JUST-IN-TIME LOGISTICS SUPPORT FOR THE AUTOMOBILE INDUSTRY *

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When Henry Ford’s book Today and Tomorrow was published in 1926, it was embraced, not by Americans, but by the Japanese. The principles found in Ford’s book are the basis for Just-In-Time (JIT).

With a philosophy that calls for eliminating all sources of waste, including unnecessary inventory and scrap in production, Just-In-Time has a significant effect on inventory control, purchasing, and suppliers. For JIT to be most effective, a total quality management (TQM) program must be adopted. The system cannot function with a high rate of defective items; its success requires detailed attention to quality both in purchasing and production.

Supplier partnerships, “players on the same side,” are optimal for JIT. These partnerships are long-term relationships with single-source suppliers who provide certified quality material while continuously reducing costs. Suppliers are even encouraged to locate their plants as close as possible to the automobile assembly plants so that assembly lines can receive frequent deliveries of small lots of parts.

JIT drastically reduces investment as well as the total cost of operation. In the early 1980s the U.S. automobile industry realized the advantage adopting JIT would bring. U.S. automakers were carrying $775 worth of work-in-process inventory for each car they built, while the Japanese carried only $150 [8]. The very existence of the U.S. auto industry depended on adopting the JIT philosophy.

In this article we will cover (1) conditions before JIT, including transportation, supplier relationships, and purchasing methods; (2) the period of change known as the “Japanese Revolution,” including how quality was affected; (3) JIT’s role in today’s environment of transportation, supplier relationships, and quality; (4) the disadvantages of JIT; and (5) prospects for the future.

CONDITIONS BEFORE JIT

Transportation

Key issues of transportation before JIT include plant locations, the role of transportation, deregulation, and transportation regulation. The placement of plants changed as a result of the implementation of JIT. During the 1970s, first-tier suppliers as well as major automobile factories were all centrally located. As a result of the proximity between suppliers and factories, transportation was not a vital concern in terms of time and cost [8, p. 161]; however, as factories gradually relocated, logistics became an important factor in the automotive industry’s success.

Efficient transportation methods were critical to the effective JIT process. For years, the automotive industry relied internally for functions such as purchasing and transportation. Society assumed that products would move from their production site to the consumer with little difficulty [8]. What began as a concentration of automobile assembly plants located in and near Michigan quickly changed to assembly plants located throughout the United States, Mexico, and Canada. It was during the 1980s that this decentralized approach proved to be very expensive and ineffective with less-than-truckload shipments. Plants were experiencing backlogs of trucks at their docks for several hours. These delays caused a diversion of key resources away from the automobile assembly plants’ car business.

Deregulation of the major modes of transportation drastically affected motor, rail, airline, and water carriers. Deregulation removed constraints on motor carriers’ products, services, and prices, resulting in an increased number of motor carriers, thus providing a higher level of competition.

* This is an edited version of the prize-winning part-time undergraduate submission in the 1998 International Student Awards Program sponsored by the APICS Educational and Research Foundation.
Along with improved economic savings came improved safety. The safety regulations included labor standards, working conditions for transportation employees, hazardous materials shipments, vehicle maintenance and insurance [8, p. 184]. The logistics executive was responsible for remaining knowledgeable about regulatory changes because of their potential impact on a firm’s logistics operation [8, p. 187].

Supplier Relationships and Purchasing Methods

Before JIT, methods of purchasing and inventory management were in many ways different from those now practiced. Before JIT was implemented, purchasing was considered a transaction of immediate need. Supplier relationships lasted no longer than the time required to fulfill a given purchasing contract. A long-term relationship was considered by many companies to be an annual buy with periodic releases to the supplier. Multi-year buys were commonly seen only in the aerospace and defense industries [16, p. 300]. A vendor’s history of service and product quality were important considerations when reviewing contract bids, but when it came time to issue a new contract, the bottom line was very often the bottom line.

