

TOPIC 4

PRODUCT WARRANTY

RELIABILITY RESEARCH

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TOPIC 4

PRODUCT WARRANTY

WARRANTY CONCEPT

- **Contractual agreement (relating to product performance)**
- **Established on sale of product**
- **Requires the manufacturer to either rectify failures occurring over the warranty period or compensate through refunding a fraction of the sale price**

EXTENDED WARRANTY

is integral to the sale of the product and factored into the sale price.

(also called service contracts) are options that customers can purchase by paying an additional amount. These are offered by manufacturers, retailers or third parties.

CUSTOMER PERSPECTIVE

- **Products are becoming more complex and expensive**
- **Difficult to assess product performance prior to purchase**
- **Warranty provides assurance - failures over the warranty period are either fixed or compensated through refund**

MANUFACTURER PERSPECTIVE

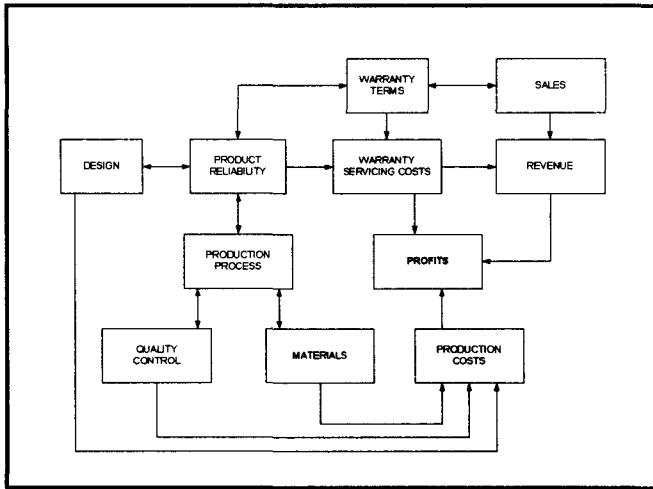
- **Marketing (promotional) tool**
 - **Signal product quality (or reliability)**
 - **Product differentiation (bundling of product and service)**
- **Better warranty terms lead to more sales**
- **Limits liability: Warranty does not cover consequential damages or losses**

SOCIETAL PERSPECTIVE

- **Protect the interests of both customers and manufacturers**
- **Warranty Legislation in the USA**
 - **Magnusson Moss Act**
 - **Lemon Law**
- **EU: All products must have at least 2 year base warranty**

BUSINESS VIEWPOINT

- **Manufacturers need to achieve business objectives (ROI, profits, market share etc)**
- **Warranty is affected by technical issues (design, production) made during pre-launch and in turn impacts on the commercial issues (sales, profits) during post-launch**



CAUSE-EFFECT RELATIONSHIPS

- The cause-effect relationships are complex
- Better warranty terms \Rightarrow Sales \uparrow , Warranty costs \uparrow , Profits \uparrow or \downarrow ?
- Reliability $\uparrow \Rightarrow$ Warranty costs \downarrow , Development costs \uparrow
- Need to understand these relationships for effective decision making

VARIOUS ISSUES

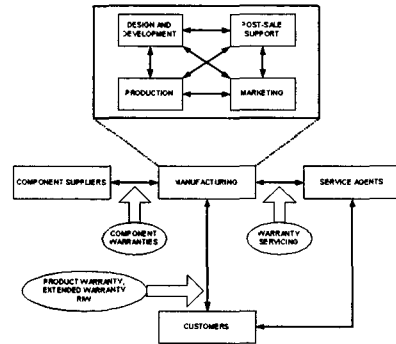
- Warranty and Engineering
- Warranty and Marketing
- Warranty and the Law
- Warranty and Accounting
- Warranty Legislation
- Warranty Logistics (**)
- Warranty Management (**)

REFERENCES

- Blischke, W.R. and Murthy, D.N.P. (1994), *Warranty Cost Analysis*, Marcel Dekker, New York
- Blischke, W.R. and Murthy, D.N.P. (1996), *Product Warranty Handbook*, Marcel Dekker, New York
- Murthy, D.N.P. and Blischke, W.R. (2004), *Warranty Management and Manufacturing*, Under preparation for publication
- Murthy, D.N.P. and Djamaludin, I., (2002), Product warranty – A review, *International Journal of Production Economics*, 79, 231-260

