

THE EFFECTS OF JUST-IN-TIME INVENTORY PROCEDURES ON THE LOCATIONAL DECISIONS OF SUPPLIERS

A new era in American manufacturing efficiency is developing by relooking at old procedures governing inventory control and industrial location.

by Daniel L. Tompkins

The J.I.T. procedure depends on producing the necessary quantity at the needed time, i.e., the manufacturer will produce only what is needed and will not stockpile finished goods or parts. In this environment, one piece is the ideal lot size. A worker will complete his/her task and pass the piece along. The timing is paced so the piece is passed along to the next worker when needed.

The object is to keep inventory at a minimum by viewing anything that does not directly add value to the product as waste to be eliminated. Since inventory only adds cost, it needs to be depleted. Therefore, the only inventory a firm will have are materials required for work in progress, and suppliers will deliver only what is needed for a day. One advantage of this system is that with less inventory available chance of damage is lessened and the product will not become obsolete while waiting for shipment.

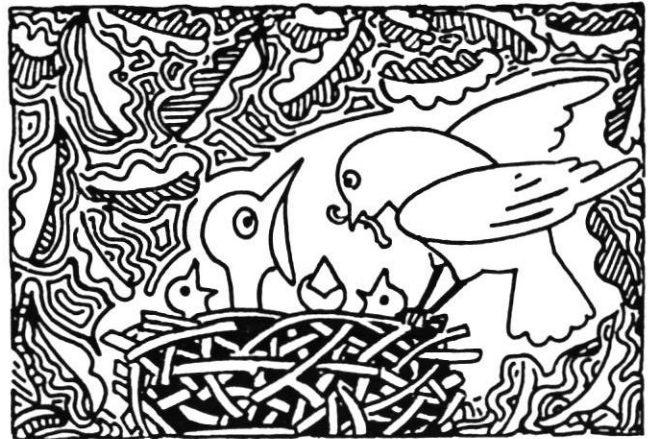
The use of J.I.T. saves the manufacturer money. "To produce 11 million cars and trucks a year, the Japanese auto industry has \$800 million in inventory. The U.S. companies need \$8.5 billion to do the same."¹ Ford estimates insurance and interest equal an additional 26% to the value of the stored parts or \$2.1 billion that could be used for working capital.²

Characteristics Of J.I.T.

Toyota's kanban system uses cards similar to those found in stores which tell clerks when to reorder. With kanban, each part container has a card needed for

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manufacturing and assembly; employees cannot use a piece without a card and never can have more pieces than the card indicates. The parts that are stockpiled must be used on a first-in, first-out basis.

The J.I.T. system can be implemented with or without a computer. Buick adopted an automated storage/retrieval system along with the J.I.T. At their Flint engine plant, they replaced 60,000 sq. ft. of storage space with a 10,000 sq. ft. area next to the engine assembly. The former storage space now is used for additional assembly and testing. As a result, part shortages were reduced and capital freed that previously was tied up in inventory.³ J.I.T. also promotes manufacturing flexibility so a company can adjust production according to demand without worry about excess inventory.

Relationship With Supplier Companies

The establishment of these economical procedures requires trust and flexibility between firms. The manufacturer must be assured suppliers will deliver according to schedule based on changes in market demand.

Similarly, the supplying company needs to trust its customers. The use of J.I.T. procedures could reduce the

number of suppliers a firm uses, yet the supplier needs to count on a stable market in order to amortize the cost of production over a long period.

Many critics of the system contend the procedures merely push the inventory problem onto the supplier. Not so if they also adopt the system. If the supplier provides a warehouse for parts, nothing is gained. The extra handling involved in storage may result in damage, and since the system disallows extras, damaged items would stop production.

The manufacturing firm adopting J.I.T. requires its suppliers to ship parts daily which also necessitates a strong working relationship with freight carriers. Usually, the supplier is located within 300 miles (one day's drive) of the firm.

Weber's Model For Industrial Location

The question remains, where will the supplier decide to locate? In 1909, the German economist, Alfred Weber, wrote the first theory on how industrial decisions are made in terms of agglomeration activities, transportation and labor costs.⁴ An industrial firm's location was at the lowest cost.

The theory relies on several explicit assumptions: first, there is an uneven distribution of raw materials across the plain; second, the markets for products are provided as points on the plain and they exist before any industrial decision is made; third, there are several fixed locations for labor with a given wage rate at each location. Between these points the wage rates may differ, however, labor is immobile and unlimited as long as the firm pays the given rate.

Weber assumes the plain has a uniform race, culture, climate and political and economic systems. A rational decision-maker seeks to minimize total cost and maximize profits. On the plain, a perfectly competitive economic environment exists; no one obtains a monopoly or enforces an oligopoly; labor and transportation are the only varying costs; land buildings, equipment, interest and depreciation are uniform. Weber assumes a uniform transportation system exists over a flat surface, therefore distance is the only factor in transportation costs.

He theorizes the decision-maker first will locate the plant at a site that minimizes transportation expense. If labor cost or agglomeration activities affect the decision, the industrialist will look for an area that will minimize total cost. If labor costs are significantly higher at the location offering minimum transportation expense, it pays the industrialist to look elsewhere. Another site might have higher transportation fees, but offers cheaper labor. Similarly agglomeration, which may affect total cost, is the savings that can occur to firms operating in the same area. Such activities represent common services used by companies such as utilities, financial service, and linkages with each other.

