Research on the Purchase or Lease of Product Service System

Nannan Wang

Inner Mongolia University of Technology

Abstract: *In recent years, the global dependence on resources has been deepened with the development of technology, economic development, social progress and the rapid growth of population. In order to ease the tension of resources, some European companies have put forward the concept of product service system (PSS), which has an important impact on the integration of resources.*

The purpose of this paper is based on the PSS theory, in the reverse logistics environment, analysis of the rental system has been established. The system includes product inspection, maintenance, upgrades, product recycling and waste disposal.PSS has two different product operations including new product sourcing and product rental. The scheduling rules of three kinds of simulation to analyze the rules (the shortest processing time, first come first served, the earliest due date), and then to the home or office case to carry on the inspection, and finally the further research and prospect of the product service system simulation.

Keywords: *Lease simulation, product service system, decision making*

1. INTRODUCTION

In early 1990, the EU introduced the concept of environmental protection-Integrated Product Policy (IPP) and producer extension liability (EPR) to encourage companies to reduce waste of resources to produce environmentally friendly products.EPR is designed to reduce the environmental impact of the product, the producer must be responsible for the environmental impact of the product throughout the life cycle. Some research shows that, from the past based on sales of tangible products, only emphasize the function of products, efficiency and enhance the service business model transformation, not only can increase the added value of products also reduces the impact on the environment, this concept is known as a product service system (PSS).PSS is a form of functional service economy, literally interpreted as a composite system for selling products and services. Product service systems include tangible products and intangible services. The key to a sustainable product service system is to design a special functional product service system for the customer rather than they must be themselves or buy the product.

The product service system has greatly improved the ratio of key elements: the ratio of economic growth and resource consumption at the social level, and the ratio of corporate income to the input of resources and environment. Therefore, the product service system creates a sustainable development path for the society, the enterprise is a competitive strategic choice.

Described in the Brezet five PSS services: (1) product/service/combination/replacement; (2) at the point of sale services; (3) the use of different concepts of products; (4) maintenance services; (5) reevaluation services. The use of different concepts can be displayed through the PSS rental system. The car industry has long been possible to lease or lease. The key issue is to design a product (car) from the traditional model to the lease model. Therefore, we explore the feasibility of building a simulation model based on the concept of PSS product leasing system. In the process of the whole system simulation, there is a simulation of the reverse logistics, repair and recovery process. The performance of the system is analyzed by controlling the inventory level, maintenance time, scheduling rules, and the economic cost/profit of the system. Scheduling rules include the shortest processing time (SPT), first come first served (FCFS), the earliest deadline (EDD).The data from the simulation model are derived from a known research survey: a survey of an international office copier company including its procurement and leasing.

2. LITERATURE REVIEW

The idea of reducing the life cycle of a product through service, remanufacturing, and recycling is the product of Stahel and Reday. They argue that the distinction between industrial and service economies, in which the product and technical service is a model of customer satisfaction.PSS stressed tha "sales is the product or service function rather than the product itself", a product service not only to reduce the burden on the environment but also meet the needs of customers and competitive in the market, and a lot of creativity and innovation are facing such restrictions. At the same time, it is not possible to meet the economic competitiveness and reduce the damage to the environment, but it is worthwhile to maintain its sustainability.

In this case, the leasing industry is quite special. Leasing process begins with the customer to sign a contract, and then drive from a station on the left, ended in to return the car at the same station, check the data including the position of the next station stops, and the length of the lease time. Fink and Reiners describe the main components of the system and the core process of the car rental business.

The lease contract states that most of the products are bought by the producer and leased to the customer, while the producer is liable for damage or malfunction of the product. After the end of the contract, the product is usually sold to customers or sold to the secondary market. Germany's 1/4 cars are purchased in this way, leasing has become the most important means of financing the purchase. As a result of the leasing strategy, manufacturers are responsible for damaged or faulty products; therefore, they need to strengthen the maintenance services to reduce the environmental impact of the product. For long-term rental, the BT industry provides functional sales services and long-term products to their customers. This makes the connection between end users and manufacturing enterprises more closely.

3. RESEARCH METHODOLOGY

In this study, a simulation model based on the concept of product service system is established to test the feasibility of the product leasing system. In addition, reverse logistics, maintenance, remanufacturing/recycling process will be reflected in the simulation system. The simulation system includes (1) customer (2) retailer (3) customer service center. The main process is as follows:1.a customer found that the product is defective, and transferred to the retailer remanufacturing.2.retailers to inform customer service/Remanufacturing centers to manufacture defective products.3.once a defective product is returned, check it first. The service center then evaluates the failure level and repairs or remanufacturing time by diagnosing the product. Then according to different specifications of the product disassembly, remanufacturing.4.waste treatment center. There are serious damage to the product, will not be able to repair or dispose of, directly into the waste disposal center.
At the same time, qualitative analysis and quantitative analysis should be carried out to ensure the objectivity and scientific research.

