DARE TO CONTROL WITHOUT WORK ORDERS AND PURCHASE ORDERS
By Bill Sandras

As lot sizes decrease, the volume of paper work and the number of transactions can increase exponentially in a JIT* environment—unless we make changes to our planning as well as our manufacturing processes. For example, if we reduce lot sizes from ten to a single piece flow we could easily have ten times the number of work orders, labor collection transactions, stock picks, purchase orders, stock receipts, accounts payable transactions, etc. The big question quickly becomes "How do we keep our systems from being a constraint to shorter manufacturing lead times?"

(*Note: JIT has many other names. Someone is constantly trying to stack his or her new term on top of earlier names. This paper will use the word JIT but other names that have been in vogue, or are currently in vogue, are Lean, Demand Flow, Short Cycle, Synchronous, Agile, etc. Perhaps the best name was and continues to be the Toyota Production System, however.)

Manufacturers have two production operations: One factory pumps product through the manufacturing pipeline and the other pumps transactions through its office pipeline. In some companies, the size of the transaction factory rivals the size of the product factory. Your customers are not going to pay you more for your product because you manage to increase the workload in the transaction side of your company—even if you do it in the name of JIT.
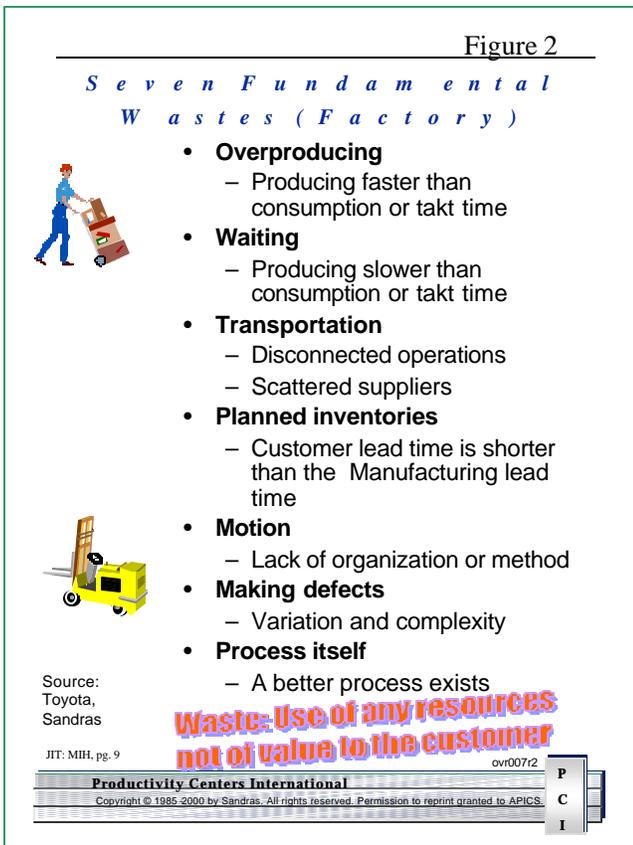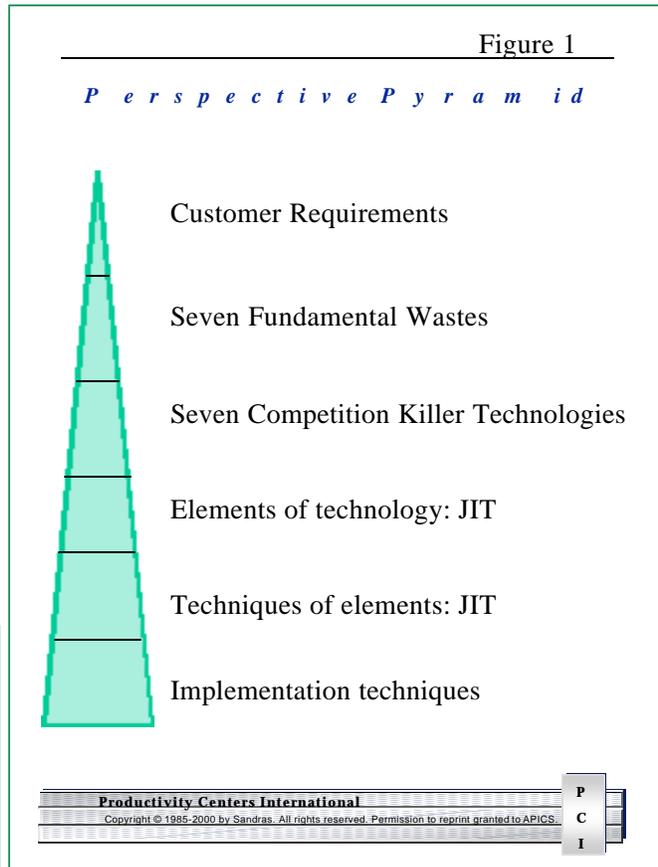
Like it or not, as lot sizes decrease, we cannot allow the cost of transactions to increase. We need to eliminate waste in the production AND in the transaction sides of our organizations. To put it bluntly, traditional purchase orders and work orders, as we know them, simply cannot exist in most JIT environments.