Contract bidding was traditionally considered the method of choice for fostering competition and thus keeping prices at their lowest. Multiple bids were solicited to customer-prepared specifications with little or no input to those specifications from the potential suppliers. As a result, specifications may have been unnecessarily limiting by excluding commercially standard items or were more likely to have been inflexible in the selection of materials, tolerances, finishes, and manufacturing methods [3, p. 132-133]. When supplier experience was utilized, it was typically in relation to the contract at hand and did not necessarily extend to the finished product as a whole [16, p. 301]. Additionally, it was not unusual for bids to result in contracts being awarded to multiple suppliers to protect against unreliable quality or delivery [3, p. 9].

Before JIT a significant portion of the parts and materials purchased were for inventory. Inventories were maintained to achieve economies of scale in purchasing, transportation, and manufacturing as well as to balance supply and demand (internal examples included the in-process inventories used to equalize manufacturing operation flows and to hedge against equipment breakdowns) [3, p. 400-401; 16, p. 300]. Inventories also served to act as a buffer at various interfaces in the channel of distribution and to protect against price increases in an unstable market [3, p. 402, 495]. Disadvantages associated with inventories included both the risk of price decreases while inventory stocks were high and the risk associated with carrying costs, including the cost of money invested as well as indirect costs such as bid tracking and evaluation, invoice management, receiving and inspection activities, and cycle counting [8, p. 302, 495-496].

Typically, materials were ordered in infrequent large-lot shipments to obtain economies of scale in the purchase of raw materials and the subsequent manufacturing of finished products. Large orders provided suppliers with assured income and simplified scheduling. The associated reduction in costs encouraged suppliers to invest in improved processes and equipment, further improving efficiencies and lowering prices. Similarly, the transport of full truckloads or railcars of raw materials and finished goods was cheaper since larger, more efficient transport equipment was used. For less than full truckloads, freight forwarders or shipping associations provided another avenue to reduce transport costs by combining loads from different companies when they had similar destinations, thus utilizing any given mode of transport more efficiently. Where large lot sizes excluded the need for the break-bulk services of freight forwarders, their elimination further streamlined the shipping process and reduced costs.

PERIOD OF CHANGE

The Japanese quality movement led the automobile industry in making changes necessary to support JIT programs. These changes forced the U.S. automobile industry to implement its own quality programs to compete with the high quality of Japanese cars.

The Japanese Revolution

The Japanese revolution started with an awareness of quality on the part of the consumer. First implemented in Japan, W. Edwards Deming’s philosophy of quality management was instrumental in developing that awareness.

At one time the “Made In Japan” label was associated with inferior products. Americans purchased automobiles manufactured in the United States and accepted their quality without question. But with the new quality awareness, changes were initiated in both the U.S. and foreign automobile industries. As foreign automobile companies developed better quality standards, consumers began to examine U.S. manufactured cars more closely and demanded higher quality and reliability. To meet their demands, management replaced traditional manufacturing approaches to quality control with improved managerial tools and techniques. Japan’s own efforts in improv-
ing quality over several decades gave them a significant share of the U.S. auto market [2, p. 6].

W. Edwards Deming began teaching statistical quality control to the Japanese following World War II. He was so influential in their quality improvement programs that the Japanese named their highest award for quality improvement the Deming Prize. Deming built his philosophy of quality on 14 points of management. "Learn the New Philosophy" is one. Management methods that were in place, such as numbers-driven production, work measurement–based quotas, a bottom-line mentality, and adversarial work relationships, created mistrust, fear, and anxiety. They focused more on "satisfying" Father than on "optimizing." Deming’s new philosophy called for developing a quality consciousness and fostering a new attitude that "good enough" is just not enough. A never-ending cycle of improvement and changes in managerial and worker attitudes were needed to do so.

Management turned to a focus on customer-driven quality. Consumers would not purchase automobiles if they were dissatisfied because of poor quality or poor fitness for use. U.S. automobile companies were forced to catch up with the Japanese in quality conformance while the Japanese were shifting their emphasis to better design quality [2, p. 82-97].

The key to Japanese competitive success is the kaizen strategy. Kaizen, the Japanese term for improvement, is the single most important concept in Japanese management. Its philosophy encompasses cost, meeting delivery schedules, employee safety and skill development, supplier relations, and new product development and productivity. Kaizen focuses on small, frequent, and gradual improvements over the long term; the financial investment is minimal. Everyone from top management to line workers is involved. People, in lieu of technologies, are the main focus. Quality improvement in the kaizen philosophy is primarily concerned with the quality of people. When the quality of people is improved, the quality of the product will follow [2, p. 233].

