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A Goal Programming Model for Partner Selection Decisions in International Joint Ventures

by

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ABSTRACT

The formation of International Joint Ventures (IJVs) has become a widely used mode of international expansion. The selection of the appropriate partner constitutes one of the major factors of success for the IJV. There have been several research efforts, which were concerned with the study of criteria needed for the selection of a partner but not with the development of an appropriate quantitative model. The objective of this paper is to present a quantitative model, based on the goal programming technique, which uses appropriate criteria to evaluate potential candidates and leads to the selection of the optimal partner.

Keywords: **Goal Programming, Partner Selection Decisions, International, Global Expansion, Joint Ventures**

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1. Introduction

As the global economy has become a reality, firms that wish to remain competitive in the international business environment realize that they need to expand to foreign markets. Thus, the use of International Strategic Alliances as a tool of competitive strategy has become a very important issue in International Business. Their importance for the expansion of a firm's activities in the international markets, as well as for sustaining the competitive position of the firm in the global business environment, is widely recognized in the literature. The ultimate motivation of the firms, which participate in alliances, is their aspiration to create value that neither firm would have been able to create alone for itself.

A specific type of International Strategic Alliance that has attracted a great degree of attention in the literature is the formation of International Joint Ventures. An International Joint Venture (IJV) is described as a new business entity that is created by two or more legally distinct organizations (the parents), among which at least one is headquartered outside the country where the new firm is located. Parent organizations hold ownership interests and actively participate in the decision making activities of the jointly owned business entity (Geringer, 1991, Park and Ungson, 1997). And as involvement in International Business is turning into a trend, the formation of IJVs is becoming one of the most commonly used vehicles of international expansion. A driving force for the extensive use of IJVs is that firms increasingly realize that the difficulty of being self-sufficient is continuously rising because of the enormous costs and risks implied by international undertakings (Inkpen and Li, 1999).

There are many benefits as well as strategic objectives that firms expect to achieve by utilizing IJVs as the vehicle for entering foreign markets. One of the most common incentives for the extensive use of IJVs is the sharing of resources, financial costs and the associated business risks with the partner(s). The achievement of the critical mass that could lead to the appearance of economies of scale or scope is another important incentive. In other cases, firms form IJVs to secure foreign sources of raw materials and intermediate goods (backward vertical integration) as well as channels of distribution abroad (forward vertical integration). In addition, IJVs facilitate the process of acquiring and/or learning new skills and technologies. They also facilitate the acquisition of access to foreign markets and contribute to the acceleration of the entry process. Furthermore, they assist firms to protect their local and foreign markets as well as to create new ones. Finally, a joint venture with a local firm provides the advantage of having a partner who has sufficient knowledge of the local business environment and practices (Geringer, 1988, Park and Ungson, 1997, Barkema and

Vermeulen, 1997).

The rising popularity of IJVs as an international expansion strategy is also supported by empirical research. As the literature shows, the number of joint ventures formed by U.S. firms increased by 423% over the period of 1986-1995 (Dacin et al., 1997). In addition, Morris and Hergert (1987), report that partnerships between firms, which compete directly, have increased significantly since the 1960s. Furthermore, Raffee and Eisele (1994) report an explosive growth of the use of IJVs. More specifically, they found that the number of cooperative ventures in the countries of the former Soviet Union increased from 1200 in January 1990 to 25,000 by December 1993, while in China joint ventures grew from 188 in 1979 to more than 30,000 by the end 1993. Another research effort has shown that, as international co-operation becomes increasingly complex, IJVs are preferred to other contractual agreements (Garcia-Canal, 1996). As a result of their widespread use, IJVs have become a critical concern for international business and that, in turn, has instigated extensive relevant research since late 60s - early 70s.

Nevertheless, several empirical studies indicate that there is high termination rate of IJVs. The dissolution rates reported by these studies range from 37% to 70% (Janger, 1980, Harrigan, 1985, Geringer, 1991, Park and Ungson, 1997, Yan and Zeng, 1999). However, the high termination rates do not necessarily reflect unsatisfactory performance and failure of the IJV to achieve its objectives. On the contrary, termination could be the result of the fact that at least one of the partner firms has achieved its strategic objectives and decides to depart from the partnership (Reuer, 1998). Nevertheless, in the cases where early termination occurs because at least one of the partners is not satisfied with the results of the IJV, one of the most common factors cited by managers as leading to early dissolution is the unsuccessful selection of partners.

The process of establishing a joint venture could be distinguished in four stages, namely, partner selection, negotiations, agreement formulation and operation and management of the IJV. The role of the partners for the success of the joint venture is catalytic in all four stages, since their attributes give birth to the factors that contribute to or undermine the successful outcome of the venture. Therefore the selection of the appropriate partner is of critical importance for the longevity of the venture and the accomplishment of its strategic objectives.

