Chapter 5- Facilities Strategy and Globalization

Four vital questions in configuring facilities networks:

* How large should our facilities be?
* Where should our facilities be located?
* What should each facility focus on doing?
* Given the focus of each of the facilities in the network and of each of the players in the broader supply chain, how will work across the network be coordinated and managed?

This chapter addresses these questions and develops a framework to link facilities strategy with the firm’s overall operations strategy.

## The facilities decision

Exhibit 5.1: Typical multistage supply chain. Suppliers – plants - distribution centers - customers.

The challenge for any given player in the supply chain in creating a facilities strategy is to first establish the strategic goals for the operation of the supply chain and then determine how many facilities to have, where they should be located, what they should focus on doing, and how they should interact with the other facilities in the supply chain.

### Using supply chain models to determine optimal facilities configurations

Two types of models that are useful in doing integrated supply chain planning

Descriptive models (forecasting models, cost relationship models, resource utilization relationship models, simulation models)

Normative models (mathematical programming or optimization models)

### Summary of facilities models

The flow of material within the supply chain is a major input in the development of the facilities strategy. If a given facilities strategy can be shown to fulfill strategic goals as based on the supply chain flow, then that particular facilities strategy should be an effective one. These models take into account only those variables that can be reasonably and readily measured – costs, capacities, times, customer service levels. There are many other considerations to be made in determining a facilities strategy.

## Facilities sizing

Looking for insights into what the cost structures of different facilities might be, and how volume might be split across multiple facilities in a network.

### Economies of scale and scope

See exhibit 5.2a and 5.2.b (p.173): summarize dynamics of the economy of scale curve.

Economies of scale are an important consideration in making vertical integration, capacity, and process technology decisions; they are important in making facilities strategy decisions as well. For any given facility, which will have a specific fixed and variable cost profile, economies of scale suggest that the firm will want to fill that facility with sufficient volume to operate as near as possible to the flat part of the curve. In a multifacility network, then, the firm will likely want to size facilities and allocate volume to those facilities so that they may all operate near the flat parts of their respective curves.

**Lower-scale production and service systems**

Two dynamics explain the increasing attractiveness of scale-reducing technologies such as FMS (flexible-manufacturing systems):

* Product life cycles are rapidly declining, and customers increasingly prefer customized rather than generic products, forcing manufacturers to produce greater product variety in shorter lead times.
* Technical advances in FMs and scale reduction are making these technologies increasingly attractive to low-volume producers, allowing them to be more competitive with the hard automation used by high-volume producers.

Through the productivity increases due to *new management philosophies* and *improved production techniques,* a facility is able to produce to the same demand with less overhead. Plant scale is thus reduced, which implies that smaller, more focused plants can satisfy demand. Overhead reductions and efficiency of newer technologies decrease labor costs as a percentage of overall product costs so that the cost structure of products is primarily determined by the other factor costs of material, capital and energy. While low-cost labor is often a driver of facility location, the other costs tend to vary less by location, and thus these new approaches can provide more flexibility in facility location.

These methodologies rely heavily on workforce quality and skill. In considering a location for an FMS or other highly automated manufacturing facility, the company must consider the local engineering labor pool.

**Generating economy of scale cost curves**

Technological changes allow smaller-scale operations and leaner manufacturing operations, reducing economy of scale effects. However, this does not make economies of scale irrelevant.

**Exhibit 5.3**: Shows the *technology envelope* (lower bounds of the scale curves; when comparing different economy of scale curves, the technology envelope gives us which technology would be the best option at different volume)

Exhibit 5.4a&b; another way to look at economy of scale cost curves. At high volumes, the best technology is the one that has very low variable costs and high fixed costs, technology 2 in this case. At medium volumes, an intermediate technology (technology 1) with higher variable costs and lower fixed costs will do, and at low volumes, a curve with very high variable costs and low fixed costs, such as a subcontracting operation, is appropriate. Cost functions need not to be linear as shown in this example and costs may not be strictly fixed or variable, so a variety of curves might be developed to understand scale effects across various technologies.

Many companies have problems developing data for scale curves: may not have multiple plants doing similar operations, may not be comparable operations because of standards, may not have data for technologies they do not use.

