

# Critical Factors in International Location Decisions: A Delphi Study

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## *Abstract*

This paper explores critical factors that influence international location decisions in real world situations. We first discuss the motivations of firms seeking to manufacture across borders. A comprehensive set of international location decision factors is identified. The Delphi method is proposed as an approach to structure this set of factors for particular circumstances. The approach to a Delphi study is described. It is being conducted using a world-wide panel of experts that includes academics, government bodies and consultants. Issues in conducting the Delphi analysis are raised.

**Key words:** Delphi Approach, International location decision

## *1. Introduction*

As companies seek to serve international markets, there has been a growing number of manufacturing plants located on a world-wide basis. International manufacturing is one of the major parts of a firm's competitive strategy today and beyond. Global expansion will offer the potential to take advantage of economies of scale and entry to new markets (Badri, 1999). Companies that decide to produce and source globally must consider a variety of factors, which may not arise in location decisions in a single country. The additional factors which differ from purely domestic activities include variation of host government policies, quality of infrastructure and so on. To stay competitive in international environments, firms need to pay attention not only to general factors but to the potential host countries' factors as well.

The intent of this paper is to investigate critical factors in international location decisions from the real world situation. The paper starts with the motivation of firms seeking to locate manufacturing plants crossing national borders. In section 3, we follow by noting a variety of factors influencing international location decisions which have been mentioned in the literature. In the next section, the approach to a Delphi study is described. The methodological procedure, the panel of experts and issues in conducting the Delphi study are proposed in order to identify those factors from the real-world view. Finally, in section 5, conclusions and ongoing research are highlighted.

## *2. Motivations for International Operations*

In recent years, firms have changed their environment dramatically. Moving into a world-wide markets involves significant changes. An important motive for international investment comes from the increased need of firms to achieve their competitive advantage. Several authors have described the motivation of firms seeking to manufacture abroad (e.g. Christopher, 1994; Dunning, 1994; Ferdows, 1997). These motives can be identified as follows:

1. Access to low cost input factors which refers to labour, materials, capital and components and so on in order to maximise profitability on manufacturing costs.
2. Access to local technological resources.
3. Proximity to markets, which results in faster and better customer service.

Ideally, these motivations would be clearly differentiated. However, international business tends to undertake several reasons at the same time in making decisions. Before making any decisions about the best country in which locates a new manufacturing plant, manufacturers must evaluate many alternatives and factors involving international location decisions. In the following section, we will discuss critical factors in international location decisions which have been mentioned in the literature.

### *3. Factors to be considered in International Location Decisions*

Several key elements are considered in the selection of international location process, some of which are not relevant in domestic location decisions such as policies and incentives from host governments, social factors, nature of supply base and the political climate of a foreign country. These factors have been grouped and discussed by numerous authors and researchers in a variety of ways. For example, Liang and Wang (1991) classify those factors into 2 categories: - *objective attributes*, which are defined in monetary terms such as transportation cost, labour cost, etc. and *subjective attributes*, which have a qualitative definition such as climate condition, etc. Alternatively, some studies (e.g. Dilworth, 1996) group the factors into three general categories:- *market-related factors*, *tangible cost factors* and *intangible factors*. Russell and Taylor III (1998) classify the factors into *dominant factors*, which are derived from competitive priorities and have a strong impact on sales and costs (e.g. cost, time, quality), and *secondary factors*, which are also important but can be ignored if others are more important. Atthirawong and MacCarthy (2000) classify all of factors affecting international location decisions, which are commonly cited in the literature, into twelve headings. These factors are displayed in Table 1 below.

These are comprehensive lists of factors involving international location decisions. It is clear that not every factor is relevant for every firm and may will not give the same priority when firms decide to make a real decision. Firms will consider only some particular criteria involving their businesses or the particular country in which they are located or wish to locate. In other words, there may be only a few important factors and they dominate the decision in each business (Stevenson, 1996). Moreover, these factors might depend upon size of business, sector or location of parent company. For instance, a US firm in the consumer products sector might look for a new location in a country which has a large market size, adequate, infrastructure, cheaper labour cost and offer favourable incentives and other privileges from host government.

The linkage between a subset of factors and type of business in which firms located, location of manufacturing plant, location of parent company or nature of firm is not yet defined in the literature. Likewise, most research does not investigate whether all these factors are still recognised and well documented in practice or not. Here we discuss the application of the Delphi technique to help clarify these difficult issues and add to the research knowledge in this area.

## *4. The Delphi Approach and Methodological Procedure*

### *4.1 The Approach*

A Delphi study is a systematic, iterative process to elicit a consensus from a group of expert opinions concerning the future. The method was originally developed as a short-term forecasting approach by the Rand Corporation in the late 1940s (Benson et al, 1982; Klassen and Whybark, 1994). Due to the fact that a single opinion may be incorrect and misinformed and may tend to a narrow view, it is assumed that a group of representative experts will provide a more accurate response than one opinion. In the Delphi approach the experts do not come face-to-face with one another. The Delphi technique has been recommended as a structured group communication process because a number of rounds of questionnaire can reduce the influence of dominant individuals and develop a consensus of expert opinions on subjective issues (Ray and Sahu, 1990; Azani and Khorramshahgol, 1990; and Klassen and Whybark, 1994). As Ray and Sahu (1990) state, the Delphi method is a helpful tool to explore and judge miscellaneous future scenarios, and is likely to provide more information than other methods.