The purpose of this paper is the presentation of a quantitative approach for the partner selection process. Since multiple factors and criteria impact this problem, the model

developed is based on the consideration of multiple objectives and more specifically on the goal programming approach. The rest of the paper is organized in the following manner. Section 2 contains a brief literature review of studies related to the selection process and the criteria used to identify the most appropriate partner as well as a review of articles that present quantitative approaches to similar decision problems, such as the country selection process. In the third section we present the goal programming model for the partner selection problem by providing its parameters, its decision variables and, of course, the mathematical formulation of the goals and objectives. Section 4 contains an illustration of the model using hypothetical but realistic data for a Greek firm. Finally, section 5 summarizes the most important results of the paper and presents some ideas for further research.

2. Literature Review

There are several issues that render the process of selecting the most suitable partner critical for the success of the IJV. Some of the most important partner related issues are the financial, human and technical capabilities desired by the foreign firm, the involvement of all partners in major strategic decisions concerning the IJV and the strong need for compatibility of their strategic objectives, management styles and national cultures. Although the selection of the appropriate partner appears to be fundamental for the success of the IJV, the research devoted to this issue is rather limited. The related studies focus their attention on the following four broad issues: the identification and analysis of various motives and selection criteria, the post-selection analysis of the significance of criteria employed in the process, the investigation and analysis of the selection process and, finally, the testing and verification of theoretical propositions using statistical methods. Furthermore, the results of these research efforts show, first, that it is not possible to develop a widely applicable list of selection criteria, second, that the nature of the criteria shows a dynamic behavior, and third, that they may differ even for the partners of the same IJV.

Beamish (1987) identifies two variables that affect the performance of the joint venture namely partner need and commitment, although his work focuses on the first one. He provides a rigorous typology of partner needs, divided into five groups called “items readily capitalized”, “human resource needs”, “market access needs”, “government/political needs” and “knowledge needs”. The author investigates the level and types of needs as well as how partner need changes both within and between each parent company. Joint venture performance is the dependent variable and the effect of each partner need on it is statistically

tested. The study concludes that the success of the joint venture is influenced by the reasons for which a partner is needed and by the length of the time period for which the need lasts.

Geringer (1988a) identifies and discusses a long list of selection criteria, which may be employed in the process of evaluating the suitability of candidates for the formation of long-term joint ventures. In a sequel paper, the same author (Geringer, 1988b), investigates various aspects of the selection process such as, the identification and screening of partners, the role of individuals who are critical to this selection (sponsors), the involvement of top management and the nature of negotiations. In another paper, Geringer (1991) discusses the strategic determinants of partner selection criteria. The criteria are distinguished between task and partner related. The paper focuses on the second type, using statistical analysis to show that the relative importance of selection criteria depends on the critical success factors (CSFs) that the proposed venture confronts, as well as the current and expected future competitive position of the parent firm relative to those CSFs.

In Brouthers et al. (1995), the authors draw upon previous theoretical and empirical work to develop a conceptual framework that can be used to analyze the likelihood of international strategic alliance success. The proposed framework focuses on four wide categories of factors called “complementary skills”, “cooperative cultures”, “compatible goals” and “commensurate levels of risk”. The so-called *Four Cs of Strategic Alliances* are further analyzed and the authors conclude that if the *Four Cs* are seriously taken into consideration, that could result in a more efficient and effective partner selection process. Kumar (1995) is concerned with the effect of the partner selection on the success of technology transfer to developing countries. In this respect, the author uses data from Indo-German technical collaborations, including IJVs, to identify and evaluate partner selection criteria, which influence the successful transfer of technology. Dacin et al. (1997) examine the partner selection criteria employed by managers from U.S. and Korean firms when formulating strategic alliances among them. They find that there are significant differences as well as similarities in the attributes sought from each national group in their prospective partners. They conclude that firms wishing to form international strategic alliances must pay great attention not only to their own selection criteria but also to what their prospective partners expect from them. Finally, for an in depth study of joint ventures from the strategic management, organizational design and the cultural and human resource perspective one could consult a recently published book by Büchel et al. (1998).

The common characteristic of the above research efforts is that they follow an ex-post

analysis of motives, criteria, practices and/or outcomes of partner selection processes. However, to the best of our knowledge, research still has not produced quantitative models that could evaluate the data and attributes of potential partners and indicate the most appropriate one. In turn, our objective is to propose such a model, which is based on the goal programming technique and that would be capable of making such recommendations. A preliminary version of this model was presented by Hajidimitriou and Georgiou (1999). A detailed and comprehensive analysis of the goal programming method can be found in Ignizio (1985) and Schniederjans (1995).

This technique has been used in a relatively limited number of cases to provide solutions to similar selection problems, such as the international site selection. More specifically, Hoffman and Schniederjans (1990) developed an international strategic management/goal programming model concerning the global expansion of operations in the hospitality industry. The mechanics and benefits of the model were presented by evaluating potential expansion sites in Eastern Europe. The same authors (Schniederjans and Hoffman, 1992) introduced another country selection process based on a 0-1 goal programming model. The proposed model provides solutions to the problem of international expansion through the acquisition of a local firm. The authors identified and employed critical success factors as selection criteria for their international business expansion model. In addition, Hoffman and Schniederjans (1994) provided a study of the global facility site selection decisions in the production industry and more specifically in the brewing industry. In this paper they developed a two-stage model in which the first stage evaluates countries and the second investigates specific facilities within the selected country.