4. RESEARCH AND ANALYSIS

In order to predict the effectiveness of the analytical results, we use an international company's Taiwan branch. The company is engaged in the development of equipment, software, solutions and services, manufacturing, marketing, financing. In addition to the sale of equipment, the company also provides consumers with copier rental and payment copy service. About 55% of the revenue comes from the sale of equipment, and the remaining $45% comes from services, including leasing, maintenance and financing.Currently,40% of the company's employees are maintenance personnel. They must respond to customer questions within 48h and solve problems within 5 days. Customer problems include maintenance, repair and complaints. The proportion of remanufactured parts ranged from 20% to 95%.To monitor and control the quality of remanufactured parts in time.

In order to explore the relationship between the system variables and its influence on the simulation model, a full factorial experimental design. In the course of the study, three system variables are considered as parameters of the system. From customer to customer service center, material supply, maintenance, research parameters in two different models remain unchanged. The analysis can be classified by the interaction between variables and variables. Sum up the impact of variables on the performance of purchasing and leasing models and conduct statistical analysis. The results showed

that the damage rate of the product was the most important factor in the enterprise, and other factors, such as maintenance success rate, had no significant effect.

Because of the correlation between the system variables, the damage rate and the success rate of product maintenance have a significant impact on the overall maintenance. For the interaction between the failure rate and the success rate of product maintenance, because the failure rate is lower than the lease mode in the procurement mode, the success rate of product maintenance is higher than that of the lease mode. Therefore, when the failure rate increases, the success rate of product maintenance also increases.

In the purchasing and leasing model, the customer's maintenance cycle this variable significantly affects performance metrics. When the failure rate increases, the success rate of the product maintenance is reduced, the maintenance requirement is increased, and the repeated maintenance is increased. Then all the maintenance cycle increases; when the failure rate is reduced, the success rate of product maintenance will increase, thereby increasing the likelihood of success, reducing the overall maintenance cycle of customers. In this mode, the total maintenance time also significantly affects the performance index. When the failure rate increases, the success rate of product maintenance increases. Therefore, it does not affect the total maintenance time. When the failure rate increases, the maintenance success rate of the product is reduced, the maintenance requirement is increased and the maintenance is repeated, which increases the total maintenance time.

Failure rate controls maintenance requirements. When the product failure rate is high, there will be more demand for maintenance. Therefore, when the failure rate and the maintenance success rate of the product increase, the effect is not significant. When the failure rate is higher, the maintenance success rate of the product is reduced, and the maintenance requirement is increased. On the contrary, the total maintenance costs will become low.

For the T test, correlation analysis, the comparative analysis of two models(purchase and lease),according to the statistical analysis of the results, when the P value was less than 0.05 level, the two models showed significant differences in the overall total cost of maintenance and maintenance. Practice has proved that enterprises need to accurately grasp the changes in consumer demand, and actively adapt to technological change. The choice always has to coexist with the risk, and the producer of the product service system, which can bring huge profits, should also bear the huge risk behind the uncertainty.

5. CONCLUSIONS AND FUTURE RESEARCH

In this study, an PSS based maintenance service is proposed, which includes maintenance, recycling, reverse logistics and final waste disposal. Therefore, the product service system can be applied to home/office electronic equipment. The total cost of the system is lower than the lease mode, when the customer that the product is their own property, the use of products will be more careful. In the analysis of main factors affecting the purchasing and leasing mode, increase the failure rate, serious impact on the overall maintenance and total cost of maintenance and parts, waste and system, the remaining variables significantly affect customer maintenance cycle. In the purchasing and leasing model, the interaction between variables affects the customer's maintenance cycle, but does not affect the total maintenance time. The rest of the variables, the failure rate and repair success rate significantly affect the overall procurement and maintenance of saving waste leasing costs; in this mode, in order to optimize the performance indicators, the failure rate should be at a lower level, the success rate of products should be at a high level, product maintenance in a low level.

In addition, if an enterprise from the procurement model to the rental mode, should make the product design more environmentally friendly. Products should also make it easier for customers to maintain. Due to the complexity of maintenance services and reverse logistics, it is necessary to do more literature work to obtain different variables and parameters to build the overall framework. Future research needs to consider transport costs, transit time, and complete reverse logistics recycling and maintenance costs. In addition to purchasing and leasing models to different models to study the "price" and profit, can promote the development of enterprises.

With the improvement of living standards, the level of public demand is also increasing, the need for more abundant content. Through the application of production service design, it has some practical significance for enterprises. At present, the theory of design method based on product service system

is still relatively small, how to inherit the traditional design theory to the PSS design is the future research direction.

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