Introduction
In the early 1980s, when the concept of Japanese "just-in-time" (JIT) purchasing was introduced in the US, many companies wondered whether or not this new manufacturing philosophy could be successfully implemented here. Top management had a tendency to believe that, although JIT purchasing makes good sense for Japanese companies, it might not be appropriate for US companies, because of sharp contrasts in management style, culture features, social, manufacturing philosophy, and, in some cases, size.

It did not take very long, however, for American companies to realise that JIT purchasing might be successfully implemented in the US, and the survey conducted for this study shows that many US companies have already done this.

Implementation of the JIT purchasing concept is a three-phase project. Phase 1 is a learning process, which involves experimenting with JIT purchasing and trying to achieve incremental improvements by reducing inventories, eliminating waste, and exposing problems for solutions. According to the Automotive Industry Action Group, a proponent of the JIT effort in America, most US companies using JIT are in this phase today. Phase 2 consists of pilot programmes. Typically, the pilot programme should begin with: (1) a few local; (2) a few part numbers, representing a high dollar investment and low volume; and (3) frequent deliveries (once or twice a week) directly to the assembly line. Starting the pilot programme with a few local suppliers and few parts increases the likelihood of the success of JIT purchasing. Problems such as poor supplier quality and late or early deliveries can be measured and adjusted easily. The final phase is functional implementation.

The purpose of this article is to determine a set of critical factors which are necessary for a successful functional implementation of JIT purchasing. This analysis is accomplished through a survey of 21 US companies that are in the third phase of implementing JIT purchasing; documents collected from the Automotive Industry Action Group and other association proponents of JIT in America; and on-site research at four US companies: Hewlett-Packard Greeley Division, Nissan USA, Kawasaki USA, and General Motors (GM) Buick Division.

Successful implementation of the JIT purchasing concept depends on factors in two basic categories: human and operational. Table 1 outlines recommendations in these categories.
Organisation of Human Factors
Human resources play a major role in the implementation of JIT purchasing programmes. The results of the survey questionnaire, followed by on-site research, indicate that top management's commitment and leadership, employee readiness, and labour union support are the most important criteria for success.

Top Management Commitment and Leadership
The most important prerequisite for a JIT purchasing programme is top management commitment and leadership. Top managers in US companies are often not familiar

Table I.
Factors Affecting the Implementation of JIT Purchasing

<table>
<thead>
<tr>
<th>Factors</th>
<th>Recommendations</th>
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<tr>
<td>Organisation of human resources</td>
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<tr>
<td>(1) Top management commitment and leadership</td>
<td>Obtain continuous top management commitment to and leadership of the programme, both in terms of ideas and actions.</td>
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<td>(2) Human resources readiness</td>
<td>Prepare employees in every department and at all levels for the goals and objectives of the programme. Also, prepare employees to learn different jobs.</td>
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<td>(3) Union leaders' support</td>
<td>Secure union leaders' support so that employees can be trained in different jobs and be flexible in job assignment.</td>
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<td>Organisation of operational factors</td>
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<td>(1) New purchasing philosophy</td>
<td>Adopt a new purchasing philosophy with the following components:</td>
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<td>Small lot sizes/ frequent deliveries</td>
<td>Purchase small lot sizes in frequent deliveries. Select suppliers who can deliver high quality parts in small batches.</td>
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<td>Reduction in number of suppliers</td>
<td>Establish a manageable supplier network; reduce the number of suppliers to a few or a single source.</td>
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<tr>
<td>Long-term relationships</td>
<td>Develop long-term relationships with suppliers. Give suppliers long-term, flexible contracts.</td>
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<td>Supplier involvement and support</td>
<td>Start supplier involvement prior to the implementation stage, so the supplier will be motivated to contribute to the success of the programme.</td>
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<td>(2) Controlled transportation system</td>
<td>Establish buyer control over, and responsibility for, inbound freight schedules.</td>
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<td>(3) Efficient receiving and materials handling</td>
<td>Eliminate formal receiving and incoming inspection.</td>
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<td>(4) Firm schedules for suppliers</td>
<td>Provide firm and accurate scheduling for suppliers.</td>
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<td>(5) Standard containers</td>
<td>Require suppliers to use standard containers for delivering parts.</td>
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with the JIT programme and therefore lack the various human and technical skills necessary for implementing it. Implementation requires more than just providing support and financial resources; in order for top management to exercise leadership, they must have more than a superficial understanding of JIT purchasing.