Furthermore, Min and Melachrinoudis (1996) used the goal programming technique to formulate a stochastic country selection model, which resulted in a mixed-integer nonlinear program. The model adopts a multiple-period, multiple-plant approach and permits the consideration of alternative entry modes. In another study, Hajidimitriou and Georgiou (2000) present a goal programming model, which provides solutions to the same problem, while at the same time it takes into consideration the financing aspect allowing the determination of the optimal loans mix in various currencies. In addition, the model provides the capability to optimally allocate the firm’s own funds and loans mix among the selected locations. Finally, Schniederjans (1999) provides an extensive collection of methodologies that can be used to investigate problems of international facility acquisition and site selection. The book contains an analysis on various quantitative methods such as scaling, ranking, mathematical

programming, simulation, AHP and heuristics, as well as a thorough list of references for each case.

3. Model Formulation

The problem that we will use to demonstrate the characteristics of the proposed model is about a firm that wishes to expand its activities internationally by forming an IJV with another firm. It is assumed that the country where the firm will establish the IJV has already been selected. Consequently, the parent firm is now examining the strengths and weaknesses of several local firms in order to select the partner that better serves its strategic objectives related to the joint venture. The strengths and weaknesses of the local candidate partners, which the foreign firm evaluates, are directly related to the incentives for the extensive use of joint ventures, presented in the introduction. Although it is not restrictive for the applicability of the model, we assume, for simplicity purposes, that the equity share of the local firm in the joint venture is the same for all candidates and it has been determined in advance by the foreign firm. Consequently, the equity participation is fixed for all local firms and it has no impact on the solution of the problem.

We will proceed now with the presentation of the goal programming model for the partner selection problem. In this respect, we will provide the set of its parameters, the decision variables, and the mathematical transformation of selection criteria into goals which, in turn, are converted into objective functionals. In addition, we will establish aspiration levels and set priorities for the various goals that will be reflected in a lexicographic objective function. The model formulation is concluded with the presentation of the rigid constraints.

As it has been mentioned earlier, the selection of the partner is accomplished by evaluating a set of criteria that reflect the attributes that the foreign firm expects to be possessed by the candidate partners. The criteria could be quantitative and, therefore, their values are measurable or qualitative in nature and their values are determined subjectively by the foreign firm's management. Some qualitative selection criteria, which are often found in the literature are, for example, the ability of the partner to contribute to the faster entry into the local market, the political advantages that the local partner can secure, his/her access to raw material sources, provision of access to distribution networks, the partner's familiarity with local business practices, economic environment, politics and customs, the ability of the partner to make available experienced managerial or technical personnel, his/her access to local financial resources, the ability of the partner to facilitate exporting, as well as the

ownership of patents, licenses or other proprietary knowledge. Once again, it becomes clear that the selection criteria are directly related to the reasons for which the foreign firm is willing to share the ownership of the new business entity with a local firm.

As analyzed in the previous paragraphs, a set of criteria is established that will be evaluated in the selection process. The management of the firm sets relevant goals for each one of them. The goals are associated with aspiration levels, which reflect the desired level of achievement for each goal. In other words, the aspiration level measures the achievement of the goal by linking its utopian perception to the constraints and conditions imposed by reality (Ignizio, 1985).

The proposed model assumes that the firm has already carried out a preliminary screening process through which it has identified a number of local firms that are considered as good candidates for the formation of the IJV. The number of candidate partners is denoted by I. We assume that the firm to be created will sell a single product in the local market and in the markets of several foreign countries. The total number of markets served is denoted by J. Furthermore, we assume that the venture will borrow funds for financing purposes. The new firm has the choice to collect a loan in one among K different currencies. It is assumed that the amount of the loan is the same regardless of the partner. However, the interest rate of the loan differs depending on who the partner will be. Finally, it is assumed that the information the firm uses in the decision process refers to a single time period of one year, that is, no aggregation over the time parameter takes place and the model is a single period model.

Let us now proceed with the description of the functional forms of the various goals. We assume that the most important quantitative criterion of the model is the profits of the joint venture. The profit function encompasses several quantitative parameters such as labor, raw material and other production costs. In the model presented below, it is assumed that the profitability of the joint venture depends on the partner selected and its maximization constitutes the ultimate goal for the firm. Therefore, the achievement of a certain profit aspiration level is assigned the highest priority. Other criteria could also be included in the first priority group or in other groups of lower priority. Prioritization within each group is also possible. As Geringer (1991) showed, the prioritization of the criteria between or within groups is determined by management and depends on the strategic objectives of the foreign firm concerning the formulation of the IJV. One of the advantages of the model is that it allows the investigation of the consequences of different orders of priorities on the solution of the problem. Then, the profit goal is the following:

$$\sum_{i=1}^{I}\sum_{j=1}^{J}\left[\left(e_j p_j - c_i - m_i - t_j\right)X_{ij}\right] - \sum_{i=1}^{I}[(E_i + TRC_i)Y_i + \sum_{k=1}^{K} r_{ik} e_k F_k U_{ik})] \; + d_{PR}^{-} - d_{PR}^{+} = b_{PR} \quad (1)$$

