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Sourcing and Manufacturing in the Market Region

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Abstract

It has been a common practice to transfer making goods to faraway low-labor-cost countries. For many managers, this seemed to make commercial sense. Sourcing in remote corners of the world takes advantage of reduced labor hour cost. This can be the most significant direct cost. This chapter focuses on the emerging trend to bring manufacturing back, via reshoring within the nation state or near(er) shoring where production is closer by taking advantage of lower cost neighboring locations. Financial analysis presented is based on differential wage rate and pipeline liability. The financial case analysis indicates overall profit that may be reduced due to labor cost; however, risk-free profit can be significantly higher. Four supply chain configurations can be determined using a simple two-by-two matrix: long and short distances between supplier and plant, and between plant and market/customer. Typically, longer distances increase the end-to-end time that is taken and increase inventory. Activity-based cost models (ABCDM) and cases originally focused on internal plant operations now are applied along the supply chain. Long inbound supply and long outbound distribution increase pipeline liability risks and typically increase the inventory due to less frequent and larger volume consignments.

Keywords: local sourcing, risk to profit, reducing obsolescence risks

1. Price-based location decision and effects

Some polluting or “dirty” industrial processes may be moved to other locations where environmental and health and safety legislation is not as strict [1]. Financial penalties for infringements may be inconsequential compared to massive margins. Businesses operate to create value and maximize contribution to profit. They should do so in an ethical, environmental, and resilient manner. It is purchasing responsibility to design new supply chains that enable work to be outsourced, while fulfilling all these criteria [2, 3].

Purchasing is based on a dyadic contract between customer and supplier. Direct comparisons between vendors supplying the same products and specification tend to be restricted to price and confidence that the delivery will be made to schedule. Purchase price can be low when most of the direct cost of production is derived from low-cost labor. With thin margins, most suppliers demand high-volume orders from their customers in order to breakeven. This can imply significant surplus inventory or increased mean inventory.

Purchasing agents are rewarded by reducing purchasing spend. However, once the good is bought, a significant proportion of purchase spend may end up as

obsolete goods. Some orders that are placed may have delivery cancelled late, resulting in payments to suppliers under supply chain *pipeline liability causes*. Contract clauses allow suppliers to have placed orders for materials and incurred costs prior to payment in order to fulfill the order. The agreement may include a maximum value of inventory, an agreed tooling cost, and incurred expenses that the customer is liable to pay for in event of a cancellation.

Less evident is for the corporations to require purchasing agents to make positive impacts on the top line, for example by helping to reduce the number of goods sold with discounted prices, and to change focus “from price to total costs of ownership” [4]. To do this, purchasing must reappraise their impact on each line of business’ performance. Beyond financial return, purchasing may contribute economic and environmental performances that together are evaluated as overall enterprise performance [2, 3].

It remains the case that high labor requirements and high wages typically are major contributors to decisions to source goods from lower labor cost regions. A significantly lower labor hour cost may become the headline figure to justify switching supplier. This research shows this may be a folly because high volumes may be delivered infrequently, resulting in increased risk to profit. The thesis of this chapter is that although lower total profits may be achievable due to more frequent deliveries using JIT and higher wages in near(er) regions, the risk to these profits is lower than sourcing from low-labor-cost regions where delivery is much less frequent and consignment volumes are much larger.

Making purchasing decisions to source from any location around the world where the unit prices are lowest is a tantalizing proposition, in order to meet purchase spend on reduction targets. While low unit prices are attractive to the customer, the supplier typically compensates by demanding significant order quantities. The margin per unit may only be a few percent. Hence, to make a large profit from an order, large volumes provide many contributions to profit. The volumes demanded by the supplier may be inappropriate for the customer. They may have to stockpile finished goods and wait for orders to use up the inventory. Large corporations may force suppliers to produce and stock pile inventories for delivery on a specific date. Capacity constraints and the lead times to produce goods mean that production could have started more than half a year before the delivery date. This can create cash flow issues for the supplier. They have to buy materials, pay workers, and operating costs, while revenue is delayed by the delivery date and payment conditions that could push the payment back months.

While purchase price per unit is a headline metric, total pipeline liability based on a loaded inbound and distribution network represents a significant investment in working capital. Working capital represents the investment in materials and value-adding processes that increase the value of the material. Long pipeline lead times increase the cash-to-cash time. A related metric is inventory turns. This is the number of times inventory is bought and sold in a time period. Increased inventories reduce turnovers for a given demand per period. In order to increase the return on capital employed, managerial accounting prefers to increase inventory turns and reduce working capital. This may, however, be achieved at a higher total direct cost where labor is the most significant cost differentiator between local manufacture and outsourcing to low-labor-cost regions. The reduced profit margin may deter businesses from producing locally. Higher potential profits may be sought; however, these may be put at risk from significant obsolescence risks associated with slow end-to-end inventory turns. Profits also may not be as great as planned as a result of discounting residual inventory in order to raise revenue.

Outsourcing to low-labor-cost countries affects economies. The balance of payments (BOP) for a nation state is made up from exports and imports. The BOP can be either a surplus or deficit. Long-term excess of imports tends to weaken an

economy. Long-term surplus can lead to economic prosperity. Workers may start to demand higher wages and a cycle of inflation can develop. Higher wages reduce the attractiveness of purchasing from such locations because it was their low-labor-cost hour rate that attracted the orders in the first place.