Locational Decision With Linkages

Agglomeration linkages are key to locational decisions,

according to J.I.T. procedures. Linkages are defined as the external contacts of an organization of its component parts, which collectively define the space within which it operates. Indeed it has been maintained that linkage patterns are a measure of spatial behavior demonstrating the role of other places in the operation of commercial enterprises.⁵

Weber believed the decision-maker was a rational profit maximizer. Accordingly, linkages were just channels where spatially variable costs and revenues occurred. The theorist assumed external economies of scale existed and the industrialist merely responded to concentrated activity. However, later researchers found agglomeration usually follows, not precedes the location decision.⁶ In other words, the industrialist wants others to locate nearby in order to reduce his/her risk and uncertainty.

Three major sources of risk and uncertainty are found. First, other decisions are made at the same time; second, the implicit risk of changing technology; and last, unlike earlier assumptions used in locational theory, the decision-maker has imperfect knowledge of the market. The outcome of the decision is based on its context which is influenced mostly by uncertainty.⁷

Under Weber's assumptions, decisions are made in an open system which allows for receiving, processing, and transmitting information and material to other organizations. However, the open system sometimes lacks information; and external circumstances may influence the decision. An example is the need for top management approval. The staff conducting the search finds a site that will reduce risk and minimize cost. However, if senior executives do not want to live there, another place will be chosen. Under these conditions, the "attributes of external sites are less relevant than the nature of the industrial and organizational environment within which the decision is made."⁸

Linkages also help determine how the firm conducts itself in terms of process, the movement of goods between firms in stages of production; service, the supply and repair of machinery and equipment; marketing, selling and distributing support; and financial and commercial support, including accounting and insurance.⁹

The J.I.T. procedure primarily influences processing and marketing. Since the manufacturing firm will not keep an inventory, selling and distribution systems need to change.

Each category of linkages has nine characteristics that influence the locational decision:

1. value of any particular contract
2. volume or magnitude of the contract
3. frequency or regularity
4. the type of goods involved in the linkage
5. the type of counterpart organization involved
6. the mode or form of interchange
7. the formality or the legal status

8. the time budget
9. spatial dimensions¹⁰

The significance of each characteristic depends on the nature of the transaction. Of particular importance is the value and volume of the contract. If the firm adopting these procedures represents a large volume of the suppliers's business, the latter will relocate to comply with the requested delivery schedule. If the supplier values its relationship with the other firm, it will make the changes necessary to keep the business.

Using the J.I.T. system increases the frequency of delivery and the importance of transportation costs. If the product is small and light, the supplier still may be able to use air freight, thus the supplier could be located anywhere in the country. However, the mode of transportation must be selected to allow for prompt delivery. For example, a semi-conductor firm could locate in the Silicon Valley and send chips by air to Detroit. However, since inclement weather conditions could restrict air traffic the auto manufacturer may be forced to select a closer supplier.

The time budget also changes. In addition to the accelerated pace for receiving supplies, the system needs flexibility, which requires changes to be made quickly. Even though communication costs are decreasing, the manufacturer may desire a supplier nearby; closeness can assure all parties that changes are understood and being made.

Of course, J.I.T. procedures affect the last characteristic, spatial dimensions; the other limitations placed on the locational decision limit the space in which the firm can locate.

Implications For Real Estate Counselors

Real estate counselors can use the trend toward J.I.T. to their advantage. Once a manufacturing firm decides to adopt this procedure, the counselor knows the supplier may choose to build a plant close by or depend on transportation for delivery. In most cases, the supplier will build a plant near its customer unless reliable transportation can deliver the goods inexpensively.

The real estate counselor should know how J.I.T. affects market segmentation. Obviously, geography is one sector influenced, and the counselor knows suppliers of local manufacturing companies are targets.

Other segmentation strategies can be used. The success of inventory control depends on the ability of the supplier to turn out quality goods; thus, a market-factor segmentation based on quality may work to attract these firms. The counselor also can point out the services available to the firm on-site, i.e., the closeness of accounting, advertising, and legal assistance.

Other segmentation strategies are benefits, volume, the location's status, and accessibility to highways or rail lines. The firm needs to be near one or the other to meet the customer's schedules. Also, the real estate counselor must find a location that fits the heavy volume produced by most suppliers.

Other Implications

J.I.T. also will effect the growth of industrial parks. Instead of heterogeneous companies locating in parks; an industrial area can include a manufacturing firm and its suppliers.

However, it negatively impacts upon the need for distribution facilities since less storage is needed throughout the production and close proximity provides convenient delivery to customers and markets. Distribution centers will have to add value to the product and warehouses either will be converted to other uses or torn down.

As long as building costs are related to square footage and less capital is tied up in inventory, the return on investment should increase. Firms should generate more internal funds and reduce the pressure on the capital markets. Hopefully this will decrease interest rates and encourage expansion into new markets.

NOTES

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6. McDermott and Taylor. *Industrial Organization*, p. 52.
7. Ibid, p.55.
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