The model incorporates three sets of decision variables, which are included in the profit goal function. The first set is denoted by X_{ij}, $i = 1,...,I$, $j = 1,...,J$, and represents the quantities produced and shipped to country *j* when partner *i* is chosen. Although these variables are integer in nature, in the model are considered to be continuous, without any loss of generality. The second set of variables is denoted by Y_i, $i = 1,...,I$. These are binary variables taking a value of 1 if partner *i* is selected and 0 otherwise. Finally, the third set includes the binary variables U_{ik}, for $i = 1,...,I$ and $k = 1,...,K$. For each partner i, U_{ik} takes a value of 1 if loan in currency k is selected and 0 otherwise.

The parameters used in the same expression are the following:

e_j : the exchange rate between the currency of country *j* and the local currency,

p_j : the product unit price in country *j*,

c_i : the unit production cost (apart from material and transportation costs),

m_i : the cost of raw materials per unit of product,

t_j : the unit transportation cost to country *j*,

E_i : the establishment cost of the joint venture given that partner *i* is selected (net of financial incentives and subsidies that the local government might offer),

TRC_i : the total personnel training cost if partner *i* is chosen,

F_k : the amount of loan granted to the joint venture in currency *k*,

r_{ik} : the interest rate for loans in currency *k* available to the joint venture when partner *i* is selected,

e_k : the exchange rate between the local currency and the currency *k* in which the loan is denominated.

In the same expression, parameter b_{PR} denotes the aspiration level for the profit goal. The latter is a realistic amount set by the management of the foreign firm and corresponds to the maximum level of profits, which they estimate that can be attained by the joint venture. In addition to the three sets of decision variables described in the previous paragraph, there are two more variables (the deviational variables), denoted by d_{PR}^{-} and d_{PR}^{+}, which accompany the aspiration level for the profit. These variables represent the difference between what is

aspired to accomplish and what is actually achieved. In fact, they represent the underachievement (d_{PR}^{-}) or overachievement (d_{PR}^{+}) of the profit aspiration level and at least one of them has to be equal to zero.

Another important selection criterion, introduced in the model, concerns the achievement of a desirable value for a financial ratio composite index. This index reflects the overall financial strength and performance of each candidate partner and it is a weighted average of *N* financial ratios chosen by the foreign firm. The weights, denoted by λ_n, reflect the importance that the firm's management attaches to each ratio RT_{in} (for candidate *i*). It is also assumed that the nature of the ratios is such that the higher the value of the ratio the better the financial position of the candidate. This criterion produces a goal which could be assigned a priority equal, higher or lower that the profit goal, according to management's judgement. Alternatively, the two goals could form a common priority set. In this case, the objectives should be brought to the same order of magnitude by scaling so that commensurability of the objectives is secured (Min and Melachrinoudis, 1996). Thus, the corresponding financial index goal takes the following form:

$$\sum_{i=1}^{I} Y_i \sum_{n=1}^{N} \lambda_n RT_{in} + d_{RT}^{-} - d_{RT}^{+} = b_{RT} \qquad (2)$$

The weights are defined such as $\sum_{n}^{N} \lambda_n = 1$. The deviational variables used in the composite index goal are d_{RT}^{-} and d_{RT}^{+} whereas b_{RT} represents the aspiration level. The functional form of the composite index provides management the capability to experiment with the values of the weights, thus testing different scenaria and hypotheses concerning the importance of each ratio.

Let us now denote by *S* the number of the remaining selection criteria. The mathematical expressions for the goals defined for these criteria, may take the following general form:

$$\sum_{i=1}^{I} a_{is} Y_i + d_s^{-} - d_s^{+} = b_s \text{ where } s = 1,\ldots,S \qquad (3)$$

Each parameter a_{is} reflects the contribution of the corresponding criterion *s* to the achievement of the aspiration level of the relevant goal, provided that partner *i* is chosen. The corresponding aspiration level is denoted by b_s and the deviational variables by d_s^{-} and d_s^{+}.

The summation $\sum_{i=1}^{I} a_{is} Y_i$ over the number of candidates *I*, provides the overall contribution of the selected candidate. When the appropriate partner is selected, the variable Y_i that corresponds to that partner takes a value of one. This variable, along with the contribution of the partner a_{is}, determines the over- or underachievement of the goal. The value obtained when $Y_i = 1$ is compared to b_s and gives the resulting values to d_s^- and d_s^+.