Economic development rates in many emerging countries are astounding; however, it is important to do so with low environmental impact [5]. Development of urban living and burgeoning middle classes increase mean labor cost and reduce the number of individuals available to do manual work. Low cost is relative and increasingly temporary. Catching the wave early requires maintaining a set of back-up plans based on alternate low-cost countries. Some regions in developing countries are more advanced than others. Seeking low-cost areas in these regions can raise the mean economic power of a nation or trading block. Cultural and linguistic differences between Western customers and Eastern suppliers, lack of language abilities, and long haul travel can increase the difficulty of doing business. Making in the home market avoids currency rate variations, cultural differences, and long-distance purchasing and expediting trips. Despite *McJob*-type work availability, federal legislation may set a minimum on the lowest cost labor available in a nation or region. This minimum may result in monthly wages many times higher than other countries. The British Chancellor has set a gradual increase over the current UK parliament term to raise the minimum wage. This could drive down management appetite to reshore manufacturing and administrative jobs [6].

Making in the home region may reduce pipeline liability at the most; however, margins may be squeezed too much due to labor rates. Buying from lower labor cost neighbor states can reduce unit costs in comparison with making in the market region where wage rates are much higher. Ultimately, quality of goods is a higher priority than cost. If lower cost goods are made to lower specifications and these are identified by customers, lower prices will be demanded to compensate. Otherwise, volume demand may reduce for consumer purchases. B2B purchases may reduce or be suspended, and claw back penalties may be imposed.

2. Location, location, location

Where should a company be? This question affects owned and subcontract plants. Final assembly entrepreneurs like Henri Ford, Soichiro Honda, Sir James Dyson, Sir Richard Branson, and Lord Alan Sugar grew their businesses initially inside their home economy. Ford corporation rapidly expanded internationally. Ford initially opened Dagenham and Frankfurt plants as assembly sites that were supplied with kits from Detroit. Rapidly it became clear to Ford that it was more efficient to establish end-to-end integrated product manufacture and assembly campuses. Despite the theoretical and actual efficiency performance, it was noted [7] that internal suppliers were more expensive, were of lower quality, and were less efficient than external, independently owned vendors. Vertical integration, where the corporation owned supplies, ensures that those suppliers are isolated from competitive pressures. Meeting budget rather than being an efficient and well-run business become the norm. As a result, many companies decided not to make all materials and parts themselves.

Outsourcing companies are focusing on their core competencies. This may be a form of “cherry-picking” whereby they choose to specialize on their strengths and competitive advantages. Other activities that are required become noncore competencies. These may be obtained from other companies that focus on providing such benefits to their clients. Specialization can reduce unit cost as a result of increased economies of scale. Companies may provide their goods and services to many clients.

They in turn compete in the market place, despite having many of the same basic elements. From the perspective of small- and medium-sized enterprises, providing services and related goods to satisfy customer contracts, will find it easier to locate close to their key account customer's sites. For purely durable, shelf-life product-based contracts, where there is no service element, production can be located offshore.

Offshoring: materials can be bought and delivered to virtually any site with minimal price differences due to transportation. Some materials import and export duty that may be charged, including value-added tax (VAT) and port taxes. The trade war between US President Trump and China has seen the US impose 25% duty on a wide range of goods, with threats to impose tariffs on billions of dollars more of goods.

Energy may cost different rates in different locations due to the abundance of gas, coal, nuclear and noncarbon-based electricity generation. Some governments subsidize energy. Other governments levy higher prices and supplementary charges that create higher gross prices for energy. Despite the presence of open market competition in energy sectors, net prices tend to be the result of many influences including the ability to buy at higher prices. The bill of materials and energy costs of production can be insignificant in some products. Labor hour rates, therefore, become a major consideration when deciding to move production to lower cost countries. Purchasing price paid for products with high labor requirements can be reduced consecutively by undertaking searches for suitable vendors in order to buy from suppliers located in the other locations where labor is found to be cheaper. Landed piece price is the top line issue for management attention and decision making. Optimizing the price-paid criteria, purchasing typically continues to search and monitor the situation, switching whenever necessary to access the cheapest offer.

It seems counter-intuitive, and therefore illogical, to make the decision to purchase from suppliers that are located considerably closer, that have much higher labor cost, that purchase higher cost energy, and that are located in high-cost industrial locations. The United States is determined to become the low-cost manufacturing country. Allen [8] reported US customers are increasingly choosing onshore suppliers. Some national governments are concerned by the de-industrialization associated with outsourcing to low-cost countries. Donati [9] found more emphasis on maintaining existing industry than on encouraging reshoring.

3. Supply chain designs: Dell versus Hewlett-Packard

Friedman [10] reported on differences in strategy between Dell Corp and HP. Dell Corp established final assembly plants for laptops and desktop blocks close to major population regions. For mature markets where most customers already tend to have a computer to order replacements, Dell focuses on final builds using an "assemble and configure to order strategy." Suppliers for variant modules are geographically close enough to produce and deliver overnight for next day assembly. Standard modules can be mass produced in a range of lower labor cost countries. From OEM suppliers of major modules including processors and memory systems, Dell's supply chain can flow end to end in 11 days. The customer typically can place orders for products 8 days after the OEM released the new iteration or specification. Dell's distribution system collects a set of boxes for delivery to the customer. Dell does have mass production facilities for emerging mass markets like India. This market by and large is made up of first-time computer purchasers.

