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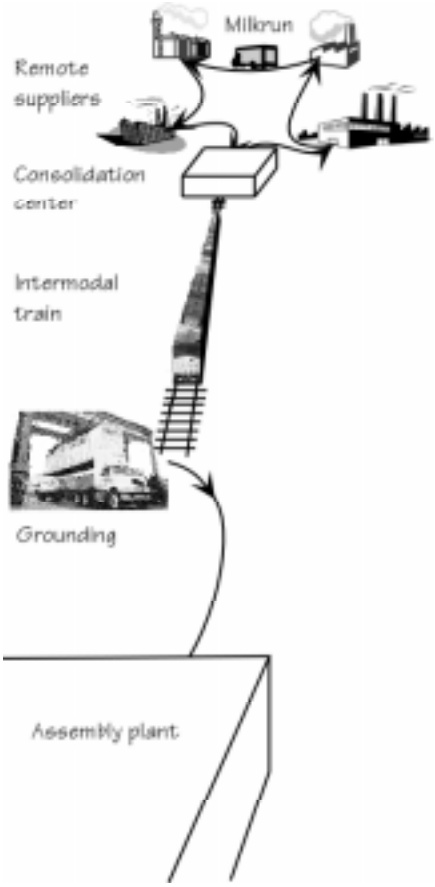

Flow of materials in long distance logistics with a cluster of remote suppliers

Long distance logistics

by David Held

Distance matters. It also affects the manner in which a lean production system is implemented. Lean production was developed by Toyota in Japan, where the majority of the supplier base is located close to final assembly. This geographic proximity minimizes transportation cost, and facilitates frequent delivery of small lots. Other factors also encourage small lot delivery, such as interlocking directorates among the first-tier parts suppliers and the final assembler, and narrow roads and municipal laws that limit vehicle length. The United States, however, is a different matter.

In the US, suppliers are often separated by thousands of miles from final assembly. It is not practical to have a 20 foot local delivery truck transport 12 boxes of parts 4000 miles round trip six times per day. The transportation cost could easily exceed the piece price by a factor of 10:1, which is clearly unacceptable. Suppliers are also less willing to work together to support a given final assembler, preferring to supply all assemblers in a given market.

Does this mean that lean production can't work here? No! Lean production still works, but it has to be adapted to a longer supply chain. It must also incorporate strategies to attain frequent small lot deliveries, while taking advantage of transportation efficiencies and economies of scale. Returnable packaging systems are also an effective cost saving device, but only if the containers are either nestable or collapsible.

One successful strategy that can be used to provide frequent, small lot delivery to the factory, while at the same time minimizing transportation cost, is to locate a *consolidation center* in the geographic center of gravity of the supplier base.

As a general rule, transport by train in intermodal containers is cheaper than over-the-road trucking when distances exceed 250 miles or so. So, to minimize cost, truck miles should be kept to a minimum and all extended distances should be traversed by train. Even intermodal express trains only average 25 mph at best, so the amount of in-transit stock will increase. However, careful synchronization of container availability at destination will avoid excessive in-transit buildups due to plants closing on weekends.

Contrary to what one might expect, train transport is not more reliable than trucking. Trains are classified into different types, which are assigned priorities. Priorities matter, because whenever two trains meet on a single track, the train with the higher priority goes through, and the other has to wait at a siding. The more frequently a train has to wait, the slower it will go on the average, and the more variability is inherent in its transit time. As a general rule, the priorities are: government, US Mail, UPS, passenger, intermodal, and

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Lean production in the Iranian car industry

by Hormoz Mogarei

What Hormoz did during his summer vacation was visit his homeland. Within 10 hours of his landing in Tehran, however, an engineer from Iran Khodro*, the largest auto assembly plant in Iran, knocked on his door...*

For four weeks in August, 1999, I visited automobile assembly plants and auto parts factories in Tehran, Rasht, and Mashhad (See map). The concepts of JIT, Lean Production, and the Toyota Production System are well known in Iran and, as in my California plant, related topics are also parts of their daily "menu" of things to discuss and examine. In several factories I met groups of young engineers who surf the internet, searching for, downloading and translating Lean Production related materials, for teaching and implementation. In addition, books and other literature are used in their original languages.