Important to understand economies of scale in making facilities decisions for both services and manufacturing operations: firms need to gather information about all the relevant technologies or infrastructure choices it has in designing its facilities network. With this cost information, economies of scale curves can be developed that suggest which technologies or infrastructure choices are appropriate at which volumes, and how many facilities of each type it may be able to support.

### Leveraging global economies of scale and scope outside operations

Companies try to sell internationally even when not operating globally. To do so effectively, they leverage economies of scale and scope on a global basis across their entire range of supply chain activities to undermine the competitive strength of local or domestic players.

Emerging global markets underscore the need for doing so. Fixed costs of manufacturing and operations have decreased, thus, the fixed costs of other supply chain activities such as R&D and marketing have come more to play a more prominent role. Firms must leverage these fixed costs across as much volume as possible globally.

Global markets also enable the economies of scale in the product life cycle (PLC). Introducing products in secondary markets after they reach the maturity or declining phases of the life cycle in the first market can extend the PLC. For example, Japanese auto and consumer goods manufacturers often delay introduction of products in the US until after they have been introduced in Japan.

### Facilities sizing summary

In developing a facilities strategy, critical to consider:

* Ways in which volumes may be built and then leveraged globally
* Economies of scale associated with breaking up that volume among facilities that have different technologies or infrastructures

Firms today have many choices of how to structure their facilities that often provide them a range of sizes they can consider from large to small. They must understand the individual scale curves for each of these options and use them to understand which choices best fit which volume requirements. Clearly understanding economies of scale and scope alone not enough in completing a facilities strategy. The firm must also decide where it wants to locate its facilities and what those facilities will focus on doing.

## Facilities location

Perhaps most complex part of the facilities strategy decision.

### Globalization impacts and strategies: some macroeconomic trends

The presence of more developed overseas markets suggests that there are large benefits of scope for firms who sell globally. Trends in trade and investment patterns, and the advent of lower-scale production and delivery technologies, suggest that the most effective way to serve the global market is often with a regional approach that provides presence in a number of marketplaces. This reduces costs, provides better customer feedback, and minimizes risk resulting from exchange-rate fluctuations and other political factors. Access to the required capabilities (skills to run the new technologies, access to suppliers, transportation and communications infrastructure) may limit the number of feasible locations. This trade-off is the heart of facilities strategy decision.

**Global markets**

Growth of large markets (as China) has led to the emergence of powerful global competitors, many of whom emphasize production for export markets. Example: Japan; domestic markets have become increasingly sophisticated, the cash flows generated at home have been used to fight market share wars in other regions.

To compete against export-oriented firms, becoming global is crucial. Corporations cannot allow their competitors the luxury of cash-generating havens in untapped markets. Global competitors make aggressive moves to overcome regional or local barriers and play in all relevant markets. Required: understanding those markets, engaging in rapid innovation of products & services to meet the needs of the specific markets.

**Trade and investment patterns**

Nontariff barriers – example NAFTA

Differences in trade policies among regions may cause companies to invest more in some regions than in others, as we see with emerging economies such as China

**Emerging economies, particularly China**

The general pattern for emerging economies is that they start by attracting manufacturing activity because they offer low labor costs. The producers they attract help them develop the required infrastructure, and as they develop, factor costs rise, pushing the original investors to seek newer emerging economies with lower factor costs. The original economies then focus on higher-value-added products.

The trend of rising factor costs that takes place in emerging economies will take a long time to play out in China. China is also different in that skills and manufacturing sophistication are relatively high. Thus it can provide the benefits of both low costs and high sophistication. Further, with the emergence of technologies that support relatively long transport links, it is possible for a global company to source a large amount of global production within China. At the same time, with lower-scale technologies they can maintain presence in other parts of the world as well.

### Considerations in facilities location decisions

Development of global markets, regional trading blocks and emerging economies is forcing companies to address globalization in all of the decisions they make.

Major considerations:

**Market access**

Accessing the global market often requires companies to have presence in the countries or locales they wish to serve. E.g. sales office, small marketing organization, procurement personnel. Manufacturing presence is often required.

Regulatory requirements, such as domestic-content restrictions, often drive companies wishing to access a market to invest in placing facilities there.

Local presence often required to gain understanding of customers and users in target market.

