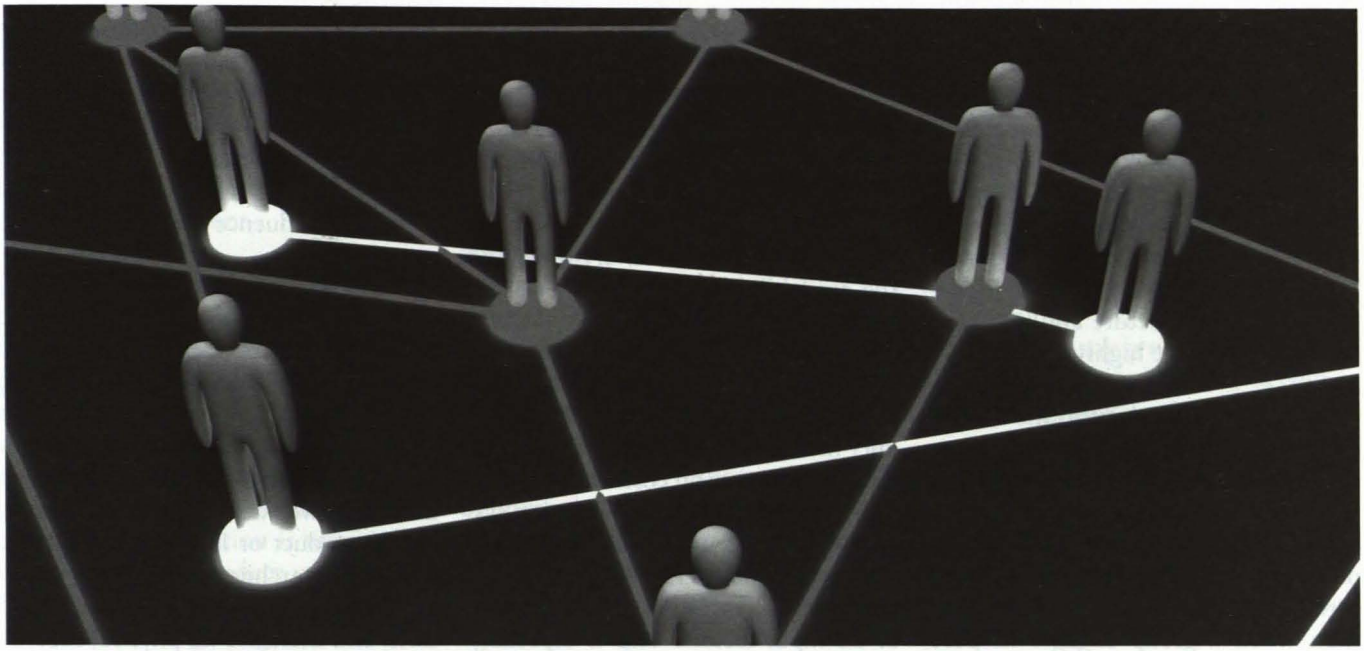

Christian Ramsauer

Today's Global Production

How Industrial Enterprises Stay Competitive[1]

In today's world economy, the trade barriers are lifting almost everywhere. Manufacturers in Western Europe and the United States are attracted by the opportunities in low-cost countries like China, Mexico and India. But the cost position of a production system is only one of several possible strategic advantages a company must choose to pursue in order to compete in a global market.

1 The material in this article comes from Christian Ramsauer, Production Strategy, TU Graz 2009.

Two hundred fifty years ago, India and China dominated world production, and manufacturers in Britain and the United States played a minor role. However, manufacturers in Britain learned lessons from India's textile makers during the British occupation of India, and the Industrial Revolution, at the end of the 18th and beginning of the 19th centuries, increased the efficiency of production in Europe and the United States. In the second half of the 20th century, industrialization reached a peak in Europe and the United States, and those regions controlled the majority of the world's land.

Before the Industrial Revolution, workers in Europe and the United States typically produced goods by hand and in single units. The Industrial Revolution introduced new systems for manufacturing, including mass production, which made it possible for more people to afford to buy products, as the principles of mass production pushed production costs down tremendously.

The four principles of the American system of manufacturing[1] – division of labor, interchangeable parts, focus on production process and use of specialized machines – changed the way the United States produced goods. The American system of manufacturing was developed further by Frederick Taylor and, later, Isaac Singer, Andrew Carnegie and Henry Ford. Frederick Taylor introduced six more principles to the American system of manufacturing – focus on low cost (high profitability), product standardization, flow principle, economy of scale, vertical integration and hierarchical-oriented organization. Mass production allowed manufacturers to produce a single product or a small variety of products at low cost.[2] After the end of the Second World War, consumers in Europe and the United States could afford to buy more products. Mass production reached its peak at that time.