The exception is for those that already make one product per work order, or buy one product per purchase order. This is sometimes the case for low volume / high variety producers of complex major assemblies. One could argue that purchase orders and work orders in these environments are still not value added activities and should be eliminated too. True, but at least the waste won't increase exponentially because of decreasing lot sizes. The real problem lies in organizations that have purchasing and production lot sizes greater than one.
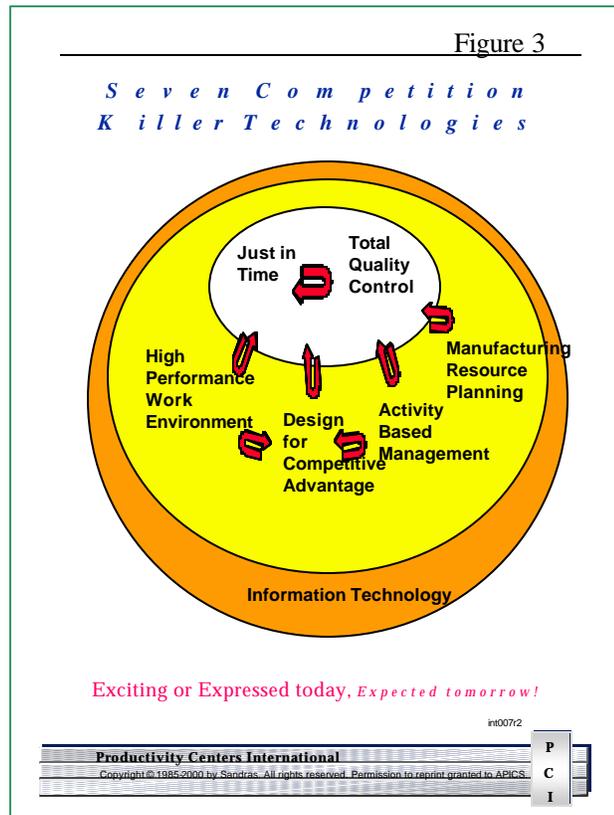
View of JIT
To understand how to plan and control without purchase orders and work orders, let's first make certain we all see JIT the same way.

Picture a pyramid (see Figure 1). At the top is the customer. In general, the customer wants Quality/Reliability, Delivery/Speed, and Cost/Value (QDC).