In the 1980s, a period of remarkable change, consumers, industry, and government became increasingly aware of quality. Consumers noticed the obvious difference between Japanese- and U.S.-made automobiles. At Chrysler, for instance, after five cars were pulled at random from a production line and compared with a new Toyota, it was not long before Chrysler foremen were saying their cars were of poor quality [4, p. 175]. U.S. automobile companies were forced to change to compete in the market.

Extensive product recalls in the early 1980s were mandated by the Consumer Product Safety Commission, and the Challenger space shuttle disaster in 1986 increased awareness of the U.S. quality gap with the Japanese. Earlier, in 1980, NBC had aired "If Japan Can ... Why Can't We?" The program revealed the key role that Deming played in the development of Japanese quality and made his name a household word among corporate executives. As a result he led U.S. companies, including Ford Motor Company, in a program to revolutionize their approach to quality [2, p. 5].

Quality Revolution

A new quality dynamic emerged during this period of change. The quality revolution that resulted was supported by a program of incoming material control and the use of JIT as a quality control method.

In the late 1980s it was clear that the only constant in the quality area was change. That was the essence of the quality revolution as U.S. automobile companies worked to develop new approaches to quality. Customers were invited into plants for inspection tours and team meetings.

New approaches were being implemented in regard to employees. There was a new focus on quality, service, and responsiveness, resulting in an increased emphasis on the importance of people in an organization’s success. These approaches led to the development of individual and team participation programs, eliminated layers of supervision, and resulted in more people involvement in day-to-day problem solving and quality monitoring.

New approaches were also developed in the area of leadership. This was a decentralized leadership, with quality values set from the top. Top managers and staff were in touch with customers and operations [2, p. 16].

Incoming material control is also an important part of the quality function. Many companies require that their suppliers provide proof that their processes are under statistical control; they then provide preferential treatment for those who maintain a high level of quality performance over time. The quality of incoming materials became more and more critical as automation increased and JIT material flow was used in the manufacturing environment.

JIT, a program consisting of material management and control, is "more than a new way of handling material management; it represents a philosophy whose objective is to eliminate all sources of waste, including unnecessary inventory and scrap in production. The basic philosophy is to reduce inventories to as close to zero as possible by producing only enough units to keep the next work station in a production process in operation. In manufacturing operations, Japanese automobile manufacturers in both Japan and
the United States routinely encourage their suppliers to locate plants as close as possible to their factories so that frequent deliveries of small lots of parts can be made to the assembly lines.” [2, p. 220-221]

JIT will not function properly if there is a high rate of material defects. Careful attention to quality both in purchasing and production is required. Since lot sizes are small and plants carry no safety stock to back up nonconforming items, a quality problem will disrupt the flow of materials.

The Ford Motor Company recognizes plants that have achieved a level of excellence and have in place a program for continuous improvement to meet the customer’s needs and expectations. The award is called the “Q1 Award” and is the basis for Ford’s vendor certification program. The criteria used to determine whether a supplier is to receive the award are based on the following five categories: adequacy of the quality system, process capability review, internal quality indicators, customer satisfaction, and management commitment [2, p. 226].

THE PRESENT ENVIRONMENT

This section describes the importance of JIT and how industry leaders are dealing with the present and the future for transportation. Supplier relationships and how purchasing and quality will play a leading role in the future will also be discussed.

Transportation

Transport innovation is the execution portion of JIT purchasing. It is the physical linkage between the inside and the outside processes. Of all the aspects of JIT, transportation is probably the one most subject to misconceptions. Typically, transportation has been viewed by manufacturing industries as “putting products on a truck, train, plane, or bus.” But JIT transport issues include every step required to move material from the hand of the last value adder at a supplier location to the hand of the first value adder at a customer location. JIT transport is a process that starts at a supplier location and ends at a customer location.

