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Just-in-time concepts and the forest industry

Contents

Abstract

The Forest Engineering Research Institute of Canada (FERIC) studied whether Just-In-Time (JIT) concepts were being applied to log delivery procedures within the forest industry in western Canada. This report provides examples of forest companies using JIT concepts in their inventory management procedures, and identifies procedures to assist companies with implementing JIT concepts.

Keywords

Just-in-time, Inventory management, Western Canada.

Author

Bruce McMorland,
Western Division

Introduction

This report examines how, or if, Just-In-Time (JIT) concepts are being applied to log delivery procedures within the forest industry. This is of interest because log inventories require financing and carry risk of fire loss and quality degradation.

FERIC planned to identify western Canadian forest companies using JIT concepts in their log delivery procedures and to assess their success or failure. We expected to compile a list of enabling technologies or procedures to aid in implementing JIT. A cost/benefit analysis would then highlight the financial implications.

FERIC surveyed approximately 60% of its western advisory committee representatives by telephone during 1999, and asked if their companies used JIT procedures. We found that the term JIT was not well understood, and that it was commonly thought to be a form of inventory control. Some operations utilized controls and felt the basics of JIT were in use. Most locations, though, simply accepted whatever log inventory was needed to ensure continued mill performance during periods when raw product supply was interrupted.

To address the lack of specific knowledge concerning JIT, information was sourced from the manufacturing and retail sectors to define the process. FERIC increased the scope of the project and modified the objectives to the following:

- Explain JIT concepts.
- Discuss these concepts relative to forest industry phases in western Canada.
- Identify procedures that will assist in implementing JIT concepts.
- Provide examples of forest companies using JIT-related concepts.

What is JIT?

JIT is a phrase developed in the manufacturing sector. It refers to the intention of providing the materials, labour and equipment only in the amount and at the time necessary to do a particular task. The concept has been widely used in Japanese manufacturing plants to control material flows between workstations.

JIT manufacturing is known in North America by various names, including Toyota Production System, Action Workout, Lean Manufacturing, and Stockless Production (Hendrickson n.d.). These descriptors refer to the manufacturing concept of a "pull" system, where activities are customer-order-driven and attention is always directed to the next stage of production. Only what is needed for the next stage is actually produced.

Hendrickson further notes that the focus is to achieve excellence by eliminating waste, which is defined as any non-value-added activity. This includes transport or waiting time, unnecessary inventory, overproduction, and defective product.

Examples

JIT is illustrated in its simplest form in the following example.[1] A workstation or warehouse (the "server") receives both a card call-order and an empty container from a downstream user (the "client") for a small, fixed quantity of product or supplies. After sending the items, the server becomes a client and generates a card call-order to its own upstream supplier. Workstations on the production line only produce or deliver their product when they receive a work order, i.e., the card and an empty bin. When the production line is interrupted, a workstation produces only enough components to fill the current container, and then stops. The underlying principle is to eliminate storage in the production area—users "pull" supplies or materials as required.

> The Japanese refer to JIT procedures as KanBan, which stands for card- *Kan*, signal- *Ban*. Plant production is regulated by KanBan, and depends on cards and containers to transport parts from one workstation to another.

The Toyota Corporation takes this logic further by having certain components provided directly from suppliers to the production line (Olsson n.d.). This eliminates or reduces dependence on a central warehouse.

Some North American retailers have been very successful in using these principles in their inventory management. For example, Wal-Mart Stores, Inc. uses advanced computer technology to link stores and suppliers to a large database, or central data warehouse (Retail Link™).[2] Wal-Mart encompasses more than 3500 retail point-of-sale units worldwide, and each is autonomous as it must satisfy local consumers and customize merchandise to local requirements. The data warehouse provides fast and easy access to sales, inventory and shipping information about a supplier's products sold at Wal-Mart. A 1999 press release from Wal-Mart's website states: "Previous day's information, through midnight, on over 10 million customer transactions is available for every store in every country before 4 a.m. the following day. Today, over 7000 suppliers access Retail Link™ and get answers to any question at any time. Wal-Mart currently averages 120 000 of these complex data mining questions each week."

