The facility location problem is an essential element of a firm’s global outsourcing strategy. It has been largely investigated from the outsourcing firms’ perspective. This study focuses on developing a model for host entities which normally provides a wide variety of incentives to attract outsourcing investment. A well designed incentive package can benefit both the host entity and the outsourcing firm. The model proposed in this study provides an analytical tool for the host entity to determine the appropriate value of the incentive. Management insights are discussed to motivate further research and opportunities for applications.

KEYWORDS: Facility location problem (FLP), Global outsourcing, Host incentive, Supply chain coordination (SCC)

INTRODUCTION

The facility location problems, including international facility location problems, have been largely investigated from the perspective of the Multinational Corporation (MNC) (Bhutta, 2004; Brand et al. 2000; Thizy et al., 1983), but not from that of the host entities, such as city, state, federal governments, or local potential business partners. Host entities are more interested in which MNCs to target and how to attract. Fridman et al. (1992) conclude that access to markets, labor availability, and state incentives are the determining factors for Japanese and European MNC’s entering in the United States markets. He (2003) analyzed the location preference of MNC’s in China and found that American, Hong Kong, and Taiwanese MNC’s prefer locations with access to local markets, whereas, those firms from Japan favor port cities for convenient transportation. Henley, Kirkpatrick and Wilde (1999) found that both local economic factors and the government policies (incentives) play a critical role in influencing the MNC’s location choice. Rondinelli and Burpitt (2000) surveyed the effect of government incentives to attract and retain international investment in North Carolina, U.S.A. Their results indicated that government incentives are not as important as some traditional location factors such as labor availability, transportation, and quality of life.

Besides low labor cost, access to local markets and cheap raw materials, the incentives provided by host entity is an important factor which impacts the MNC’s decision. Canel and Khumawala (1997 & 2001) summarized the most common factors in existing International
Facility Location (IFL) models. They are: (1) availability of low-cost production inputs, (2) proximity and access to markets, (3) host government attitude towards foreign investment, (4) political and economic stability, (5) host government tax, trade, and exchange rate policies (incentives), and (6) existence of other competitors. In their international facility location model for MNC’s, the tariff, taxes, financial incentives and direct export incentives are all considered as the known parameters of the host entities.

From the perspective of the host entity, the incentive it can provide is more flexible than local labor cost, access to market and transportation cost etc. In fact, a properly designed incentive program can both maximize the host entity’s expected profit and positively impact the MNC’s decision to select the host location. Lowergart and Menipaz (2000) presented a conceptual framework to simulate the process of the MNC selecting the facility location. They surveyed the perceptions of Middle East and south European host countries in fourteen characteristics including government involvement, legal issues, and taxation etc. Host countries could determine their advantages or disadvantages compared to the competitors, and then decide what the incentives should be given to compensate for their disadvantages. The model proposed in this study provides the host entity with an analytical model and a strategy to determine the proper incentive(s) for attracting MNC’s outsourcing.

**THE MODEL**

In a facility location model from the perspective of MNCs, labor cost, transportation cost and host entity incentives, etc. are all considered (Canel & Khumawala, 2001). Here, we use LT to stand for all other cost as a single input except for the incentive from host entity. The incentive from host entity is the decision variable in this model. We assume LTs of all competitors are known in an open market. The number of competitors in the market also impacts the host entity’s decision of incentives. We start with a two-competitor case, and then expand our model to a multiple-competitor case.

<table>
<thead>
<tr>
<th>Table 1: Notations</th>
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<tbody>
<tr>
<td>$i$ : Total cost except for host incentive for MNC selecting location</td>
</tr>
<tr>
<td>$\pi_i$ : Expected profit for host entity $i$</td>
</tr>
<tr>
<td>$W_i$ : Benefits for host entity $i$ if it is selected</td>
</tr>
<tr>
<td>$F_i$ : Penalty for host entity $i$ if it is not selected</td>
</tr>
<tr>
<td>$P_r(I_i)$ : Probability of host entity $i$ being selected with an incentive of $I_i$</td>
</tr>
<tr>
<td>$I_i$ : The value of incentives offered by host entity $i$</td>
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**Two-competitor Case**

In a two-competitor case, for host entity one, its objective function of expected profit is as follows:

$$\text{Max} \quad \pi_i = P_r(I_i) \times (W_i - I_i) - (1 - P_r(I_i)) \hat{\iota} \ast F_i$$  \hspace{1cm} (1)

Where, the probability for host entity one being selected can be expressed as:

$$P_r(I_i) = P_r(\hat{\iota}_1 - I_i < \hat{\iota}_2 - I_2)$$  \hspace{1cm} (2)
\( \hat{\gamma}_i - I_1 \) is the firm's adjusted costs at location \( i \) by including the incentive offered by host 1. Let \( \Delta < \hat{\gamma}_1 - \hat{\gamma}_2 \). Assume the incentive from the other host entity, i.e. \( I_2 \), is uniform distributed between 0 and \( W_2 \). Rearranging Eq. (2), we get,

\[
P_r(I_1) = P_r(I_1 > I_2 + \Delta LT) = \frac{I_1 - \Delta LT}{W_2}
\]

(3)

Substitute \( P_r(I_1) \) in Eq. (1) by \( \frac{I_1 - \Delta LT}{W_2} \), we have

\[
\pi_1 = \frac{I_1 - \Delta LT}{W_2} \times (W_1 + F_1 - I_1) - F_1
\]

(4)