Figure 1

P e r s p e c t i v e   P y r a m i d

Customer Requirements

Seven Fundamental Wastes

Seven Competition Killer Technologies

Elements of technology: JIT

Techniques of elements: JIT

Implementation techniques

Figure 2

S e v e n   F u n d a m ental   W astes (F a c t o r y)

- **Overproducing**
  – Producing faster than consumption or takt time
- **Waiting**
  – Producing slower than consumption or takt time
- **Transportation**
  – Disconnected operations
  – Scattered suppliers
- **Planned inventories**
  – Customer lead time is shorter than the Manufacturing lead time
- **Motion**
  – Lack of organization or method
- **Making defects**
  – Variation and complexity
- **Process itself**
  – A better process exists

Source: Toyota, Sandras

JIT: MIH, pg. 9

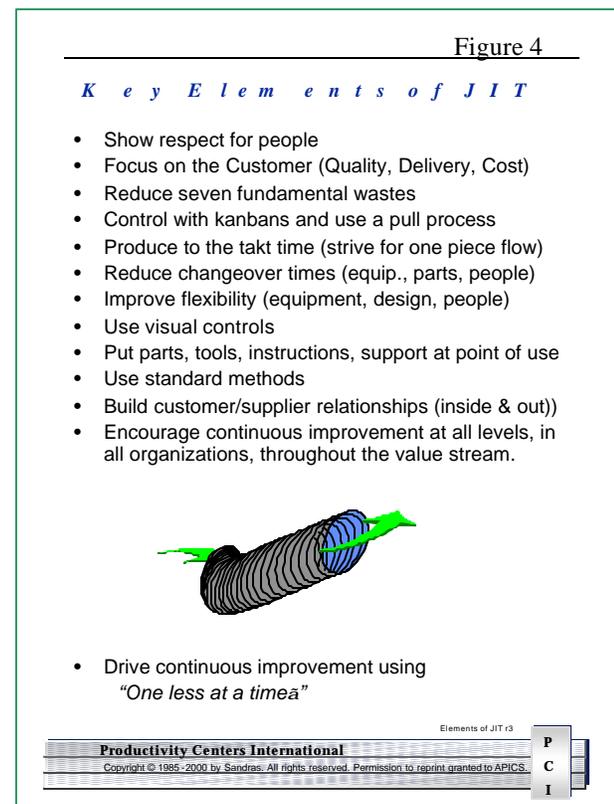Waste: Use of any resources not of value to the customer

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One level down from the top we find the Seven Fundamental Wastes (see Figure 2). These wastes are true impediments to achieving competitive quality, delivery, and cost performance.

Once we recognize the wastes, we need to decide how to eliminate their causes. We can choose from many technologies to help us at this point. The Seven Competition Killer© technologies you see in Figure 3 are all approximately at the same level. To remain competitive all of them are necessary (or will become increasingly necessary), but none are sufficient by themselves. We must use the technologies together.

Figure 3

Seven Competition Killer Technologies

Just in Time

Total Quality Control

High Performance Work Environment

Manufacturing Resource Planning

Design for Competitive Advantage

Activity Based Management

Information Technology

Exciting or Expressed today, *Expected tomorrow!*

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Productivity Centers International

If we examine the key elements of JIT, one of those seven technologies, we can see why purchase orders and work orders become a problem (see Figure 4). We are using visual controls, building to takt time, flexing quickly, and reducing inventory "one less at a time" to systemically drive continuous improvements.

Figure 4

Key Elements of JIT

- Show respect for people
- Focus on the Customer (Quality, Delivery, Cost)
- Reduce seven fundamental wastes
- Control with kanbans and use a pull process
- Produce to the takt time (strive for one piece flow)
- Reduce changeover times (equip., parts, people)
- Improve flexibility (equipment, design, people)
- Use visual controls
- Put parts, tools, instructions, support at point of use
- Use standard methods
- Build customer/supplier relationships (inside & out))
- Encourage continuous improvement at all levels, in all organizations, throughout the value stream.

- Drive continuous improvement using
  "One less at a time…"

Elements of JIT r3

After implementing JIT it is not unusual that we improve our ability to respond to change by a factor of ten times. Products that used to flow through our factories in twenty days now take under two days. Products that used to flow in a batch now have single piece flow. Production can change from one product to another very fast, replacing each item as it ships from inventory, or building each customer order in the sequence in which they arrive.