For retail sales, the next logical step in the JIT process is e-commerce over the Internet. Some retailers are already taking this step. For example, The Home Depot has integrated e-commerce with some of its stores in the United States, with plans for further integration.[3] Customers who live in areas served by the e-commerce sites can order on-line, then pick up at a store as soon as two hours later or have the products delivered within two days.

This is a complex task, for there are between 40 000 and 50 000 individual products stocked at most of The Home Depot locations. Nonetheless, this retailer is

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[1] Example was obtained from the website of the Business Open Learning Archive of Brunel University (http://sol.brunel.ac.uk/~jarvis/bola/jit/jit.html).

[2] Information about Wal-Mart's Retail Link database was obtained from Wal-Mart's website (http://walmart.com) in 1999. This information is no longer available from the website but is available from the author upon request.

[3] Information about The Home Depot's e-commerce site was obtained from archived press releases from the company's website (http://www.homedepot.com) in April 2001.

Forest Engineering Research Institute of Canada (FERIC)

Find us Online! www.feric.ca

Eastern Division and Head Office
580 boul. St-Jean
Pointe-Claire, QC, H9R 3J9
☎ (514) 694-1140
(514) 694-4351
admin@mtl.feric.ca

Western Division
2601 East Mall
Vancouver, BC, V6T 1Z4
☎ (604) 228-1555
(604) 228-0999
admin@vcr.feric.ca

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convinced that this commitment to customer service, needs, interests and convenience is the only route that will maintain The Home Depot as the world's largest home improvement retailer.

In contrast, a company like Costco Wholesale does not incorporate JIT-type concepts. Instead, such retailers use a strategy that provides bulk products at low unit cost. The inventory strategy is not customer-driven as out-of-stock situations can occur quickly.

Customer-driven, integrated philosophy

The JIT concept of material flow is a simple principle, but JIT is more than an inventory control mechanism. It is a complex process of relationships between supplier, manufacturer, and customer. It encompasses a firm's productive activities, including material and technology management; vendor relations; purchasing and delivery; and human resources. JIT is a customer-driven process and involves very active employee participation and commitment. JIT requires:

- a clear understanding of "who is the customer"
- employees at all levels dedicated to providing customer service, identifying and eliminating non-value-added activities, and producing the highest quality manufactured product
- a relationship between customer and supplier that is based on agreements and trust
- reliable delivery of raw materials
- high, consistent quality of raw materials to avoid production stoppages
- stable, predictable production schedules
- small lot sizes
- existing inventory in the right place at the right time

JIT and the forest industry

JIT perfection

Ideally, the use of JIT in the forest industry would minimize the time between order acquisition and product shipping. For example, a lumber order might arrive in the morning and by that afternoon, the appropriate trees would be sourced in the forest. Harvesting and transporting to the mill would occur on Day 2, and the stems would be converted to lumber and shipped on Day 3. That is the essence of JIT: high customer service, everyone working towards one common goal, high quality of raw material and finished product, dedicated attention to detail, little or no waste, short cycle, virtually no pipelines, and no inventories.

The reality is that this process does not happen in three days. Excluding planning and development phases, the time in the product pipeline varies greatly in the forest industry across Canada. Hot logging techniques can move raw product through the pipeline in relatively short times—as little as 5–6 days for harvesting, 1–2 days in the woods prior to loading, and 2–8 days at the mill prior to conversion. However, FERIC's survey showed most mills cycle through felled production in 4–6 months, while some speciality mills may take up to 30 months.

A logical question is "Can JIT be implemented within the forest industry?"

Considerations for the forest industry

There are a number of considerations within the forest industry that pertain to the implementation and use of JIT. These include definition of customer, the acceptance of large inventories, availability of raw material, customer agreements, distance from market, and resistance to change.