Transport innovation requires that all three parties, the supplier, the carrier, and the customer, work together more closely than ever before. That means transport partnerships have to be forged, just like supplier partnerships. There will be fewer carriers than there are today; each will be a single source for a “family” of businesses that will be treated as a part of the operation, as though they were “in-house” carriers [16, p. 317-320].

Advancements in technology have fostered many changes in transportation logistics. One example of transport innovation resulting from these advancements is global positioning systems (GPS). By synthesizing satellite tracking, computer, communications, wireless and Internet technologies, GPS offers fleet managers a powerful tool to increase productivity and achieve major cost savings and operating efficiencies. Global positioning systems provide fleet operators with the ability to display the location of vehicles on their PC screens using high-quality, street-level detail maps, cargo and vehicle security, route optimization, and driver monitoring. GPS providers are utilizing the Internet as a communication medium, offering low-cost solutions for companies wishing to monitor vehicle fleets around the country from a central location.

A basic GPS functions with a compact vehicle-mounted remote unit that picks up GPS signals from orbiting satellites and tracks the vehicle position to within 10 meters. This remote unit relays its position to the fleet office computer via cellular phone or digital radio signal. With a message display unit in the cab, interactive messaging capability is also provided. Fleet managers can track any vehicle’s location on a zoomable map display on their personal computer screens. This display gives them remote control and monitoring over functions such as locking and unlocking cargo doors, turning alarms on or off, and monitoring sensors such as temperature. These systems can also provide extensive reporting, including idle time, delivery/stop, speeding, event history, route animation, and other tracking reports [10].

A brief study of the modern transportation system follows, with highlights of three industry leaders.

Federal Express

Federal Express (FedEx) began in 1973 as an overnight delivery service. With a fleet of 14 Falcon business jets, it shipped 186 packages on its first night of operation. Headquartered in Memphis, Tennessee, FedEx is now the world’s largest express transportation company, employing approximately 140,000 people and serving 212 countries. The company maintains 605 aircraft and a fleet of more than 39,500 vehicles worldwide. It averages more than 600,000 calls daily and ships over 3 million packages a day. Its 1997 revenues were $11.5 billion.

Federal Express has evolved into a business that not only moves parcels, but also manages the supply chain from end to end. Its packages are controlled with electronic communications from order to delivery. The company has committed approximately $1 billion for new technology to ensure it remains a leader in electronic communications.
communications. Of the 2.5 million packages moved every day, 1.5 million move electronically without air-bills. With Internet connectivity for tracking and service transactions on the World Wide Web, FedEx claims air-bills will soon be obsolete. The company has 350,000 customers on line with a proprietary network of 79,000 electronic data interchange accounts [14, p. 1-5; 9].

**United Parcel Service**

United Parcel Service (UPS), now the world's largest package distribution company, was founded in 1907. Headquartered in Atlanta, it transports more than 3.1 billion parcels and documents worldwide each year. UPS employs 338,000 people and has more than 500 aircraft, 147,000 vehicles, and 2,400 facilities providing service in more than 200 countries. Currently, UPS moves 12 million parcels and documents daily, providing fast, convenient delivery service coast-to-coast and around the world.

United Parcel Service Airline is among the 10 largest airlines in the United States. It features some of the most advanced information systems in the world. The computerized operations monitoring, planning and scheduling system (COMPASS), for example, is unique in the industry. It provides information for flight planning, scheduling, and load handling and can be used to plan optimum flight schedules up to six years in advance.

Technology at UPS spans an incredible range, from specially designed package-delivery vehicles, to global computer and communications systems. UPSnet is a global electronic data communications network that provides an information processing pipeline for international package processing and delivery. It has more than 500,000 miles of communications lines, including a UPS satellite, and links more than 1,300 UPS distribution sites in 46 countries. The system also tracks 821,000 packages daily.

Using a hand-held computer device called a delivery information acquisition device (DIAD), the UPS driver can electronically capture information about each package, including the time of delivery and even the signature of the person receiving the package. This information is transmitted via cellular telephone directly from the package car to UPS computers, where it is available to allow customers to trace their packages or to verify proof of delivery. Between 1986 and 1991, UPS spent $1.5 billion on technology improvements, and plans to spend an additional $3.2 billion during the next five years.