WARRANTY MANAGEMENT

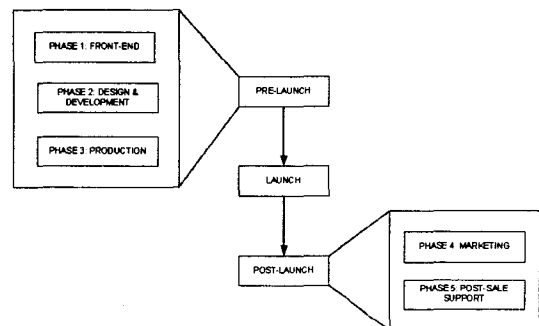
KEY ELEMENTS



WARRANTY STRATEGY

- **Manufacturers need to define for their products (as opposed to “an after thought”)**
- **The warranty strategy needs to be linked to other strategies (technical and commercial)**
- **Strategy formulation must be done using a product life cycle approach**

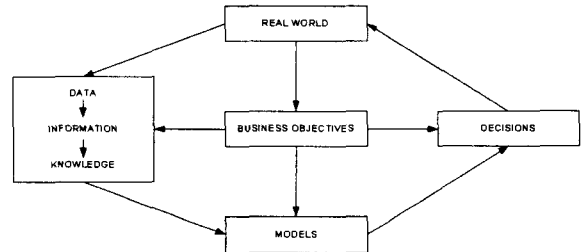
PRODUCT LIFE CYCLE



WARRANTY STRATEGY

- Terms and duration of base warranty
- Terms and duration of extended warranty options to be offered
- Strategy formulation requires decision making
- Models are needed to assist the decision making process
- Data is needed for model building

FRAMEWORK FOR DECISION MAKING

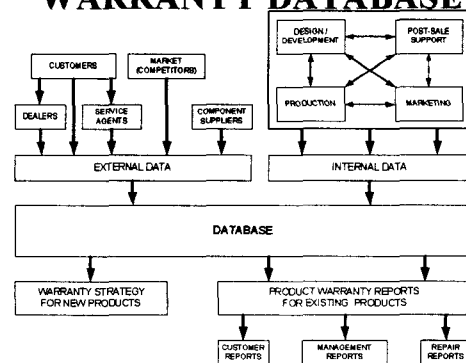


DATA / INFORMATION / KNOWLEDGE

Illustrative Example: Component Failure

- **Data:** Failure times
- **Information:** Data analysis reveals underlying patterns and different modes of failures
- **Knowledge:** Understanding of the different physical mechanisms at work

WARRANTY DATABASE



NEW RESEARCH

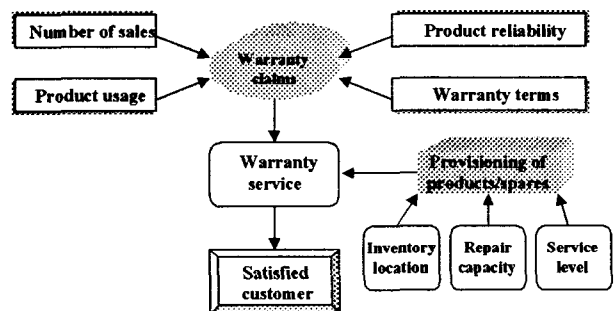
- **Warranty data analysis (1-D and 2-D warranties)**
- **Building better models for the various elements (technical and commercial)**
- **Warranty data collection systems**
- **Warranty management systems to assist in the decision making**

WARRANTY LOGISTICS

WARRANTY SERVICING

- **Warranty claims depend on product reliability, usage pattern and warranty terms**
- **Warranty servicing costs depends on claims and warranty servicing logistics**
- **The cost can vary from 1% to 10% of sale price**
- **This has implications for manufacturers**

