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Exploring Inter-partner Fit of Malaysian Offshore International Joint Ventures: A Cluster and Discriminant Analysis

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ABSTRACT

This paper aims to classify firms with international joint ventures (IJVs) into distinctive grouping with respect to their degrees of inter-partner fit. It applies cluster and discriminant analysis on the dimensions associated to inter-partner fit amongst Malaysian firms which engage in IJVs. The respective dimensions are strategic fit, organizational fit, inter-partner relations fit, national culture fit, and organizational culture fit. Hierarchical cluster analysis indicates four groupings of firms with different extents of conformity to the criteria whilst discriminant analysis signifies strategic fit, inter-partner relations fit, and organizational culture fit as predominant facets that demarcate the firms. The findings are significant in the sense that each of the firms can better understand its position *viz*. the rest of the firms and hence make necessary adjustments that need improvement. In addition, since strategic fit, inter-partner relations fit and organizational culture fit are more important in distinguishing one firm from another, firms can gain greater efficiency by just concentrating on these facets in their strategic plans.

Keywords: Inter-partner Fit, Cluster Analysis, Discriminant Analysis, International Joint Venture
JEL Classification: M16

1. INTRODUCTION

Firms engage in strategic alliance for a number of reasons, including cost and risk sharing, knowledge acquisition, product development, market exploitation, and as a means of survival. Through alliances too, a firm gains the opportunity to develop resource-integration and partnering knowledge. Specifically, International Joint Venture (IJV) involving equity sharing appears to be more effective a conduit for the transfer of cross-boundary capabilities than contract-based alliance such as licensing.

Nonetheless, due to different characteristics of partners, it is not easy to achieve "inter-partner fit," a critical precondition to performance of IJV, between firms of dissimilar country origins (e.g., Murray et al., 2009). Therefore, not all firms possess the same level of inter-partner fit with foreign partners. Strategically, it is necessary for top management to know how its firm has performed in respect of inter-partner fit *viz*. other comparable firms. Extensive studies in IJVs examined the relationship between partner fits and IJVs performance by using regression analysis (Yan and Duan, 2003; Ozorhon et al., 2008; Heiman et al., 2008; Avny and Anderson, 2008; Idris and Tey, 2011; Tey and Idris, 2012). However, there is no study applied cluster and discriminant analysis to identify the level of fit of partners which engaged in IJVs.

In light of the above, the primary objective of this study is to classify firms with IJVs into distinctive groupings with respect to their degrees of inter-partner fit. The firms sampled are those of which shareholders and top management are predominantly Malaysians[1]. The statistical tool deployed is hierarchical cluster analysis and the criteria examined are the facets of inter-partner fit, namely strategic fit, organizational fit, inter-partner relations fit, national culture fit, and organizational culture fit (Yan and Duan, 2003; Ozorhon et al., 2008;

1 This is a project associated with University of Malaya, Malaysia; hence it is natural that the subjects concerned are closely linked to Malaysians.

Heiman et al., 2008; Avny and Anderson, 2008; Idris and Tey, 2011; Tey and Idris, 2012).

This exercise will allow each of the sampled firms recognize the number of other firms homogenous to itself and compare its degree of inter-partner fit against the rest of the firms. Upon obtaining the groupings, a subsidiary motivation is to identify which of the five facets of inter-partner fit contribute more to the partitioning. To accomplish this, a discriminant technique is utilized.

This paper is also significant in the sense that the application of hierarchical clustering and discriminant analysis provides another piece of reference of which its usefulness can be judged especially in the field of strategic management in which the use of this approach is comparatively rare.

Along these lines, two hypotheses can be generated:

i. Malaysian firms maintaining joint ventures with foreign partners can be categorized into groupings of different extents of inter-partner fit
   If the preceding hypothesis cannot be rejected, then the following hypothesis can be posed:
ii. Amongst the dimensions of inter-partner fit, there exists a subset of dimensions which is more predominant in defining the groupings of firms.

The remainder of the paper is structured as follows. In the second section, we go through the literature on the five facets operationalizing inter-partner fit. In the third section, we explore the methodology, concentrating on hierarchical cluster analysis and discriminant analysis. The fourth section delivers the findings whilst Section 5 discusses prospective implications of the findings. Lastly Section 6 concludes.

2. LITERATURE REVIEW AND THEORY

This section briefs the dimensions defining inter-partner fit, namely, (i) Strategic fit, (ii) organizational fit, (iii) inter-partner relations fit, (iv) national culture fit, and (v) organizational culture fit.