By contrast, Hewlett Packard's supply chain for consumer units exclusively relies on production of the core computer unit in China. End-to-end supply chain flow of similar OEM parts to point of sale is in the order of 85 days. CNN reviewed the train journey taken by HP computers from China to Germany. Just that train journey

takes 17 days (CCTV [11]). To reduce transport empty train returns, parts made in Europe are sent to China rather than sourcing there.

HP's end-to-end time leaves Dell with a virtual monopoly on a specification release for 74 days. The net effect of this is that Dell can sell at a higher price to early adopters. HP brings the same specification to market later as a standard product made to forecast rather than assembled to order. Price decay and fewer product updates can reduce mean revenue.

4. Defining re- and nearshoring

Reshoring focuses on bringing manufacturing back to the brand's country of origin. This does not require the corporation to move back to the same city and region. Lower cost areas in the country can be identified that still yield the legitimacy of being made in that nation. Tax holidays and other capital investment subsidies may be on offer. A reverse bidding war may ensue as regions offer more and more incentives and benefits. The federal government may intervene, in much the same way as Mrs Thatcher's government offered Nissan land to build plants and a supplier campus.

Nearshoring focuses on locating capacity within economic zones. The aim is to benefit from tax-free border crossings and relatively faster distribution than remote manufacturing. Goods can be distributed from comparatively lower cost locations to markets in neighboring countries that are members of the same economic region. As an example, new plants established in any EU country compete against existing plants and imports for orders in the common market and as exporters to nonaffiliated countries.

It is possible to offshore and near- or reshore simultaneously [12]. Some work that has been done abroad may be reintroduced. Some work that currently is done in-house or locally may be relocated to locale with lower costs.

5. Nearshoring cost justifications

Uncompetitive prices within a market ensure that the work remains overseas. Full cost analyses and strategic responsiveness to market fluctuations and technology sales window closures can focus CFO's attention on costs stemming from pipeline liability—the amount of inventory in the supply chain that has contractually to be paid for regardless of sale demand and may become obsolete. Total cost of acquisition takes into account many factors, not just the absolute lowest labor costs. Total cost can be reduced by buying from low-cost locations that geographically and logistically are nearer the market. Making fast-moving consumer goods in Eastern Europe for Western European consumption, and making in Mexico's Yucatan for NAFTA sales are examples of production inside the trading region. These strategies take advantage of integrated logistics and distribution to deliver materials to plants and distribute finished goods across the economic zone. The relative lower costs in the production region compared to the sales region as a whole enable purchase prices per unit to be kept low, while ensuring minimized pipeline liability that is a risk to profit from obsolescence and quality problems.

Nearshoring can aid in reducing duty overheads and charges. An example of this is Ford Motors opening of an engine assembly plant in Russia. The company aims to purchase at least 60% of requirements in the country in order to qualify for duty exemption on imported parts (Automotive [13]). Adil Shirinov, Ford Sollers' Chief Operating Officer reportedly stated "Our main target in line with our long-term

localization strategy was to launch engine production with a significant level of localization ... We are fully committed to this strategy which is key for our business in the current environment” (Ibid).

Reshoring: this strategy involves bringing manufacturing back to the brand’s home nation. They do not necessarily need to return to the same sites or cities they previously had shed. Near- and reshoring choices can carry significant risks or can provide competitive advantages. Tactics can be used to mitigate direct risks to the company. Reshoring does not imply bringing activities back in-house. As a result, capital investments can be avoided because suitable vendors already exist that can supply at lower cost, higher quality, and more responsively than internal suppliers would be able to achieve. Suppliers take the risk that demand is volatile. If they have alternate customers, this may enable released capacity to be used for such accounts.

6. Purchasing and logistics

Traditional purchasing focuses on purchase price paid. Lower unit prices are demanded by purchasing. To achieve this, suppliers typically require much higher volumes in order to generate viable margins. This creates an imbalance between the rate the goods are produced and the rate consumed by the customers. Large volumes ensure transportation costs that are spread across the goods. For high-value goods, transportation costs may be less than a quarter of 1%.

Price of landed goods is the prime metric many purchasing departments use. This omits a significant issue: pipeline liability. Pipeline liability relates to the total amount of investment in working capital inventory, work in process, and finished goods, made by suppliers on behalf of their customer. If materials are bespoke for a client’s products, the supplier’s supplier, or lower tier materials producer, will have invested in producing and storing materials for a specific client. The immediate buyer may be tier one or tier two suppliers. Typically, it is tier one suppliers that have to reserve materials at their highest value prior to part production and subassembly. Pipeline liability is the total amount of financial exposure the brand owner has against the commitments made on their behalf by their suppliers.

Purchasing also wants to reduce the purchase spend. Price paid may reduce at a constant rate each month during production window. Sales price may decay equally fast. It is vital for companies to pay and ensure that they do not buy too much too early and, therefore, be left with high-cost finished goods that are commanding lower sales prices. Spot purchases at lower and lower prices can offset lowering constant spot sales prices. While price decay at the point of sale is noted, B2B contracts over as much as a 10 year horizon tend not to permit any price rises. In many cases, the aim is to reduce price per unit via total quality, supplier development, reengineering, scrum, and any other improvement scheme that is “flavor of the month.” The argument here is that by eliminating unnecessary costs, these benefits may be divided between the participants that helped achieve them. Customers that help their suppliers reduce costs can agree to share half or third of these reductions.