Today, UPS provides many customer information services, including TotalTrack and MaxiShip. TotalTrack, based on a nationwide cellular mobile data system, can instantly provide customers with tracking information for all bar-coded air and ground packages. MaxiShip is a computer-based system that lets customers manage the entire distribution process, from the rating and zoning of packages, to preparing user-defined management reports.

Another service that UPS offers is Inventory Express. It is a contract logistics management service in which UPS stores the customer's merchandise, then ships it as needed ... "just in time."

Even more far-reaching is UPS Worldwide Logistics, a comprehensive consulting service in which UPS assembles services based on the customer's individual needs, which might include freight payment, customs clearance, warehousing, carrier selection, rate negotiation, tracking, information systems, electronic data interchange (EDI), fleet management, order processing, and inventory control.

The highest priorities for UPS over the next five years will be to deploy technology that will allow UPS to continue introducing new services, to provide customers with comprehensive information about their shipments, and to provide training so that all employees will clearly understand UPS services and the technologies that make them possible and will be able to communicate that information to the customer. [12]

**Roberts Express**

Based in Akron, Ohio, Roberts Express is a transportation company specializing in emergency shipments and those that require special care and handling. It is the largest surface-expedited carrier in the world, handling thousands of critical-needs shipments every week throughout the United States and Canada. An operating company of Caliber System, Inc., it is a leading provider of value-added transportation, logistics, and related information services.

To stay close to its customers, Roberts Express uses state-of-the-art AT&T network technology to identify callers and route them to the proper customer assistance team (CAT) member. This technology gives CAT members instant access to critical information about the caller and enables them to get a vehicle to the pickup location as fast as possible. Constant monitoring of the communications equipment and lines ensures that customer calls are answered quickly.

In addition, 24-hour two-way Qualcomm satellite communications are combined to link CAT members to each driver. They can immediately locate an available vehicle sized to a customer's needs and get all necessary information to the driver, who can be enroute to the pickup within minutes. Two Sun computers tie the network technology and satellite communications together.
Using the computer-monitored two-way satellite communications system and the latest in integrated software and hardware, Roberts Express can, in minutes, pinpoint a shipment to within 300 yards, access its on-board computer, and communicate vital information about a customer's shipment. If a shipment is more than 15 minutes late, both the shipper and the consignee can be called. Problems caused by any delay can be immediately addressed and solved [11].

**Supplier Relationships and Purchasing Methods**

Just as the JIT environment has affected transportation providers, requiring them to change and streamline their methods of operation, and make long-term investments in technology, JIT purchasing in today's automotive industry requires that manufacturers and suppliers form long-term relationships with the intent that they become permanent. Simultaneously, the number of suppliers is streamlined so that each is the sole provider of a particular item or items, with purchase agreements issued with durations of years. These changes result in strong bonds between the manufacturers and suppliers, with each becoming thoroughly dependent on the other for survival and prosperity. Each supplier recognizes that any failure on its part in quality, quantity, or timeliness could potentially result in the shutdown of the customer and thus all suppliers, itself included. However, with that large responsibility comes the benefit of stable production and assured income. In this environment, major automobile manufacturers team with logistics specialists to manage material flow. This move results in reduced less-than-truckload costs and reduced transit times and it eliminates the receiving function at the dock. All these actions combine to reduce inventories.

As a result of JIT implementation, the quality of delivered goods has improved to near 100%, as no extras are available to replace defective items. Typically, statistical process controls are implemented by the supplier thereby drastically reducing the number of unacceptable parts produced and effectively eliminating final inspections [16, p. 303]. Quality standards are set by the customer's quality engineers, who also work with the supplier to resolve quality concerns [8, p. 501].

Shipping damage is nearly eliminated. Materials come directly from the supplier to the customer and are not repeatedly transferred between transport mediums, greatly reducing the opportunity for damage to occur.

The quantities of parts delivered to the customer must be exact. Shipments of plus or minus 10% are no longer acceptable because the parts are ordered on a strict as-needed basis with little or no buffer stocks [8]. Delivery of finished goods to the customer must be on a strict schedule to ensure their availability for assembly operations. Again, because buffer stocks have been eliminated or reduced drastically, these deliveries must be of small quantities arriving within hours or minutes of the need for final assembly. Timing is just as important as the quality and quantity; there is little or no margin for error.