According to Benson et al. (1982) there are three particular features to the Delphi method: (1) anonymity among the panel of experts, (2) controlled feedback, and (3) statistical group response. The method is therefore different from brainstorming which allows the interaction of individual opinion and no anonymity which may result in induced answers. The panel of experts must be selected carefully, representing the group of people who are familiar with the problem under consideration. Then they will be asked to participate in responding to a questionnaire in writing. After the questionnaire is returned, all comments by the respondents are combined in order to modify the questions for another round of the Delphi process. The process is repeated until a consensus is reached. The most important part of the process is designing the questionnaire. The questionnaire should be simple and easy to understand for the respondents to provide answers. By avoiding a complex questionnaire and providing some examples, a simpler questionnaire will help the experts to give more accurate answers. The Delphi method has been applied and is well demonstrated in a range of application areas. An application concerning location planning is reported by Azani and Khorramshahgol (1990). Klassen and Whybark (1994) have applied the Delphi method to identify the key barriers in the management of international operations.

### *4.2 The Methodological Procedure*

#### *4.2.1 Major Issues*

The objective of this study is to elicit a consensus of judgements on issues of critical factors in international location decisions and to classify these factors under type of business which firms located, location of manufacturing plant, location of parent company and the nature of business. The major issues in this study are as follows:

1. Identification of motivations of firms that seek to manufacture across the borders.
2. Determination of steps in international location decision process.
3. Identifying the most difficult problem in making an international location decision and recommending ways to overcome the problem.
4. Identification of factors relating to international location decisions by asking the experts indicate the importance of each of the thirteen major factors using a seven-point scale. Explanatory on the importance of sub-factors and the sectors, types of business or countries in which they are most relevant.

5. Identifying factors that need to be considered in international location decisions under location of manufacturing plant in different geographical areas i.e. Western Europe, Eastern Europe, Japan, United States, Middle-East, Far-east, Africa, Latin America from experts' points of view.
6. Identifying factors that need to be considered in international location decisions under location of parent company I United States, United Kingdom, Western Europe and Japan from experts' points of view.
7. Identifying factors that need to be considered in international location decisions under type of business i.e. Automotive/Motor Vehicles, Electronic Products/IT and Software, Electronic Equipment and Appliances, Textiles/Apparel, Consumer products/ Food and Beverages, Rubber/Plastics, Chemical/Petroleum and Coal and other businesses from experts' points of view.
8. Identifying factors that need to be considered in international location decisions under nature of firm i.e. world-class manufacturing, large company and medium-sized company by identifying the top four important factors from experts' points of view.

The following assumptions are also made in this study:

1. Those factors are different according to types of business which firms conduct.
2. Those factors are different according the size of business which firms conduct.
3. Those factors are different according to location of parent company.
4. Those factors are different according to geographical areas.

#### *4.2.2 The Pilot Study*

An initial pre-test was conducted with 6 experts who attended the International Conference for Production Research (ICPR-special 2000) in Thailand during 2-4 August, 2000. The list of factors involving international location decisions was developed from the related articles, existing documents and other archives. The questionnaire was sent to each person beforehand and followed by an interview to receive comments. The pre-test helped to clear up the ambiguities and group similar sub-factors within the same criteria. Rearrangement among sub-factors had been done and then thirteen major criteria were identified for the first round of the Delphi study.

#### *4.2.3 The Delphi Panel*

The Panel of experts was designed to have representatives from academics, government bodies and consultants world-wide. Thirty-eight persons with experience involving international business/operations were selected to participate in the first round of the Delphi study. The questionnaire was mailed to the panellists in late October 2000. Another reminder letter was sent via email to all experts who had not replied between November and December, 2000. The Delphi study was conducted in strict confidence and anonymity was guaranteed to respondents.

### *5. Conclusion*

The Delphi study has been employed to investigate and identify critical factors relating to international location decisions outlined in the early section of this paper. Moreover, it has been proposed to underline those factors under type of business, location of manufacturing plant, location of parent company and nature of the firm from the real world situation. The

nature of the method is a time-consuming process as it may need a number of rounds of questionnaire / iteration to reach the consensus of the final results. However, this method is a valuable technique in developing a consensus of subjective issues in strategic planning.

The final study is still far from complete. The first round responses are being analysed and collated in order to send back to the same participants to get feedback and comments. The early indications are that factors considered in the decision making process are not equally important, some may be ignored in some businesses and some sectors. The considerations seem to depend upon the above assumptions, especially by the type of business. We intend to publish the final results arising from the study when it reaches the consensus or overall clarify.