Logistics aims to transport materials and goods at the lowest cost per unit. Cost of transport for small, high value, goods can be in the order of <0.3% of the cost of the goods being transported. More costs of transportation per unit maybe incurred by the consumer going to the retail point of sale and returning home than the goods’ entire logistics costs incurred through the supply chain. In the pursuit of ever lower logistics costs per unit, greater volumes are required in order to divide the administrative and transport service costs to the desired level.

Costs of organizing a container movement from low-labor-cost manufacturing base to distribution center or customer in the market region can vary, typically in the region of €9000–€15,000. These costs typically include carriage and insurance elements. These costs are carried as part of the resale price or as a separate transportation contract agreed between sender and receiver. INCO terms will be agreed in advance.

With potentially <10% of the pipeline liability—cost of materials in the supply chain, and many smaller deliveries, transportation costs can rise dramatically as a *percentage* of costs of materials in the supply chain. However, percentage is misleading. The real saving as a result of lean manufacturing is the 90%+ reduction in pipeline liability. Lean aims to reduce risk to profit, rather than increasing profit *per se*.

The result of outsourcing to low-labor-cost countries is to turn the operation located in the original country into a reseller. Goods printed with the US' stars and stripes, and the UK's union flag may be made in China or other Asian countries. Moves to change the law to ensure Nations' flags are printed only in the nation start to emerge.

The Government of the nation, with massive spending power, may change purchasing policy. They may insist that purchases made on behalf of the people for the benefit of the people should have proven local content. "Local jobs for purchased goods that service local needs" can become a mantra, political, and fiscal policy.

Lean manufacturing focuses on eliminating waste by minimizing effort, movement, space, raw materials, work-in-process materials, finished goods, human effort, rework, and scrap. There is a vast difference between lean processes and a lean supply chain. Lean processes have very small material waiting buffers, produce rapidly without defects, and have very small buffers that have undergone the process. These goods are moved to the next process in very small lots, typically one at a time. To achieve this, they may be transferred via robots, conveyors, or gravity feed. Goods may be produced in the sequence they are required, rather than produced in batches. Key to this is the ability to change the setup economically between units. Single minute exchange of dies (SMED) may be used, combined with computer numerical control (CNC) part production program direct feeds from a synchronizing controller. Use of fully integrated flexible manufacturing cells has become relatively rare. The investment cost of automated cells and systems reduces the return on investment. Use of robots continues as a means of learning how to manipulate and orientate parts. Once learned, these lessons maybe taught to people in order that they may become more efficient. Learning does not stop there. The workers in time will develop their own ways of doing the work with less effort. In effect, people can outperform robots.

From a cost perspective, employing low-labor-cost employees has been considered by offshoring proponents as a means of reducing unit costs. If suppliers exist in low-labor-cost regions, then the investment on new plant and equipment can be avoided. Unit costs come closer to the variable cost element as a result.

Each unit produced may have a very slight margin between costs and price they are sold for. In order for suppliers in such locations to generate profit for themselves, they must rely on multiplying the margin per unit. This is achieved by requiring their customers to place very large orders. A consequence of this strategy is that there are a lot of products to ship. This in turn requires efficient packaging and space utilization in containers and other types of vessels. The benefits of efficient interprocess movements using one-piece flow within lean manufacturing plants can be written off against the huge volumes of finished goods that are stock piled because the customer does not want delivery yet. Months of production output can be held pending the dispatch.

7. Plant location as a key factor

Governments represent their electorate in constituencies located in their national boundaries. It is in the individual representative's own self-interest to ensure that existing plants and businesses located within their constituencies remain viable and employment opportunities are not lost due to outsourcing. Corporations typically are managed by professionals that aim to maximize returns for their investors. Other stakeholders, including local and state government (tax revenue) and employees (salaries and wages) may be secondary to the commercial exploitation of opportunities.

Outsourcing all value-adding activities including part production, subassembly, and final assembly to low-cost countries can reduce the unit cost. Content sourced from the final market may be significantly reduced as a result. The knock-on effect of outsourcing final assembly to low-cost countries halfway round the world can also be to transfer part production work undertaken by suppliers in the market to suppliers closer to the new low-labor-cost manufacturing center. The effect is to strip out many of the supply chain jobs that had existed. If the economy is fully open for business, new jobs will emerge to replace the old ones. Entire regions may undergo periods of deindustrialization, depression, and then regeneration.

Intellectual property (IP) rights in the form of knowledge process may be transferred to franchisees, only to be disseminated locally without consent of the IP owner. Other risks become apparent when outsourcing to countries that have widely divergent cultures. Quality expectations may differ. Entire batches may be written off due to defects introduced by the subcontractor. To ensure they follow orders and comply with specifications, entire teams may need to jet off frequently to review what is going on and to bring the supplier back on track. Local representatives that are "on our side" and speak both languages may be recruited to undertake this vital role. Their salaries increase the overhead element on top of the purchase price. The company must aim to identify other factors that put the commercial viability at jeopardy. Risks to be mitigated include wage rises, lack of literate and skilled employees, language barriers, dishonest and unethical behavior, transport failure including train derailment, fire, ships sinking, new trade barriers, incoming border inspections, and administrative compliance issues that lead to refusal to admit the consignment.