Methods used to meet those requirements are varied. In some cases the parts manufacturing facility is constructed at or near the final assembly plant, allowing small deliveries of parts to be made in smaller, cheaper vehicles, with greater control over timeliness. Where local manufacturing is not feasible, other methods are used including dedicated trucks or closed loop transportation in which delivery trucks make stops at various suppliers on a predetermined schedule, simultaneously returning empty shipping containers and taking on new loads for scheduled delivery to the assembly plant. Disposable packaging can be replaced with reusable containers and racking compatible with assembly-line use, eliminating the costs of removing and disposing of packaging materials and simplifying and speeding the loading and unloading processes [16, p. 321-323].

With no receipt inspections required, materials are now unloaded at or near the final point of use in the assembly plant, eliminating the additional steps required for distribution from a centralized receiving point [16, p. 328]. Costs associated with equipment used to speed the delivery process, such as specially configured trucks, containerization, and unloading equipment, are offset by the associated improvements in efficiency.

The stringent demands of the JIT manufacturing process require maintaining communication between the supplier and customer at the highest levels. Notifications of disruptions, quality problems, or engineering changes are immediate, and resources are shared to resolve technical difficulties [16, p. 311].

That improved communication gives suppliers information about future needs and improves their ability to plan, process, and implement capital equipment improvements. With the stability that the JIT environment provides, suppliers can more confidently make these investments, thereby increasing efficiency and reducing costs [16]. Other areas of cost reduction associated with JIT include the customer’s reduced overhead due to the smaller number of suppliers, reduced expediters on invoice processing and bid tracking, fewer contract negotiations, elimination of expediting, near elimination of costs associated with inventory including carrying costs and costs associated with the movement of materials, elimination of cycle counting, and reduction of incoming inspection activities and tracking and handling of defective parts [8, p. 502-503].
Streamlining the shipping process will also decrease expenditures by reducing damage and simplifying packaging and containerization as much as possible. That reduces or eliminates expendable costs and the time and effort required to deal with them [8, p. 321].

The Current Quality Approach

Today’s approach to quality is identified as total quality management (TQM). TQM is supported by the use of quality circles and qualified sources and requires employee involvement to be successful. It is “both a philosophy and a guiding set of principles that represent the foundation of a continuously improving organization. TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach focused on continuous improvement. The TQM approach stresses long-term benefits resulting from continuous improvements to systems, programs, products and people [8, p. 457].”

Quality circles are small groups of volunteer employees who meet on company time to identify, analyze and solve problems of their choice. Their solutions are then presented to management for implementation authorization. Management must actively react to the recommendations in order to provide an environment for continued employee involvement [16, p. 107].

The automobile industry uses quality circles to involve employees in the quality program. It’s a way to implement the people policies and practices necessary to obtain continuous improvement in the workplace. The objectives of quality circles are to improve the enterprise, build a better workplace, and develop individual abilities. Although not an objective of a quality circle, a by-product of the process is “saving money.”

Another current quality management tool is the use of qualified sources. Qualified sources are developed to allow material to be supplied to the manufacturing plants without performing incoming inspections. Automobile manufacturers negotiate with suppliers to lock in a quality system and the quality of the part before a product is started. As a result, nonconformances are worked out with suppliers before mass production.

This program of developing and using qualified sources then allows parts to be delivered directly to the assembly lines in lots small enough to complete only the current task, leaving no excess inventory to clutter up the shop floor or cover up part defects or assembly mistakes [6].

Quality benefits to the buyer include:

• Less need for inspection, since process control is implemented.
• High quality of parts purchased, including the products they go into.
• Quality benefits to the supplier include:
  • Avoids production of large lots of defective material.
  • Improves coordination on quality assurance matters.” [8, p. 502-503]

DISADVANTAGES OF JIT

For more than a decade, JIT manufacturing has been touted as a prime way to keep costs down and assembly lines running smoothly. But because JIT requires plants to keep trim inventories, even the smallest glitch in the supply chain can bring production to a standstill. JIT systems are designed so that parts and components arrive at factories just as they are needed for assembly, reducing and sometimes eliminating the need for warehousing expensive parts. Billions are saved on inventory, but when a plant making a critical part shuts down, there is little buffer stock from which to draw [7, p. 1B-3].

