# *Relative Importance of Plant Location Factors*

# globalization & time-based competition

- borederless organization
- the speed with which products are manufactured, delivered to market, and serviced

- A firm that sets up a manufacturing plant in a third world country to take advantage of lower labor costs may find its time-based performance eroded(被腐蝕) because of poor infrastructure (公共建設) or non-availability of skilled personnel. The location decision is thus a strategically important managerial challenge that significantly impacts the long-term performance of global firms, and in particular, long-term operational performance of global supply chains.

# Two categories of plant location decision:

- Quantitative analyses based on assumed costs of land, labor and transport, scale economies, and other cost-based variables. **Key qualitative – availability of skilled workforce, efficient business services and infrastructure, and stability of government policies (*culture*) are ignored.**
  - **Both quantitative as well as qualitative variables referred to above.**

- Data were collected from 327 firms located in Singapore and Malaysia. Important comparison of international business since both are direct competitors in attracting foreign direct investment. Variation in terms of level of economic development – Singapore: highly developed country (?) & Malaysia: a developing country.

# Cost-Based Plant Location Models

- The objective of cost-based capacity expansion/location problems is the minimization of discounted costs associated with the plant location/expansion process. For example, costs of expansion, shortages, congestion, idle capacity, maintenance, and inventory are included as representative cost variables. Often the decision maker imposes limits such as budgetary constraints, upper bounds on expansion sizes, excess capacity, and capacity shortages.

# Qualitative Variables in Plant Location

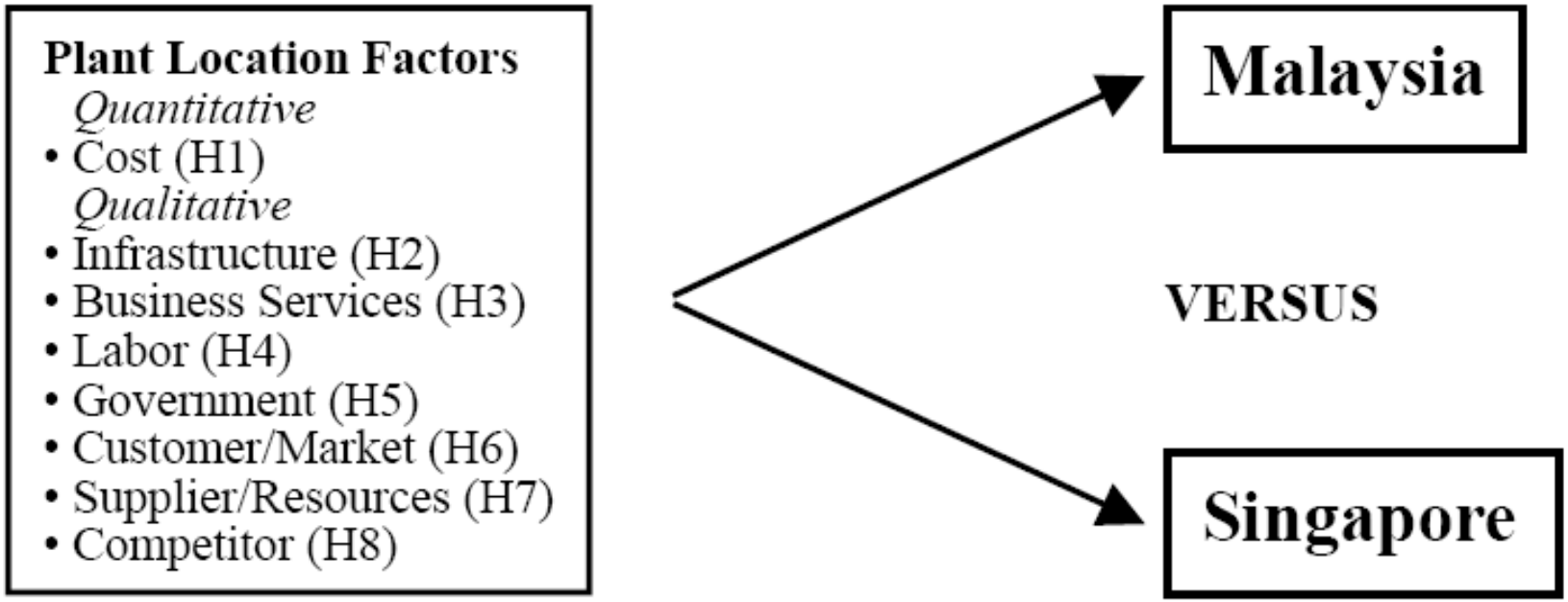
- A weighted checklist approach in which various important but diverse factors like proximity (鄰近的) to customers, business climate, legislation (法規), tax incentives, and other support factors, and rated on a weighted scale and combined into a composite score. **This approach is subjective and the outcome often depends on the preferences of the decision maker.**