A further factor that needs to be considered is the ability of the organization to respond to changes in volume demanded and sudden emergences of rival technologies and new competitor products. This can lead to significant discounting in order to sell the goods available, consignment recalls, and enforced upgrading activities. Lean aims to reduce the pipeline liability and obsolescence risk in the supply chain. If the goods are heavily discounted, revenue decreases. If they cannot be sold, their value must be paid for from profit and the goods are written off as obsolete. This can significantly reduce the viability of any business. To counter this, companies may mitigate the effects by producing a range of goods. Distance from market incurs logistics distribution time. Time-sensitive priced goods suffer from price erosion. It is necessary to ensure that goods are made, distributed, and sold as quickly as possible in order to minimize the stock holding cost associated with reducing prices. Companies like to reduce the time between placing orders with suppliers and receiving the goods. This is because the earlier they buy the parts, the higher the price that would have been paid for them. If purchase prices are high because orders were placed too early, and sale prices have dropped due to price erosion, then margins will be squeezed.

To reduce the price erosion, design teams should be included throughout the production life cycle in order to supply a constant stream of product upgrades. Each variant or iteration is only produced for a short period of time. All of the goods should be designed to be produced using the same production processes and

assembly sequence. This avoids constant plant redesigns. An optimum sequence from supplier to customer should be identified in each plant. Designers should be instructed to design future iterations that fit that forward flow sequence from raw materials to finished goods. Group technology concepts including rank order clustering and to/from techniques can be used to identify the most efficient process sequence. Creating manufacturing cells can allow some backward flow without incurring overly long walks between the processes; (if we are walking, we aren't working). Minimizing the distances between processes eliminates the space beside each process to put work-in-process. One-piece flow can then be created where the material is walked from machine to machine. Some conveyor and robot movements may be permitted.

Plant location is a vital issue. Land cost, energy prices, average labor hour wages, and staff salaries, tax rates, transportation duration, and costs are vital pieces of the puzzle. Honda Corporation's motto can be summed up as "make where you sell, buy where you make" (adapted from [14]). In effect, it is necessary to identify major markets, make there, and buy from suppliers that are already there or can be encouraged to install themselves there as a global partner that sets up transplants alongside the producer.

Different locations have different ethical and responsible business practices. Emphasis may range from strict compliance through completely lacking on environmental protection, emissions control, pension contributions, healthcare schemes, employee training and education, and employee family education.

Ford Motor Company initially set up assembly plants in East London and Germany. These plants were supplied with kits from Detroit. It soon became apparent that it was more efficient to establish complete part and subassembly facilities to supply the final assembly plants. Ford's Dagenham plant had the largest brand dedicated iron and steel foundry in Europe. It was industrial disputes, repeated strike action, and union demands for higher equal pay for women that led to Dagenham's assembly plant being shut and production sent to Spain.

8. Supply chain configurations

Four basic supply chain configurations are possible. Using a two-by-two matrix, we can map long and short inbound supply chains and outbound logistics: (1) Long inbound, long outbound is mass production; (2) Short inbound, long outbound is just in time; (3) Long inbound, short outbound is just in time; (4) Short inbound and short outbound is just in time 3.

Strategic financial commitment may be less than expected if most or all of the value-adding activities are undertaken in subcontractors. Empirical testing using a supply chain game [15] showed lower initial investment with JIT3, which reduces the volume required to breakeven. While salaries may be higher closer to the market, they should be few in number. Initial starting stock of 10% is achieved and maintained. Overall cost savings in terms of lower space, working capital, and cost of inventory offset the higher salaries. Profitability of a JIT3 operation is higher due to lower total costs and lower lost sales to competitors. Agile/mass production applied to the game using JIT3 enabled significantly increased capacity with the same number of people involved in JIT3, together with about 4% of the starting stock of mass production. Higher overall average revenue is achieved via more frequent product upgrade releases that maintain the sales price.

Many managers today believe it is cheaper to buy parts from low-labor-cost countries, import the goods, produce the finished product, and export these to the market that may be in high-labor-cost countries. Products with infinite inventory

shelf lives could achieve a sustained sales price. However, overall sales volume per period may stagnate. Cost of holding the inventory may counter the savings from sourcing from low-labor-cost countries.

Figure 1 shows dyads from supplier to assembler and assembler to client. Many supply chain tiers can exist that can require many inbound and outbound kilometers. Mass production is induced by long inbound and distribution chains. To make long journeys, a viable option, large volumes are transported. Large loads deliver more volume than immediately required. Lean philosophies consider this to be a waste.

Lean supply chains can be setup in three configurations that enable inbound JIT, outbound JIT, or both. These correspond to JIT1, JIT2 and JIT3.

JIT1 is typified by Toyota City. This was developed following Toyota engineer’s extensive study tours at Ford’s Crystal Palace. Suppliers are encouraged to be “close by the plant” [16]. The issue Japan had, when they were the workshop of the world from the 1970s through the 1990s, was that they produced goods in a far-away country. Japan had to import much of the ore and energy required to produce basic engineering materials. Just-in-time deliveries were achieved from part producers, through module assemblers, and on to final assembly plants. They also required huge fleets of ships to transport their goods to markets, particularly in North America and Europe. In effect, only inbound just in time was used. Downstream distribution used large container ships full of finished goods. The key metric for distribution is not just in time. Instead the metric is *just on* time, where the just changes meaning to “only.” Ships are expected at the docks neither too early, nor too late. If they are early, they have to wait until the current ship is off-loaded and new cargo is loaded. If they arrive too late, they use time reserved to service the next ship.