## 6. References

Atthirawong, W. and MacCarthy, B.L.. “Factors Affecting International Location/Allocation Decisions: Can we structure them?”. *Proceeding of the 5<sup>th</sup> International Manufacturing Research Symposium*, Cambridge, UK, (2000). pp. 1-8.

Azani, H. and Khorramshahgol, R.. “Analytic Delphi Method (ADM): A Strategic Decision Making Model applied to location planning”. *Engineering Costs and Production Economics*. Vol.20 (1990). pp.23-28.

Badri, M.. “Combining the analytical hierarchy and goal programming for global facility location-allocation problem”. *International Journal of Production Economics*. Vol. 62, No.3 (1999). pp. 237-248.

Benson, P., Hill, A. and Hoffmann, T., Manufacturing Systems of the future-A Delphi study, *Production Inventory Management*, Vol.23, No.3 (1982). pp.87-105.

Chase, R. and Aquilano, N.. *Production and Operations Management: Manufacturing and Services* ( 7<sup>th</sup>ed.) Irwin, USA, 1995.

Christopher, M.. *Logistics and Supply Chain Management* (2<sup>nd</sup> ed.) Irwin, USA, 1994.

Dilworth, J.. *Operations Management* (2<sup>nd</sup> ed.) McGraw-Hill, USA, 1996.

Dunning, J.H.. “Re-evaluating the benefits of foreign direct investment”. *Transnational Corporations* . Vol.3, No.1 (1994). pp. 23-51.

Evans, J. et al.. *Applied Production and Operations Management* (3<sup>rd</sup> ed.) West Publishing Company, USA, 1990.

Ferdows, K.. “ Making the most of foreign industries”. *Harvard Business Review*., March-April, (1997). pp.73-88.

Hoffman, J. and Schniederjans, M.. “A Two-stage Model for Structuring Global Facility Site Selection Decisions”. *International Journal of Operations and Productions Management*, Vol.14, No.4 (1994). pp. 79-96.

Klassen, R. and Whybark, D.. “Barriers to Management of International Operations”. *Journal of Operations Management*. Vol.11, (1994).pp. 385-396.

Liang G., and Wang M.. “A fuzzy multi-criteria decision-making method for facility site selection”. *International Journal of Production Research*. Vol. 29, No.11 (1991). pp. 2313-2330.

Lockett, A.. *Resource Allocation for Management: A Mathematical Programming Approach* (1<sup>st</sup> ed.) Gower Press Limited, Essex, UK, 1976.

Milkovich, G., Anthony, J.and Thomas, A. “ The Use of Delphi Procedures in Manpower Planning”. *Management Science*. Vol. 19, No.4 (1972). pp.381-388.

Nahmias, S.. *Production and Operations Analysis* (2<sup>nd</sup> ed.) Irwin Inc., USA, 1993.

Pongpanich, C. and Gregory, M.. “Insight into International Manufacturing Location Decisions”. *Proceeding of the 4<sup>th</sup> International Manufacturing Research Symposium*. Cambridge, UK, (1999) pp.115-119.

Ray, P. and Sahu, S.. “ Productivity Management in India: A Delphi Study”. *International Journal of Operations and Production Management*. Vol. 10, No.5 (1990). pp. 25-51.

Russell, R. and Taylor III, B.. *Operations Management: Focusing on Quality and Competitive* (2<sup>nd</sup> ed.) Prentice- Hall, Inc., USA, 1998.

Stevenson, W.. *Production Operations Management* (5<sup>th</sup> ed.) Irwin, USA, 1996.

Sule, D.. *Manufacturing Facilities: Location, Planning and Design* (1<sup>st</sup> ed.) PWS-KENT Publishing Company. USA, 1988.

**Table 1:** Critical factors in International Location Decisions

<b>Factors</b>	<b>Considerations/details</b>
Favourable labour climate	labour costs, quality of labour force, skills, availability of labour force, labour unions, attitude of present employees, wage rate, labour unions, productivity
Transportation costs	costs involving transporting materials and finished goods, delivery times, distribution costs
Proximity to markets and customers	location of demand, number of customers, size of markets, delivery speed
Proximity to suppliers and resources	quality of suppliers, alternation suppliers, competition for materials from other companies, nature of supply process, location of suppliers
Proximity to parent company's facilities	distance between plant and parent company
Location of competitors	number of competitors nearby, type of manufacturer
Quality of environment/climate related factors	geographical characteristics of plant, level of quality of life index,
Political environment factors	record of government stability, stability of regime, effective of government, consistency of government policy
Tax structure related factors	tax structure, custom duty, tariffs, quotas, regulatory barriers, bureaucracy
Social environment factors	culture, customers' life, language differences, norm and custom, customer characteristics, standard of living
Economic related factors	currency, exchange rate, interest rate, inflation, employment level
Other related factors	Utility costs, water supply, power supply, infrastructure, telecommunication, etc.