Customer definition

In a JIT concept, the local conversion mill is simply part of the supply pipeline to a retail customer. The mill is not the primary focus and its performance might not be optimized. It could be shut down or sharply curtailed on a frequent basis. However, as wood conversion plants cost in the tens of millions of dollars to build and carry large daily ownership costs, it is unlikely operational

The underlying assumption to JIT is that the customer is the primary focus of attention. In the forest industry, the question is who orders the tree—the local mill, or a retail lumber/fibre buyer?

curtailment will occur on a frequent basis. Instead, it is likely that most wood conversion facilities in Canada will continue to be, as they are now, classed as the customers for raw wood. The intent will be to keep conversion plants operational, occasionally even independent of orders for finished product. This will result in inventory buildup at the infeed and output end of the mill.

How many raw materials should be stockpiled? How many manufactured products should be carried after conversion? These are questions about inventory management, which is really a process of accepting and managing risk. There is no standard that defines an acceptable amount of risk. Owners or boards of directors decide the acceptable levels of risk for a company, and may establish those as local policies. Risk acceptance is personal, and the comfort level differs between people.

Reasons for inventory

In traditional manufacturing, raw materials are "pushed" (as compared to JIT pulled) through system processes to get to the place where they are needed next. Inventory zones are buffers against unreliable suppliers, or fluctuating demand from clients. This structure applies to a very large proportion of the forest industry in Canada. The conversion mill is considered as the customer, so the millyard usually becomes a highly visual indicator of inventory buffers from both supply and demand sides.

The survey showed there were three main factors that caused inventory buildup at the mill site:

- The company could not get raw product for part of the year, so a stockpile was needed for the non-supply periods.
- A variety of raw materials, sometimes hard to get, had to be maintained onsite to fill anticipated orders.
- The mill might be run at high capacity so that expensive mill production machines have the lowest hourly costs possible.

Forest companies with multiple mills may have complex scheduling situations. For example, the pulp mill may operate for 360 days per year, the sawmills for 250 days, and the logging force for 175 days. A company that faces a fibre supply problem with this scenario may have little choice except to stock raw material inventory.

Inventory buffer zones also often exist between harvesting phases. Supply buffers ensure that a phase machine can continue work if an upstream machine activity stops, and the size of the buffer can range from a few hours to a few weeks.

JIT does not work in situations where the primary intent is to minimize the cost of an activity phase.

Availability of raw material

JIT requires an assured and constant supply of raw materials. The forest industry is subject to several factors that can interrupt the flow. Four potential constraints are:

- approval to harvest
- environmental protest
- labour withdrawal
- ability to harvest and deliver wood (terrain or weather constraints)

The first two constraints are outside the control of the company, although company practice may influence the intensity of environmental protests. In either case, the ability to provide raw material may be affected. The normal protection in both situations is to store raw product in inventory zones. The latter two constraints are more controllable by the company, and may be influenced by company policy.

Situations that disrupt normal operational practice, such as fire- or insect-damaged trees, would disrupt JIT scheduling as well.

Long-term agreements

To successfully implement JIT, a stable, long-term relationship is necessary between a manufacturer and its suppliers or customers. Such relationships frequently do not exist between a conversion mill and its customers. Many consumers of wood products have a specific policy of sourcing the least expensive product available.

Distance from market

Long pipeline distances tend to increase a customer's inventory levels. This translates to a lower frequency of orders to a converting mill, but with larger quantities for each order. In turn, the converting mill must have the required volume of product available to ship, which dictates an inventory of finished product stored in the millyard.

Resistance to change

Cammarano (n.d.) describes the resistance in implementing JIT in a long-established manufacturing plant. It was impossible to parachute a JIT culture into a situation not predisposed to it. Widespread adoption of JIT logic requires changes in thinking and philosophy to alter procedures, attitudes and perceptions. Alterations must occur through slow progress in carefully planned steps.

Can JIT be implemented?

Forest product companies are primarily commodity providers. They produce standard items like dimension lumber or panelboards. These products are usually sold on the open market, and low prices and large volumes normally entice buyers.

A value-added manufacturer does additional, or secondary, processing to wood products. The final result is finished or semi-finished specialty items, e.g., mouldings or doorframes, which are sold to specialty customers. A value-added manufacturer usually targets a niche market, rather than the mass market.