WARRANTY LOGISTICS



TWO CASES

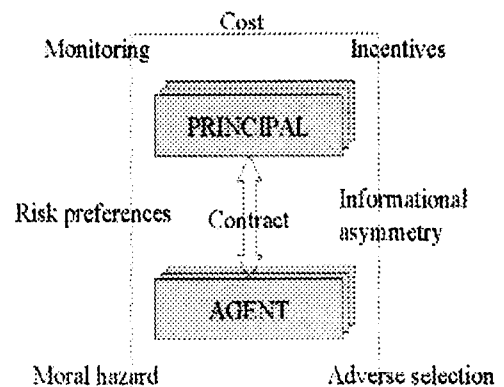
- Failed item brought to a service centre by the owner (PCs, small appliances etc)
- Repair person to visit the site to fix a failed item (white goods, air-conditioners, many industrial products, lifts etc) -- need for traveling repairman
- The resources needed for these cases are different

STRATEGIC PROBLEMS

- Optimal Number and location of warehouses (multi-echelon)
- Optimal transportation of components (mode, frequency)
- Optimal inventory levels
- Optimal repair capacity at different service centres

SERVICE CENTRE

- Owned by the manufacturer
- Independent of manufacturer: An agent carries out the warranty servicing under a contract with the manufacturer
- This raises a whole range of new issues
- The Principal - Agent (or Agency) Theory deals with such problems



ASSUMPTIONS

1. Individuals choose actions to maximise their own personal welfare. As a consequence, as decision-making authority is delegated by principals to agents, agents use this power to promote their own well-being. Actions that are chosen by agents to achieve this goal may or may not be in the best interest of principals.

ASSUMPTIONS

2. Individuals are assumed to be rational. Rationality implies that every individual recognises the self-interest motivations of all others so that future decisions by agents based on their own interests are anticipated and taken into account by principals. [Stackelberg game formulation]

AGENCY THEORY

- There may be informational asymmetry between the principal and the agent, and it causes costs.
- The agent's action is not observable, but the principal can invest in monitoring, which will yield him information about the agent's action. Monitoring causes costs.

AGENCY THEORY

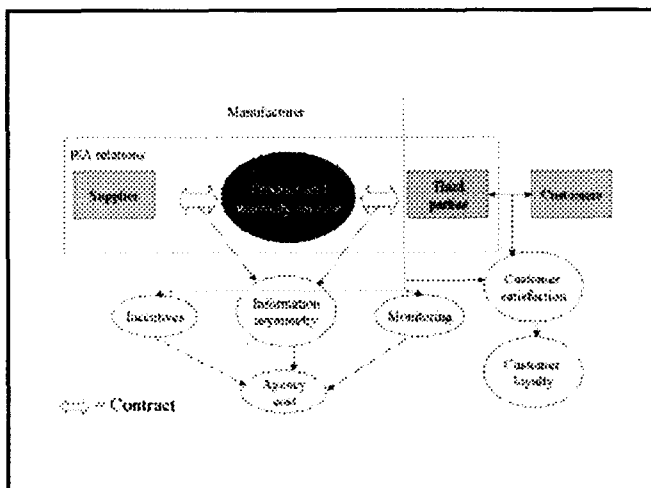
- The principal must give the agent incentives to perform in the interest of the principal.
- The central unit of the principal-agent relation is the contract. A proper contract can provide the right incentives for the agent to provide the optimal effort.

AGENCY THEORY

- The structuring, administering, and enforcing of contracts causes cost which is referred to as agency cost.
- There may be a lack of effort on the part of the agent or the agent is shirking. This is referred to as the moral hazard problem.

AGENCY THEORY

- There may be a misrepresentation of ability by the agent. This is referred to as the adverse selection problem.
- The principal and agent may have partly differing goals and risk preferences



NEW RESEARCH

- The use of mathematical models to solve different problems in Agency Theory is a very active area of research
- No study in the past dealt with issues in the context of warranty logistics.
- Scope for lot of new and challenging research.

OPERATIONAL PROBLEMS

- **Servicing strategy (repair versus replace)**
Many papers dealing with this issue but there is scope for new research
- **Spare part inventories**
Need to link to warranty claims which in turn depends on product reliability and usage