Of course, MRPII systems have shop floor control modules that allow us to plan, track, and control individual pieces. But the problem is we can easily have a ten-fold increase in the number of transactions. Things just happen too fast on the shop floor, particularly in a JIT environment, to make it practical and economical to keep an MRPII system informed on-line, real-time, all the time. Fortunately, we don't need to suffer the burden of increased manual transactions if we use JIT and MRPII in harmony. Let's review the key changes in how we plan and control production in a JIT/MRPII environment.
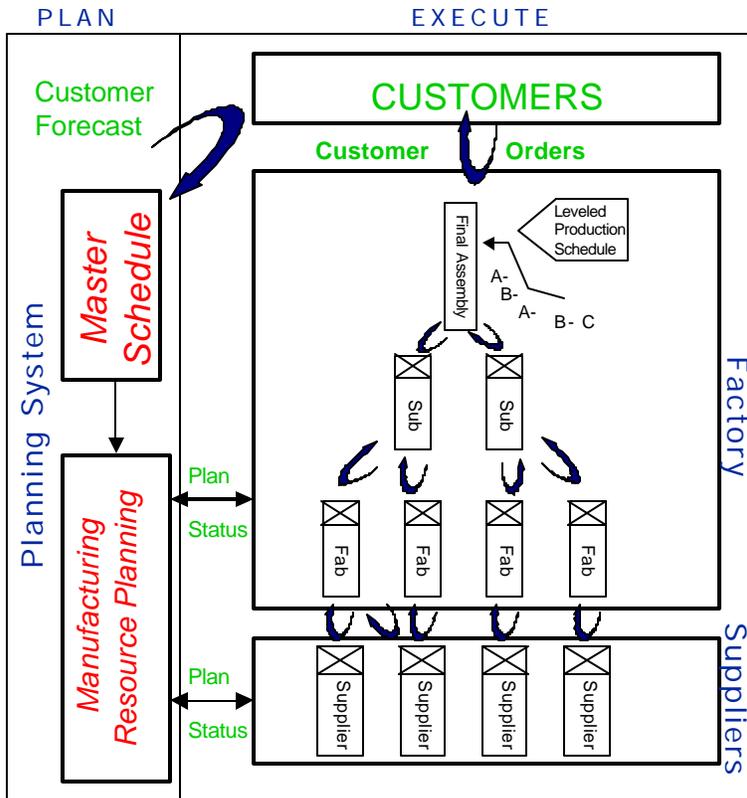

