

AN EVALUATION OF DIRECT FOREIGN INVESTMENT
USING THE MULTIATTRIBUTE UTILITY MEASUREMENT
——the case of Company N——

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I Introduction

Various theories are applied to interpret the motives and causes for a company's direct investment to foreign countries. The following are representative ones.

〈International Division of Labor Theory〉

Direct foreign investment based on the international division of labor theory was explained by Professor Kojima (1977). In that theory, Kojima points out three motives and causes of the corporation's behavior. They are as follows:

1. Natural resources oriented
2. Market oriented
3. Production elements oriented

In viewing the trends of the direct foreign investment behavior of Japanese companies, the following tendency becomes apparent.

Natural resources oriented → Production elements oriented →
Market oriented

〈Environmental Change Theory〉

Using the environmental change theory, Professor Shishido (1977) listed six direct foreign investment promotion factors. These factors are as follows.

1. Resources problem
2. Environment and site problem
3. Labor force and cost
4. Market assurance against decreasing economic growth

5. Rise of protectionism
6. Requests for industrialization by developing countries

The behavior of Japanese companies were also interpreted using these factors.

The above economic theories explain the general behavior of a corporation. Yet, the individual firm has its own motives and causes and invests for its own sake. Thus, every company has to evaluate its behavior from its own point of view. In this paper, the multiattribute utility measurement method is used as an evaluation. By applying this method to the direct foreign investment pattern of Company N, we can see how Company N views its own behavior.

II The Evaluation Procedure

Several kinds of methods are used to evaluate states, acts, consequences, or alternatives. In this paper, the author uses a psychological value evaluation called the multiattribute utility measurement. Psychological value or utility is the basis used for the selection of future alternatives and the evaluation of past actions. In order to measure this psychological value the author uses the Simplified Multi-Attribute Rating Technique, hereafter referred to as the SMART method, altering it somewhat to serve his purposes. The SMART method was proposed and developed by W. Edwards (1971,1978) and consists of the following ten steps.

Step 1

Identify the person or organization whose values are to be evaluated. The generic name for such individuals or groups is stakeholders.

Step 2

Identify the issue in reference to which the values needed are evaluated. This will often depend on the purpose of the evaluation. Depending on the purpose, the same objects may have many different values. Generally, the value is a function of the evaluator, the entity being evaluated, and the purpose for which the evaluation is being made.

Step 3

Identify the entities to be evaluated. This will also depend on the purpose of the evaluation. Formally, these entities are the outcome of possible actions. Yet, in a sense, the distinction between an outcome and an opportunity for future actions is usually fictitious.

Step 4

Identify the relevant dimensions of value used in the evaluation of the entities. This value structuring task is probably the most important part of the multiattribute utility method. Most evaluations can be performed by using value tree-objectives hierarchies. This value tree is characterized by having abstract and unmeasurable values at the top and well-defined measurable values at the bottom. The values of all stakeholders should be represented in the value tree. Figure 1 shows a schematic example of a simple value tree with two objectives and seven branches.

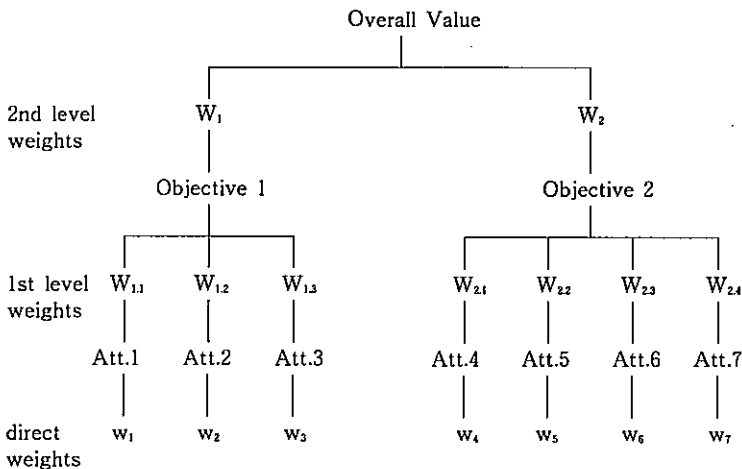


Fig. 1 Schematic Value Tree

Step 5

Rank the dimensions of value in order of importance. If the attributes are arranged in a value tree, one can obtain the ranks for the values from beneath each separate branch of the tree.

