



Chapter II

Service Engineering and Extended Artefact Delivery

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Abstract

Recently, the manufacturing business is moving from an economy of scale to an economy of scope, under global competition for customers' satisfaction. Under those conditions, for companies around the world, surviving in business means to satisfy at least three challenges: granting the on-duty performance, at the point-of-service; addressing value-added intangibles; and lowering life-cycle eco impact. These changes in industry reflect on the human society; they are driven both through economical and political measures, as well as being increasingly affected by ecological constraints. Servicing and recovering become challenging demands. Besides technical aspects, the emphasis is in enabling economic profits on the supply chain (by new businesses in maintenance, remanufacturing, etc.), with account of legal acts (suppliers responsibility, landfill regulation, etc.), ruled by voluntary agreements or by compulsory targets frames. Our emphasis is on the following new paradigms: extended virtual enterprise and extended product, service engineering, life-cycle engineering, product life-cycle management, proactive maintenance, recovery, reuse, recycling, ubiquitous computing and communication, and so forth.

Introduction

The affluent society, brought forth by the industrial revolution through the economy of scale, cannot last for long, being based on the ceaseless replacement of tangible goods, manufactured by depleting the earth's resources, transformed into pollution and wastes. The eco-consistency requires new business paradigms. At this time, the measures for sustainable growth are not fully acknowledged; to address pollution and dumping minimisation is only an attempt to establish more conservative supply-chains, looking back to the thrifty society. Indeed, the earth is an almost isolated system, with limited input taken from sunlight and a limited output released into space (this is an *energy*, not an *entropy*, balance). In time, the eco-decay will limit the *industrial* growth unless upgrading ecological issues are found, nondependent on entropy (e.g., by information value-added chains, such as information communication technology [ICT] aids; or by bio-mimesis, such as restoration processes emulating the living beings).

Manufacturing and the corresponding business are moving from an economy of scale to an economy of scope, under global competition for customers' satisfaction (Michelini & Kovacs, 2004; Michelini & Razzoli, 2005). To stay in the global competition, the following main challenges should be met:

- Meet customer requirements, granting the on-duty performance, at the point-of-service.
- Diversify the offers by information which is value-added (e.g., supplying lifelong servicing).
- Manufacture products with lower life-cycle (on-duty and at dismissal) impact.

These changes in industry reflect on the human society; they are driven both through economical and political measures, as well as being increasingly affected by ecological constraints. Service, recovery, maintenance, remanufacturing, and so forth, are getting more and more important even in the profit-making procedures. These all are widely stimulated by law-enforced recovery quotas and taxation policies in commodities procurement, or by waste disposal restrictions and corresponding charges. Thereafter, the vision of technology-driven solutions will move with factual checks of their financial appropriateness. The emerging industrial fields will track reciprocal ways:

- Modify the forward value chain, expanding the intangibles delivery for more efficiently satisfying the clients' needs, while watching the eco-impacts; profitability is achieved by selling products and services.
- Resort systematically to the backward value chain, for effective utilisation of the pawned natural capital; profitability is deferred to reverse logistics activities, rewarded by taxing actual net burdens.

These added challenges have been the object of special concern, with pertinent investigations included, for example, by the IV and V EU Framework Programmes, aiming at supply

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