Ultra-manufacturing: Driving profitability with information technology

Introduction
While the particular issues faced by manufacturers vary from geography to geography, manufacturers worldwide can learn from the challenges and strategic changes being contemplated by their Japanese peers. Faced with declining profits in areas of traditional strength, Japanese manufacturers are urged to consider a new approach to manufacturing—both as a business entity and as a process.

The manufacturing arena consists of three main areas:

• Component processing
• Single-use product assembly
• Integration of converged products.

Of these areas, Japanese manufacturers have traditionally been strongest in single-use product assembly. However, in recent years, the Japanese manufacturing industry has seen little or no profitability in product assembly. This has forced many Japanese manufacturers to consider a complete overhaul of their current production processes.
Component processing and integration of converged products can offer future promise for the Japanese manufacturing industry, but before that promise can be realized, manufacturers must reconcile a number of key issues. In the area of component processing, manufacturers must develop a system for capturing, sharing, and archiving their intellectual property (IP) to capitalize on the unique skills and experience, or “tacit knowledge,” of employees. To move toward integration of converged products, Japanese manufacturers must not only realize their own core competency in developing converged products, but also leverage their capabilities to forge global alliances.

The ability to elevate the individual knowledge and skills of technologists to organizational knowledge that can be shared across the company will be key to surmounting these obstacles. The use of information technology (IT), such as knowledge management and the Internet, will aid in the realization of these goals. However, to achieve their desired profit increases while providing customers with the level of value they require, Japanese manufacturers must rethink what they manufacture (business type), as well as how they manufacture it (business process).

Until now, supply chain management (SCM) has been the most-effective business initiative in targeting this process. An ultra-manufacturing strategy includes both process and IT to address the key issues that Japanese manufacturers face as they drive internal efforts to fuel profitability.
By the end of the 1990s, the entire Japanese economy was losing its foothold; consequently, the Japanese manufacturing industry was losing heart. Uncertainty in the economy at large triggered the emergence of several issues that were unique to the Japanese manufacturing sector. Price wars with Southeast Asia, China, Taiwan and others made profitability in the manufacturing industry extremely difficult.

Another issue, one that could affect the financial stability of Japanese manufacturers regardless of company size, is that Japanese manufacturers’ current technical competence depends heavily on the personal skills, or tacit knowledge, of their employees on the production line. Presently, there is no process for transferring these skills from more-experienced workers to new recruits. If these exclusive skills are allowed to diminish—and eventually disappear—as the decade progresses, Japanese manufacturers will face grave impacts to efficiency and profitability.

In Figure 1, the horizontal axis represents the component processing, single-use product assembly and integration of converged products areas of Japanese manufacturing; and the vertical axis represents the level of added value.
In single-use product assembly, subassembled goods and finished goods products—including single-function appliances such as televisions, washing machines and refrigerators—are manufactured by assembling parts and modules. While this is an area where Japanese manufacturers have traditionally shown strength, the technologies involved are not new. Competition centers on knowledge and experience in product development and manufacturing techniques, producing high-quality products while reducing manufacturing costs.

In an era of growing IT and networking capabilities, integration of converged products is an area of increasing focus. Typical examples of converged products are network-enabled products, like Internet televisions; and converged products, such as a combination video camera and player. A new level of expertise in the area of integration will be a critical success factor for manufacturers of converged products, to effectively integrate their exclusive technology and knowledge with that of other companies.

From an added-value perspective, Japanese manufacturers score highest in single-use product assembly and lower in integration of converged products and component processing. The resulting bell curve resembles a frown (see Figure 1). Due to increasing pressure to lower costs, product assembly has significantly decreased in profitability. Therefore, many companies are transferring manufacturing to sites outside of Japan where both labor expenses and taxes are lower, which has led to deindustrialization.

As seen in Figure 1, component processing and integration of converged products are promising areas for added value in manufacturing, resulting in a curve where both ends are tilted upward like a smile. For manufacturers who want to increase profitability, a shift in business focus may be in order. Both the Japanese manufacturing industry, as a whole, and individual manufacturers must decide which manufacturing style they will adopt.
Japanese manufacturers draw their strength in component processing from a long tradition of individual masters: company technologists and technicians who have years of experience working with the almost imperceptible details and nuances of production. The problem is that there are few successors in line to these “masters” when they retire or move to new roles. The technology-related knowledge, techniques and skills that belong to each employee are tacit, or individually-owned. However, with a focused effort on knowledge management and teamwork, such knowledge can be transformed into “organizational knowledge,” becoming the company’s IP. The continued success of Japanese manufacturers depends on “technology + IP:” a coupling of exclusive manufacturing or product technologies with IP.

IP is not limited to the knowledge and skills of technologists. For example, in the case of a semiconductor manufacturer, IP can include manufacturing methodology, circuit and logic libraries, test patterns of experimental results, characteristic values, and so on. If an ample menu of IP is available across the company, an applicable “recipe” can be provided quickly when employees receive orders and customers need advice. When a full menu of IP is in place and accessible, it creates a continuous flow of added value for the company.

Until now, the individual knowledge of technological masters within each company has supported technology in the Japanese manufacturing industry. But, the usefulness of this experience or “know-how” is limited if it resides in the minds of only a few people. To be of exponential use to the company, this accumulated knowledge must be organized logically and objectively and built for reuse so that all employees can easily understand it. The result could be the creation of a highly skilled workforce to replace the diminishing numbers of masters on the production line.
Japanese manufacturers trail Western countries in integration of converged products. One reason for this is that Japanese manufacturing is traditionally weak in the creation of product concepts. While these manufacturers can typically out-manufacture competitors after new, converged products are conceived, they are not as fruitful in conceptualizing new product ideas. The ability to integrate multiple product functions and create solutions under a clear product concept is imperative in the development of converged products.