Step 6

Assess the weight of importance of each branch of the value tree. In this stage, respondents compare the relative importance of the respective branches using various methods ranging in complexity. When there are a few attributes, direct judgment techniques will be used. These weights of importance are the essence of value judgments, and should thus be assessed by the relevant stakeholders.

Step 7

Normalize the weights and calculate final weights. The next step is to multiply all the normalized weights downward through the tree to obtain the weights of the branches.

Step 8

Obtain location measures. The location measures are referred to as single-attribute utilities. The form of these single-attribute utilities depends on the attitude toward risk. In order to facilitate the calculation process, the following utility function is usually used.

$$u(x) = a + b(-e \cdot \exp(-cx))$$

$$u(x) = a + b(dx)$$

$$u(x) = a + b(e \cdot \exp(cx))$$

Where a and $b > 0$ are constants to insure that u is scaled from zero to one (or on any scale desired) and that c is positive for increasing utility functions and negative for decreasing utility functions.

Step 9

Combine Step 7 and Step 8. Step 7 produced a set of branch weights which sum was one. Step 8 produced a location measure for each branch for each entity being identified. In Step 9 we take the aggregate of Step 7 and Step 8 by defining U_k as the aggregate utility of the k th entity being evaluated, and the index j refers to the branches of which there is a total of T .

$$U_k = \sum_{j=1}^T W_j U_{kj}$$

In this equation, w_j is the final weight on the j th branch, and u_{kj} is the location measure calculated from the single attribute utility of the k th object of evaluation on the j th branch. This is the equation for a weighted average.

Step 10

Evaluate and decide. The main point of this step is that an evaluation context depends on the reason for the evaluation.

Steps 1 to 9 are summarized in Figure 2. This scheme shows how to use the evaluation method.

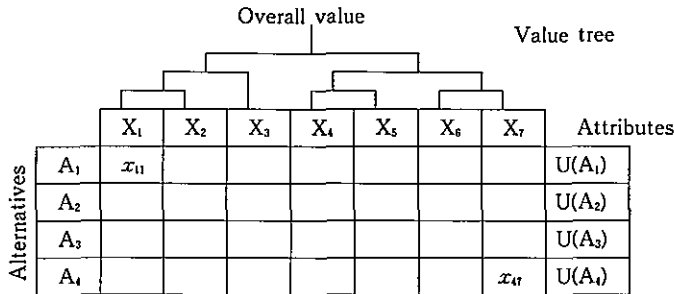


Fig.2 A Schematic Representation of
Multiattribute Evaluation

III The Evaluation of Company N's Direct Foreign Investment

(1) An outline of Company N

Company N is one of the largest ceramic corporations in Japan and consists of three divisions. The first division mainly produces and sells chinaware and is responsible for 54 percent of Company N's total sales. The second division makes and sells a micro-grinder which is used in precision machinery. The third division makes and sells electric and electronic parts for fluorescent indicators.

The company motto is "Good Products, Export, and Mutual Prosperity." Company N bases its actual activities on these three principles. Over 50 percent of ceramic pieces are exported to North America, and the future exporting target is EC. Company N is putting a great deal of effort into developing export markets in the EC. Yet, it is experiencing the following difficulties.

1. Raw materials for the ceramic pieces

The difficulty of obtaining high quality raw materials from one place has forced Company N to order from various places in Japan

and to import some raw materials from countries such as the UK, Korea, and India.