Local presence may be dictated for logistics reasons (transportation costs etc.)

**Capabilities access**

Companies may wish to locate facilities in certain regions to access the capabilities available at that location. Examples: Japan (new technology), specific skill sets (India; software programming), connection to a supplier base. In all cases, location in a country or region allows a firm to build desired capabilities.

* **Lean operations and JIT**

JIT: better synchronized with customer demand, less waste, reduced cycle times. Can be realized with very little investment and with wide applicability to a diversified industry base.

Lean operations and JIT:

* Highly dependent on the quality of front-line labor as well as the quality of process designers and engineers. Employees must be highly flexible and multiskilled as they perform tasks including preventive maintenance, repairs, and complex planning activities. Although some companies host extensive internal training programs, they must regard local employee skills as a key decision variable and support plant locations with a strong educational infrastructure as well as employee exposure to modern technology and practices.
* Relationship between the manufacturer or service provider and its supplier network and support services. Reliable institutional and local infrastructures are both critical. Lean systems require a supplier base that is capable, reliable, and physically close.
* **Total quality management and organizational learning**

Highly skilled dependent capabilities that many organizations wish to develop.

TQM: continuous improvement. PDCA (plan-do-check-act)

Those firms that are capable of learning and disseminating knowledge faster than their competitors will achieve superior performance. Companies that succeed not only garner cost advantages but are also better poised for further incremental improvement.

TQM and organizational learning affect facilities decisions in two ways:

* Require problem solving and learning skills in the workforce
* Decentralized facilities network may well allow an organization to augment its learning and thus build its capabilities by accessing knowledge – new technology, market and management trends – from many parts of the world

Labor requirements of advanced systems and techniques are driving the need for a better educated direct-labor or front-line workforce. Advanced technologies and lean manufacturing systems place greater importance on the flexibility of workers and their ability to operate under growing autonomy. The increasing sophistication of product and process technology has also increased skill requirements. Access to all of the capabilities underlying these shifts – the skills, the technologies, and processes themselves, and supportive supply bases – is a critical consideration in facilities location decisions.

**Low-cost access**

Important to understand the cost implications of location decisions.

The development of a firm’s facilities strategy must determine how important each of the factor costs (costs of direct and indirect labor, capital energy and materials) are, identify locations that allow for minimization of the costs, and assess how much variability in the costs there might be.

Understanding the cost structure of an industry and the importance of minimizing costs to competitive success are thus critical starting points in assessing the cost structures and risks associated with facilities location strategy.

* **Factor cost variation**

Vary not only due to regulatory and economic conditions in a region, but also due to exchange-rate variation.

* **Coping with variable and uncertain factor costs**

If a company sells in a particular market, not producing in that market exposes it to a risk of currency depreciation, thus lowering revenues. Conversely, having a large production site in a country exposes the firm to the risk of currency appreciation. Increased flexibility reduces these risks and can reduce average costs. Such flexibility can be gained in operations by having a number of facilities, either within the firm or in the firm’s supply network, to serve demand with the ability to vary facility loadings according to factor cost and exchange-rate trends.

* **Operational hedging models**

A firm with multiple facilities could find those with higher than average costs due to exchange rates at any given point in time and move production or service delivery from those facilities to ones with lower costs. The increased investment in capacity and flexibility required by such a scenario actually reduces expected costs.

**Risks in facilities location**

Political risk (government and financial system stability), terrorism, environmental risks, natural disasters, labor force stability, and labor relations.

Depending on a single facility for most of the global production can expose a company to currency exchange risks as well as these other risks. To hedge against these risks, companies may choose to have facilities in multiple locations and carry extra capacity at all of them.

**Facilities location summary**

Facilities location in a global economy is complex. Firms must consider the macroeconomic trends – global markets, development of trading blocks and nontariff trade barriers, and emerging economies. In this context, they must determine where they need facilities in order to gain access to a market, where they need facilities in order to tap needed capabilities (skills, technologies, supply base) and where they need facilities to obtain low or at least reasonable factor costs. They must consider the many risks associated with any given location, including currency exchange risks. These decisions are complicated by the dynamic nature of the global marketplace.