In a JIT2 scenario, the factory is close to the market, including locations with much passing trade and key account high-volume customers. McDonalds is a good

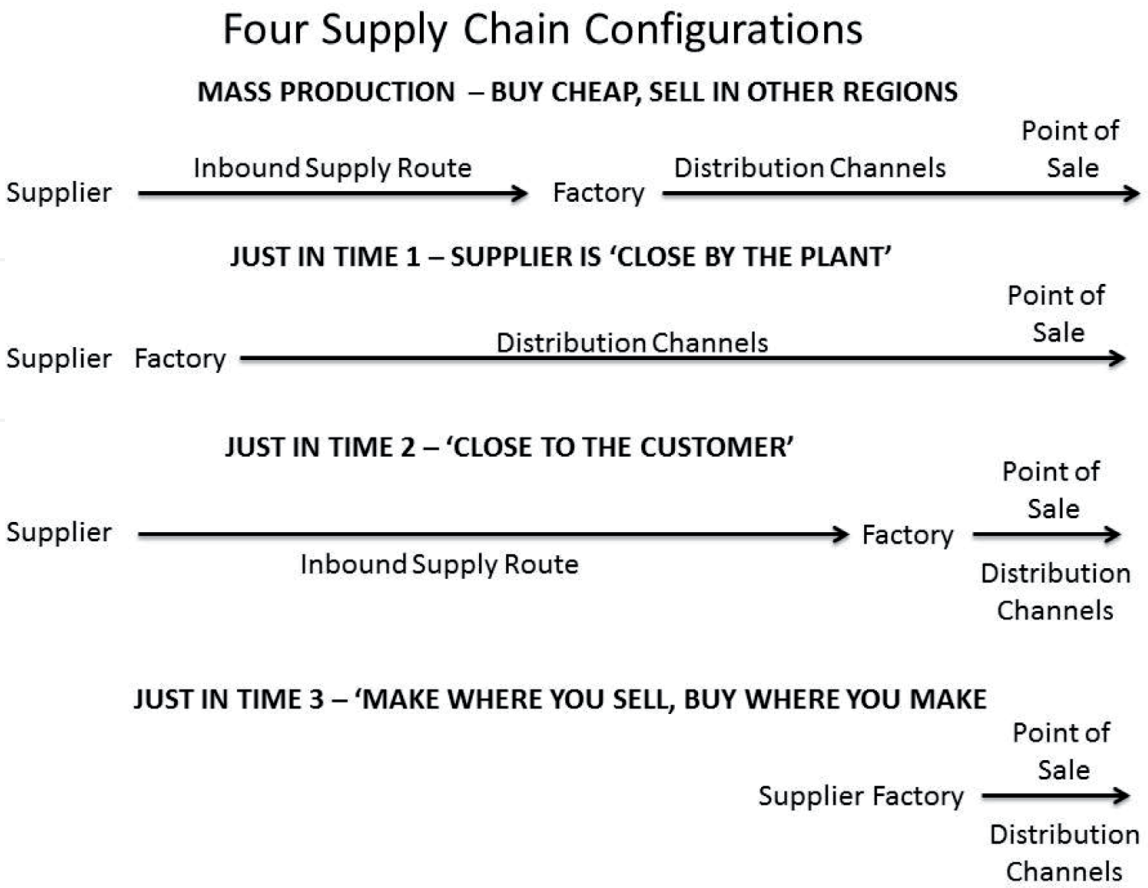


Figure 1.
Four general supply chain configurations.

example of this strategy. Food must be fresh for people to eat it. Hence, the company cooks and assembles Big Mac's only a few meters from where they are bought. While in most cases, to reduce the purchase spend, suppliers may be faraway in low-labor-cost countries, but this is not the strategy taken by McDonalds. McDo' buy in UK and Ireland for that market. They buy in France/Belgium for that market, etc. Only two ingredients for the European market are imported in bulk. They are the sesame seeds on the buns from Mexico and the syrup for sodas that come from Atlanta.

JIT1 and JIT2 reduce pipeline stock and the number of people involved typically by half. However, this is not the 90%, *order of magnitude* [17] reduction hoped for as a result of radical supply chain reengineering.

To achieve the 90% reduction in inventory espoused by just-in-time advocates, JIT3 is used. JIT3 is based on buying and making close to the point of sale. Many SMEs do this. A small-family-run bar or shop for example typically buys from cash and carry outlets. They may add value in their location and sell there.

9. Pipeline liability trumps low labor cost

This chapter proposes that a loaded supply chain is a risk to profit. This risk trumps low labor costs when demand for the product can be switched off rapidly. To sell remaining products, companies typically reduce the price. A key performance indicator is how much of total volumes ordered are sold at less than the full price. This represents over-ordering or late deliveries to points of sale. If we take Christmas trees as an example, it takes years to grow each unit. They start to have value at the beginning of October. Peak sales price is sought from November 1 through December 24. No one is buying on December 25. They have zero value from December 26. Any residual inventory in the pipeline is 100% obsolete. Consumers may discard their tree in the street as trash. Remaining inventory must be paid for from the high margins made from goods sold. This reduces trader's overall contribution to profit. Traders may store long-term nonperishable goods in anticipation of demand build up during next season. However, they will have incurred holding costs and the older goods shall compete against the new inventory that may be sold with a higher margin.

