tr>
<tr>
<td>Engineering estimation</td>
<td>Not applicable</td>
<td>Applicable</td>
<td>More applicable</td>
<td>More applicable</td>
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</tbody>
</table>
Cost accounting

Cost accounting is an important part of cost management, which provides object, accuracy, fine degree and timeliness for cost analysis and assessment, which is a key index to measure the quality of accounting work. Remanufacturing should be done in many steps, and the cycle is longer. With the remanufacturing products toward the multi-species, small batch development, the use of dedicated pipeline approach has been uneconomical, feasible, flexible development has become an inevitable trend, so the cost of flexible accounting is causing new problems. Therefore, it is necessary to innovate the cost accounting method and promote the remanufacturing cost management.

Cost Control

This paper takes you to explore cost control, from micro-and macro-level analysis of cost control. From the macro-level, it focuses on the re-manufacturing technology and product development from the macro-level, which can be used to control the cost of the product and the cost of the product.

IMPROVEMENT MEASURES

For the remanufacturing products cost control problems, from the management level, should be addressed from the following aspects:

The first: The R & D process system is optimized, namely to model-based system engineering R & D system is established by model-specific, specifically between system and subsystem, between subsystem and subsystem, design and technology. Information: on the one hand to break the boundaries of the original R & D process, real-time interactive information, on the other hand a large number of mature experience through the model down and be copied down to reduce duplication of design work, but also reduce the risk of late errors.

Second: In the demonstration of the program, through the product design features in-depth understanding and analysis, to develop practical solutions to ensure that product development process, the key issues as far as possible does not appear repeated. In addition, the overall planning of the project, detailed combing the existence of various types of risk identification sort, and one by one to develop avoidance measures, thereby shortening the development cycle and reduce costs.

Third: The introduction of advanced management concept of remanufacturing, it is necessary to change from the ideological concept of the cost of design. Products in the design stage, about 90% of the cost has been basically determined. Therefore, technology and other staff will participate in the design of the program to carry out collaborative product design to avoid the blind pursuit of re-manufacturing products such as high quality and performance indicators to bring unnecessary costs in the design early stage.

Fourth: In the production organization, fully explore the potential of personnel, to achieve a multi-skill, reduce the dependence between manufacturing equipment and skilled
workers, to avoid uncontrollable risk. At the same time, the rational allocation of staff, lean production organization, to reduce or even avoid the skills of workers in the useless labor, to maximize the efficiency of production. In addition, through the rationalization of the layout, the establishment of product-oriented production lines, reduce product turnaround time, to achieve effective control of production costs.

CONCLUSIONS

Remanufacturing enterprises in the development process, to enhance the effectiveness of enterprises must strengthen the cost of product management. In view of the shortcomings of current cost management, this paper introduces the theory of product life cycle and analyzes the costs of cost management in different stages of the life cycle. The cost structure of remanufacturing products at different stages has different characteristics. Cost management focus on the different needs of the implementation of the corresponding cost management, and enterprises should build the concept of product cost responsibility, from all stages of the life cycle of the decomposition of responsibility to enable employees to participate in cost management, so as to the most effective play The role of cost control. In addition, the detailed implementation of the cost management at each stage of the technological innovation life cycle will be further discussed in the follow-up study.

REFERENCES