

# LCM – a synthesis of modern management theories<sup>1</sup>

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**Abstract.** *Life Cycle Management (LCM) draws together main concepts in the theory behind the many new management tools of the last decades – TQM, Benchmarking, Just-in-Time, Activity-Based Costing, Supply-Chain Management, Business Process Re-engineering, QFD, Core Competence, Learning Organisation, Empowerment. The presentation highlights the similarities and common focus point of these concepts and tools, and how this is linked to the concept of the “Functional Unit” in the life cycle approach. This also provides insight in the prerequisites for a productive application of the LCM concept.*

In the last two decades of the 20<sup>th</sup> century, a large number of new management theories and concept were presented. The enthusiasm with which they were presented, and the speed with which they could seem to supersede each other, might mislead the uneducated spectator to see each new theory or concept as “the management fad of the year.” Nevertheless, practically all of these concepts have gained a lasting influence on today’s business management, and each concept may be seen as another piece in the same big puzzle.

The primary challenge to the previous bureaucratic management theories came from the successful Japanese business culture, which sent shockwaves through Western business thinking in the late 1970’ies. The obvious need for re-thinking business culture opened up for a wealth of new management ideas, which can be summarized in the overall concept of “Throughput-thinking”. While the old management theories relied on a relatively *static, bureaucratic* understanding of business, in which each part of the organisation have well-defined functions that can be analysed and optimised in isolation, the new theories share a *dynamic* view of business as a series of *value-chain relations*, all with the *product* or *throughput* as a common focus.

To illustrate the radical difference in thinking, you may think of business as a *system of water pipes*, illustrating what we today have come to call the *value-chain*, flowing from raw material extraction (the source) to customer satisfaction (the sea). The pipes are characterized by stretches of large diameter as well as bottlenecks and contaminations that cause friction (see figure 1a). You may think of the cross-section of the pipes as their cost function – or if environment is the issue: as the environmental effect at any given cross-section in the value-chain. The bureaucratic management paradigm will focus on the parts where the cross-section is large, because these are seen as the most problematic and as the places where the relatively largest reductions can be made. The modern management paradigm will focus on the contaminations and the bottlenecks, in order to improve the overall throughput, and will sub-ordinate any local improvements to this overall aim. The pipe analogy in figure 1 shows us why the modern management paradigm is the more successful: If you reduce costs (or environmental effect) at X by 20% while maintaining throughput, this will of course reduce the overall burden of the value-chain, but only with this *specific* improvement (figure 1b). If, instead, you improve throughput at Y with 25%, you may reduce the necessary diameter of the *whole* pipe system with 20%, still maintaining the same output (figure 1c).

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<sup>1</sup> Presentation for the 1st International conference on life cycle management, Copenhagen, 2000.08.26-29.

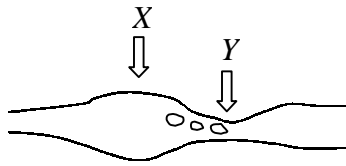


Figure 1a. The value-chain with heavy burden at X and bottleneck at Y

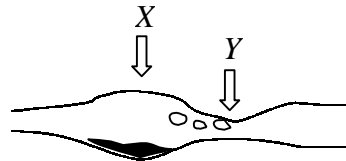


Figure 1b. Effect of reducing burden at X

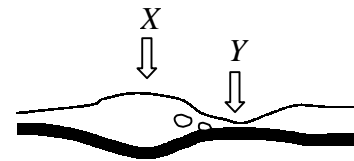
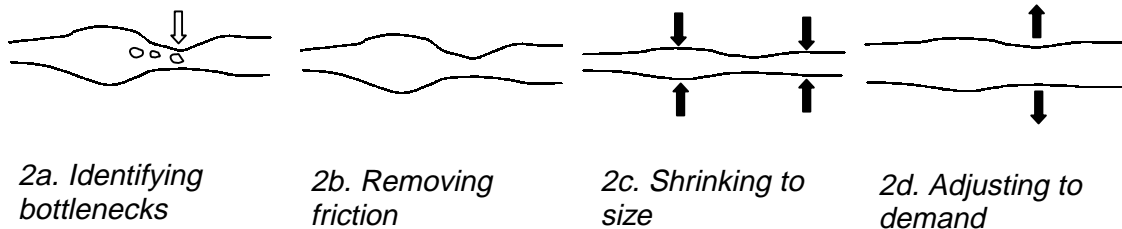


Figure 1c. Effect of increasing throughput at Y

The pipe analogy can also be used to illustrate the key elements of most modern management tools. These key elements have different names in the different management tools and theories, but in the pipe analogy, we can name them:

- a. Identify bottlenecks
- b. Remove friction
- c. Shrink to size
- d. Adjust to demand

To identify bottlenecks is what we already discussed in relation to figure 1, where the current bottleneck was identified at Y. The bottleneck is the limiting factor for the overall throughput. In business reality a bottleneck is a capacity constraint, whether physical or social. By removing friction at the bottleneck, throughput can be increased (figure 2b). Also friction may be either physical or social. Since the bottleneck determines overall throughput, overcapacity in the rest of the value chain can be removed to fit the capacity at the bottleneck, thereby saving unnecessary burdens (figure 2c). Finally, the capacity at the bottleneck may be adjusted to fit the demand of the now streamlined value-chain (figure 2d), thus replacing other, less streamlined chains.



2a. Identifying bottlenecks

2b. Removing friction

2c. Shrinking to size

2d. Adjusting to demand

Figure 2. Four key elements in modern management tools, illustrated by the water pipe analogy.

Although sharing the same paradigm, the different modern management tools and theories may appear quite disparate, due to differences in scope. Some concepts, like *Just-in-Time*, are limited to one of the four key elements (in this case: Shrink to size), while others, like *Total Quality Management*, covers the full width. Also, the theories differ in focus, typically having their starting point in one specific organisational area, such as cost (*Activity-Based Costing*), product quality (*Total Quality Management*), logistics (*Supply-Chain Management* and *Just-in-Time*), product development (*Concurrent Engineering*), or human resources (*the Learning Organisation*). In figure 3, some of the most important modern management tools have been placed in relation to their managerial and organisational scope.