Pipeline liability is the value of stock loaded into a supply chain. Orders placed with suppliers are translated into orders they then place on their suppliers. They in turn place orders with their suppliers. Despite this loading, in many cases, materials can be used for other orders and other clients. If this is not the case, the client will be liable for orders placed on their behalf up to a maximum level. The brand owner may buy materials directly and act as an agent to sell their materials to suppliers. They then buy back the finished units. They therefore can control supplier's material costs and can gauge the supplier's ability to efficiently transform materials into finished goods.

In just in time three (JIT3), suppliers are close to the factory and the factory is close to the market. The resulting reduction in pipeline inventory, and hence reduction in risk to profit, can support higher wages. German auto workers earn ~37€/hr., compared to equivalents in Poland on 7€/hr. (Automotive News Europe). Making in Poland is "nearshoring." Goods made there could be transported to European sales regions within 1 or 2 days, with delivery on a regular basis. Other costs including plant costs, taxes, and indirect managerial overheads significantly may be more advantageous than German sites. Achieving apparently lower unit prices by outsourcing in relatively near lower labor cost countries can become a fallacy if delivery frequency is low.

10. Fast-moving consumer clothing case

The example provided in **Table 1** compares “as it is in Asia and Morocco” and a modified version of Moroccan initial conditions that result from supplier development and a changed ordering philosophy. The Asian purchase model uses the mass production supply chain configuration of long inbound supply pipelines and long outbound distribution. It requires suppliers to produce goods for 9 months with a single delivery date scheduled before the most significant seasonal sales period. The Moroccan supply chain initially takes the same delivery schedule as Asia. Modifying this to a short lead time and frequent delivery mode significantly reduces pipeline liability.

North Africa offers a relatively low-labor-cost alternative that logistically is near Europe. Moroccan workers in a clothing company were reported by a client to earn 3.80€/hr., whereas Asian workers about 1.30€/hr. Moroccan labor initially was 20% less efficient than Asian counterparts. Thus, more workers were required at a higher wage rate. This motivated the client to source from Asia, based on a single “headline” budget line. Various minor import and export duties apply to Asia and Morocco that negate these charges. Making goods in Morocco appears expensive by comparison. Making in Poland, with labor at around 7€/hr. seems to double the cost compared to Morocco. Making in Germany at 37€/hr.—*hell is not that stupid?* The simple answer to that, from a total cost perspective, is a counter intuitive *No*. Better training is required to improve workers' efficiency. That is half the issue. The other is pipeline liability and the consequent risk to profit.

This research found that using JIT3, companies could cover wages and costs up to 60€/hr. and still make a profit, provided that productivity is equivalent to the best and providing pipeline liability dramatically is reduced. To achieve the labor productivity, benchmarking and activity training are required, together with known productivity targets.

Given a JIT3 supply chain structure, greater productivity can be achieved by better line balancing. This enables JIT3 to double productivity over mass production. Using JIT3 as a basic supply chain structure, modular product assembly to reduce hand time, sharing some assembly work with suppliers and some customer co-production, and agile mass production, therefore, may double productivity *again*. This enables more revenue from more products being made and sold in less time. As a result, labor cost per unit is significantly reduced. Simultaneously, capacity per time period can be raised. Capacity utilization can be increased prior to major sale seasons. This approach avoids stockpiling finished goods that have been made months in advance, because capacity has not been created or is not available to respond to actual market demand.

Full cost analysis beyond pipeline liability, direct cost, and taxation should include other factors such as plant space costs, management overhead differential costs, legal administrative requirements and bureaucracy, healthcare and pension overheads, site security, and maintenance. These arguments are not well understood by operations managers, and even less so by managerial accountants/CFOs. This article aims to explain the logic of “making where you sell and buying where you make.” By contrast, KPMG [12] perspective is that near- and reshoring is to set up facilities near the corporate headquarters. They suggest “an ‘in country for country’ approach that encompasses not just manufacturing, but the location of product management and R&D functions.” That article is from the headquarters' perspective of where the market is. Based on research for this article, advice proposed is “produce within or close to both large and rapidly expanding markets.” In summary, “buy, make, and sell locally.”

	Asia pacific	Morocco	Morocco improved
			weeks
Customer assembler order window (w)	40	15	1.6
			days
Customer assembler order window (d)	280	105	11.2
Total number of stock pipeline liability volume	5,580,420	2,092,657	223,217
Number of work days/year	286		
Total number of days worked/year	365		
Working hours per day	8		
Number of work days/week	5.5		
Efficiency factor of Asia over EU	0%		
Daily production volume	19930		
Avg. human time needed to prepare one unit	31	mins	
Annual production demand	5,700,000	units	
Material BOM cost	€ 4.02	€ 4.38	€ 4.38
Transport cost percentage	€ 0.10	€ 0.06	€ 0.06
Transport cost unit	€ 0.10	€ 0.06	€ 0.06
Tax %	10%	0%	0%
Total material cost	€ 22,433,286	€ 9169,605	€ 978,091
Total transport cost	€ 558,041	€ 125,559	€ 13,393
Total tax	€ 2,243,328	€ 0.00	€ 0.00
Total mat cost + transport + tax	€ 25,234657.34	€ 9295165.38	€ 991,484.31
Number of employees	1287	1545	1287
Mean cost per labor hour	€ 1.29	€ 3.86	€ 3.86
Total labor cost	€ 3,786,428	€ 13,634,845	€ 11,359,285
Working capital	€ 26,777,757	€ 22,930,011	€ 12,350,770
Total margin (excluding any sales or risk)	€ 29,729,571	€ 18,046,894	€ 20,322,454
		61%	68%
Total margin clear of stock risk	€ 7,296,285	€ 8,880,991	€ 19,344,363
		122%	265%

Table 1.
Summary of mass to JIT3 financial comparisons for fast-moving consumer goods.