A good product concept can increase the attractiveness of the product to the customer. Manufacturers must know:

- How the product will be used
- How the product will change the habits of users
- Which product function will be most attractive to customers
- What the end-product will look like.

Converged and network-enabled products are more difficult to conceptualize. However, compared to single-use products, much more of their value is derived from their conception than is realized by their production. In the case of converged products, the concept must be supported by a standard architecture, a consideration with which Japanese manufacturers have little experience. They have focused more of their efforts on manufacturing, and not enough on the ability to conceptualize new ideas. They are currently paying the price for their oversight.

In the world of converged products, end-product attractiveness is created by combining products or solutions with different functions into one device. The synergy of the combined products and solutions is what creates value. Likewise, when companies with different competencies combine to form alliances, they can enhance their mutual strengths. As contributing partners within these alliances, it is necessary for Japanese manufacturers to clarify and refine their own core competencies.

A core competency is an integrated form of intellectual capital (IC). Making use of knowledge management and practicing teamwork are key success factors. Identifying core competencies allows management to better focus on and prioritize business opportunities, and can help strengthen brand value, as well as investor relations. Most importantly, however, a well-established and well-defined core competency is the strongest weapon that a company can have when forming alliances. Without a definite core competency, a manufacturer will be shut out from possible business partnerships in an industry where network-enabled and converged products—and requisite business relationships—dominate.
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Today, a single manufacturer cannot cover all areas of technology alone. Partnerships are becoming more and more important, providing channels for outsourcing and original equipment manufacturing (OEM). For many Japanese people, the concept of partnership closely resembles the image of a friendly group or club. But partnership in this context represents a legal relationship where companies mutually disclose technologies and IP, operate under mutually agreed-upon business rules and mutually share whatever profits are earned. Accordingly, learning and mastering the art of establishing alliances will be an inevitable future reality for companies that intend to manufacture network-enabled and converged products. In addition, as manufacturers consider mutual disclosure, knowledge of risk-management and crisis-management practices may inevitably become determinants of success.

Manufacturers of network-enabled products and converged products can align along two axes: the power axis focuses on product manufacturing itself; the intellect axis emphasizes product planning and development. The latter is typically affordable even in small companies, and, in fact, some venture companies in overseas countries specialize in intellect.

It might sound paradoxical, but it may be necessary to go outside of Japan, forging strong international alliances, to revitalize Japanese manufacturing. Using global IT should be a standard practice when forming domestic or international alliances. In any case, it is important to establish a core competency and to transform the business structure to readily lend itself to networking and forming alliances.
An e-business is a business that is formed by integrating a core business competency with the extensive reach and high accessibility of the Internet. This can bring unexpected business opportunities. With the help of Internet technology, a core competency can reach a heightened level of speed and efficiency, perhaps becoming an exclusive service or solution that the manufacturer can market to other companies.

In an e-business, a core business process is reinvented to take advantage of the possibilities offered by the Internet, including the creation of new service and solution applications. To help ensure that e-business services are of value to the customer, it is important to track experiences electronically. This information can be transformed into organizational knowledge that can be leveraged in the next phase of product development or for process improvement. This is the e-business cycle.

Some manufacturers may shift from product- or manufacturing-focused business models to a services focus. But the eventuality of manufacturing companies entering the service industry, or industries such as finance or real estate, seems doubtful. Manufacturing is the fundamental business of manufacturing companies. To truly revitalize the industry, Japanese manufacturers should seek inspiration for future development within their core competencies, with services that complement their products.
Traditionally, technology development has advanced the manufacturing industry. The same holds true for the foreseeable future: it is inevitable that human beings will continue to pursue technological development well beyond the IT era. But technologists and engineers who work in development and manufacturing facilities must develop a new mindset about their knowledge and skills. In essence, engineers must establish a core competency within their individual skill set.

Each person should have an area of specialization in which he or she is an expert, instead of having partial knowledge and skills in various areas. As Peter F. Drucker, a U.S. economist, advised in his book, *The Essential Drucker on Individuals: To Perform, To Contribute and To Achieve*: It will be more effective in the future to cast the anchor of “knowledge” in strong points and explore the knowledge than to make efforts to cover weak points. Knowledge management and teamwork promote complementary knowledge sharing, where experts team together and rely on one another to shed light on areas for other individuals. Each engineer therefore is both a specialist and a contributing team member.

If a company emphasizes individual and organizational improvement through knowledge sharing and teaming, it will naturally boost the morale of each engineer, resulting in a vital corporate culture. It is this kind of environment that has the motivational power to promote technological development.
In the past, manufacturing companies depended on individual knowledge and technological skills of employees. However, these companies must commit to building the strategy and architecture necessary to organize and integrate individual knowledge across the company into organizational knowledge. They must learn to extract core competencies from organizational knowledge and use core competencies as leverage in forging alliances.

Whether discussing manufacturing as a business or as a process, the key conditions for success are the same: Japanese manufacturers should utilize IT and network capabilities to improve speed and productivity. Ultra-manufacturing is a system-oriented, customer-oriented and globally-oriented new manufacturing style, and a key survival strategy, not only for Japanese manufacturers, but for manufacturers around the world.

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