Commodity manufacturers differ from value-added manufacturers in many ways, including their relationship to JIT concepts.

Commodity manufacturers

JIT will probably not implement well at most commodity-based forest operations in Canada for two reasons:

- As noted earlier, the industry is subject to large fluctuations in demand for finished goods and in sourcing of raw material. Polito (1995) notes that JIT assumes an even production rate, and a JIT master production schedule cannot tolerate load fluctuations of more than 10%.
- An underlying tenet of JIT is that of partnering. A strong, long-term relationship between supplier and customer must exist. This type of partnering is currently not common in the Canadian forest industry.

The existing traditional push system of manufacturing will likely remain the model used by most commodity-based forest companies in Canada.

Value-added manufacturers

In contrast, value-added manufacturers are strongly predisposed to JIT. Johnson et al. (1999) describes the approach to "long-term customer intimacy" used by Boise Cascade mills in Oregon. Financially troubled mills re-focused their performance by targeting a niche market, dedicated themselves totally to producing quality product for that market, and established committed, long-term relationships with a greatly reduced number of customers.

Inventory management

JIT may not become widely used in the forest industry, but parts of its rationale are applicable. Inventory management is of interest, and reducing or eliminating inventory is one of the benefits of a fully integrated JIT operation.

Concern about inventory levels is usually strongly associated with market conditions. Good markets generate high sales and revenues, and there are usually few concerns expressed about the size or value of inventory. On the other hand, when revenues fall the company's financial group may issue cost-control warnings to reduce high inventory levels.

Even with good markets, however, inventory management is important to all business operations. The concepts are not restricted to JIT situations, and the concepts do not disappear simply because sales revenues increase.

Industrial cost accounting systems normally provide managers with the value of current inventory, usually expressed in dollars. For a company with two or three operating divisions, inventory values for raw materials can easily approach 100 million dollars.

Accounting systems rarely show the cost of maintaining an inventory. That information is usually masked under various headings. There may be a general ledger account for interest or bank charges, another for insurance, and another for repair and maintenance. The cost of inventory must be clearly identified to serve as the benchmark against which to compare the cost of alterations to practice.

Few accounting systems clearly track the age of raw materials. The costs or reduced profits due to product waste, spoilage or degradation are usually examined indirectly. For example, through lower inventory there may be an improvement in the lumber recovery factor and product value due to fewer stems drying and checking while sitting in storage.

Benefits of reducing inventory

- Reduce financing costs. The time period between raw materials expense and sales revenue determines financing cost, or the cost of money to carry inventory.
- Pay lower insurance premiums. There is less total risk to the insurer.
- Buy less storage space. If the space is already owned, maintain a smaller portion of it.
- Possibly use yard equipment less.
- Avoid or reduce deterioration of raw materials, resulting in improved product quality.
- Potentially reduce handling and associated costs.

Although there are benefits from reducing total inventory, there are also some risks or considerations. The most obvious is the possibility of running out of inventory and not being able to restock. Additionally, supervisory staff may find themselves working increasingly under crises management scenarios.

Case studies

The following case studies were selected from survey respondents who not only indicated an awareness of JIT concepts, but could also identify specific policies of inventory control applied at their location. There is no intent to provide a company-by-company report card on inventory control policies.

Case Study A – Slocan Group, Mackenzie Operations

Reason for selection

Tracking, waste reduction, extending the operating season

Overview and background

The Slocan Group operates a sawmill complex at Mackenzie. The timber supply area surrounds Williston Lake and exceeds the size of Vancouver Island. The lake is a primary transportation corridor that currently handles approximately 65% of annual mill requirements. The balance is direct-hauled from areas closer to Mackenzie.

