

# Manufacturing Management: The Work Force of the Future

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In the year 2005, manufacturing will cease to exist as a world apart from product conception, design, delivery, and disposal. Manufacturing – the people, the systems, and the knowledge base – will be fully integrated into a seamless process of value creation. Accordingly, manufacturing workers will be virtually indistinguishable from other participants in that process. They will share with other employees a dedication to performance improvement – incremental and transformative – and to learning and change. In return, manufacturing managers, engineers, and workers will expect employers to provide them with greatly expanded opportunities to refresh and expand their skills.

This picture of the world of manufacturing 10 years hence grew out of a critical insight gained early in a meeting of manufacturing leaders in Troutbeck, New York: contrary to many prognostications, the factory of the future will not be a „lights out“ monument to the triumph of technology over human beings. Instead it will be a system that thrives on a vital and highly complementary relationship between technology and human beings. Instead of a zero-sum relationship between technical and social systems, where every advance in technology would require a reduction in human input and human importance, colloquium participants quickly agreed that a positive-sum relationship would emerge.

While the colloquium participants devoted considerable energy to debating the future direction of developments in supply chain management, environmentally sound manufacturing, and product design, the discussion kept returning to the importance of developing a positive-sum, complementary relationship between people and technology. The executives foresaw four major elements as essential to successful manufacturing management in the year 2005: steady increases in the volume and application of process knowledge; learning as a core competence; a committed work force; and change as a stimulus to growth.

In this article, we will explore each of these major elements, illuminating key points with comments and examples from the colloquium discussions. We will also sketch a road map of the changes we can expect by the year 2005.

## **Steady Increases in Process Knowledge**

Process knowledge was referred to early and often as an essential support to the coming generation of manufacturing firms. But what is process knowledge? A pair of working definitions emerged from workshop discussions. First, process knowledge means the organization's understanding of core manufacturing processes, ranging from the highly practical to the theoretical. Process knowledge can grow over time or it can be depleted through inattention to retirements or employee turnover. It can also be superseded by developments on the scientific front. Process knowledge of core manufacturing processes – be they surface-mount assembly or blast furnace operation – is a critical strategic asset that must be recognized, managed, nourished, and renewed.

Stephen Holmes, Corporate Vice President, Technology Development and Advanced Manufacturing, Whirlpool, made this point emphatically: „There's no way in the world that management can do problem-solving and process improvement on all those thousands of processes [that make up manufacturing]. Which means your work force has to be empowered, knowledgeable, and given the opportunity to solve problems – every worker a process thinker and process improver.“

Jack Shilling, Senior Vice President-Technical, of Allegheny Ludlum, cited a specific example of how his company has changed its investment strategy regarding process knowledge: „Fifty percent of our R&D budget goes into process knowledge development right now... 10 or 15 years ago, it was 80 to 90 percent new product development... and only 10 percent process.“

The second working definition of process knowledge expanded the conventional definition of processes as technical or purely physical activities to include the social activities of production. For example, Joseph Keating, Merck's Senior Vice President, Quality and Commercial Affairs, explained that leadership and personal effectiveness are deemed critical elements of process knowledge in his company. Merck's belief in a social dimension to process knowledge is backed up with cash: the company has dedicated itself to providing training on social processes to 10,000 employees. Without the confidence to express their views on how to improve the manufacturing process, production workers' process knowledge would forever remain a hidden and underutilized organizational asset.

## **Learning as a Core Competence**

Most manufacturing companies – and certainly those represented in our colloquium – have abandoned a blind faith in technology as the only key to competitive survival. They have not abandoned technology, by any means.

But they are seeking to find more effective ways to balance investments in people and technology.

For example, virtually everyone agreed that technology confers agility and speed. But that agility and speed, in turn, require a work force with greater latitude to act and therefore more skills and a greater understanding of the company's overall direction.

This struggle to leverage value out of investments in people and technology has led to a focus on learning. Hewlett-Packard, long recognized as a leader in both product innovation and employee development, exemplifies the critical role of learning in value creation. TOM Order Fulfillment Manufacturing Manager Dan Bechtel, in describing a wide series of reengineering efforts at HP, put it succinctly: „We really believe that the organizations that learn the fastest are going to be the most successful. Being able to change continuously is the key. And, of course, embedded in the idea of change is this idea of a learning organization.“

In a manufacturing environment, learning cannot be a vague or amorphous concept. Anything that doesn't add value or reduce cost tends to get swept aside pretty quickly. So how are investments in individual and organizational learning justified?

At Motorola, which annually makes enormous investments in product and process development, learning is held to be critical to present as well as to future performance. In addition to its continued support of Motorola University and its grants to research programs worldwide, the company invests in individual and team learning in all of its manufacturing facilities. According to Sherita Ceasar, Director of Manufacturing Operations, Motorola Paging Products Group, teaming and learning support systems are essential to achieving mass customization – an approach to manufacturing that has had very tangible payoffs for the company in the booming pager industry.