First, managers must become thoroughly familiar with JIT. Then they must publicise their commitment to JIT purchasing by:

(1) giving the programme implementation the highest priority as an organisational goal;
(2) providing sufficient resources and proper training for employees;
(3) establishing a top-level steering committee, consisting of directors of manufacturing, personnel, engineering, purchasing, and reliability. This committee provides counsel, oversight, and direction to the company efforts:

Top management must continue its leadership as implementation gets under way. At Nissan USA, for example, the president put on the company uniform and spent time on the assembly line with workers to demonstrate his commitment to the success of the programme. This is crucial in the initial stage of functional implementation when the production line may halt due to a lack of parts or poor quality. At Kawasaki's plant in Lincoln, Nebraska and at the Hewlett-Packard Greeley Division, it is not uncommon to see assembly lines stop for a few minutes or even hours because of lack of parts. It will take years before JIT can be fully implemented. Thus, management commitment and leadership must be clearly established before a company can move forward with a long-term programme.

**Human Resources Readiness**

Another important factor in the implementation of JIT purchasing is human resource readiness. A company must have the support and commitment of every employee in every department, all the way down to machine operators. Once top managers become familiar with the JIT purchasing concept and realise its potential benefits for the company, the company must ensure that all employees are properly trained. In the US top management believes that JIT purchasing will be more successful if the employees become involved at an early stage. But often this does not happen, resulting in an unwillingness to contribute to the success of the programme.

Prior to the implementation, top management should prepare employees for:

(1) the goals and objectives of the programme;
(2) accepting changes within their work procedures and unlearning years of conventional wisdom;
(3) accepting cross-section training, learning different skills, and moving from one job to another as the system requires;
(4) accepting more responsibility within their jobs; and
(5) being active participants in the programme by suggesting new ideas.

**Union Leaders' Support**

Co-operation between union management and company management in implementing JIT purchasing is also a vital prerequisite. When unions are involved, the company should seek commitment from union officials for the programme. Implementation of
JIT necessitates labour flexibility so that employees can be reassigned from one job to another as the system demands.

Often, such drastic changes are perceived as threats to existing work situations and thus are strongly opposed either by workers or their union representatives. In US companies where job descriptions are for the most part defined specifically, it is unlikely that the JIT implementation effort will be successful without union leaders' support.

Fortunately, wage employees and their union officials are now more concerned about policies regarding employee involvement, commitment, long-term employment and quality of work life, which all relate ultimately to the success of a JIT programme. On the other hand, they are also cautious, because they are uncertain what effect the changes will have. These are not unusual or unnatural concerns; the company must proceed with the co-operation of the wage workers and their union representatives.

**Organisation of Operational Factors**

Several important operational factors were found necessary for successful implementation of JIT purchasing. These factors are: a new purchasing philosophy which includes lot size, number of suppliers, long-term relationships, and early supplier involvement and support; a controlled transportation system to meet JIT delivery; efficient receiving and materials-handling procedures; accurate and firm supplier scheduling; and the use of standard containers.

**New Purchasing Philosophy**

When a company adopts the JIT purchasing philosophy, the role of the buyer changes. The basic functions (locating good suppliers, negotiating contracts, expediting orders, and following up to assure compliance with purchasing system standards) remain the same, but the response of the buyer changes. The buyer becomes more active, working very closely with the suppliers to establish long-term relationships for better product quality, on-time delivery, and other needed services.

The new philosophy requires a consistently high quality of purchased parts. The Senior Buyer at Buick Division stated that: “Quality is the heart of JIT purchasing implementation; other aspects, such as moving parts from point A to point B on time, are just a matter of logistics”. Four factors have been identified as important in improving quality and thus implementing JIT.