Mass Customization to Satisfy Today's Customer Demand

In the last decades of the 20th century, European and American customers became more demanding and wanted to choose from a variety of products. A new system for manufacturing was needed to satisfy them, and the system of mass customization appeared

1 Cp.: Pine, B. J.: Maßgeschneiderte Massenfertigung - Neue Dimensionen im Wettbewerb, Wien 1994, page 42

2 Cp.: Hayes, R. H.; Pisano, G. P.: Beyond World-Class: The New Manufacturing Strategy, in: Harvard Business Review 1-2(1994), page 78; Drucker, P.: The Emerging Theory of Manufacturing, in: Pisano, G.; Hayes, R.: Manufacturing Renaissance, Boston 1995, page 47

in the 1980s.[3] While only one or a few products can be produced with mass production, the mass customization system of manufacturing can produce a variety of products. Mass customization systems of manufacturing use flexible production facilities instead of specialized machines. To keep costs low, products are designed with modular product architecture and manufacturing facilities are highly utilized.

Instead of vertical integration, mass customization focuses on core processes and uses the benefits of suppliers. Because production is complex when a manufacturer offers a wide variety of products, the organization is structured in teams and is less hierarchical than when a group engages in pure mass production.

Today the majority of industrially produced goods are manufactured using the principles of mass customization. The development of machinery and computer technology enables factories to produce a high variety of products within a short period of time. Sometimes products like mobile phones are manufactured for only several months before the next model is produced. This highly flexible and adaptable manufacturing system allows companies to satisfy the demand of today's customers.

Where and How to Compete - A Strategic Question

A company's production strategy must be developed hand-in-hand with its overall business strategy. The question that must be answered: Where and how to compete to win the order from the customer? The goal of a production strategy is to create and sustain a competitive production system for a company.[4] It is essential to know how the production system must perform in different categories. Some companies own outstanding products or process technologies and are competitive because of that. Other companies using the same products or process technologies as their competitors must compete in other areas. Examples of other areas in which companies might compete include product variety, quality, reliability and durability; response time to changes in demand; delivery time; and the availability of the product on the market.

Companies that cannot compete on flexibility, quality, timing or technology of the production process or product must offer low-cost production in order to compete on costs. To optimize the cost position of the production system, companies can look at two main categories: The overall equipment efficiency (OEE) measures the utilization of all input factors. This is especially important when expensive equipment is installed. The optimization of the transactional or landed costs focuses on manufacturing costs, overhead costs, transportation costs, inventory costs and country-specific taxation and custom duties. The costs involve all costs from the place of manufacturing to the marketplace where the products are sold to the final customer.

It has to be clear up front where and how to compete with production strategy. When the required performance of the production system in different categories is set to achieve the required competitiveness of the product on the market, manufacturers can design production processes accordingly.

To measure and monitor the performance of the production system, key performance indicators must be defined. These indicators must be visualized for the management all the way down to the shop floor in order to make sure that everybody in the company knows the competitiveness target and the actual performance of the production.

Product Development Enables Production Strategy

The way products are developed strongly influences production strategy. Product architecture and design will determine the opportunities for sourcing, the supply chain, the network structure of worldwide plants, the flexibility of order fulfillment and product variety and can make a difference when competing on the market. The majority of a product's costs are determined by product development. Once a product's architecture and design have been defined, production and purchasing have a limited influence on the product's costs.[5]

There are two distinctive characteristics of a product's architecture with consequences for production and sourcing: Modularity and integrality. Modular architecture means that parts are grouped in a module, and several modules with well-defined interfaces result in the product or in another module. Integrated architecture means that no interfaces between groups of parts exist, and therefore no physical subsystems of the product can be defined.

Most of today's production systems need to react quickly to market changes and offer a variety of products in a short period of time in order to be competitive. Modular product architecture is a prerequisite for today's mass customization systems of manufacturing. Product platform strategies allow companies to produce product families within a highly flexible production system at low cost.