11. Conclusions

Buy locally, make locally, and sell locally—the so-called “Glocal” strategy operates by making the goods tailored for local markets. The focus should be on where the markets are rather than on the headquarters.

Mass production configuration supply chains are operated because it seems to be obvious. Buy cheap and sell expensive. However, pipeline liability from loaded inbound supply and outbound distribution chains creates increased end-to-end times. This reduces the flexibility to respond to market changes. If the good is stable in terms of technology and design specification, with high demand and unrestricted supply, the strategy may enable organizations to achieve viable cash flow. Taking an end-to-end perspective, working capital is excessive and represents a significant risk to profit if the sales window closes.

JIT1 and JIT2 reduce the amount of goods in the supply chain approximately halfway between mass production and JIT3. JIT1 can make use of low-cost material and labor to produce a finished good. Logistics infrastructure may be used to transport finished goods to other regions where premium sales prices justify the extra risk from a loaded distribution network. If the goods are made and supplied to other corporations as part of agreed volume contracts, the risk to profit is minimized.

JIT2 can use low-cost parts from low-cost countries. Using nearshoring for final assembly and offshoring for part production is a strategy noted near Monterrey, Mexico. Between the city center and the airport, the majority of the companies are Chinese owned. Parts are produced in China. Finished goods are assembled in Mexico from these parts. Since the majority of the value add is undertaken in NAFTA, duty among Mexico, the USA, and Canada is avoided.

Risk to profit needs to be minimized. This is achieved by sacrificing a loaded supply chain that is filled with millions of examples of cheap goods. Instead, emphasis is placed on productive labor that is comparatively cheap compared to home markets, but may be much more expensive compared to remote low-labor-cost countries. In Europe, the highest salaries tend to be within the triangle Liverpool, Hamburg, and Paris. The further East and South the production site is located, the lower the general factory wage tends to be. A one-day distribution circumference can determine likely “nearshore” production locations. While total cost per unit may seem to increase, focusing on doubling the productivity and doubling it again should be primary design team and operations’ objectives. This can be achieved by simplifying the product, reducing hand time to make them, worker training, supplier, and customer co-production.

A fast-moving consumer goods case supplying own-branded sport clothing outlets is presented. Reduced end-to-end pipeline times were achieved via adopting buy, make, and sell close to market point of sales. Now, redundant continental and regional distribution centers can be converted from cost centers to profit centers by undertaking “late configurability” value-adding activities. The products must be designed to permit this and must become part of the market offering. Premium prices may be commanded, for example, The Bear Factory.

The summary shown in **Table 1** is an example of financial effects of JIT3 versus mass production provided in Section 9 “Pipeline liability trumps low labor cost.” Financial analysis is shown highlighting critical factors that need to be managed that are *force multipliers* for the supply chain configurations.

The analysis given in **Table 1** shows the ability of the client to reallocate work to Morocco from Asia. They have understood the potential risk to profit from having a loaded supply chain, and significant discounting that was required to sell remaining goods after the end of the sales window. Total margin clear of stock risk is significantly higher for the baseline Morocco “near-production” scenario. The revised plan with more frequent deliveries doubles more than that. The client adopted JIT3 strategies, making closer to reduce pipeline inventory yet not too close that skyrocket labor wages. JIT3 can be enhanced with agile/mass customization approaches. This can enable the corporation to delay the point of variation and facilitate assemble-to-order strategies.

Making in country, or trading region, primarily for sales, does not prohibit sales abroad, except where they are contractually bound to do so by intellectual property owners. Excess production beyond local market absorption may be exported to other market regions. This approach differs from make in low-cost countries exclusively for export to other, richer, markets.

Specification and legal compliance in sales regions imposes two options: comply with each market requirement separately or supersede requirements of both home and remote regions.

Mass production could yield higher margins; however, this strategy has higher potential risk of obsolescence that would yield the smallest total margin. The amount of profit free from pipeline obsolescence risk is significantly higher than JIT3 supply chain configurations. Mass production in remote low-labor-cost countries would suit “pile ‘em high and sell ‘em to everyone.” This also suits undeveloped markets and monopoly technology scenarios. The results in the table indicate that nearshoring in inefficient plants yields the smallest total margin, while ensuring more than 20% higher minimum margin as a result of reduced pipeline liability. Optimizing nearshoring performance maximizes risk-free total margin, at least 250% more than the mass production model. The strategic choices must be re-evaluated as BOM cost approaches zero and as BOM costs become significantly more than total labor costs.

This model is static rather than stochastic. Static models are viable when distance to market, order-fulfilment lead time, delivery duration, and price and productivity are consistent.

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