Derivate Eq. (4) with respect to \( \hat{I}_1 \) and set it equal to 0. We have,

\[
\frac{\partial \pi_1}{\partial \hat{I}_1} = \frac{W_1 + F_1 - I_1}{W_2} \cdot \frac{I_1 - \Delta LT}{W_2} = 0
\]

Therefore, the optimal value of incentive from host entity 1 is,

\[
\hat{I}_1^* = \frac{W_1 + F_1 + \Delta LT}{2}
\]

(5)

The second order derivate at \( \hat{I}_1^* \) is

\[
\frac{\partial^2 E(P)}{\partial \hat{I}_1^2} = - \frac{2}{W_2} < 0
\]

(6)

Therefore, \( \pi_1^* \) is the maximal value of expected profit for host entity 1. \( \hat{I}_1^* \) is the optimal incentive that host entity 1 should offer in order to maximize its expected profits in a two-competitor case.

**Multiple-competitor Case**

If there are multiple competitors in the market, the probability for location \( i \) to be selected can be expressed as below. The incentive from any host entity \( j \) is uniform distributed between 0 and \( W_j \).

\[
P_r(I_i) = P_r(I_i > \forall I_j, j = 1, 2, \ldots, N \land j \neq i) = \frac{I_i^{N-1}}{\prod_{j \neq i} W_j}
\]

(7)
\( N \) is the total number of competitors on the market. If the MNCs conduct a global search for outsourcing location, various locations with similar background will be considered. It is very hard for each potential host entity to identify where other competing locations are in order to conduct the analysis aforementioned. Therefore, we make one more assumption that the differences of \( LT \) between host locations are not significant in a multiple-competitor case, especially when \( N \) is large enough. Hence, host incentives play a more important role in a multi-competitor case than in a two-competitor case. The objective function for host entity \( i \) to determine optimal incentive \( I_i \) in a multiple-competitor case is:

\[
\pi_i = \frac{I_i^{N-1}}{\prod_{j \neq i} W_j} * (W_i + F_i - I_i) - F_i
\]

Max

\begin{equation}
(8)
\end{equation}

Derivate Eq. (8) with respect to \( I_i \), and let it equal to 0. We get,

\[
\frac{\partial \pi_i}{\partial I_i} = \frac{n - 1}{N} I_i^{N-2} (W_i + F_i - I_i) - \frac{I_i^{N-1}}{\prod_{j \neq i} W_j} = 0
\]

Solve the above equation, we have

\[
I_i^* = \frac{N - 1}{N} (W_i + F_i)
\]

Calculate the second order derivate,

\[
\frac{\partial^2 E(P_i)}{\partial I_i^2} = -(N - 1)(W_i + F_i)I_i^{N-3} < 0
\]

Where, \( W_i, F_i, I_i > 0 \).

Therefore, the optimal solution of \( I_i^* \) maximizes the expected profit for entity \( i \).

From the above results for both the two-competitor and the multiple-competitor cases, we find that the benefit for a host entity being selected (\( W_i \)) and the penalty for not being selected (\( F_i \)) play a critical role in determining the appropriate incentive for each host entity. \( W_i \) and \( F_i \) are determined by each host entity and depend on the local economic and political situation. Therefore, \( W_i \) and \( F_i \) indicate how important this MNC business opportunity is to host entity \( i \). Although \( W \) and \( F \) are not shared among the competitors, we see from Eq. (5) and Eq. (10) that other competitors’ \( W \) and \( F \) won’t influence host entity \( i \)’s decision on the level of incentive. The incentive, \( I_i \), only depends on host entity’s own situation.

For the host entity to determine \( W \), they must consider the impact on income tax, potential business for local suppliers and related tax revenues. For the host entity to determine
they must consider the impact on “inventory cost” for unemployment, loss of raw materials sales, and potential loss for local suppliers (Brand et al., 2000).

CONCLUSIONS

In a facility location model from the perspective of MNCs, the host entities’ incentives are considered as known inputs. How the host entity can influence the MNC’s decision by offering a strategically designed incentive still remain a challenge issue. This research proposed a decision making approach for host entities to determine the value of an incentive that maximizes host entities’ expected profit. From our results, the following conclusions are drawn:

1. The host entity’s optimal incentive is independent of other competitors’ incentive. It is only related to how important the host entity considers this business (\(W\) and \(F\)) and their local economic environment (\(\tilde{\xi}\), in the case of only two competitors).

2. Comparing the results from Eq. (5) and Eq. (10), we find that more competitors will cause higher incentives, because more competitors will reduce the probability of being selected with the same incentive. This is similar to an auction procedure.

3. The incentive will positively influence the MNC’s decision but may not change the result if the difference of other factors (LT) is significant. In a two-competitor case, the incentive is determined by Eq. (5),

\[
I^* = \frac{W_1 + F_1 + \Delta LT}{2} I_1 < I_2
\]

Here, \(\Delta I_1\) is the extra cost for selecting location one over location two. Therefore, host entity one has to provide more incentive to compensate this disadvantage. If host entity one cannot afford this additional compensation by the incentives, it means the difference in \(LTs\) is larger than host entity one’s capability. The host entity one will likely lose the bid for the MNC business. This is consistent with Rondinelli and Burpitt (2000)’s results.

4. Eventually, a host entity who considers this business opportunity more seriously (larger \(W\) and \(F\)) will provide sufficient incentives to win the bid in an independent competition environment. This is a fair result. The MNC also want to cooperate with a host entity who give more priorities.

REFERENCES

References available upon request.