The objective function of the model is comprised of deviational variables, taken from the various goals. Since the foreign firm wishes to achieve or even exceed the aspiration level for the profit, the undesirable deviational variable that should be minimized is the underachievement d_{PR}^-. The firm also wishes to achieve an aspiration level for the composite financial index, which is as high as possible, and therefore the undesirable deviational variable is the underachievement d_{RT}^-. The appropriate deviational variables for the remaining goals are allocated in *M* priority groups according to their importance for the selection process. The variables within each priority group may also be weighted according to their relative importance in the group. This process generates functionals which are weighted sums of deviational variables. The ordered set of these objective functions forms the lexicographic achievement function of the model. The vector form of this function is the following:

Lexicographically Minimize $\mathbf{z} = \{z_{PR}, z_{RT}, z_1 ..., z_M\}$ (4)

In the above expression the first priority function is $z_{PR} = d_{PR}^-$ which corresponds to the underachievement of the profit goal. The second priority function is $z_{RT} = d_{RT}^-$ which represents the underachievement of the composite financial index. As mentioned previously, the remaining objective functions $z_1, ..., z_M$, contain linear expressions of deviational variables, while the subscripts reflect the corresponding priority levels. The aspiration levels for these functions, denoted by $b_{z_1}, ..., b_{z_M}$, are calculated accordingly from the constants on the right hand side of the set of expressions (3).

The lexicographic minimization is restrained by a set of rigid constraints regarding product demand (D_{ij}), production capacity (CAP), the selection of the currency of the loan and the number of partners to be selected. The mathematical formulation for the set of constraints associated with demand is:

$$\sum_{i=1}^{I} X_{ij} = D_j \text{ for all } J \text{ countries} \quad (5)$$

For each country j, $j = 1,\ldots,J$, constraint (5) assures that the total quantity of product shipped to this country meets the total demand in this country, denoted by D_j.

Since total production is decomposed in quantities shipped to each market *j*, the second group of constraints relates production capacity with these quantities and assures that total production does not exceed the capacity of the facility.

$$\sum_{j=1}^{J} X_{ij} \le CAP * Y_i \text{ for all } I \text{ candidate partners} \quad (6)$$

The presence of the binary variable Y_i at the right hand side of the constraint assures that none of the production variables X_{ij} becomes basic in the solution, if the corresponding partner *i* is not selected.

The next group of constraints assures that no binary variable U_{ik} takes a value of 1 if the corresponding partner is not selected and secures that the joint venture will receive a loan in one currency.

$$\sum_{k=1}^{K} U_{ik} = Y_i \text{ , for all } I \text{ candidate partners} \quad (7)$$

The last rigid constraint assures that only one partner is selected.

$$\sum_{i=1}^{I} Y_i = 1 \quad (8)$$

The application of the model in a real business case requires that the management of the interested firm goes through a number of stages. The first stage involves the identification of the selection criteria. At the second stage the criteria are prioritized according to their relative importance. Then, aspiration levels for each goal are set and, at the final stage, the necessary data are collected. In the following section we provide an illustration of the model using hypothetical but realistic data for a Greek firm.

4. Application of the model

The current section contains an illustration of the model, which is based on a case study of a Greek firm contemplating expansion in the Eastern Europe area. The firm has already selected Hungary as the most appropriate country to establish its production activities and wishes to choose a local partner, among *I* available candidates, to setup a joint venture. More specifically the firm has identified three potential partners that seem to be suitable to co-

operate with ($I = 3$). It is assumed that the joint venture will finance its activities through loans granted in one of three currencies, namely Euro, US dollars and Yen ($K = 3$). On the other hand the venture will sell its product not only in the local market, but it will also export it to Poland, Czech Republic and Greece ($J = 4$). In Table 1 we provide exchange rates between Hungarian Forint and the rest of the currencies that will be used in the model.

Table 1 Exchange rates e_j, e_k

Local currency	Market Currency				Loan Currency		
	HUF (j=1)	PLZ (j=2)	CSK (j=3)	GRD (j=4)	USD (k=1)	EUR (k=2)	JPY (k=3)
HUF	1	63.98	7.12	0.77	271.5	258.6	2.60

Note: HUF: Hungarian Forint, PLZ: Polish Zloty, CSK: Czech Koruna, GRD: Greek Drachma, USD: US Dollar, EUR: Euro, JPY: Japanese Yen.

Source: Exchange rates taken from the "*Classic 164 Currency Converter*" for April 18, 2000 at http://www.oanda.com/converter/classic.

The funds the firm wishes to borrow do not depend on the partner selected and they are given in Table 2. Note that the loan will be granted in one currency and the currency selection depends on the interest rate which, in turn, depends on the partner. Table 3 contains these interest rates.

Table 2 Loans granted (F_k)

Loan granted in foreign currency	Currency (*k*)		
	USD(k=1)	EUR(k=2)	JPY(k=3)
Amount	230,000	241,500	24,035,000

Table 3 Interest Rates r_{ik}

Candidate Partner	Currency (*k*)		
	USD(k=1)	EUR(k=2)	JPY(k=3)
Partner (i=1)	5%	6%	7%
Partner (i=2)	8%	7%	5%
Partner (i=3)	6%	7%	5.5%

There is a fixed cost for establishing the production facility of the joint venture, as well as a fixed cost associated to personnel training. These costs along with the unit material cost and the unit production cost are tabulated in Table 4. It is assumed that all of these costs are partner dependent. On the contrary, the production capacity of the venture's facilities does not depend on the partner and equals to 2,500,000 units.