## Facilities focus

### Dimensions of focus

**Process-focused facilities**

The ways in which a firm chooses to separate the different stages of its manufacturing or service delivery process dictates to a great extent the choices it has for facilities focus.

Centralize higher-scale operations (economies of scale)

Decentralize lower-scale operations (final assembly etc., minimizing final transportation costs to customers)

When different stages of a manufacturing/service delivery process have different levels of technological complexity 🡪 companies often prefer to separate them. Sometimes done to allow the separate operations to access needed technologies or skills in different locations.

Advantages:

Can locate in different places, presence in more markets, reduce factor costs specific to that stage of the process, access technologies or skills specific to that stage, or locate in one or more tax havens.

Can achieve some of the desired benefits of facilities focus, specifically the ability of each facility to do a small number of activities well and optimize that stage of the process.

Separation may facilitate an outsourcing strategy.

Downside of separation: resultant difficulty in integrating, streamlining or optimizing the full process.

Process focus with highly specialized facilities optimized for a limited set of operations is particularly prominent today given the degree of outsourcing in many industries.

Process-focused manufacturing facilities as they are implemented today tend to have a high degree of machine pacing, high economies of scale, a high level of automation, few variations in the sizes and shapes of the products they produce, and a small geographic reach compared to market- or product-focused facilities.

**Product- or service-focused facilities**

See exhibit 5.9: matching facilities to product/process pairings

Product-focused manufacturing facilities as they are implemented today tend to produce many SKUs or end units, have relatively few setups (suggesting that the products they produce share similar designs), and have a large geographical shipment area with high variability in delivery requirements relative to facilities that are focused along other dimensions.

**Market-focused facilities**

To compete in a local market, understand the needs of that market, and deal with trade barriers and local content requirements, companies increasingly need to have presence in those markets. The form of that presence may be small facilities focused on sales, marketing, product development for the local market (customization or localization), service delivery, or manufacturing. Often, if the facility is to do manufacturing, it does final assembly and test of products, sometimes customized to that market. Placing a facility in a local market may not be simply a matter of wanting access to the market; it may be the most cost-effective means of serving that market.

Market-focused manufacturing facilities, as they are implemented today, have a low degree of flexibility with few alternative routing in their processes and few variations in the sizes and shapes of the products they produce relative to facilities that are focused along other dimensions.

**General-purpose facilities**

Some firms deliberately choose to maintain a small number of facilities that can be assigned any of a number of capabilities; product, process, market or some combination thereof. This provides flexibility in the facilities network.

### Establishing roles of facilities in a supply chain

Six strategic roles a facility might play in a global network (remember SOLO-CS)

1. **Offshore facility**: Established to gain access to low wages or other factors integral to low-cost production or service delivery
2. **Source facility**: like an offshore facility, chartered to gain access to low-cost production or service delivery, but with the resources and expertise to develop, produce, and/or deliver a part, product, or service for the firm’s global market.
3. **Server facility**: a market-focused facility that supplies a specific regional or national market with products or services designed in another location.
4. **Contributor facility:** like the server facility, a market-focused facility that serves a specific market, but that makes active contributions to the firm in product or service customization, modification or even development, and process improvement.
5. **Outpost facility:** established to access capabilities – technologies, skills, knowledge – in a local market and feed them back into the firm.
6. **Lead facility:** with the strongest of the facility charters, has the ability, skills and knowledge to innovate and create new products and services, processes, and possibly technologies for the company.

Exhibit 5.11 summarize these types, showing how they are connected.

These facilities may be internally owned, or these roles may be played by external subcontractors. Over time, low-competence facilities may develop additional competencies that allow them to grow into higher-competence roles.

## Integrating and managing a dynamic facilities network

Recognition that the processes a company must execute cut across organizational units and facilities is critical.

### Product and service design and development

Firm growth, indeed survival, is dependent on the ability of the firm to innovate.

*Design for manufacturability*: general engineering art of designing products in such a way that they are easy to manufacture (Wikipedia). People from the operations function work closely with R&D in order to design the new product or service to take best advantage of existing operational capabilities.

In short, new product and service development are critical to the competitive success of almost all firms. Manufacturing or service delivery personnel must work closely with product or service design and development personnel to successfully transition new products or services from development to production or delivery. The development of facilities strategies must consider this critical relationship and decide where and when R&D should be co-located with operations to optimize the process, and what tools or organizational structures will be used when they are not co-located.