General Motors Corporation (GM), for example, received recognition for its highly integrated JIT system. The system required reduced inventories because parts were delivered to vehicle assembly lines daily and sometimes in one-hour or 30-minute time windows. However, the system’s Achilles heel was apparent when a 17-day labor strike at two part suppliers forced GM to close 22 of its 29 car and truck plants in North America. Analysts estimated that shutdown cost GM between $600 million and $800 million in lost profits [1, p. 28].

Reliable suppliers seem to be at the heart of the problem. Most firms are still struggling to develop the critical mass of reliable, cost-effective, lead-time-stable suppliers that will allow them to operate their production lines on a JIT or demand-pull basis. It also appears that most companies continue to rely on forecast (often from sales and marketing departments); only a handful have begun to provide suppliers with consistent real-time access to their ever-changing production schedules. Another difficulty is the removal of the “human element” from the systems that generate requirements. Because computer algorithms are limited, there is still a need for good people with experience in reading the ups and downs of the industry [13, p. 18].

THE FUTURE

The technology that will control the future of transportation is efficient information flow and automated data collection. Forget about trucks, trains, ships, and
jets. The key issue in the future will be providing information on a shipment: its location, where it needs to go, and when it will get there. As cycle times shrink and inventory-lean manufacturing processes become the norm, transportation buyers will need to be focused on where a shipment is in the distribution pipeline, rather than with the physical shipment itself.

A carrier will be more an information management company than a transportation company. Shippers will demand more information on their shipments than ever before. That need for more information will be driven by change. Manufacturers will no longer be able to afford to stockpile parts and finished goods in warehouses. Instead, they will rapidly adopt JIT and lean manufacturing strategies, which operate with little or no inventory. That will have a profound impact on shipping and the information associated with it.

Carriers will respond to the challenge by investing in a wide array of technology, including on-board computers and communications equipment for trucks, scanning technologies for containers, equipment locator tags, and roadside and satellite tracking systems. GPS technology and wireless communications systems will be the norm.

Paper, including the shipping label, the bill of lading, and the freight bill, will be replaced with electronic data interchange and the Internet to transfer shipping documents. Advanced two-dimensional bar code will play a large role, allowing a great amount of information to be attached to packages.

To make the process better, information such as production, supply, and cycle times data will have to be continually shared with suppliers and carriers. This sharing of information will become increasingly important as more and more companies adopt supply chain management practices that aim to link operations from the supplier’s supplier to the customer’s customer.

Companies will recognize the importance of information to supply chain management. Microsoft Corporation has already done so. The company recently launched the Value Chain Initiative, which paired more than 50 transportation providers, software companies, and computer makers in an effort to develop a standard software tool kit to enable the flow of data from raw material suppliers to the ultimate customer.

The launch of the World Wide Web introduced a low-cost platform for customers and information owners to make information more accessible worldwide. In the information age, savvy shippers will know not only where to get accurate data on their shipments but also how to leverage that data to improve operations along their companies’ supply chains [15, p. 38]. It is apparent that JIT has not been taken to its limits, and it would appear that with the advanced technology coming to the marketplace, the future for JIT is very bright [5, p. 76].

SUMMARY

So far, JIT implementation has resulted in the development of supplier relations, reductions in inventory investment, and improved efficiencies in manufacturing and transportation. However, like any other evolving process, JIT logistics support may still require change. Improved technology including computers, communications equipment, and satellite tracking will have a major effect on JIT in the future. These changes will be predicated on consumer wants and needs. An ideal process is one that is flexible enough to allow for quick change. This has been the case within the automobile industry.

JIT has served as a useful tool in the automobile industry and a very effective method for managing functions such as production, purchasing, inventory control, warehousing and transportation. Its potential benefits are limitless [8, p. 471].

REFERENCES