Table 4 Establishment costs E_i, training costs TRC_i, unit material costs m_i, unit production costs c_i (all in HUF)

Candidate Partner	E_i	TRC_i	m_i	c_i
Partner(i=1)	30,000,000	1,000,000	5	10
Partner(i=2)	28,000,000	900,000	8	7
Partner(i=3)	33,000,000	700,000	12	4

The selling price and per unit transportation cost depend on the destination market. The selling price is given in the corresponding country's currency, while the transportation costs are expressed in Hungarian forints. Table 5 contains these data as well as the estimated maximum quantity demanded for each market.

Table 5 Unit price p_j, unit transportation cost t_j, demand D_j

Market	p_j	t_j	D_j
HU(j=1)	100 (HUF)	10	500,000
PL (j=2)	1.56 (PLZ)	15	400,000
CZ (j=3)	14 (CSK)	20	350,000
GR (j=4)	130 (GRD)	30	550,000

The data needed for the composite financial ratio criterion consists of scores achieved by the candidate firms for certain financial indices and for a predetermined time period. More specifically, the values of four financial indices (N=4) are taken into account in the calculation of the composite index. The foreign firm considers these indices sufficient in reflecting the financial status of the candidate partners. In addition, as it is shown by expression (2) of the description of the model, the financial ratios are weighted according to the degree of importance the firm assigns to each of them to yield the overall composite index for each partner. The financial indices, along with their weights, are the net profit margin ($n=1, \lambda_1 = 0.3$), the operating profit margin ($n=2, \lambda_2 = 0.2$), the return on investment - ROI ($n=3, \lambda_3 = 0.3$) and the return on equity – ROE ($n=4, \lambda_4 = 0.2$). In Table 6, rows correspond to the candidate partners and columns to the financial ratios.

Table 6 Financial Ratios (RT_{in}, $i = 1,2,3$ and $n = 1,2,3,4$)

Candidate Partner	***RT (n=1)***	***RT (n=2)***	***RT (n=3)***	***RT (n=4)***
Partner(i=1)	0.05	0.07	0.09	0.06
Partner(i=2)	0.04	0.075	0.08	0.09

Partner(i=3)	0.045	0.08	0.07	0.08

The rest of the selection criteria are represented by equation (3) of the model. The management of the Greek firm evaluates each candidate partner with respect to the qualitative selection criteria. Their subjective evaluation is converted into quantitative scores according to a five-point discrete scale (1-5). At this point the question of how quantitative scores are assigned could arise. In fact, the procedure of assessing a candidate depends on the criterion. Generally, it is based on information that the firm's managers gather from various sources. Such sources could be independent reliable business publications, similar ventures that the candidate partners have formed and the discussions and negotiations with senior managers of the candidate firm. The information collected is evaluated by the Greek firm's senior managers to formulate a subjective judgment. A classification scale that may reflect management's judgment takes the form 1=very unsatisfactory, 2=unsatisfactory, 3=neutral, 4=satisfactory and 5=very satisfactory. The use of such a process provides the capability to measure qualitative criteria, such as the candidates' willingness to share their expertise, the compatibility of their strategic objectives, the quality of their distribution network etc.

Table 7 provides twelve ($S=12$) selection criteria used in this application as well as the associated assessments (a_{is}) that reflect the overall opinion of the Greek firm's management regarding the fulfillment of a criterion by each candidate. In addition, based on their importance for the achievement of the firm's strategic objectives, the selection criteria are ranked into three (M=3) priority groups, denoted by P1, P2 and P3. It is assumed that the criteria are equally important within each group. The aspiration level for each goal is set to the utopian level of 5 (i.e. $b_s=5$, $s=1,...,S$). The priority rankings as well as the aspiration levels are also provided in Table 7. The set was selected from a wide range of criteria that appear in the relevant literature and it is not exhaustive. The selection was done subjectively and its sole objective is to illustrate the nature of the criteria and the relevant data.

Table 7 Selection Criteria, Priorities, Goals and Scores

	Criterion	Priority	Goal	Candidate 1	Candidate 2	Candidate 3
1.	Rapid Market Entry	P1	5	3	2	3
2.	Compatible Management Styles	P1	5	5	4	3
3.	Political Advantage	P1	5	4	5	5
4.	Compatible Strategic Objectives	P1	5	4	4	4
5.	Distribution Network Quality	P2	5	3	4	5
6.	Willingness to Share Expertise	P2	5	5	4	4
7.	Compatible Organization Cultures	P2	5	4	5	2

8.	Better Export Opportunities	P2	5	4	4	3
9.	Technological Level	P3	5	3	4	5
10.	Quality of Local Personnel	P3	5	3	2	2
11.	Knowledge of Local Business Practices	P3	5	3	2	4
12.	Location of Joint Venture Facilities	P3	5	5	3	3