In 1995, the company initiated a change from tree-length (TL) logging systems to cut-to-length (CTL) systems. This was prompted by an interest in extending the working year for logging contractors to allow more summer operating. The CTL soft-footprint systems were seen as a means of allowing this while complying with the incoming Forest Practices Code. The change to CTL systems was also made to decrease the occurrence of product breakage and loss, and to reduce inventory values which were perceived as being too high. Winter logging production at up-lake staging sites was stored until the lake thawed and the logs could be towed to Mackenzie. This meant that large inventories existed and had to be stored twice—first for winter production at the up-lake sites; and second at the Mackenzie millyard each winter

Case Study A - Mill statistics	
Annual mill consumption:	1.6 million m³
Annual scheduling:	251 days
Millyard storage capacity:	350 000 m³
Daily scheduling:	two 8-h shifts
Infeed maximum log length:	6.1 m
Daily throughput:	6400 m³

so the mill could continue to operate through the following spring breakup.

Inventory management

Along with CTL, a change was made to the lake transportation phase, from towing to barging. The combined changes allow Slocan to be successful with three important inventory management activities: tracking, waste reduction, and extending the operating season.

- Inventory tracking. In the harvest block, stems are manufactured into 4.9- or 6.1-m log lengths and sorted into one of seven species and size sorts. The logs are transported by truck to the lakeside staging sites where the truckload bundles are stored and tracked, in sorted queues, by load identification. The queues allow inventory to be tracked with high precision.
- Waste reduction. Breakage and loss, which had been identified as ranging from 3 to 8%, has been reduced to about 0.25%, and occurs mostly during loading or unloading of the barge. The improvement results from avoiding sinkage loss, and avoiding breakage from the pushing, dumping and de-watering phases associated with towing.
- Extending the operating season. While the change to CTL equipment lengthened the harvesting year, the change to barging lengthened the transportation year. The barge, or transporter, is a 5966-kW self-propelled icebreaker barge that measures 30 m wide and 110 m long. It operates year-round. Volume capacity has ranged from 4500 to 7600 m³, and averages about 5500 m³. The barge can be directed to load any combination of sorts from any combination of staging sites. The precision of the tracking procedure allows sort integrity to be maintained right through to the millyard. The Woodlands Division runs the millyard and directs flow into the mill, so the whole raw-product pipeline is supervised within one group.

The requirement to store inventory has not been eliminated, but it has been reduced. Log storage occurs at the Mackenzie millyard and at the four up-lake staging sites. The goal is to maintain a total system inventory of 175 000 m³ over all five sites. This will build to a peak of about 450 000 m³ by the end of March, to allow continued mill operations after logging stops for breakup, and then reduce to less than 25 000 m³ by the end of June. This compares to previous inventory totals that ranged between 650 000 and 750 000 m³. At a value of $80/m³, this represents a reduction of at least $16,000,000 in inventory value.

The peak, system-wide total inventory represents approximately 28% of annual mill requirements, which roughly equals 70 days for which log deliveries are unavailable to the mill (peak system inventory divided by daily mill consumption).

Case Study B – Lignum Ltd., Williams Lake

Reason for selection

Scheduling, controlled buildups, delayed purchases

Overview and background

Lignum Ltd. operates a sawmill complex at Williams Lake. The mill has two infeeds—one accepts 16.8-m logs while the other accepts 6.4-m logs. Much of the timber supply comes from a 610 000-ha Innovative Forest Practices Agreement surrounding the township. The operating area ranges from 250 km west of town to 150 km east.

CTL systems, employing harvesters and forwarders, provide about 60 000 m³ per

Case Study B - Mill statistics	
Annual mill consumption:[4]	930 000 m³
Annual scheduling:	250 days
Millyard storage capacity:	230 000 m³
Daily scheduling:	two or three 8-h shifts
Infeed maximum log length:	16.8 m
Daily throughput:	3700 m³

year. This represents 6–7% of mill consumption. Feller-buncher/grapple skidder combinations provide the balance. Roadside processors convert these stems into measured logs, with maximum lengths for the long-log side of 16.31 m, and for the short-log side of 6.25 m. All wood is transported by truck to the millyard

Like most companies, Lignum maintains an inventory to supply its mill through breakup. Normal summer practice is to have an inventory of about 10 days consumption stored in the millyard. A gradual buildup starts in the fall and continues through the winter. The target is to have 230 000 m³ in the millyard at the end of February, and continue delivering logs at the daily mill consumption rate until mid-March. By the end of March, millyard inventory is approximately 190 000 m³.