2. Labor costs

The ceramic industry is highly labor-intensive with the labor cost representing 60 percent of the production cost. Due to this high percentage, the yearly increase in labor costs has become a pressing problem for Company N.

3. Research and development

The R&D department performs two main tasks, product development and product design. Product development consists of the improvement of the quality and the process of the development of kiln. Product design is the process of matching the product with the wants and needs of the customer. In order to achieve these respective tasks, Company N has invested in Sri Lanka, Ireland, and the Philippines. Although each of these countries offers several conditions which are highly advantageous to Company N, they also pose management problems in terms of political stability and cultural differences.

(2) Evaluation of Company N's direct foreign investment

Step 1

In this case, the following five members of executives and staff from Company N evaluated the current situation.

President

Head of the foreign business division

Head of the foreign trade department

Chief of the president's office

Section chief of the foreign trade department

Step 2 and 3

The evaluation is done for examining and reviewing the current situation of Company N's direct foreign investment.

Step 4

Based on the discussion concerning Company N's current direct foreign investment situation, the evaluators depicted the following value tree. (Figure 3)

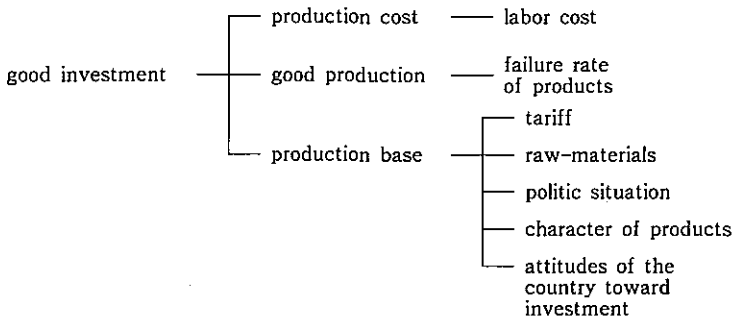
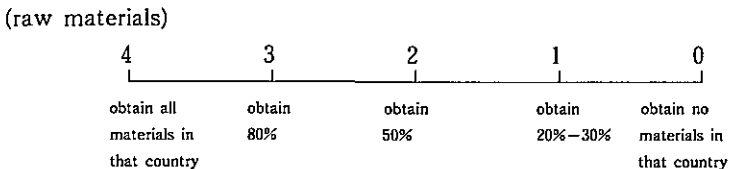
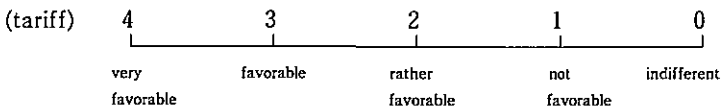


Fig.3 Company N's Value Tree

Using this value tree, the evaluators saw the investment problem as having seven attributes.

Step 5

The evaluators concluded that although Company N could capture the figures of the cost of labor and the rate of product failure objectively, it must create the production base figures subjectively. These subjective figures are represented by the following examples.



These examples are summarized in Table 1 and 2.

Table 1 Evaluation Points of Labor cost and Failure Rate of Products

	Sri Lanka	Philippines	Ireland
labor cost	below 10%	15%	60%
failure rate	85%	85%	70%

Table 2 Evaluation Points of Production Base (subjectively)

		Sri. Lanka	Philippines	Ireland
president	tariff	2	2	2
	raw materials	2	2	2
	politic situation	2	2	3
	character of product	2	2	3
	attitude of the country	2	2	3
head of foreign business division	tariff	2	2	2
	raw materials	2	2	2
	politic situation	2	3	3
	character of product	2	2	3
	attitude of the country	2	2	2

Step 6 and 7

The evaluators assessed and normalized the importance weights of each of the branches of the value tree. The results are shown in Table 3 and 4.

