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Warranty analysis - A review

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ABSTRACT

This paper is a review on Warranty analysis, it basically explain about how warranty cost is important to handle carefully by all element of organization. Warranty cost needs uniformity to analyze throughout its user. Warranty cost analysis is challenging procedure as data become complicated when it consider different real life situations. Warranty claims are also part of effective warranty analysis. Different models explained by researches discussed to understand warranty analysis aspect. It studied different model for warranty analysis.

Introduction

To improve profit margin, it is require estimating warranty of a product. Warranty itself explain secure life of a product, simultaneously it carries cost which make product price. Decision related to warranty varies from manufacturer to manufacturer though functional availability of product materially exist identical behavior. Any industry decides warranty of their product based on available data.

An industry has strategy to analyze product performance in market. Every manufacturer develops own database, which is assisted by dealers and suppliers related with industry. Dealer collects warranty related data i.e. defect occurred, direct from customer and compare it with Standard data available with them. Dealer stores data in computer system and they share it with vehicle manufacturer using network. Manufacturer decide whether to go for replacement of product by new one or repair is sufficient. Problem started with data storage and capture as this data varies from dealer to dealer. It creates dilemma in customers as every dealer has its own point of view, this particular situation results in bad impression of industry in Business. To avoid this kind of situation manufacturer can standardize warranty data acquisition and warranty data flow.

Warranty analysis

Different reserchers find methodologies to analys warranty.

Kazuyuki Suzuki [1], explained that when date specific data is not available for the situation total sale quantity can be calculated

From other sources, for non-repairable warranty a non-parametric maximum likelihood estimator of claim frequency based on a multinomial model. These estimators are mathematical and effective in repairable case.

Stefanka Chukova[2], proposed warranty cost analysis model based on non renewing warranty with repair time, this research work contribute to allow non-zero repair time and associate a cost with it, also it explains about time in resolving warranty claim is an important component in product warranties as it is part of warranted time and it may be connected with very costly penalties.

Hongzhou Wang[3], suggested four models for warranty cost analysis to be realistic, relationship of preventive maintenance and corrective maintenance with warranty policies and developed models imperfect repair, quasi-renewable processes are effective tool and based on purely failure rates can be used for model design, all these models explains

i) Warranty cost estimation before selling
ii)Warranty cost for projected demand
iii) Additional warranty cost for extended warranties
iv) Design for warranty
v)Win-Win situation for customer and supplier

Ruey Huei Yeh[4], proposed K-product inspection scheme for a deteriorating production system when all the products are sold with free minimal repair warranty, this method helpful to determine optimal lot size and number of products so that there should be reduction in expected total cost per unit time.

Shaomin Wu[5], analyzed warranty cost for products with a dormant state, building products before commissioning undergo aging deterioration and other causes, manufacturer and contractor find corrective maintenance and preventive maintenance suitable for building products under warranty. Maintenance cost are considered in warranty.

Zhefang Zhou [6], modeled dynamic nature of pricing and warranty policies, according to author, dynamic nature of warranty helps manufacturer to improve his profit. Continuous dynamic programming used to model changing price and warranty policies. Basically this research makes manufacturer ready solution for managerial decisions in case of high-tech products with heterogeneous nature of customer, also it personalized risk attitude of customer to provide with particular warranties, lastly competing world can use this methodology to optimize their strategies regarding warranty policies.

Chung-Ho Chen [7], investigated existing model of Pulak and Al-Sultan's (1996) and Ladany and Shore's (2007) modified model with quality loss and inspection error. Warranty period and expected life of product simultaneously calculated. It shown that expected profit depends on processing, demand and selling price.

Hong-zhong Huang [8], suggested that diagnostic features can be used to reduce warranty cost. A diagnostic design decision model can help in to predict and rectify more common faults therefore it reduces number of times servicing needed for

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product. This approach increases production cost for the item under warranty at the cost of servicing expenditure, diagnostic design decision models investigates the robustness of diagnostic design decision to the key parameters and decision variables. It assist manufacturers to implementation of diagnostic features.

Yu-Hung Chien [9], developed cost model from user/buyer point of view, Author suggested local optimal replacement age can be derived to minimize long run expected cost rate, a concept of fully renewable free replacement with a Pro-rata warranty, which help to identify minimum long run expected cost as function of local and global optimal replacement ages. These assist buyers to adjust the optimal age replacement policy for a product under a fully renewable free replacement warranty and Pro-rata warranty.

