

Chapter 2

Drivers for Change in Manufacturing

Abstract During the last two decades the markets for industrial goods have become saturated with competing alternatives. Quality and price are still important but customers' needs as well as other stakeholders' requirements have changed. This has led to a new and dramatically changed competitive situation. Flexibility and the ability to capture opportunities are important issues in the continuously changing and complex business environment in the new economy, and are often considered as basic elements of today's manufacturing strategies. Companies need to constantly define and redefine their position in the supply chain since changes and innovations are evolving faster and faster. Increased competition and complex market demands also complicate this environment. Companies are constantly considering which partners are the right ones to provide value for their stakeholders and this is demanding flexibility and agility to form and reform partnerships along the supply chain. In outsourcing and partner selection new criteria will need to be added such as the ability to create, transfer and act on new knowledge.

2.1 Globalization, Extended Enterprise, Digital Business, Innovation

Over the last two decades the markets for industrial goods have become saturated with new products and services. This could be said to have its origin after the Second World War, when there was a large demand for industrial goods. In this post war era mass manufacturing allowed products to be manufactured cheaply. This has changed over the decades and today there are arguably more products available than there is a need for. A high-quality product at a reasonable price will no longer automatically find a market. Customers' expectations have changed. Of course this has led to a new and dramatically changed competitive situation. Productivity and competitive advantage have become a major issue. The new

competitive situation has forced the development of new business operation strategies. At an Intelligent Manufacturing System (IMS) meeting in Zurich in 2007, leading academics and industrialists from around the world identified four major drivers for change [1]:

- *Globalization* of manufacturing including decisions on which manufacturing plants should go offshore and which should remain onshore.
- *Extended enterprises* and the way manufacturing organizations are increasingly becoming collaborators in a value chain.
- *Digital business* and its enormous effect on change and potential for even more change.
- *Innovation* with its ability to not only increase productivity but also enable innovative new processes for new types of products.

These forces reinforce each other and have increased the competitive pressure to improve and change and represent a business environment wherein companies have to create and implement their strategies. If we go beyond these forces, we see that increased availability and capacity to analyze and make use of data and information has been a common denominator for the changes in competitive situation and strategies.

Globalization includes two aspects: markets and manufacturing. Markets have been global for a while. Lately, manufacturing has also become global. Enterprises are moving in a multinational direction. Better information and communication technologies (ICT), and access to global markets have encouraged companies to rely on distributed networks and supply chains that are not only long, but also shared among different firms, and in which not necessarily anyone owns the whole chain [2]. The basic supply chain is rapidly evolving into what is known as a supply chain network [3]. It is especially true in a situation where flexibility is required that such networks might become crucial parts of a manufacturing strategy. Such types of networks rely heavily on knowledge sharing and represent important coordination challenges.

Extended enterprises are spread all over the world. They are located where the total conditions for operation are most favorable. The same is true for design, product development, technology development, and other crucial business processes in the enterprise. However, most favorable location for different units of the extended enterprise, depends not only on the products, customer needs, and market size, but also on the production process, factor inputs, and increasingly also a business environment that can stimulate innovation. In a virtual enterprise the modern enterprise will see its customers and suppliers as part of their own company by establishing strategic alliances. Kurihara discusses next generation manufacturing enterprises and sees support for the virtual enterprise as a key characteristic [4].

Customization is a market focus aimed at providing the customer with a product as close as possible to his point of demand as we have seen in craft manufacturing, but without losing the advantage of low cost mass production. This concept is further developed towards customer focus or customer satisfaction. The enterprise

tries to gain new market share by surpassing the customer's expectations and constantly establishing new market standards. This means excellence in all respects including zero defects, short delivery times, customization and low costs, and where employees are trained to think customer satisfaction. The global situation with the virtual or extended enterprise, extends the customer satisfaction approach beyond the customer and includes stakeholders such as suppliers, vendors, after sales, financial institutions, and even local authorities. To have the best suppliers is considered an asset. There is therefore an open competition in the marketplace not only for customers, but also for suppliers and owners [5]. This customization and agility in supply networks that we see in virtual manufacturing obviously requires integrated and flexible ICT systems between the various stakeholders. The stakeholders involved in the production, distribution, after sales, and so on will need to have effective ways of sharing data and information. However, the more intangible aspects related to the customers or market segments also need to be captured. This knowledge could be more difficult to capture and share within a virtual enterprise since it is often less explicit.

We have seen that social responsibility and environmental issues have received increased importance not only in academic and political forums, but are now also represent the basic premises in how manufacturing systems operate. This is a result of more public attention on these issues and a more common understanding of issues such as limited resources, global warming and other effects of environmental imbalances. Corporate social responsibility and sustainable manufacturing are now more than just a way for companies to respond to new regulations and standards. We see that innovation in product and process development are increasingly focusing on sustainability, and consequently also set the direction for knowledge creation in manufacturing. In the future we will see that social responsibility and sustainability are even more than today will represent significant business opportunities for manufacturing companies. We will see more business models where companies build relationships with key stakeholders and customers aiming to make a true difference when it comes to social responsibility and sustainability.

2.2 New Versus Old Economy

Hayes et al. [2] have described the evolving “new economy,” and the characteristics they identify that differentiate between the “new” versus “old” economy are summarized in Table 2.1.