Criterion 1 refers to the help the partners offer in entering the local market faster (Beamish, 1987, Geringer, 1991). The second criterion refers to the compatibility of the foreign and local firm's management approaches (Geringer, 1988a, Brouthers et al., 1995). The next criterion evaluates the ability of the partner to provide political advantages (Beamish, 1987). Criterion 4 assesses the compatibility of the candidates' and the IJV's strategic objectives (Geringer, 1988a, Brouthers et al., 1995). The fifth criterion refers to the quality of the distribution network that the partner could provide to the IJV (Beamish, 1987, Geringer, 1991, Dacin et al., 1997). Criterion 6 accounts for the candidates' willingness to share their expertise with the IJV (Brouthers et al., 1995, Dacin et al., 1997). Criterion 7 evaluates the compatibility of the partners' organization culture (Geringer, 1988b, Brouthers et al., 1995). The next criterion refers to the partners' capabilities to assist the IJV in exporting its product (Beamish, 1987, Geringer, 1988b). Criterion 9 assesses the candidates' technological capability (Beamish, 1987, Brouthers et al., 1995, Dacin et al., 1997). The next criterion accounts for the skills of the partners' personnel (Beamish, 1987, Geringer, 1991). Criterion 11 refers to the partners' knowledge of local business practices (Beamish, 1987, Dacin et al., 1997). The last criterion evaluates the advantages of the site that the candidate offers for the location of the venture's facility (Geringer, 1991).

The aspiration level set for the profit goal is b_{PR} = 100,000,000 HUF, whereas the composite financial index goal is b_{RT} = 0.1. The undesired deviation for the profit goal is represented by the negative deviation variable d_{PR}^- and the undesired deviation for the composite index goal is d_{RT}^-. Consequently, the first priority objective function is $z_{PR} = d_{PR}^-$, corresponding to the underachievement of the profit goal. The second priority objective function is $z_{RT} = d_{RT}^-$ representing the underachievement of the composite financial index. The remaining objective functions z_1, z_2, z_3 are linear expressions of negative deviation variables taken from the three priority groups of the selection criteria presented in Table 7. Since within each group the goals are considered equally important, the linear expressions for the three objective functions are $z_1 = d_1^- + d_2^- + d_3^- + d_4^-$, $z_2 = d_5^- + d_6^- + d_7^- + d_8^-$ and

$z_3 = d_9^- + d_{10}^- + d_{11}^- + d_{12}^-$. The aspiration level for each of the above functions is the sum of the aspiration levels for each component goal. In result, the target of the first goal is $b_{z_1} = b_1 + b_2 + b_3 + b_4 = 20$. In the same manner $b_{z_2} = b_5 + b_6 + b_7 + b_8 = 20$ and $b_{z_3} = b_9 + b_{10} + b_{11} + b_{12} = 20$.

Using the data presented, the goal programming model was formulated, compiled and optimized using XPRESS-MP (Dash Associates, 1999). In the first run of the model we employed a pure preemptive approach using the 5 goals described earlier. The top priority goal was the achievement of the profit aspiration level (function z_{PR}), the next was the composite financial index (function z_{RT}) and the three goals represented by functions z_1, z_2 and z_3 were ranked 3rd, 4th and 5th, respectively. Under this set of assumptions, the solution of the model suggests to select the second candidate ($Y_2 = 1$) and to borrow the funds needed in Yen ($U_{23} = 1$). The solution generated the following deviations from the respective goals:

1. $d_{PR}^- = 13{,}658{,}030$, meaning that the partner selected does not fully attain the profit goal set as the top priority goal. In goal programming terms, the above value provides an estimation of the underachievement of the profit target and it indicates that the estimated highest profit the firm can achieve is 86,341,970 HUF.
2. $d_{RT}^- = 0.032$, meaning that the composite financial index goal is not fully satisfied either. The valued achieved by the selection of the second candidate is 0.068.
3. The values achieved for the three remaining groups of criteria are 15, 17 and 11, meaning that these goals were underachieved by 5, 3 and 9 points, respectively.

In order to investigate the implications of a different priority ranking of the two most important goals, we ran the model after reversing their priorities. In this case, the model selects the first candidate ($Y_1 = 1$) and suggests to borrow the funds needed in USD ($U_{11} = 1$). Now the deviations from the respective goals are:

1. $d_{PR}^- = 15{,}755{,}730$, meaning that the second priority target is underachieved by this amount and the estimated highest profit the firm can achieve is 84,244,270 HUF.
2. $d_{RT}^- = 0.031$, meaning that the composite financial index goal, set as the first priority goal here, is not fully attained. The value achieved by the selection of the first candidate is 0.069.
3. The values accomplished for the three remaining groups of criteria are 16, 16 and 14 meaning that these goals were underachieved by 4, 4 and 6 points, respectively.

As we can see, reversing the order of the first two goals resulted in the selection of candidate 1 over candidate 2, a solution that slightly improves the performance of the composite index goal but, on the other hand, reduces the profits by approximately 3.8%. The trade-offs that clearly arise by the different solutions led us to investigate more closely the relation between the two goals. This was carried out by combining the first two objective functions, weighted accordingly to bring them to the same magnitude and setting them in the first priority. Therefore, in a series of subsequent runs the first priority objective function was $z_{PR-RT} = w_{PR} z_{PR} + w_{RT} z_{RT}$ while priority rankings of the rest of the goal groups remained the same. For example, in a third run we used weights of 60% for z_{PR} and 40% for z_{RT}. Although the profit goal was assigned the highest weight, the model selects candidate 1 (as obtained in run 2), a result that at first seems to contradict the solution obtained in the first run.