- Schmenner's (1982) research – reported a comprehensive survey of the plant location/relocation practices among Fortune 500 companies in the United States. Identified *favorable labor market, nearness to market, quality of life in the area, nearness to suppliers, and low labor rates* as the most important variables considered by managers in the location decision. (the cases of different industry groups, a location strategy focused chiefly on financial assessments could often result in a poor solution involving recommended relocation and opening of new branches over on-site expansion)
- Plant location decisions that ignore skill levels of the local workforce could significantly affect the ability of the firm to implement new process technologies, or limit the effectiveness of total quality management programs.

- Consider a manufacturing company that locates a key manufacturing facility in a country with poor energy infrastructure. The frequent and unpredictable blackouts due to poor energy infrastructure could lead to frequent shutdown of production lines. This would lead to process uncertainty that will eventually hamper the company’s performance and competitiveness in terms of performance indicators such a lead time, inventory levels, and cycle time.

## FIGURE 1

## RESEARCH FRAMEWORK



# Plant Location Factors

- For ease of interpretation of the results, the items were classified into eight categories: infrastructure, business services, labor, government, proximity to markets, proximity to suppliers, key competitors' locations, and cost.

## TABLE 2

## MEASUREMENT OF PLANT LOCATION VARIABLES

| Variable | Measures Used |
|---|---|
| Cost | Perception of Cost of Land, Energy, Transport Infrastructure, Business Services, Telecommunications, and Labor |
| Infrastructure | Availability of Land, Energy, Transport, and Telecommunications; Quality of Telecommunications and Transport Infrastructure |
| Business Services | Availability and Quality of Air Freight Services, Sea Freight Services, Land Transport Services, Financial Services, Legal Services, and Information Technology |
| Labor | Education Level, Skill Level, Impact of Labor Action, Availability of Engineers, Executives, Operators, Foreign Workers, and Productivity |
| Government | Presence of Support Agencies, Stability of Government Policies, Stability of Tax Policies, Stability of Fiscal Policies, Protection of Foreign Investment, Level of Government Support, Administrative Efficiency and Transparency |
| Customer/Market | Proximity to Market, Size of Market, Stability of Market Conditions |
| Supplier/Resources | Availability of Suppliers, Proximity to Suppliers |
| Competitor | Key Competitors' Locations, Likely Competitors' Reaction to Site |

- Respondent were asked to indicate the relative emphasis placed on each factor on a five-point Likert scale with end points of 1 (extremely important for making a plant location decision) and 5 (not important at all for making a plant location decision)

# Assertions and Hypotheses

- Main assertion: *Relative emphasis on plant location factors at the time of initial manufacturing site location has a significant effect on the eventual location of the plant in one country as opposed to another. Specifically, the objective is to identify those factors that significantly predict eventual plant location in Singapore as opposed to eventual plant location in Malaysia.*