Flexibility and the ability to capture opportunities are important issues in the continuously changing and complex business environment in the new economy, and are often considered as basic elements of modern manufacturing strategies. Flexibility can be in terms of products, order volumes, speed and responsiveness. In such cases a company must be able to offer a wide product range, deliver non-standard or customized products, and/or take the lead in introducing new products [2].

Table 2.1 Old economy versus new economy operations [2]

Issue	Old economy	New economy
Unit of analysis	An operating unit	A network of semi-independent players
Goal	Sell product/services	Develop ongoing relationship with customers, suppliers, and complementors
Domain of operational management (OM)	Product and processes	Systems of complementary products provided by different organizations in networks
Dominant operational management activity	Managing flows through a stable process	Managing the dynamics of highly flexible products through ever-changing processes and networks
Operational management tools	Flow analysis, scheduling, expediting, and so forth	Project management, negotiating, building consensus, designing incentives, and so forth
Primary measures of performance	Incremental unit cost and “quality” (i.e., low defects and/or high performance)	First unit cost and “acceptable quality” (i.e., low defects, ease of use, and improvability)
Competitive imperative	Achieve superiority along some valued dimension(s)	Get high volume quickly and induce others to support one’s product/network
Performance improvement	Continuous improvement using PDCA cycles and other Kaizen tools	Learning across development projects
Competition	“Prevail” through differentiation	Jointly prosper through collaboration, resulting in a dominant standard

Larger companies may make other strategic choices through volume flexibility, exploiting an ability to accelerate or decelerate production very quickly and juggle orders in order to provide unusually rapid delivery. Mass customization based on module-based manufacturing can be a strategy to gain flexibility together with volume effects [6]. To meet increased complexity and customer pressure, Original Equipment Manufacturer (OEMs) and retail companies have handed more responsibilities to their suppliers in order to maximize the efficiency of their supply chains [7]. Suppliers have a derivative demand and must understand not only the driver who ultimately buys the end product, but also how the economics of their products increase the OEMs’ profits. This requires not only knowledge transfer within a supplier’s own company, but also a collaborative supply chain approach around where knowledge is.

From Table 2.1 we might think that in the future, outsourcing and location issues are not as important as they were in the past, since we in the future will face a situation where more of the activities are performed in collaboration between independent partners. But this is not necessarily the case. Companies need to constantly define and redefine their position in the supply chain since changes and innovations are occurring faster and faster. Increased competition and complex

market demands are also substantiating this picture. The need for more flexibility requires that companies need to constantly consider whether their partners are the right ones. However, in outsourcing and partner selection, new criteria will be added such as the ability to create, transfer and act on new knowledge.

2.3 Sustainability: On Top of the Manufacturing Agenda

The over-exploitation of resources is one of the most important challenges facing us today. Increased consumption and more urban population raise environmental issues, for example issues related to water supply. Another area where change is observable is on the global climate, where the next 10 years are considered crucial for obtaining lasting emission reductions. The global energy supply consumption and supply will continue to be dominated by oil, gas and coal, but we are heading into a future decade marked by a transition towards low- carbon energy [8].

These global challenges also represent opportunities for innovation and improved technologies for recycling and better utilization of waste, energy efficiency, alternative materials, and so on. In sustainable manufacturing these challenges are basic elements of the manufacturing strategy.

Sustainability has definitely reached the strategic planning agenda in manufacturing [9]. To some extent the sustainability discussions have been focusing on quite radical changes in manufacturing and the “way of living”. The availability of scarce resources, the need for a stable and educated workforce and a healthy environment are examples of issues that have often a direct impact on a company’s productivity and the quality of products. We believe that sustainability will be an even more important premise for manufacturing in the future. This is not only because regulations and public pressure requires so, but also as a consequence of the increased direct impact of social and environmental aspects on the economic bottom line in the future.

2.4 Quality and Productivity

There are many ways companies can succeed in the market place. Garvin [10] has proposed eight dimensions or categories of quality that can serve as a guideline or framework to identify customers’ requirements in manufacturing:

- *Performance*—is about the primary operating characteristics and to which extent the product performs to its standards
- *Features*—are the additional benefits through the product
- *Reliability*—is the probability of perform well and consistently over a specified period of time

- *Durability*—is about how well the product will last with daily use, the amount of use one gets from a product before it physically deteriorates or replacement preferable
- *Conformance*—describes the degree to which physical and performance characteristics of a product match any agreed internal or external specifications such as safety regulations and laws
- *Serviceability*—is the prerequisites for speed, competency, and competence of repair, if the product is easy to service and the organization offers enough service support
- *Aesthetics*—is a dimension that could be both tangible and intangible focusing on how a product looks, feels, sounds, tastes, or smells

Perceived quality—could be even more difficult to manage as it is based on subjective assessments resulting from image, advertising, brand names, etc. that could differ between people, regions, and change over time.

Making products meet customers' requirements doesn't help much if we are unable to produce them at costs accepted by sufficient number of customers. This in turn raises productivity issues, issues that have always been a basic premise for manufacturing. Productivity is basically about how well a company or an organization transforms input into output that meets with customers' requirements. Innovations and improvements in quality and productivity will continue to be an important aspect of manufacturing. And as the market place is continuously changing with increased competition, quality- a productivity improvement will be even more important.

When trends and drivers for change in manufacturing are described they are to a large extent describing how quality and productivity could be influenced by changes in the business environments, through innovations to products, processes, services and organization.

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