Process Architecture of Production Systems

After determining the concept and design of the product and the required performance of the production system in all categories, a company can then discuss the options for manufacturing. Generally, factories use flow production for high-volume projects and job-shop production for low-volume projects. Today's industrial manufacturers tend to produce a high volume of a wide variety of products using the principles of mass customization. For this kind of production, the process architecture can be defined by several characteristics.

First, the process architecture must handle a variety of products and capa-

3 Cp.: Pine, B.: Mass Customization – The New Frontier in Business Competition, Boston 1993, page 33

4 Cp.: Peters, T.: Thriving on Chaos – Handbook for a Management Revolution, New York 1987, pages 194-210

5 Cp.: Anderson, D.; Pine II, J.: Agile Product Development for Mass Customization – How to Develop and Deliver Products for Mass Customization, Niche Markets, JIT, Build-to-Order and Flexible Manufacturing, Chicago 1997, page 133

city and react to order changes. Product variety helps reduce the investment risk, ensures that a company can satisfy customer needs and results in a low cost position compared with non-flexible production due to the high level of utilization of the plant.

The ability to make changes to orders provides an additional value to customers. Second, the technology approach of the production process can make the significant difference of how a production system stacks up against the competition by resulting in special product features or a unique cost position. Third, automation is required to ensure constant product quality and fast delivery at low cost, especially in countries with high wages. Fourth, the ability to quickly ramp up new production processes allows a company to grab unique market opportunities with an adequate cost position when producing new products or products with new features.

Sourcing Strategy

Companies using suppliers for sourcing parts, equipment or other services know that they depend on their supplier's capacity or knowledge. But in order to be competitive, it is necessary for firms to also use the technological edge or operational advantages of suppliers. Japanese companies tend to purchase a large number of their product components from suppliers and often develop their production equipment to produce the remaining components by themselves. In contrast, U.S. companies generally produce a larger portion of their product components in-house and purchase the necessary production equipment from suppliers.[6] It's important for companies to determine what their core manufacturing processes are, and what is better to source from a supplier. Once that is clear, companies can focus on how to increase the performance of the production processes through additional investment and innovation. Often companies do not have a strategic sourcing process in place and make short-term decisions based on sourcing from suppliers.

Reasoning for Changing the Location of Production

The location of production is a strategic decision involving long-term investments. Often, companies need a global network of dependent factories to offer products for customers globally.

In the last 25 years, the scope and the dynamic of a company's relevant environment have increased. Worldwide economic growth offers tremendous opportunities in certain countries. For example, China's exports increased by more than 20% and imports increased by almost 30% in the year 2008. The world's merchandise exports and foreign direct investments are again rapidly growing after the recent economic crises. Regional trade agreements like EU, NAFTA, Mercosur and AFTA, mostly established in the early 1990s, have changed the rules of international business and opened up new opportunities for global production. New customers in developing countries are now within the reach of Western companies and also within their competition's reach.

Innovation in transportation technology has significantly reduced logistics costs.[7] Modern ships with automated systems, reliable and efficient engines and modern ports and well-packed planes with jet engines and modern airports have lowered transportation costs in the last decades. Costs for sea freight were 10 times higher 60 years ago and costs for air freight were 10 times higher 40 years ago. At the same time, innovation in information technology has changed the world.

In the 1990s, the Internet arrived in the U.S., then grew quickly in Europe and spread through the rest of the world, connecting people and making it possible to cheaply transfer huge amounts of data for production and other needs. Unified standards all over the world for everything from transportation containers to software interfaces and financial institutions have supported globalization.

Investing in foreign countries is risky and the political stability and the quality of institutions and policies can be critical. Taxes, tariffs and non-tariff barriers between countries can enforce or hinder business. Market liberalization and new regulations to foster private competition in formerly-closed economies like China can open up new opportunities. But manufacturers in countries that pay very low wages often have to deal with a low level of education among employees.

Model for Optimal Production Network

The following five steps can help companies find candidates for future global production sites: First, generate a list of potential site locations by analyzing the industry, including development of market prices and behavior of competitors. Second, narrow the list by checking potential production sites for proximity to future markets. Third, evaluate the infrastructure of those countries, including the quality of transportation infrastructure, communications infrastructure and official authority infrastructure. Fourth, evaluate country-specific risks. Finally, narrow the list further by evaluating and ranking potential production network structures in the countries that remain.