Figure 5
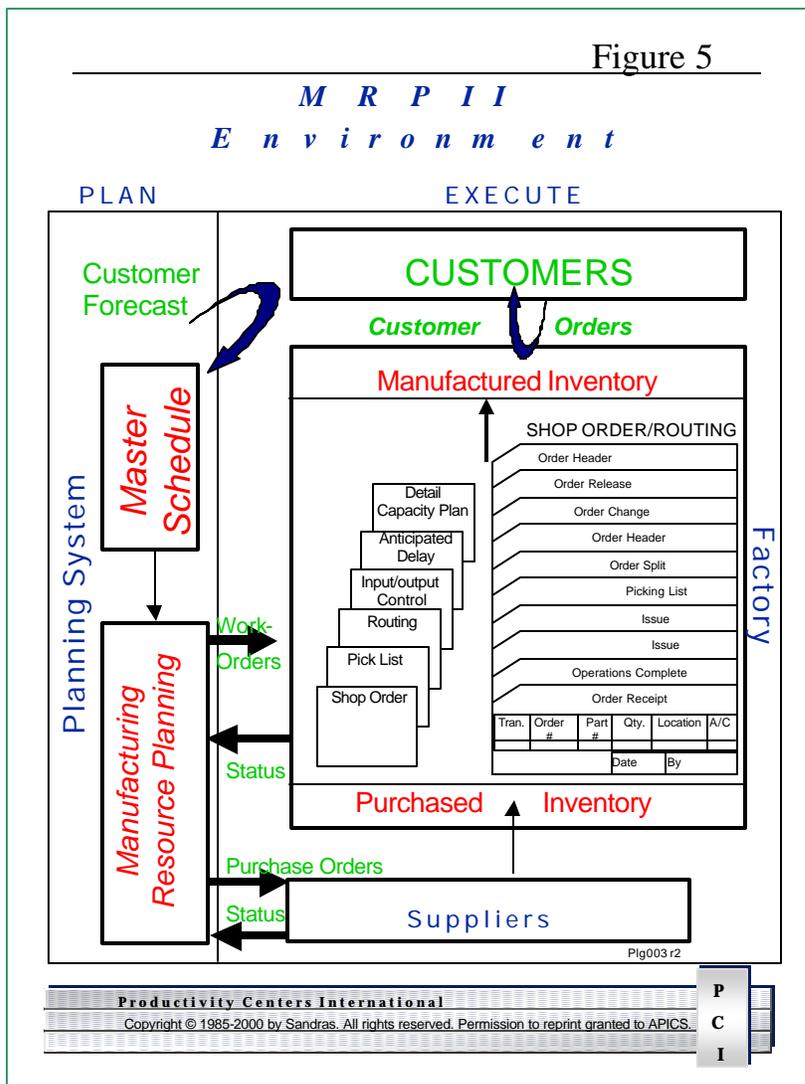
Planning Changes
Just the words "changes in how we plan and control production" indicate that this will have some affect on the role of the Production Planning and Control Department. In a traditional work order environment (MRPII), Planning develops a detailed production plan, and controls Production through the release of work orders and purchase orders. In other words, Production Planning plans and controls Production. People in both Planning and Production are measured on how well they meet the plan (See Figure 5).

Figure 6

JIT / MRP II Environment

PLAN   EXECUTE

Customer Forecast

CUSTOMERS

Customer Orders

Planning System

Master Schedule

Manufacturing Resource Planning

Final Assembly

Leveled Production Schedule

A-
B- A-
A-
B- C

Sub   Sub

Fab   Fab   Fab   Fab

Supplier   Supplier   Supplier   Supplier

Factory

Suppliers

Plan
Status

Plan
Status

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In a kanban environment (JIT), Planning prepares a macro production plan, but Production executes to the customer orders (see figure 6). In other words, Planning plans, but Production controls. A macro plan in this environment shows planned production rates for each product line, rather than hourly or daily loads for each shop's equipment.

The shift from detailed planning to rate based planning requires a different mental picture. Imagine a garden hose connected to a faucet with water running through it. After the hose fills up we could plug both ends and then measure the work in process. Now start the flow again.