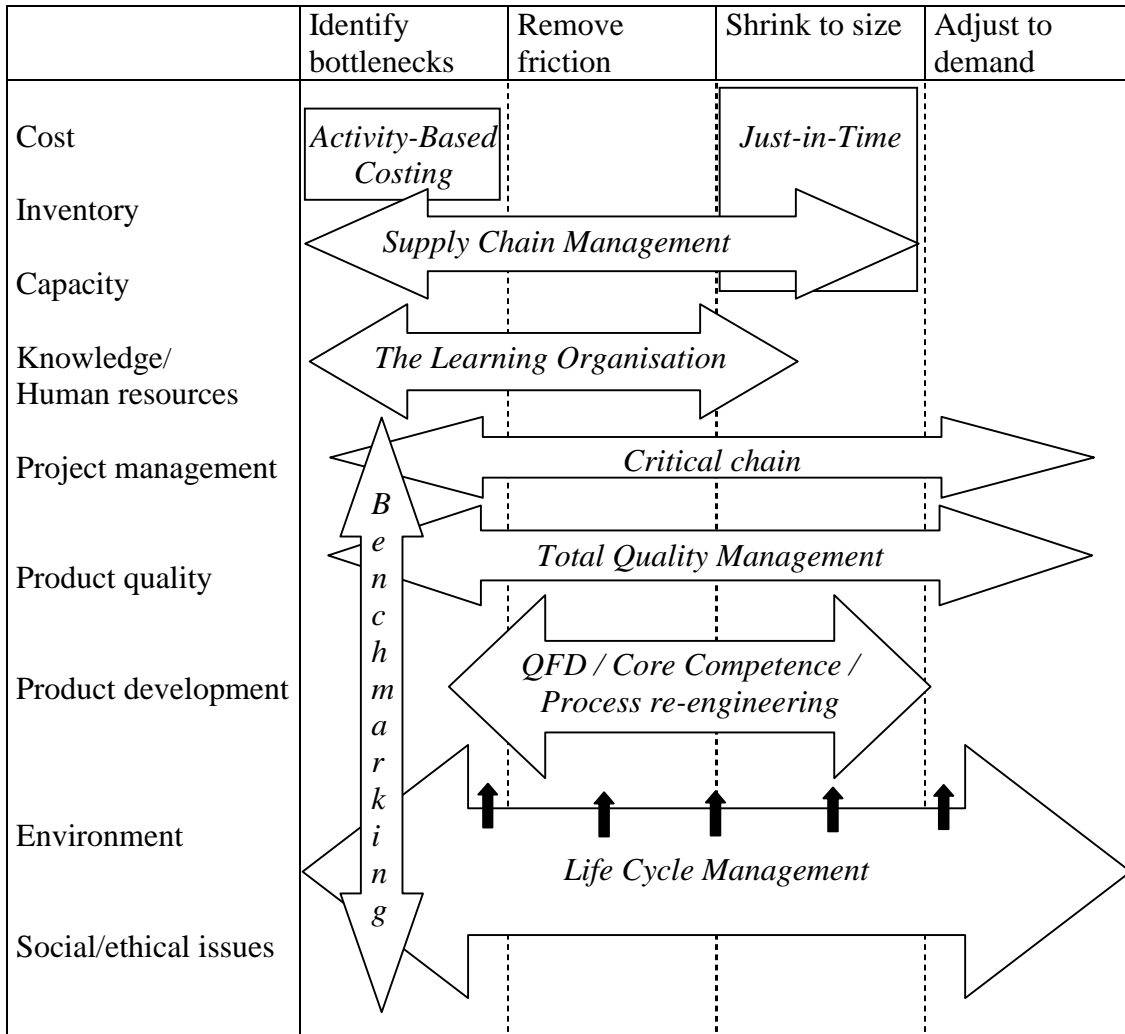


Figure 3. The managerial and organisational scope of some modern management theories and concepts.

In the same way, Life Cycle Management (LCM), or Integrated Product Management as we usually name it<sup>2</sup>, has had its historical starting point in a specific area, namely environmental management. When I, in spite of this, venture to point out LCM as having the potential to provide a synthesis of the modern management theories, this is due to its extraordinary wide scope, both in terms of organisational issues covered (from life-cycle costs to business-external social, ethical, and environmental issues) and in terms of management approach, covering all the four key elements.

LCM is a management paradigm that takes optimisation of the product chain as its fundamental viewpoint. The objective of LCM is a continuous, integrated optimisation of the economic, technological, and social aspects of products. As a management paradigm, it includes the concepts, tools and procedures to reach this objective. The original inspiration behind LCM comes from Product Life Cycle Assessment (LCA), a technique to assess the environmental impacts related to a product with the aim of minimising these impacts seen over the entire life cycle of the product, from raw

<sup>2</sup> Product orientation, chain-orientation and life cycle orientation are synonyms, since the integrated optimisation of a product must necessarily consider the entire production-consumption chain, i.e. what in environmental contexts has come to be known as “the product life cycle”. Since the term “life cycle” has other connotations in biology and business economics, we generally prefer the terms “product chain” or “value chain”, with “life cycle” as a synonym.

material extraction to final disposal. In LCM, the life cycle concept is expanded to other areas of concern, notably management of economic costs and quality.

A key concept in the life cycle approach is the *Functional Unit*; the measure of performance (in terms of customer satisfaction) of the value chain (or *product system* in life cycle terminology). By insisting on relating all other measurements to the overall throughput of the value chain, the LCM approach provides a global incentive for Throughput-thinking in all business aspects. Therefore, LCM requires:

- *Activity-Based Costing* throughout the value chain (*Life Cycle Costing*), thus relating all costs to specific products,
- *Re-engineering* of all business processes throughout the value chain, relating its *Core Competences* to the needs of the customers and the overall performance measurement (the functional unit),
- *Benchmarking* performance *per product* to identify current bottlenecks,
- Application of *Supply Chain Management* and *Just-in-Time* principles to remove unnecessary friction and limit capacity and inventory to the minimum necessary to deliver the functional unit,
- A life cycle business culture that encourages systems thinking and innovation throughout the value chain, by optimising the flow of information and the full utilization and development of human resources (applying concepts of the Learning Organisation and Empowerment),
- Use of *Quality Function Deployment* and *Concurrent Engineering* in the product development.

In terms of having the widest managerial scope, the closest parallel to LCM among the modern management tools, is *Total Quality Management*. However, as shown above, LCM expands the supplier-customer throughput-thinking of *Total Quality Management* to all business aspects, reforming and revitalising the entire organisation, throughout the value chain.

The above understanding of LCM is not a matter of course. It is well possible to apply life cycle thinking to management without integrating all the advantages of the modern management paradigm. But in that case, LCM will be an impotent instrument, merely expanding bureaucratic management to the entire value chain, leading to a focus on the heaviest burdens rather than on the bottlenecks. A parallel to this can be found in current applications of life cycle assessment (LCA), especially for identifying hot-spots or for product declarations. There is a widespread tendency to apply a bureaucratic, accountancy or engineering approach to LCA, which links processes without regard to what processes will actually be affected by potential changes. This leads to a focus on the processes that currently have the largest environmental effects, rather than on the processes that can be altered to *reduce* the overall environmental effect, much in parallel to the illustration in figure 1. Thus, in spite of its ambition to the contrary, this approach to LCA can lead to actions that are sub-optimised. Similarly, LCM can be defined and applied in a limited way, focusing on isolated technical issues at specific processes in the value chain, or it can be used in the integrated way advocated in this presentation, focusing on the bottlenecks and the relations (both technical and social) between processes and the options for optimising the entire chain.