2.1. Strategic Fit

According to Heiman et al. (2008), strategic fit involves congruence of partners' objectives and complementary resources in the context of an alliance. In a nutshell, strategic fit explains the way the strategic needs of the alliance partners can be met. To achieve strategic fit, Douma et al. (2000) pointed out that a firm's interests are weighed against the anticipated advantages and potential risks of the alliance. In this regard, Ozorhon et al. (2008) noted that previous experience with the host country and with similar projects; adequacy of management and technical skills; and human capital are substantive in determining strategic fit. Idris and Tey (2011) found that the strategic fit of the partners in IJVs contributes much to the innovativeness of the IJVs. The more the strategic fit between the partners, the less conflicts the partners will have. Partners do not have to spend much time in conflict resolution but in innovativeness.

2.2. Organizational Fit

Organizational fit can be interpreted as the matching of parent firms' size and international experience between partners (Ozorhon et al., 2008). Size affects organizational fit and performance through the workings of economies of scale, market power, and process innovation (Luo, 1997) whilst partners with similar international experience will find it easier to communicate with each other (Barkema et al., 1996). One challenge to organizational fit, however, is disparities in business environment and commercial norms across countries of varying levels of economic development (Idris and Tey, 2011).

2.3. Inter-partner Relations Fit

As explained in Barkema et al. (1996), inter-partner relations fit can be understood as the match of commitment, communication, trust, and conflict resolution between partners. When inter-partner relations fit is high, parallel movements of partners can preclude conflicts, resulting in greater performance (Luo, 2002). In addition, with high degree of this fit, it is not necessary to have complicated control and monitoring mechanisms between partners (Cullen et al., 2000).

2.4. National Culture Fit

National culture can be defined as the collective programming of the mind (the value) which distinguishes the members of a country from those of another (Hofstede, 1994). Broadly, the differences of national culture can be assessed through power distance, individualism, masculinity, uncertainty avoidance, and long term orientation. Correspondingly, national culture fit pertains to the underlying agreement in national culture between two firms of a transnational alliance (Pothukuchi et al., 2002). Differences in race, social norm, religious belief, and language are the potential hindrances to national culture fit (Tey and Idris, 2012).

2.5. Organizational Culture Fit

Organizational culture involves perceived common practices, such as symbols, heroes, and rituals that carry specific meaning within an organizational unit (Hofstede, 1994). Accordingly, organizational culture fit can be thought of as the symmetry in organizational culture between strategic partners (Pothukuchi et al., 2002; Qureshi et al., 2014). When two or more firms are communicating with each other, the levels of homogeneity of core elements between organizational cultures can directly affect the effectiveness of communication. Hence, organizational culture symmetry influences satisfaction of partners and performance (Tey and Idris, 2012).

3. METHODOLOGY

Data used were collected by distributing postal questionnaires to top executives of listed companies in Kuala Lumpur Stock Exchange that engage in joint ventures abroad. As such, the responses reflect the Malaysian side of the transnational alliance.

The questions used are adopted from Ozorhon et al. (2008), Avny and Anderson (2008), and Molina et al. (2007). To promote response rate and reduce non-response bias, reminder letters were sent out and respondents were promised a summary of the findings