Through the internet these engineers have access to the same information as their American or European counterparts, and seem to be using it fairly well. Foreign consultants are also working with executives. I met Korean consultants from KIA and engineers from France, and heard of Japanese consultants planning to come as well.

Awareness among young engineers, however, has yet to translate into lean production practices and performance levels for the industry. The largest company, Iran-Khodro employs about 15,000, including both office staff and shop floor personnel, and currently assembles 2 different types of vehicles:

- The *Paykan* is the Iranian sister of the British "Hilman" car.
- Peugeots, under license from France's PSA.

Total production is about 550 vehicles per day, working two 8-hour shifts, with potential to increase capacity. It is a huge plant, with about one million square feet of assembly area. Productivity at Iran-Khodro is clearly not up to par, with gross overstaffing everywhere I looked.

As is common in developing countries, efficiency in the use of people is not a priority. Their focus is on supplier quality and delivery improvement, which they perceive to be the major obstacles on their way to higher production and greater customer satisfaction. With such a high internal demand for their vehicles, they wouldn't have any trouble selling if they could just build more.

If, however, the managers of Iran-Khodro get serious about becoming lean, they will have to shift their attention to their own shop floor and to the way they are using people, and thereby develop a basis for helping suppliers improve. This being said, the plant is clean and well organized, with 5S and many mistake-proofing devices in place.

In the auto parts factories in Rasht and Mashhad, engineers and managers also want to embrace more efficient production systems and learn how to put the JIT theories to work, but they don't know how to make it happen. Often, I would see engineers and managers living on site in the "Industrial Town," in furnished apartments within walking distance of the plant.

As a result they spend more time on the shop floor, especially after hours. In fact, much more time than what the "typical" managers and engineers spend here in the American factories. Under those circumstances, they save the commute time between work and home and instead spend time on their "Gemba" issues.

Iran wants to export vehicles, starting with Middle-Eastern markets. But first they will have to resolve their quality, efficiency and delivery issues to gain acceptance in the outside world. Iran has a young automobile industry but by all accounts is geared towards putting to use what has already been tried and fine-tuned by the rest of the automotive world. Based on that, I believe it has a promising future.

Long distance logistics

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general freight. For general freight trains, the cross country transit time can vary from 7 to 17 days, which is extremely unreliable. As a customer, you are happy just to have your freight show up at all. As a general rule, intermodal trains arrive within 8 hours of schedule about 70% of the time, but on-time performance is better for "grounding time" -- that is, the time by which the containers have been lifted off the train, placed on a chassis and are ready to leave the intermodal yard. By working closely with the railroad, and being a "squeaky wheel" whenever delays occur, one can raise on-time performance to above 90%.

Trucks can actually run on time a higher percentage of the time, if the routes are reasonably determined, and the truck drivers properly trained. As long as the route transit times are calculated according to DOT speed recommendations, which assume that trucks can only average 480 miles per day, the truckers actually tend to be early, rather than late. Although mechanical problems with railcars are fairly frequent, trucks do break down more often than trains, but trucks can usually be fixed in 6-8 hours, and contents can be transloaded into a second truck if necessary.

Weather does effect trucks more than trains, but trains are not immune either. To get into California from Chicago on the Union Pacific, for example, all traffic is funnelled through the Feather River Canyon. Every once in a while, the canyon either floods or is blocked by snow. When that happens, nothing moves on rail for up to a week. Trucks can often alter their route.

Milkruns, most of which originate at the consolidation center, visit suppliers on a daily basis or even more frequently if justified by geography and volume. Frequent pickups of less-than-truckload quantities, coupled with leveled sequencing of final assembly, discourage suppliers from overbuilding. The result is decreased cost for the supplier, and a lower piece price to the factory. It also minimizes the risk of obsolescence and the waste of overproduction.