Inventory management

Lignum uses four policies to control system inventory. Unlike the situations at Slocan and Sundance, where practices were altered in part to address inventory considerations, the policies at Lignum have evolved over time and have been in place for some years.

- Alter logging startup and scheduling. After breakup, logging contractor startups are phased in. Contractors also schedule their operations for one shift per day, and for shorter hours per shift. These scheduling intensities increase as the year progresses to meet the inventory buildup plan.
- Control phase buildup in woods. The buffer-zone allowance in the summer is normally kept to 1–2 days between phases, or approximately 1 week between felling and loading. The reason is to keep the decked wood from drying out, thereby avoiding volume and value loss in the mill outturn. This control is relaxed during non-summer conditions.
- Delay open market log purchases. This option is exercised as needed.
- Build a decked inventory in woods through March. The intent is to have 50 000 m³ stored in roadside decks. This volume will be available for transport to the mill in early June.

In total, Lignum has about 240 000 m³ of system-wide inventory by the end of March, composed of the 50 000 m³ in roadside decks and the end-of-March millyard inventory of about 190 000 m³.

The peak, system-wide total inventory represents approximately 26% of annual mill requirements, which roughly equals 65 days for which log deliveries are unavailable to the mill.

Case Study C – Sundance Forest Industries Ltd., Edson

Reason for selection

Blue stain, extended operating season, buffer zones

Overview and background

Sundance Forest Industries Ltd. operates a sawmill complex at Edson. The mill has two infeeds, one for tree-length stems and the other for CTL logs having a maximum length of 5.49 m. The Sundance complex only manufactures lodgepole pine, and has encountered blue-stain problems in pine log decks under summer conditions. The problem was measured as degrade (value lost) from lumber outturn at the mill.

Like Slocan at Mackenzie, Sundance incorporated soft-footprint CTL systems to extend the operating season by adding more summer operating capability, and to provide the mill with additional shortwood segments to enhance mill productivity. The in-house CTL systems provide about 50 000 m³ of short logs (cut to 4.98 m) per year which,

[4] Includes approximately 140 000 m³ of purchased wood.

when combined with the CTL from external sources, account for 20% of mill consumption. Feller-bunchers, grapple skidders and delimbers provide the balance in tree-length form. All wood is transported by truck to the millyard.

Normal practice is to stockpile approximately 10 000 m³ in CTL decks in the woods during March and April. The winter millyard inventory is reduced to zero by mid-June while concurrently starting a new inventory year through active logging startup in June, combined with bringing in the 10 000 m³ stored in the woods. Inventory levels stabilize at about 12 days consumption at the millyard from then until mid-September, when a gradual buildup begins towards the target of 150 000 m³ millyard inventory at the end of February.

Case Study C - Mill statistics

Annual mill consumption:[5]	528 000 m³
Annual scheduling:	246 days
Millyard storage capacity:	150 000 m³
Daily scheduling:	two 8-h shifts; one 5-h
Infeed maximum log length:	unrestricted
Daily throughput:	2150 m³

Inventory management

Sundance developed the following inventory management procedures over the last seven years, partly to manage the time frames surrounding the blue-stain fungus, but also to accommodate a mill demand that had more than doubled.

- Cycle the inventory. The blue-stain fungus is active in summer, but is sensitive to variation in temperature and moisture. Cycling through millyard inventory in a 3-week period during the summer disrupts the growth cycle of the fungus by disrupting the temperature and moisture regimes.
- Extend the operating season. The CTL system increased the length of the harvest season. Independently, the length of the haul season was also significantly altered. The increased mill-consumption requirements meant that harvest planning had to forecast 1–2 years in advance. The company did not have a road construction program—seasonal oil company roads were used for site access—and the planning process highlighted the requirements for an all-weather road system. Now, approximately 30 km of ditched and gravelled roads are constructed annually and the haul season has increased from 155 to 173 days. There is interest in attaining 180 days and reducing the size of the truck fleet.
- Phase independence. Sundance has a target of allowing two weeks between felling and loading. The intent is to keep the delimber and loader in different blocks, separated by 150–200 loads. This is to avoid pressure on the delimbing phase, which is considered to lead to a reduction in log product quality. Although this creates inventory buffer zones, the company manages the buffer volume by maintaining consistent block sizes.