Someone will be willing to sell us equipment to measure the molecules as they progress through the hose. On the other hand, all we need to do in this flowing environment is watch the rate water is pouring out the end of the hose. If the flow of water decreases, we scan the hose for a kink. A kink in a JIT environment looks like empty or full kanbans. The amount of water in the hose is controlled by the size of the hose, and in a JIT environment by the sum of the kanbans.
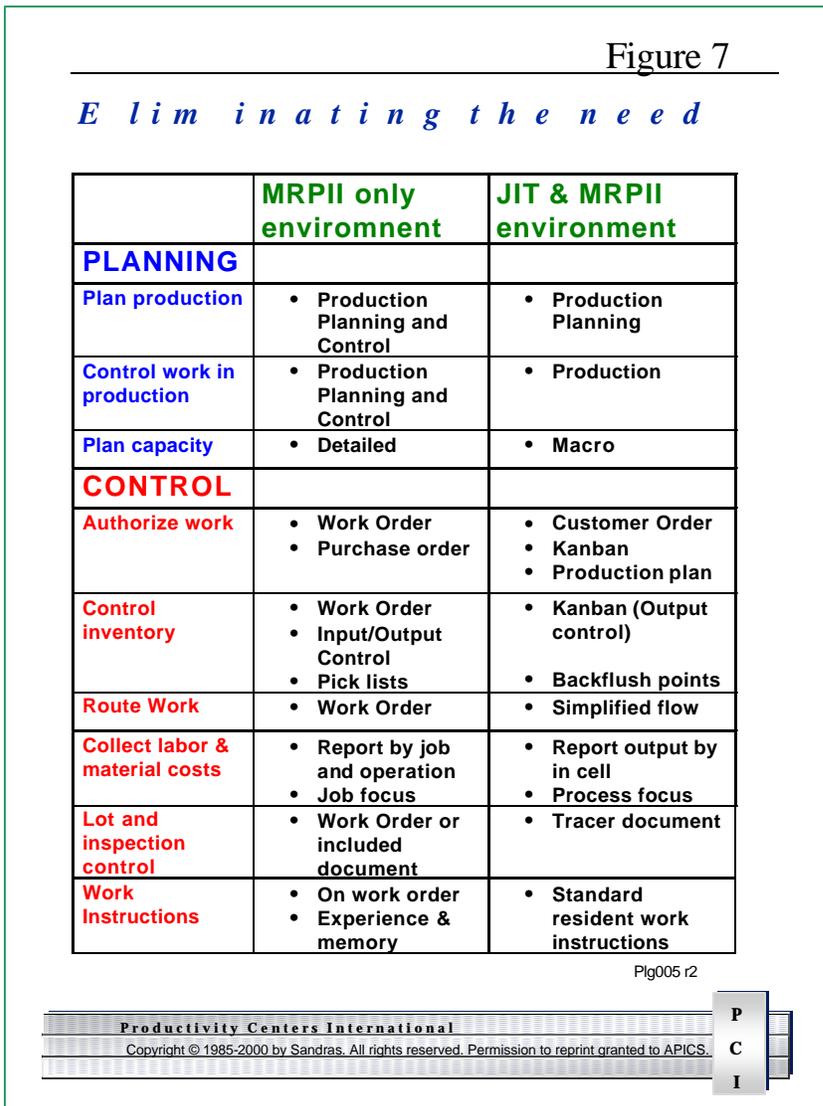
Of course, it is easy for us to locate someone that will sell us expensive sensors, readers, computers, and software to automatically handle the increasing volume of transactions (conversely, it seems to be easy for them to locate us too.) Sometimes that equipment is appropriate, but in general, we need to focus on eliminating the transactions, not automating them.

Now that we have discussed the changes in Planning, lets look further at the control issues, that is, at the changes that happen on the shop floor.

Control Changes

We need to understand that work orders are not evil—they just do not function well in agile JIT environments. But, we do not simply get rid of them; rather, we eliminate the need for them. To do that, we must understand the function work orders play in helping us manage our planning and production processes. True to the spirit of JIT, we want our cake and want to eat it too. That is, we want to maintain control while decreasing the cost of transactions.

When we discuss eliminating work orders, we need to be a little careful with terminology. Sometimes, what is referred to as a work order is really a collection of different items (e.g., work order, product drawing, work instructions, lot control log, labor collection form, inspection sheet, etc.). Figure 7 shows the role work orders play, and what we can substitute in a JIT environment.

Figure 7

E l i m i n a t i n g   t h e   n e e d

	MRPII only enviromnent	JIT & MRPII environment
PLANNING		
Plan production	• Production Planning and Control	• Production Planning
Control work in production	• Production Planning and Control	• Production
Plan capacity	• Detailed	• Macro
CONTROL		
Authorize work	• Work Order • Purchase order	• Customer Order • Kanban • Production plan
Control inventory	• Work Order • Input/Output Control • Pick lists	• Kanban (Output control) • Backflush points
Route Work	• Work Order	• Simplified flow
Collect labor & material costs	• Report by job and operation • Job focus	• Report output by in cell • Process focus
Lot and inspection control	• Work Order or included document	• Tracer document
Work Instructions	• On work order • Experience & memory	• Standard resident work instructions

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In environments where inspection and/or lot tracking is required, the traditional work order is still not necessary. Some companies have what are called "tracers" that are no more than abbreviated places to document required inspection steps, lot numbers, or serial numbers. Frequently, the first production operator prints this one-page document at the time the first operation is started. No involvement is needed from other departments such as Production Planning and Control on a routine basis.