Sony's Tony Abbot, Senior Vice President, Pittsburgh Manufacturing Center, linked learning and business performance this way: „The manufacturing environment is going to be digital. That feeds back into the need for multiskilling in the work force. And that requires a training revolution.“ He added that, „The surviving manufacturer must recognize the need to train, retrain, and update continuously. It's what the CEO's job should be – continually improving the skill base of the organization.“

## **A Committed Work Force**

In order to achieve and sustain breakthroughs in performance, it is now widely recognized that organizations need to engage employees' minds and hearts, not just their hands. But, as many manufacturing leaders conceded, commitment is a two-way street. Stephen Holmes, Corporate Vice President, Technology Development and Advanced Manufacturing, Whirlpool, put it best when he commented that, „Management has to let go of responsibilities. And the work force has to be willing to pick them up ....“ Put differently, commitment doesn't happen automatically in response to the offer of training or the formation of work teams. As Sony and other firms that have experimented with team-based production have found out, employees want to be able to put their skills to work in meaningful ways – and to share in the benefits they accrue through self-direction.

According to Chrysler's Craig Corrington, Manager of the Warren Stamping Plant, when CEO Robert Eaton appealed to company employees to commit themselves to aggressive objectives, he explicitly noted his own commitment to providing leadership based on clear goals and open communication. Acknowledging the importance of reciprocal commitments, Hillary Thomas, a member of the United Auto Workers and Training Coordinator at Chrysler's Warren Stamping Plant, talked about the concerns of hourly workers: „Our hourly people are concerned about their production numbers. And, they're very concerned about the quality of what goes out the door.“

The manufacturing managers agreed on a set of expectations for the next century: Trust and respect going both ways. Breadth – a bigger tool kit, including entrepreneurial skills among workers. And shared knowledge – which implies a continuing commitment to learning.

## **Change as a Stimulus to Growth**

Each participant in the Manufacturing Management Colloquium acknowledged that he or she faced enormous change. Together, they concluded that the transformations they predict will dramatically affect their companies' financial structure and access to capital. Furthermore, the work force they envision can come about only as a result of material changes in labor law. And the reconfiguration of manufacturing into smaller business units raises ownership

and intellectual property issues. The changes in education represent another direction for investigation.

In addition, all participants yearned for a way of thinking about change that involved growth – growth in volume, in revenues and profits, and in jobs, especially high-paying manufacturing jobs. Virtually all the companies represented were weary of exercises in reengineering that focused solely on cost reduction and downsizing. Keying in on the desire for growth through change, several participants hypothesized that an organization's „capacity to change“ ought to be considered a critical feature in its ability to prosper in an era of high-velocity change.

In a turbulent environment, it is the capacity for change that distinguishes those who prosper from those who flounder. The capacity for change can be compared to an athlete's lung capacity. For example, a runner's lung capacity determines how much oxygen gets transported in the blood to revitalize muscle tissue to exert motion, to endure hardship and changing conditions, and to win. Lung capacity isn't evident in the runner's stride. But without it, without the ability to make the critical transformations, to oxygenate the blood, to fuel the motion, the runner cramps a muscle, his objective is unfulfilled, the race is lost.

What would be an organization's lung capacity? What could a manufacturing firm do to increase its capacity for change? David Kirk, Director of Manufacturing, Refrigerator Division, Copeland Corporation, offered a valuable insight when he suggested that mastery over change needs to be a fundamental goal of the manufacturing firm: „Our objective is getting every employee to be a part of the business, to understand not only the job he or she is doing but what the whole factory is doing, what the whole company is doing – giving them a global perspective.“ Chrysler's Craig Corrington extended the idea to include trust as an essential ingredient in increasing employees' readiness to accept – and then to initiate – change: „There are three levels (of trust). Predictability – knowing what someone will do. Delivery – knowing that if someone commits to something, they'll do it. And care – sincere, proactive, mutual trust. That's the level of trust that opens up all sorts of possibilities.“

Framed in these terms, the „capacity to change“ in an individual or in an organization is all about gaining mastery over change. Not just adapting to change in response to a new rule or a new piece of equipment, and not just change for its own sake, but active mastery over change. This means becoming comfortable with flux and transformation, rather than fearful of it. In sum, mastery over change becomes a stimulus to growth because the entire work force is dedicated to expanding and applying its process knowledge.

### **The Best of the Best in 2005**

In the year 2005, the pace-setting manufacturing firms will have become masters of change – in large measure because they will be driving change at all levels. They will define the state of the art in process technology and manufacturing management because they will have found (or, more likely, they will have invented) the most effective means for harnessing the creative energies of all employees. More emphatically, they will have established a positive-sum relationship between people and technology: a relationship in which each stimulates the other – and from which greater value is the consistent outcome.

### **How to Recognize a Best-of-the-Best Manufacturing Company in 2005**

Ten years from now, great manufacturing companies will:...

• *Integrate seamlessly with suppliers and customers*

• *Move information and production quickly around the globe, leveraging technology and capacity*

• *Understand their processes deeply and manufacture with virtually no disruptions*

• *Design and manufacture with a full understanding of the cost savings and environmental benefits of eliminating waste and pollution*

• *Grow and compete on learning and knowledge as well as speed, quality, and price*

• *Employee a multiskilled, continuously trained, highly committed workforce*

Does this sound Utopian? Perhaps. Nearly 200 years ago, when Eli Whitney's New Haven, Connecticut, musket factory began turning out guns with interchangeable parts, the emphasis in manufacturing swung from the worker to the process and the machine. In 1995, the Best-of-the-Best executives – many trained as engineers – unanimously returned to human issues as the greatest challenge for manufacturers going into the next century.

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