Jun-Wu [10], developed and studied general periodic preventive maintenance policy for repairable revenue-generating system, it assumed that preventive maintenance slows the system deterioration process and therefore reduces ageing losses. This model is important from the point of view both the warranty contracts and system ageing losses are incorporated in the maintenance cost modeling and implementation of preventive maintenance action does not have to be strictly periodic. Cost model is developed for buyer and for two variables calendar time of first preventive maintenance and degree of preventive maintenance.

M.A. Wartman [11], Examined two stochastic processes for warranty modeling i) remaining total warranty coverage time exposure and ii) warranty load. These two warranty measures permit warranty managers to better understand time dependent warranty behavior and thus better measures warranty cost reserves.

Feng Chen [12], presented solution for problem of dynamically routing warranty repairs to service vendors when warranties have priority levels, each time a product under warranty fails, It is send to one of the vendors for repair, Items covered by higher priority warranty receive higher priority in repair service. The manufacturer pays a fixed fee per repair and incurs a linear holding cost while an item is undergoing or waiting for repair. The objective is to minimize the manufacturer's long-run average cost. Author suggested five heuristic which applicable to real life, the index based Generalized Join the Shortest Queue(GJSQ) performed policy remain best out of other four, The simulation results suggest that the GJSQ policy is a robust, efficient algorithm to use in practice over a large parameter range. GJSQ policy remain profitable from manufactures point of view.

Vidyadhar Kulkarni [13], proposed a Bass model using poisson process representation of sales process. Author successfully developed model for manufacturers to compute warranty costs for a specified period, This particular model helps in warranty variability as sales varies randomly. It also helps manufacturer in financial planning, so they can more accurately account for and predict warranty liabilities in proper fashion.

Joseph C. Hartman [14], analyzed a number of extended warranty contracts which differ in design, including restrictions on deferrals and renewals. With the use of dynamic programming, Author compute the optimal strategy for a consumer with perfect information and determine the optimal pricing policy for the provider given the consumer's risk characterization. Author also provide insight into when different contracts should be issued. Results illustrated how profits can be dramatically increased by offering menus of warranty contracts, as opposed to stand alone contracts, with the use of integer programming. Concluded with risk-taking consumers provide the greatest benefit to offering menus. These insights can help a company develop a comprehensive warranty planning strategy for given products or product lines.

Ming-Wei Lu[15], discussed lognormal distribution model and predicted method to identify vehicle components that have the potential to become actionable items (such as a recall decision) based on their early field failure (4 or 5 months in service) warranty data. Earlier recall action results in cost-effectiveness for both the vehicle manufacturer and customer. The ability to measure month-to-month continuous improvement and reliability growth is the positive aspect of the method

Final conclusion on Warranty analysis from researchers work can be summarized as below

1. Maximum Likelihood Estimator effective in repairable case.[1]
2. Warranty cost models are functions of non-zero repair time.[2]
3. Preventive maintenance and Corrective maintenance have key role in warranty costs and extended warranties.[3]
4. For deteriorating production system K-product inspection Scheme helps to decide optimal lot size.[4]
5. Product in dormant state needs preventive maintenance and corrective maintenance under warranty period.[5]
6. Continuous dynamic programming helps in model changing price and warranty policies.[6]
7. expected profit depends on processing ,demand and selling price.[7]
8. A diagnostic design decision model can help in reducing warranty cost.[8]
9. local optimal replacement age can be derived to minimize long run expected cost rate.[9]
10. General periodic preventive maintenance helps in revenue generation in repairable case.[10]
11. Proposed models helps managers to better understand time dependent warranty behavior. [11]
12. GJSQ policy remains profitable from manufactures point of view.[12]
13. Bass model using poisson process representation of sales process can be used to calculate warranty cost for a specified period.[13]
14. the use of dynamic programming , compute the optimal strategy for a consumer with perfect information and determine the optimal pricing policy for the provider given the consumer's risk characterization.[14]
15. Earlier recall action results in cost-effectiveness for both the vehicle manufacturer and customer.[15]

Different models explained are helpful from manufacturer, customer, vendor and dealers point of view and have effective results in analysis.

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