| Firms Emphasizing The Location Factor | Likely Plant Location | Rationale |
|---|---|---|
| Cost | Malaysia | The cost of land, energy, and infrastructure is lower in Malaysia in comparison to Singapore |
| Infrastructure | Singapore | The availability and quality of land, energy, and infrastructure is higher in Singapore in comparison to Malaysia |
| Business Services | Singapore | The availability and quality of support services such as multi-modal freight services, financial services, and information technology services are higher in Singapore in comparison to Malaysia |
| Labor | Singapore | The availability and skill levels of engineers, executives, operators, and foreign workers are higher in Singapore in comparison to Malaysia |
| Government | Singapore | The presence of support agencies and stability of government policy are higher in Singapore in comparison to Malaysia |
| Customer/Market | Malaysia | The access to markets that are high volume and relatively stable is higher in Malaysia in comparison to Singapore. Products developed in Singapore typically involve high technology in dynamic markets of uncertain market size. |
| Supplier/Resources | Singapore | The availability and proximity to key suppliers are higher in Singapore in comparison to Malaysia |
| Competitors' Locations | Singapore | The location of competitors plays a greater role for firms locating in Singapore in comparison to Malaysia. Specifically for plants in high tech industries, firms tend to locate close to one another for cross-fertilization of learning. This is similar to the location decisions made in the "Silicon Valley" area for most technology companies in the United States. |

# The following hypotheses summarize our assertions in Table above:

- **H1**: Firms that place a higher emphasis on *cost* in making plant location decisions are more likely to locate in Malaysia rather than Singapore.
- **H2**: Firms that place a higher emphasis on *infrastructure* in making plant location decisions are more likely to locate in Singapore rather than Malaysia.
- **H3**: Firms that place a higher emphasis on *business services* in making plant location decisions are more likely to locate in Singapore rather than Malaysia.
- **H4**: Firms that place a higher emphasis on *labor* in making plant location decisions are more likely to locate in Singapore rather than Malaysia.
- **H5**: Firms that place a higher emphasis on *government stability* in making plant location decisions are more likely to locate in Singapore rather than Malaysia.
- **H6**: Firms that place a higher emphasis on *customer/market-related factors* in making plant location decisions are more likely to locate in Malaysia rather than Singapore.
- **H7**: Firms that place a higher emphasis on *proximity to suppliers* in making plant location decisions are more likely to locate in Singapore rather than Malaysia.
- **H8**: Firms that place a higher emphasis on *location of key competitors* in making plant location decisions are more likely to locate in Singapore rather than Malaysia.

- Broadly, firms interested in *minimizing cots or accessing stable markets* are likely to locate their plants in Malaysia, On the other hand, firms emphasizing *quality of labor, infrastructure, business services, and suppliers* are likely to locate their plants in Singapore. Similarly, firms desiring *stable government policy with respect to investments, taxation and financing* are likely to locate in Singapore. Finally, firms that are more *sensitive to the locations of their key competitors*, in particular, *high tech industries*, are likely to locate in Singapore to tap into the immense (廣大的，無邊的) learning potential that results from locating in contiguous(接觸的;鄰近的;連續的) areas.

# Methodology

- Sampling Procedures
  - Unit - Companies with manufacturing operations in Singapore or Malaysia that had been in operation for at least three years for making a meaningful comparison.
  - 2,556 companies with manufacturing sites were selected for mailing of the survey.
  - Received 341 out of 2,556 and 327 were usable, response rate = 12.8%. (Singapore: 20.6%, Malaysia: 7.8%)

# Analysis and Findings

- Electric and electronic equipment(18.9%), machinery(14.4%), and chemicals and allied products and rubber(20.2%). Almost a third of the respondents (32.7%) had their head office in Singapore. The next three major regions were Malaysia (19.6%), Japan (17.4%), and USA (11.3%).

- The small employee-size plants include firms with 250 or fewer employees and accounted for 55.4% of the total respondents. Firms with between 251. and 500 employees represented the medium employee-size group and comprised 19.6% of the respondents. Finally, the large employee-size group, consisting of firms with more than 500 employees, accounted for 25.1% of all the respondents. More than one out of two respondents (52.6%) indicated that the average life cycle of their products exceeded three years. While about a quarter of the respondents (24.2%) reported annual R&D expenditures above 3% of sales.