**Purchase of Small Lot Sizes in Frequent Deliveries.** The hallmark of JIT purchasing is the steady purchase of parts in small lot sizes, rather than in large batches as is traditional under US purchasing practices. Despite the strong indication in the literature that the geographical location of suppliers is an important criterion for effective implementation of JIT purchasing, the results of the survey did not completely support this contention. Only two of 21 companies surveyed indicated that suppliers' geographical location is an important factor. Surprisingly, 11 of 21 companies indicated that this is of little importance or not important at all. The Transportation Manager at Nissan explained this attitude. Nissan will buy wherever possible, he said, as long as suppliers provide high-quality products, on-time delivery, technical assistance and fair pricing.
**Drastic Reduction in the Number of Suppliers.** All US companies which have implemented the concept of JIT purchasing have drastically reduced their number of suppliers, to five or less for a given part. Without this reduction, JIT purchasing becomes unmanageable and strong long-term relationships with suppliers cannot exist. Having many suppliers for a given part forces purchasing personnel to concentrate on co-ordinating them rather than on the primary objective of improving quality.

In order for suppliers to be competitive and meet high quality standards, they must implement SQC techniques. A massive, continuous training and education programme in the JIT purchasing philosophy must be initiated for suppliers. Fewer suppliers means fewer companies requiring training by the buyer’s company.

There are several other important advantages in having a single or a few sources of supply:

1. **Higher Quality.** A single source of supply can be managed more easily, with the buyer having more time to work closely with the supplier. This results in greater contributions from the supplier in areas of design and product quality.
2. **Better Communications.** There are fewer communication problems with a single source of supply. For example, there is only one source to receive changes in order quantity and delivery time for specific parts.
3. **Operational Advantages.** A certain amount of production time and paperwork which is usually spent changing from one supplier to another can be eliminated when dealing with a single source of supply.
4. **Cost Reduction.** A single supplier can constantly contribute to cost-cutting ideas. The engineering people can spend more time and work very closely with the supplier to reduce high costs.

**Long-Term Relationships.** Long-term and mutually beneficial relationships between the buyer and supplier also contribute to the improvement of product quality. Such a relationship encourages the supplier to be more innovative and to economise in the production process. More importantly, long-term relationships and flexible contracts encourage supplier loyalty and reduce the risk of an interrupted supply of parts to the buyer plant. Also, there is a constant improvement in the system of production and services. Hewlett-Packard, for instance, has given its JIT suppliers 18- to 36-month flexible contracts with the potential for renegotiation every six to 12 months in exchange for quality improvement and cost reduction.

**Early Supplier Involvement and Support.** Another prerequisite for successful implementation of JIT purchasing is early supplier involvement and support. Ninety-five per cent of the companies surveyed indicated that without early involvement and close co-operation between the buyer and suppliers, JIT purchasing would fail. Buick Division Senior Buyer said: “The real owners of the plant are the suppliers”. Buyers must, therefore, concentrate on educating and training suppliers for JIT purchasing.

**Controlled Transportation Systems**

Another important requirement is on-time delivery. The buyer must design a transportation system compatible with JIT materials delivery schedules. Because of the complexities involved, such as methods and routines of shipments, the traffic manager in the buying company should have complete control and responsibility for inbound as well as outbound freight.
JIT purchasing cannot be successful if the responsibility for inbound freight schedules is left solely to the transportation company, whose primary concern is maximising profits. In the JIT environment, the traffic manager should be more concerned with on-time delivery than with achieving a lower inbound freight cost. To meet JIT delivery requirements, delivery dates and times, types of carriers, routing decisions, and shipping processes should be designated by the buyer company. The questionnaire responses indicated that the majority of US companies implementing JIT purchasing have transportation/traffic departments that control inbound freight delivery schedules.

Efficient Receiving and Materials Handling
The JIT system requires reduction of the receiving area as a whole, due to the high costs involved in incoming inspection and materials handling and the possibility of damaging parts during handling processes within plants. The formal receiving and inspection of incoming purchased materials should be eliminated so that suppliers can get as close to the assembly line as possible and deliver parts directly to the workstation. Quality inspection at the supplier's plant greatly reduces the need for receiving inspections at the buyer's plant. The questionnaire results indicated, however, that many companies still have not completely eliminated formal incoming inspection.

According to the company documents collected, the Automotive Industry Action Group has suggested the elimination of incoming inspection through certification of supplier quality. Under their “Just-in-Time in America” programme, the buying company educates and trains suppliers with regard to quality assurance and quality control techniques. Subsequently, the supplier certifies that the quality specifications have been met.