### Facilities network dynamics

Exhibit 5.12: Evolution of facilities strategy of specific products. Take a look at it – should be known from the internationalization of firms – “rings-in-the-water”

## An approach to developing a facilities strategy

### Five step facilities planning process

A company developing a facilities strategy can take the following approach (see also exhibit 5.14 for a visualization of the model):

1. Based on the overall business and operations strategy, develop criteria for plant focus and charter.
2. Using cross-sectional data, benchmarking of other companies, and analysis of other technologies, develop the appropriate multiple-technology scale curves for the plants (in each geographical region for a global strategy)
3. If operating globally, identify the major options for the facilities network such as how the company will source and in which markets it should have operations presence.
4. Identify potential locations and major decision choices covering plant and process options, such as potential sizes, and separation of stages.
5. Analyze the detailed options for flow of materials and production, potentially using a computer model.

*Step 1: Business and Operations Strategy and Plant Charters*

Collect basic background and context information on the firm’s corporate and business strategies, the availability of capital, the structure of the existing site network – which may include facilities outside as well as inside the company – and the company’s growth strategy. Understand where the firm wishes to be positioned with respect to cost, quality etc.

Understand what capabilities the firm has and what capabilities it wishes to develop.

**Forecast industry evolution**

**Identify internal constraints on facilities location choices**

Review the internal constraints that may limit a firm’s ability to implement an optimal location strategy – primarily, the availability of investment capital and managerial resources. While industry dynamics may suggest that global scale is necessary for success, financial and managerial limitations may restrict the options available for expansion. In such cases, firms may seek alliances to increase product volumes.

*Output step one:*

Assessment of industry dynamics

Basis of how the company competes within that industry

Growth strategy and requirements for company’s operations and facilities strategies

*Input step one:*

Understanding of the global market, the competitive dynamics within that market, capacity factors, strengths of the company itself and the basis of which it chooses to compete, and any internal constraints it may have on capital and managerial resources. These factors are the primary determinants of the nature of the global operations network, the roles of individual facilities, and the degree to which such a network can generate and sustain competitive advantage.

*Step 2: Develop multiple scale curves*

*Step 3: If operating globally, identify the major facilities network options*

To complete this step:

* Examine the company’s outsourcing strategy, including the degree to which it relies on outside suppliers, and understand the current regional network configurations of those suppliers
* Understand government regulations and market access requirements. To avoid tariffs and other nontariff trading restrictions, firms should locate within trading blocks.
* Assess the degree of risk inherent in serving the regional markets and the options available for managing that risk
* Define the characteristics of regional demand including the level of homogeneity in customer requirements across a region, the size of demand in each region, and the forecast for future development of that region

*Step 4: Narrow the set of potential locations*

Examine in more detail the relevant facilities network options surfaced in step 3. Identify specific locations and analyze size and process options.

The output of this step is a narrowed set of potential options for facilities network configurations that have sufficient infrastructure to meet the firm’s competitive needs.

*Step 5: Analyze and Model to identify final recommendation*

**Develop, implement and measure**

## Summary of chapter summary

Key things to remember:

Technology-scale envelope: shows which type of technology or process is appropriate for which size facility

Set of criteria for thinking through facilities location issues: market access, capabilities access, low-cost access.

Companies needing to be close to their customers generally seek locations that will provide them with access to those markets. Companies needing to develop certain skill sets or access certain technologies seek locations near the sources of those capabilities. Companies driving for low cost find locations where factor costs are minimized. Factor cost minimization is complicated by variability in both the cost themselves and in exchange rates.

Facilities may be focused according to markets to be served, according to specific steps or stages of the production or service delivery process, on selected families of products or services, or around required components or materials. The roles of facilities may be defined according to their focus and/or according to the type of access they provide- market, capabilities or cost. Facilities can be of “low” competence in providing access or can be allowed to develop “high” competence over time.

Difficulties of and need for integration of a dispersed facilities network, in particular the need for links with a R&D or service design organization as production and service delivery are dispersed around the world.

Five step-process for facilities planning

Facilities strategy is clearly critical to the performance of many organizations.