Similar to Lignum's practices, logging contractors are phased and scheduled through the summer and fall to allow the gradual inventory buildup at the millyard. As at Slocan, the Woodlands Division runs the millyard and directs flow into the mill.

In total, Sundance has about 115 000 m³ of system-wide inventory by the end of March, composed of the 10 000 m³ in road-side CTL decks and an end-of-March millyard inventory of about 105 000 m³ (February's total less consumption in March).

The peak, system-wide total inventory represents approximately 22% of annual mill requirements, which roughly equals 53 days for which log deliveries are unavailable to the mill.

[5] Includes approximately 158 500 m³ of purchased or exchanged wood.

Implementation

Canadian forest companies could implement a number of measures that would reduce existing inventory levels.

- Identify the cost of inventory. Knowing the cost of inventory does not guarantee that inventory levels will shrink, but knowing the inventory cost is important when changes are being considered to operational procedures. In many places, the only measure, or gauge, of a change is whether or not the operational cost per cubic metre changes. This is not the most effective way to measure the impact of a change, particularly when large inventory volumes are involved. Most companies should be able to include a measure of inventory cost on the monthly financial statements. This could be as simple as identifying the total value of system-wide inventory and applying a generic "cost-of-borrowing".
- Establish long-term contracts. Forest companies could implement some longer-term, multi-year agreements with certain customers and with some harvesting contractors. This could result in a further cost saving, as longer-term agreements stabilize planning and are usually helpful when negotiating lending rates.
- Increase site access. Use harvest technology that extends site access in rough terrain, sensitive soils or poor weather. Examples are feller-bunchers with cab levelling, and ground machines with high flotation.
- Extend the haul season. This has two components—improve the roads, and improve the trucks. Consider implementing central tire inflation (CTI) on the truck fleet to extend the haul season by, for example, an additional 20 days. This reduces the average daily inventory value at the mill. The hourly trucking cost can decrease, because the yearly ownership cost is written off over more working hours in the year.
- Implement hot logging techniques. Reduce pipeline inventory by shortening the gap between phases.
- Educate staff. Some staff are unaware of JIT and its benefits. Expose staff to the concepts of JIT, particularly the customer-oriented pull strategy, which requires staff to have an understanding and acceptance of the customer's requirements.
- Identify for control. Nearly all forest companies must deal with matching particular raw products to a mill. The primary benefits of making the appropriate match are to optimize mill performance, and avoid extraneous transport. For companies that face complicated scenarios in matching particular logs to a mill, the logistics require that raw log product be sorted and identified early in the production pipeline. Essentially, this requirement generates the data for an inventory tracking system, which is used to monitor and control product flow.

Controlling inventory flow does not automatically correlate to reduced inventory, but the tracking data does allow an understanding of where product volumes are.

Conclusions

The term "JIT", in the pure and true sense of the term, does not apply to the majority of the forest industry in western Canada. Rather, the concepts surrounding inventory management seem more appropriate for the industry.

Conversion plants that produce commodity products are likely to remain as the customers for raw wood product. Also, these plants must usually store large volumes of finished product to entice buyers who shop low prices or large volumes.

Conversion plants require that raw product be stored in quantities large enough to carry the plant through non-supply periods. Based on the case studies, companies that identify and apply inventory management procedures still require peak system-wide inventory to be between 20 and 30% of total annual plant requirements.

The most significant potential to further reduce inventory quantities lies with reducing the non-supply periods. This may provide additional benefits such as better streaming of product flow, and possible reductions in peak quantities of operating machinery and personnel.

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