The same result was still obtained when we started increasing the weight of the profit objective function, even when the value of w_{PR} approached unity. Of course, when w_{PR} was almost equal to 1 (0.9999), we have the case of the first run of the model and candidate 2 is preferred over candidate 1. Finally, in a fourth run we decreased significantly w_{PR} setting it equal to 0.1. The model selected again candidate 1 suggesting USD as the appropriate currency for the loan and therefore resulting in the same solution as in the second run.

Other experiments with intermediate values for the weights gave results similar to the ones obtained in the third or fourth run. In conclusion, the suggestion of the first run was obtained with a pure preemptive approach by placing the profit goal in the first priority. This solution, indicating the candidate 2 as the appropriate one, would be misleading if the management's preference towards the profit goal was not really very strong. By reversing the priorities in the second run (i.e. absolute preference to the composite index goal), candidate 1 was now selected providing a slight improvement on the financial index goal. The experiments carried out in the subsequent runs used a weighted objective function for the first two goals. At this stage the solution revealed elements from both previous runs. These solutions were not sensitive to the degree of importance assigned to the profit goal and would not change unless the weight for the profit goal becomes almost 1.

The presentation of the application concludes with Table 8, which contains a summary of the most important results of the runs. It is evident that the model is flexible enough to allow management to test numerous scenarios regarding various strategic assumptions by altering its parameters and priority rankings.

Table 8 Summary of results obtained by model runs

Run 1 – Candidate 2 selected- Loan currency Yen			
Criterion	**Priority**	**Goal**	**Deviation**
Profit	P1	100,000,000	$d_{PR}^{-} = 13{,}658{,}030$
Composite Financial Index	P2	0.1	$d_{RT}^{-} = 0.032$
1st group of equally weighted selection criteria	P3	20	5
2nd group of equally weighted selection criteria	P4	20	3
3rd group of equally weighted selection criteria	P5	20	9
Run 2 – Candidate 1 selected - Loan currency USD			
Profit	P2	100,000,000	$d_{PR}^{-} = 15{,}755{,}730$
Composite Financial Index	P1	0.1	$d_{RT}^{-} = 0.031$
1st group of equally weighted selection criteria	P3	20	4
2nd group of equally weighted selection criteria	P4	20	4
3rd group of equally weighted selection criteria	P5	20	6
Run 3 – Candidate 1 selected - Loan currency USD			
Profit (60%) + Composite Financial Index (40%)	P1	100,000,000 0.1	$d_{PR}^{-} = 15{,}755{,}730$ $d_{RT}^{-} = 0.031$
1st group of equally weighted selection criteria	P2	20	4
2nd group of equally weighted selection criteria	P3	20	4
3rd group of equally weighted selection criteria	P4	20	6
Run 4 – Candidate 2 selected - Loan currency YEN			
Profit (99.99%) + Composite Financial Index (0.01%)	P1	100,000,000 0.1	$d_{PR}^{-} = 13{,}658{,}030$ $d_{RT}^{-} = 0.032$
1st group of equally weighted selection criteria	P2	20	4
2nd group of equally weighted selection criteria	P3	20	4
3rd group of equally weighted selection criteria	P4	20	6

5. Summary and Further Research

The strategic importance of IJVs has made them a critical concern for international business strategy and it has resulted in a large volume of research on this topic. It is generally accepted that the successful performance of an IJV strongly depends on the choice of the partner. Furthermore, the process of selecting a partner has become an increasingly complex decision process.

Existing studies investigate motives, criteria, practices and/or outcomes of partner selection processes. Nevertheless, the literature lacks of quantitative approaches that could assist the decision process at all stages, by evaluating data related to potential partners and by making recommendations regarding the most appropriate one. This article addresses this issue by presenting a multiple objective model based on the goal programming technique. The model handles a series of major concerns that management takes into account when looking for a partner in order to establish an IJV in a foreign country. These concerns include the

quantitative and qualitative key criteria that reflect the strategic objectives of the firm, the goals associated with these criteria as well as their rankings. The model can easily accommodate these concepts and provides suggestions by simultaneously considering all relevant factors. It is also flexible enough to allow the investigation of different scenarios with minor effort, thus providing alternative solutions and trade-offs. The importance of this capability becomes apparent by the finding that the use of the simple preemptive method could be misleading in the case where the preference of the management for the profit goals over the financial index goal is not absolute.

Naturally, the solutions obtained by solving the model (as it holds for any quantitative model) should not be considered as absolute or rigid for the final business decision. The models can only provide estimations on the consequences of various strategic actions, based on available data that can be more or less accurate. The final strategic actions are the output of the simultaneous consideration of a wide range of quantitative and qualitative factors. In our opinion, quantitative techniques, such as goal programming, can greatly assist this decision process, as long as reliable data can be obtained.

There is, of course, potential for further research and refinement of the model. For example, interesting extensions may be developed, including the selection of multiple partners, the consideration of multiple products, the introduction of dynamic behavior using a time parameter and the simultaneous country and partner selection.

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