Spare Parts Management In Existence of Dynamic Installed Base

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Lifecycle of products consists of growing, maturity and decline phases. During their economic lifetimes, products require (ir)regular repair and maintenance demand, a.k.a. after-sales services, that need careful planning and organization by manufacturers. From a commercial perspective, after-sales services have higher profit margin compared to sales of main products. Therefore, Original Equipment Manufacturers (OEMs) seek to control after-sales market of their products. Demand for after-sales services is mainly drive by the number of products in use, which is known as *Installed Base* in the literature.

Operational management and planning of after-sales services is more difficult in the growth and decline phases of a product's life cycle due to nonstationary nature of demand. Specifically, in the growth phase of a product the repair and spare parts demand randomly increase with new sales of products. Such a stochastic growth of repair demand is depicted In Figure 1. In the decline phase, the size of installed base decreases over time leading to stochastically declining maintenance demand. Such a stochastically declining system is given in Figure 1.
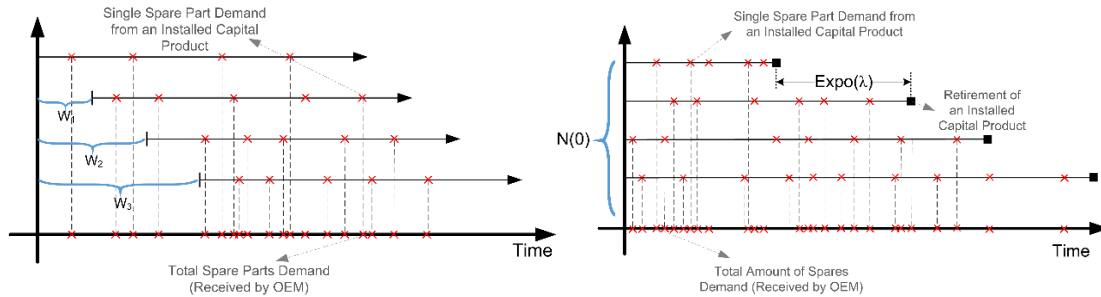

Figure 1: (Left) Growing Installed Base and Randomly Increasing Repair Demand, (Right) Declining Installed Base and Randomly Decreasing Repair Demand

In this paper, we provide an analytic characterization of time-dependent distribution of random spare parts demand distribution. This finding is useful for OEMs who seek to plan their operations and spare parts inventory for planning of their medium and long-term operations. These theoretical findings are applied to the following practical problems:

- Spare parts inventory control in case of growing and declining installed bases: Our method creates savings up-to 1%.
- Lifetime extension investment of manufacturers for their existing products: Optimum time of investment and installed base size is derived for a given investment cost.
- Remanufacturers' availability of used products.

For further details of our mathematical models, a detailed exposition of our practical findings and managerial insights we are pleased to share our paper upon request. Contact: Dr. Hekimoğlu or Dr. Karlı.