Table 3 Each Attributes Weights

	labor cost	failure rate of products	production base
presideint	0.5	0.2	0.3
head of foreign busi. divi.	0.25	0.3	0.45
head of foreign trade dep.	0.5	0.2	0.3
chief of president office	0.45	0.2	0.35
a section chief of f. t. dep.	0.5	0.3	0.2

Table 4 Weights for Production Base

	tariff	raw materials	politic situation	character of products	attitude of the country
president	0.25	0.15	0.1	0.15	0.35
head of f.b.d.	0.1	0.2	0.15	0.35	0.2
head of f.t.dep.	0.1	0.2	0.2	0.2	0.3
chief of p.office	0.3	0.1	0.2	0.05	0.35
a section chief	0.2	0.15	0.15	0.2	0.3

Step 8 and 9

Each member's single-attribute utilities were assessed using

$$U(x_i) = a - b \cdot \exp(-\lambda x_i)$$

a 50–50 lottery process. The following function was used:

The president's result in Figure 4 as an example.

The president's multiattribute utility function is:

$$\begin{aligned}
 U(x_1, \dots, x_7) = & -0.9104(1 - 1.6267 \cdot \exp(-0.4878x_1)) \\
 & - 0.1776(1 - 0.4566 \cdot \exp(0.4566x_2)) \\
 & + 0.0186x_3 + 0.0113x_4 + 0.0075x_5 \\
 & + 0.0113x_6 + 0.0263x_7
 \end{aligned}$$

The president's evaluation of Sri Lanka is:

$$x_1=0.1 \quad x_2=0.85 \quad x_3=2 \quad x_4=2 \quad x_5=2 \quad x_6=2 \quad x_7=2$$

The president's utility value of Sri Lanka is:

