1. INTRODUCTION

The development of modern products is being decisively influenced by the application of technologies contributing towards increasing efficiency. Products are becoming complex highly-integrated systems with internal technical intelligence enabling the user to utilize them reliably, economically and successfully even in the fringe ranges of technology. As a result, business strategies are aiming more and more towards perfecting technical systems, optimizing product usage and maximizing added value over the entire life time of a product. In this context, the total management of product life cycles associated with the integration of information and communications systems is becoming a key success factor for industrial companies. [1, 2]

When manufacturing technical products, industrial corporations generally direct their strategies at economic targets. Their main business lies in developing, producing and operating products either for individual customers or for complete sectors of the market. Service and maintenance are considered by many companies to be necessary to achieve lasting business relationships with customers.

As a result, industrial manufacturing companies are concentrating their businesses more and more on engineering, assembly and services. They are following new paradigms in order to add value by customer orientation, systems management and services in the life of products. [1, 3]

Manufacturers of machines and other industrial fields such as the automobile industry have reduced their own capacities down to the main or core technologies and
final assembly. The manufacturing of parts and components is performed by suppliers or specialized companies. More and more often, profit is becoming a result of business operations in design, engineering, final assembly and service. These phases of production are the core competencies of companies which produce strong market or customer-oriented products and add value during a product's life cycle. [4]

The functionalities of products are defined in the processes of design and engineering. By assembling, maintaining and disassembling real configurations, the functionality of products and their specific or characteristic properties for usage are determined (as-built) or altered. In the usage phase, special know-how concerned with the design and characteristic properties is required, such as specific process knowledge for optimizing utilization and performance. Increasing technical complexity is promoting product-near services and manufacturer assistance. This brings about new business models for marketing only the functionality of capital-intensive products rather than selling the products themselves.

Behind these tendencies, there is a new paradigm: in order to add value and maximize utilization, products are linked in the manufacturer's network from beginning to end. For this paradigm, manufacturers need life cycle management (LCM) systems, tools and technologies. Assembly and disassembly play the key roles in life cycle management. This will be demonstrated below with a focus on high-value technical products or capital-intensive goods, such as machines for manufacturing or production purposes.

2. THE NEW PARADIGM OF LIFE CYCLE MANAGEMENT

Influenced by limited natural resources, the environment is becoming endangered due to emissions and more severe technical general conditions. Consequently, a change in strategies has taken place which takes not only economical aims but also ecological aspects into account in the design and utilization of technical products. Manufacturers have to accept more and more responsibility for the usability of their technical products and for their consequences of usage. However, many companies only follow statutory general conditions in pre-sales and after-sales in order to prevent them from losing their markets. There is a general impression that the cost-benefit ratio, especially in after-sales business, is insufficient. This also applies to industrial recycling. One main factor is the availability of actual information about the products and a lack of synergy between final assembly and after-sales operations. [3, 5, 6]

The concentration of all processes into the total life cycle of a product and the optimization of usage of each single technical product can be described as a new paradigm. Seen from a global point of view, (macro-economy), this is only logical. Seen from an operational point of view (micro-economy), it is proving difficult to initiate such strategies due to the fact that fundamental structural changes are required in products as well as in organization and production technologies and that the economic benefits involved are either uncertain or associated with risks. [3, 6]

But there is a future vision in life cycle management for optimizing the total utilization of each product and to reduce environmental impact to a minimum. In reality, the different types of products need to be taken into account. For some products, it makes economic sense to link them to the manufacturer's network as shown in Figure 1. If the