When we discuss eliminating purchase orders, the process is similar to work orders. Rather than releasing a purchase order for each delivery, many companies have already adopted Supplier Schedules. These Supplier Schedules show the planned requirements over time. A "blanket" purchase contract can be written to authorize shipment according to the Supplier Schedule.

However, while Supplier Schedules can minimize the number of transactions, they have one aspect that is not consistent with the spirit of JIT. Supplier schedules are based on the MRPII plan, and authorize shipments to support that plan. In a JIT environment, we may still want to plan with the MRPII plan, but we want to authorize shipment based on the actual customer orders (or consumption). So, we establish kanbans between the supplier and ourselves. The plan is for planning purposes, but the kanbans serve as authorization for the supplier to ship.

But what happens if our customer's don't follow our plan of what they are supposed to order? In a JIT environment, will continue to build to satisfy the customer orders, recognizing that if the deviation between the plan and the actual continues, we will have a material supply problem. However, the primary focus continues to be on satisfying the customer, not the plan.

Getting rid of traditional work orders and purchase orders may be very emotional for some, but fortunately, it is technically not too difficult.   And you don't have to throw out your MRPII system to accomplish the change, either. MRPII is an excellent macro planning system and we can continue to use it for that purpose. We just need to implement JIT techniques on the shop floor, and in our office areas, to control the flow and the number of transactions.

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Productivity Centers International LLC

The mission of Productivity Centers International (PCI) is to help organizations (1) reengineer their manufacturing, service, and support processes, (2) incorporate processes for continuous improvement and problem solving, and (3) develop their people to become self-sufficient in PCI's methodologies.

PCI achieves it s mission by providing education, facilitation, implementation, and project management support to:

- Implement the full concepts of Lean (i.e., Just-in-Time) using broad projects to link multiple operations and focused Kaizen events to improve specific areas,
- Reduce defects and variation using the quantitative Total Quality Control tools (TQC1) and Problem Solving Storyboards (i.e., TQM or Six Sigma),
- Discover solutions to non-quantifiable management problems using the new thought-based Management and Planning tools (TQC2), and
- Develop project plans to manage complex changes.

Bill Sandras founded PCI in 1985, and has provided his expertise and services to manufacturing, engineering, distribution, chemical, health care and service companies throughout the world.

William A. Sandras, Jr.

Bill began his career with Continental Oil Co. as a computer systems/programmer analyst. He then worked for Hewlett-Packard (HP) for 16 years in various management positions. While at HP, Bill worked at two mature divisions and helped to start three new divisions. These divisions manufactured high-volume/low-variety products, and complex low-volume/high variety products.

As a manager, Bill led HP's first successful Manufacturing Resource Planning (MRPII) and JIT/TQC implementations. Later he championed three more MRPII and two more JIT/TQC implementations. He and his team were the first to link JIT and MRPII together, and pioneered Team-Based Organizations and efforts leading to Activity Based Costing. He also led product design, and then product marketing and support efforts for an MRPII software package

At HP, Bill managed production, manufacturing engineering, purchasing, planning, order entry, warehousing, shipping, transportation, software development, product marketing, product support, and information systems. Bill also introduced and managed the JIT/TQC worldwide education and consulting services for the Oliver Wight Consulting Companies for four years.

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He wrote the popular "how-to" text book titled Just-in-Time: Making it Happen, booklets titled About Face to JIT (100 Changes), Competition Killers (Competitive Technologies for 2000), and TQC2: The New Management and Planning Tools, plus many articles including "*High Velocity Manufacturing*" selected for the *Best* of Chief Executive Magazine. He is on the Association for Manufacturing Excellence editorial board for their Target magazine.   *R990607*

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