In addition to reducing incoming inspection costs, elimination of formal receiving operations results in less handling, a smoother movement of materials between stations, less time spent on the physical movement of materials from the time received until used, and less chance to damage parts. A Buick Division manager stated that his division was in the process of eliminating the incoming inspection of all parts, which requires bringing parts into the box, setting them down, moving them to storage, stacking them up, and then moving them back to where needed.

The Hewlett-Packard Greeley Division has adopted a new procedure to reduce handling for some bulky parts. According to the Traffic Manager, scheduling will be arranged to have a full trailer of foam inserts at the receiving dock at all times. When the trailer is almost empty, the truck company is called and it delivers a full trailer within one hour and pulls away the empty one. Currently, the Buick Division has developed similar procedures to improve its efficiency in receiving and materials handling.

Firm Scheduling for Suppliers
Another organisational requirement is firm and accurate supplier scheduling. Since one of the primary objectives of JIT purchasing is to have little or no inventory, suppliers must receive firm schedules so that materials can be secured and delivered in the right quantities at the right time. Fifty-two per cent of the companies indicated that successful JIT purchasing depends on accurate production schedules with little fluctuation in quantities and delivery times. One technique that can be used to back up the
assembly schedule into the fabrication operation is the kanban system. This technique can successfully replace purchase orders, vendor invoices, and receiving reports; the companies interviewed, however, have not yet integrated the kanban system in their operations.

Among the surveyed companies, suppliers who deliver parts on a JIT basis usually receive a firm monthly schedule of requirements, two to four weeks in advance, plus a one or two months tentative requirements schedule. A few trusted suppliers even have direct access to the buyer's computerised MRP system, so that they can update their schedule constantly.

The buyer's schedule must be stabilised in order for the supplier to meet it smoothly. The Buick Division Production Manager explained that, when schedules fluctuate by 15-20 per cent, suppliers tend to believe the company does not know what it is doing; therefore they build extra inventory, just in case a schedule comes up next week demanding more inventory than they have. They start operating independently, no matter what the company says the schedule is.

**Utilisation of Standard Containers**

The use of standard containers for delivering parts or materials has great potential benefits. These benefits can be categorised into five groups:

1. easy identification of precise quantities and specification of the part number;
2. facilitation of receiving and materials-handling procedures, which results in less need for manpower and prevents mistakes;
3. elimination of potential damage to the parts in and out of the plants;
4. reduction of packaging costs; and
5. reduction of waste, which results in clean work areas and saved space.

Among the companies surveyed, the number that require suppliers to use standard containers is very small; a few were in the process. The Buick Division, for example, is designing trailers for the Detroit area, where there is a heavy concentration of suppliers, to optimise space and meet JIT requirements. Each trailer will have four tiers. When a trailer leaves the plant in the morning, the top shelf is full of empty containers, arranged by suppliers according to the delivery sequence. When the trailer goes to the first supplier, empty containers will be replaced by full containers and placed in the bottom tier. By the time the trailer returns to the plant, the bottom tiers should be full of materials and the top tier empty.

Without a doubt, implementation of new purchasing concepts requires fundamental changes in the way many operation systems work. In addition to the JIT purchasing factors discussed, changes must be made in group technology, flexible machining systems, robotics, process-controlled quality, optimum layout, assembly, design and process engineering, and production. These factors have already been discussed in detail by many authors.

**Conclusion**

Once US companies have experimented with JIT purchasing and run pilot programmes, successful implementation depends on several critical factors. The results of the survey questionnaire and on-site research indicate that these factors can be grouped as organisational human resources and operational factors.
Prior to implementation of JIT purchasing, top management must be aware of several factors. First, top management must understand that JIT is not just a series of techniques. Rather, it is a manufacturing philosophy which requires the support, commitment, and participation of human resources at all levels of the organisation. It also requires fine-tuned planning among different departments within the organisation as well as careful co-ordination with outside companies, such as suppliers and transportation companies. Second, the implementation of the JIT programme is not a one-time effort with a distinct beginning and end. It is a continuous process. Third, the implementation of the JIT purchasing philosophy involves fundamental changes in corporate culture, human resources and training programmes, and internal organisational structures.