# Comparison of Means of Location Factors for Singapore and Malaysia

**TABLE 5**

**DIFFERENCES IN MEAN SCORES FOR LOCATION FACTORS**

| | Singapore | Malaysia | Significance |
|---|---|---|---|
| Cost | 13.3738 | 12.6529 | 0.061* |
| Labor | 16.2282 | 15.5868 | 0.120 |
| Government | 16.8932 | 15.7686 | 0.026** |
| Infrastructure | 12.9320 | 11.4628 | 0.000*** |
| Business Services | 30.7961 | 28.9669 | 0.014** |
| Customer/Market | 6.7621 | 6.8430 | 0.772 |
| Supplier/Resources | 4.4660 | 3.9091 | 0.002*** |
| Competitor | 5.8495 | 5.9752 | 0.530 |

*significant at .10 level
**significant at . 05 level
***significant at . 01 level

**Note:** For each factor, the mean score was obtained by summing the component item scores for that factor. For example, the score for cost was obtained by summing the scores of its six component items, i.e., cost of land, energy, transport infrastructure, business services, telecommunications, and labor. The Likert scales for each item had end points of 1 (extremely important for making a plant location decision) and 5 (not important at all for making a plant location decision). Thus the cost factor had a possible range of scores between 6 and 30 for each respondent. Please refer to Tables 2 and 4 for details of the component items for other factors.

- National origin, plant size, industry – which may have an impact on the location decision didn’t take into consideration.

# Logistic Regression Analysis

- The logistic regression analysis results outlined in Table 6 indicate some interesting results. Table 6 shows that the Chi-Square test statistic for the model is 234.796 with 21 degrees of freedom. This has a corresponding p value of 0.0000, which indicates that the set of independent variables used in this research are statistically significant predictors of whether the eventural plant location is Malaysia or Singaport.

- Three experimental factors – infrastructure, supplier, and customer-related factors – were found to be significant predictors of whether the ultimate plant location choice is Singapore or Malaysia.
- Singapore's more developed status, especially in the electronics and machinery industries, has led to the development of an efficient upstream supply chain. Hence, locating in Singapore yields the benefit of quick access to a diverse set of suppliers.

- Firms that emphasized factors related to customers/market were more likely to locate in Malaysia. This result broadly indicates that managers of firms locating in Malaysia are aiming at local rather than regional or global customers and would like to locate close to them.
- Further analysis – three control variables: location of parent company, plant size, and industry classification – had a significant impact on the eventual location of the plant. Not surprisingly, the results indicated that if the parent company is headquartered in Singapore, the plant is likely to be located in Singapore and vise versa.

- Those that had headquarters in the US or in Japan preferred to locate in Singapore versus Malaysia. This finding supports Singapore's image as a preferred location among firms from developed markets. (Ferdows 1997)
- Plant size: The results indicate that if firms are planning small plants (defined as those employing less than 250 people), they are more likely to locate in Singapore versus Malaysia, assuming all other factors are identical. Significant differences were not evident between the two countries if the plants were medium (251 to 500 employees) or large sized (more than 500 employees).

- Industry classification: The results indicate that Singapore is a preferred location for the machinery industry while Malaysia is a preferred location for the rubber/chemical industry. This finding broadly reflects the competence of the respective industries in Singapore and Malaysia. The results also confirm that managers consciously take these strengths into consideration in making the location decision.
- No significant differences were evident between Singapore and Malaysia in terms of other factors like R&D expenditures and product life cycles.

- What is the implication for supply chain managers who make location decisions? For policy makers who through their actions or lack of them have significant impact on the various factors analyzed? As discussed earlier, the results indicate that managers of plants located in Singapore emphasize infrastructure and supplier factors while managers of plants located in Malaysia emphasize customer-related factors. Former researchers highlighted the importance of qualitative factors like quality of labor force, stability of government policies, efficient infrastructure, and business services in the location decision.

- Singapore and Malaysia compete directly for foreign direct investment. Singapore has been seen as a relatively expensive location. If firms place a higher emphasis on the qualitative factors associated with a location, then a location in a country that is seen as better in terms of these qualitative factors will be preferred even if it is somewhat more expensive. Investment in infrastructure and availability of a diverse supplier base have enabled Singapore to attract investment evn though it is perceived to be an expensive location. This is especially true of the multinational companies headquartered in the US and Japan.