Each truck driver also acts as a Parts Loading Supervisor and Inspector on his/her Milkrun. Boxes that appear to be damaged are not accepted from the supplier, and all boxes are placed in the trailer and secured to eliminate transportation damage between the supplier and consolidation center. Only parts that have been ordered are accepted.

Soft-sided trailers are often used to minimize double handling of previously loaded boxes and to simplify the returnable delivery process. Soft-sided trailers have moveable curtains on the sides that can be pulled back to reveal the freight. They are very convenient for returnables deliveries, but have more moving parts than a standard trailer, and so tend to require more maintenance and break more often. Especially as a trailer ages, it often requires two people to pull back the curtains, which is an annoyance to dock workers. For this reason, suppliers sometimes refuse to load from the side. In fact, suppliers sometimes use the side loading dock for storage of old pallets. As a result, the penetration of soft-sided trailers is not as deep as one might expect.

After making all pickups at the designated appointment time, usually within 15 minutes of schedule, the milkrun arrives at the consolidation center. A consolidation center is *not* a warehouse as parts are not stored there for an extended period of time. In fact, a more appropriate term might be "flow-through center" or "sequencing center". Milkrun arrivals should be scheduled to support live unloading with immediate loading of the outbound intermodal container, to the extent practical. In the ideal situation, the parts would never touch the consolidation center floor from inbound to outbound.

Parts should be loaded onto outbound containers such that a maximum of four hours production of a given part number is present on each container. Subject to damage prevention, weight and stackability constraints, containers should be loaded for delivery to the line or the store, at the destination plant. It goes without saying that loading patterns should be consistent with the leveled sequence of final assembly, and that the finished containers should have external sequence numbers to aid the assembly plant in the proper unloading sequence.

After loading is complete, the container should be drayed to the intermodal yard and lifted onto the scheduled train. Train status should be closely monitored to ensure that each container arrives at destination according to the established schedule, and is grounded and available on-time. A small inventory of loaded containers is often kept adjacent to the plant, and is a necessary result of transit time and work schedules, since suppliers and the plant are often open Monday to Friday, while containers arrive over the weekend. Containers should be parked in designated areas by destination dock and in order of unload, to minimize in-yard congestion. By carefully coordinating the schedule of the consolidation center,

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destination in-transit inventory can be kept to a minimum.

At the scheduled time, containers are brought to the plant and unloaded. The parts then either go to the in-plant store, or directly to the assembly line. Returnable packaging is then loaded back onto the now empty container, and returned back to the consolidation center by reverse rail, for furtherance to the supplier.

Because of the distance involved, it is usually cheaper to send fewer full containers back to the consolidation center: one-way rail rates are higher, but if only 1/3 of the containers go back loaded, the net result is lower cost. To achieve this end, all returnable packaging systems must be either collapsible or nestable. To minimize handling, the plant should stage returnables by destination milkrun group, and only load the returnables into a container when sufficient volume is present to fill the container. Milkrun groups must be designed to minimize plant dwell time, and thus the requirement for additional days supply of a given packaging system to fill the supply chain. At the consolidation center, returnables are taken from the container and loaded onto the first available Milkrun bound for the supplier.

By following the practices described above, small lot lean production delivery can be obtained from a geographically distant supplier group. Low transportation cost is maintained, while the factory enjoys the benefits of reduced inventory, scheduled even-flow parts arrival, and reduced transportation damage.

Schedule of events for Nov.-Dec. 1999

- *Lean II — The details of lean production: Where the devil is*, Michel Baudin, Nov. 8-9, Livonia, MI
- *Lean III — Lean production Implementation: avoiding the bumps in the road*, Michel Baudin, Nov. 10, Livonia, MI
- *Lean supply chain management*, a one-day seminar with David Held, Jim Ayers, and Michel Baudin, Dec. 9, Irvine, CA

For enrollment information about the Lean II and Lean III classes, please call the University of Dayton's Center for competitive change at **(937)229-4632.**

For the lean supply chain management seminar, please call us directly at **(650)856-8928**.

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