To find the optimal global production network structure and best cost position often requires building simulation models featuring the location of the production processes, the required suppliers and the customers. This is a complex process and before time-consuming data are collected to feed the model, the type of network and the options should be limited. During experimentation, the model might need to be rebuilt as lessons are learned.[8] The simulation process should produce three to five favorable supply chain architectures, then the necessary costs for transferring the existing production situation to the "greenfield" solutions must be added. This can change the picture and require a new search for the optimal "brownfield" solution. Sometimes

6 Cp.: Fine, C. H.; Whitney, D. E.: Is the Make-Buy Process a Core Competence? MIT working paper, Boston 2/1996, page 4

7 Cp.: Abele, E.; Meyer, T.; Näher, U.; Strube, G.; Sykes, R.: Global Production – A Handbook for Strategy and Implementation, Berlin Heidelberg 2008, page 11

8 Cp.: Thomke, S.: Experimentation Matters – Unlocking the Potential of New Technologies for Innovation, Boston 2003, page 219

Priv.-Doz.
Dipl.-Ing. Dr.techn.
Christian Ramsauer
Managing Director, Active Equity Management GmbH, Munich

the shutdown costs for existing sites are enormous and a firm might not be able to completely shut down an existing plant due to high severance payments or remediation costs of contaminated plants. A speedy implementation of the new production plan is as crucial to keeping the investment costs on budget as it is with other mega construction projects like building bridges. The right legal structure is also necessary to establish a successful new entity in another country.

Changing of Behaviour of Employees

For 200 years, the hierarchical and strictly cost-focused system of mass production dominated the role of employees in production. This system created extremely passive production managers in the boardroom and monotonous work for blue-collar and white-collar workers. "For many decades, a career in production has been considered to be a devotional job with a fast-paced routine, a job that offers little chance of reaching the top level in a company, but plenty of opportunities to get lost in details".[9] Production was not the first choice for managers with high potential.

The recent rise of mass customization systems of manufacturing requires a new set of skills for production managers and also for blue-collar and white-collar workers. Working in teams removes monotonous work on the shop floor and in offices. High performance is demanded in areas of competition like technology and product variety as well as cost, unlike mass production, which is mostly concerned with cost.
Managers drive benchmarking within and outside the company and introduce experimentation with "learning-by-doing" attitudes in order to increase the performance of the processes. Production managers are usually more self-confident than their colleagues from pure mass production and play a more active role in board meetings. A globalized network of mass customization production plants create new challenges for production management and attract employees with high potential. The mixture of local and international management connecting with modern communication and site visits creates a vibrant and interesting multicultural workplace.

Conclusion

Competitive global production is more then just moving a plant or parts of a plant to a low cost location. The production strategy needs to be developed hand-in-hand with the overall business strategy. This is the starting point of every successful production, regardless of whether production is done at one site or within a global network of sites. Product development - the R&D strategy - strongly influences the options for production strategy and therefore the sourcing strategy and the architecture of a production system. Today's global production requires a new type of employee, substituting the "Taylor-minded" employees of the mass production age.

9 Clark, K. B.: Competing Through Manufacturing and the New Manufacturing Paradigm: Is Manufacturing Strategy Passe? in: Production and Operations Management, 5 (1996)1, page 44

Author:

Christian Ramsauer is a Managing Director of Active Equity Management GmbH, a private equity company working exclusively with private investors. The company focuses on medium-sized industrial companies providing necessary funds to acquire majority shares and providing operative management to turn around or expand the business activities. He is also a lecturer at the Frank Stronach Institute and teaches a production strategies course in the masters program in Production Science and Management.

He was assistant professor at the Institute of Industrial Management and Innovation Research at Graz University of Technology and spent two years conducting research on product and process development as a visiting scholar at the Harvard Business School in Boston, Massachusetts, working with Harvard professor Stefan H. Thomke. He was several years with McKinsey & Company Germany, focusing on product and process development and on strategic issues, mainly with automotive and steel companies in Europe, the US and Mexico. As shareholder and CEO of UNTHA Shredding Technology he developed his company into a fast-growing, international and profitable enterprise.

He has been invited to lecture at numerous organizations, including the World Bank in Washington, D.C. He has written several publications, including two books Dezentrale PPS-Systeme (1997) and Production Strategy – Mastering the Dynamics of Globalization (2009).

Christian Ramsauer holds a Dipl.-Ing. degree and a Dr.techn. degree from the School of Mechanical Engineering at Graz University of Technology. In 2009 he finished the habilitation in production management. Recently, he was appointed as full professor starting in October 2011 at the Institute of Industrial Management and Innovation Research and as curator at the Institute of Production Science and Management at Graz University of Technology.