$$U(0.1, 0.85, 2, 2, 2, 2, 2) = 0.762$$

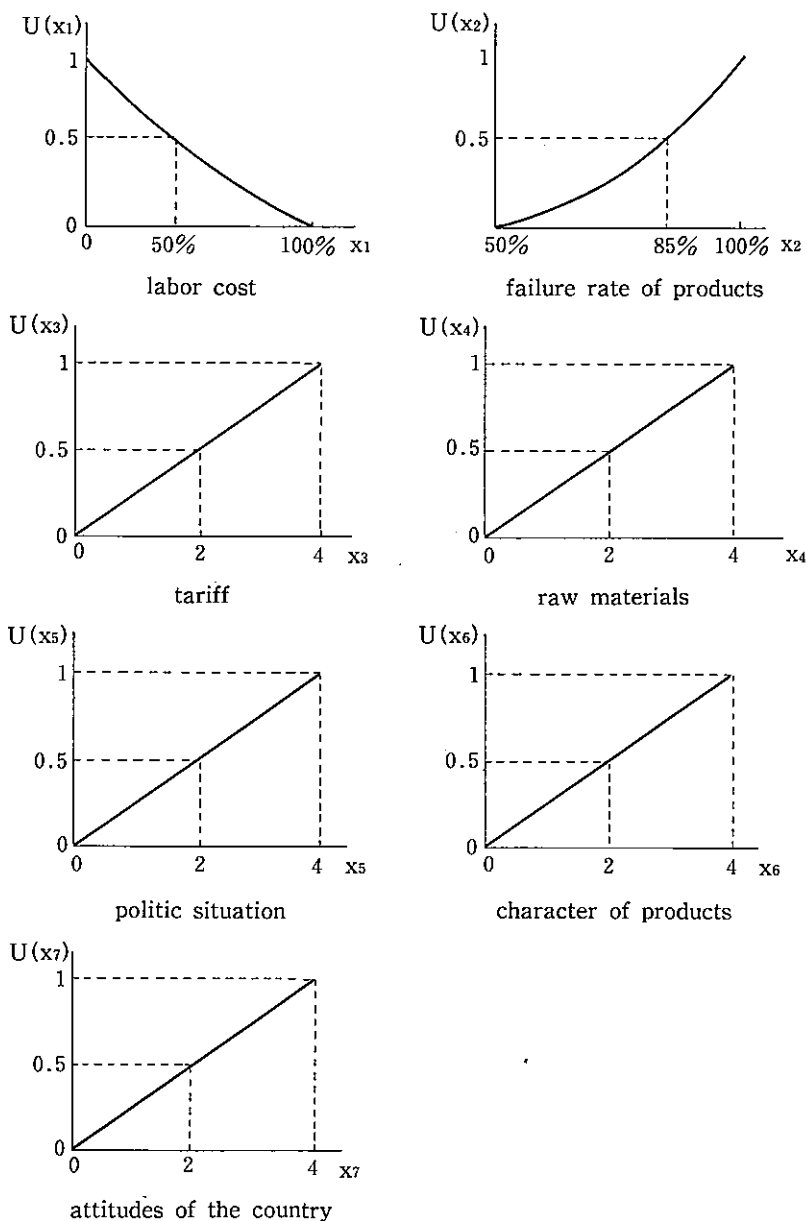


Fig. 4 Single-Attributes Utility of the President

The results of a similar assessment of the utility values of the remaining members are summarized in Table 5 and 6.

Table 5 Multiattribute Utility Value

	Sri Lanka	Phillipines	Ireland
president	0.799	0.739	0.453
head of foreign business div.	0.647	0.632	0.421
head of foreign trade dep.	0.765	0.726	0.370
chief of president office	0.790	0.759	0.449
a section chief of f.t.dep.	0.792	0.751	0.436

Table 6 Utility Value on Production Base

	Sri Lanka	Phillipines	Ireland
president	0.558	0.500	0.650
head of foreign business div.	0.472	0.500	0.588
head of foreign trade dep.	0.550	0.600	0.725
chief of president office,	0.570	0.570	0.511
a section chief of f.t.dep.	0.538	0.500	0.738

Step 10

From Table 5 and 6, one can see how the executives of Company N viewed direct foreign investment in the various countries. Sri Lanka had the most points overall. Yet, this result is mainly due to Sri Lanka's low labor cost. Instead, Ireland is the best choice in terms of a production base, especially since it is located in the targeted EC region.

IV Conclusion

This paper presented the result of the evaluation of Company N's direct foreign investment by its own executives. Using the value tree and the multiattribute utility method allows one to compare the different evaluations of various members on a similar basis. The result can also be applied to evaluate the future behavior of the firm from the same point of view.

Notes

The situations and figures in Company N are the case of 1978's. But this paper's aim is to show a evaluation method using multiattribute utility, and doesn't have a purpose to analyze Company N's activities. So, I don't think the essence of the paper is changed.

References

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多属性効用理論による海外投資の評価

〈要 約〉

土 居 弘 元

社会科学ではいろいろな評価方法が用いられる。多属性効用理論もその一つである。本論文では多属性効用理論を用いて、一企業の海外直接投資を会社関係者がどのように評価しているかを見、それが意義ある方法であることを示したい。

企業が海外直接投資をする目的はさまざまである。それぞれ、企業は独自の目的に基づいて行動している。したがって、大勢を見るには統計的に集計したデータを用いることが重要であるが、個々の企業関係者にはあまり意味が無いことである。そこで、企業が独自の評価方法を確立する必要がある。

多属性効用理論が実際問題に適用され始めたのは1970年頃であるが、その後10年にわたって理論面、実際面で検討が加えられ、幅広く受け入れられるものとなった。しかし、適用に当たって、簡略化された方法を用いるか精微な方法を用いるかは、適用する問題に要求される内容、関係する人々の関心度、等によって異なってくる。ここでは、原則的に SMART とよばれる方法により、一部修正を行った。

対象とする企業N社は、日本有数の陶磁器生産、販売会社である。そこが海外3カ国で操業している工場に対し、コスト、生産状況、生産基地としての有利さ、の3つの観点から、会社関係者がどのように評価しているかを多属性効用理論によって把握する。N社の関係者は投資国に対し一応の満足をしている、という結果から得られるが、背景となる状況に変化があればそれは変わってくるものである。