Table 1: Results of reliability test and exploratory factor analysis

Variable	Factor and item (item label)	Factor loading	Variance explained (%)	Cronbach's alpha
Strategic fit	Similarity of partners in terms of previous experience in the host country is important to the success of the JV (SF_2)	0.624	9.06	0.766
	Similarity of partners in terms of management skills is important to the success of the JV (SF_4)	0.590		
	Similarity of partners in terms of technical skills is important to the success of the JV (SF_5)	0.632		
Organizational fit	Similarity of partners in terms of financial capability is important to the success of the JV (OF_1)	0.770	13.59	0.838
	Similarity of partners in terms of size is important to the success of the JV (OF_2)	0.771		
	Similarity of partners in terms of management system is important to the success of the JV (OF_3)	0.805		
	Similarity of partners in terms of international and national work load is important to the success of the JV (OF_4)	0.792		
Inter-partner relations fit	Commitment to the JV and the partner is important to the success of JV (IRF_1)	0.671	14.10	0.797
	Communication between the partners is important to the success of JV (IRF_2)	0.825		
	Trust among partners is important for the success of JV (IRF_3)	0.690		
	Previous cooperation among partners is important to the success of JV (IRF_4)	0.711		
	Reaching a consensus in making strategic decisions is important to the success of JV (IRF_5)	0.816		
National culture fit	Similarity of the home countries of the partners in terms of power distances is very important to the success of the JV (NCF_1)	0.774	13.48	0.836
	Similarity of the home countries of the partners in terms of individualism/ collectivism is very important to the success of the JV (NCF_2)	0.817		
	Similarity of home countries of the partners in terms of uncertainty avoidance is very important to the success of the JV (NCF_4)	0.793		
	Similarity of the home countries of the partners in terms of long-term orientation is very important to the success of the JV (NCF_5)	0.809		
Organizational culture fit	Similarity of the partners in terms of process vs. result orientation is very important to the success of the JV (OCF_1)	0.764	14.09	0.805
	Similarity of the partners in terms of employee vs. job orientation is very important to the success of the JV (OCF_2)	0.728		
	Similarity of the partners in terms of parochial vs. professional approach is very important to the success of the JV (OCF_3)	0.830		
	Similarity of the partners in terms of loose vs. tight control approach is very important to the success of the JV (OCF_5)	0.709		
	Similarity of the partners in terms normative vs. pragmatic approach is very important to the success of the JV (OCF_6)	0.699		

at the end of the study. A total of 74 usable questionnaires have been collected[2].

The factor loadings, variances explained, and Cronbach's alpha for the measures are laid out in Table 1. Exploratory factor analysis was carried out on the items and five factors could be identified. Amongst the items, 4 items cross-load onto more than one component and thus removed. The remaining 22 items each loads onto a single component and are hence retained to test their reliability. The Cronbach's alphas for five factors of inter-partner fit are all >0.70, affirming the reliability of the scale.

4. HIERARCHICAL CLUSTER ANALYSIS

According to Lorr (1983), hierarchical cluster analysis methods are often preferred for classification as it reflects a developmental or evolutionary pattern or sequence. Recent application of this approach can be found in Quah and Crowley (2010) and Quah (2013; 2014). The analysis is run using Matlab with the tools provided by Martinez and Martinez (2005).

In the terminology of cluster analysis, there are *n* objects (cases, observations, firms, etc.) and *p* variables (features, criteria,

2 The profile of the 74 IJVs is summarized here. In terms of duration, 31 of them had been operating for up to 5 years and the remainder for more than 5 years. 58 of them are located in Asia, 6 in North America, 6 in Europe, 3 in Australia, and only 1 in Africa. Almost three-quarters are in manufacturing, and the remaining in services. Finally, on revenue, 34 earn more than 7 million dollars per annum, another 34 from 3 to 7 million, whilst the rest earn <3 million.

dimensions, etc.) in a dataset with each object being denoted by a vector x_i ($x_i = (x_{i1}, x_{i2}, \ldots, x_{ip})$ for $i = 1, 2, \ldots, n$). Each variable is standardized with mean and standard deviation being equal to zero and unity respectively so that they are treated as having equal importance in determining the structure.

The dissimilarity coefficient or distance d_{ij}, between two objects x_i and x_j is defined by the Euclidean distance:

$$d_{ij} = \sqrt{\sum_{l=1}^{p} (x_{il} - x_{jl})^2} \quad (1)$$

The definition of the distance between two clusters is important in determining the shape of homogeneous groups. For hierarchical cluster analysis, there exist few agglomerative algorithms which differ only in the definition of distance between clusters. For details, Anderberg (1993). Three of the most often used algorithms, namely the average linkage, centroid linkage, and Ward's linkage methods are alternatively used here. These methods tend to produce spherical clusters.

For average linkage, the distance *DistA* between two clusters *r* and *s* is defined as:

$$DistA = \frac{1}{n_r n_s} \sum_{\substack{i \in r \\ j \in s}} d_{ij} \quad (2)$$

Where n_r and n_s denote the number of objects in clusters *r* and *s* respectively. This method tends to combine clusters that have small and approximately equal variances.

The centroid linkage defines the distance *DistC* between two clusters *r* and *s* as the Euclidean distance between their cluster centroids. A centroid $\bar{x}$ (*r*) together with its coordinates $\bar{x}_l r$ (for $l = 1, 2, \ldots p$), may be expressed as:

$$\bar{x}(r) = (\bar{x}_1(r), \bar{x}_2(r), \ldots, \bar{x}_p(r)) \quad (3)$$

Where,

$$\bar{x}_l(r) = \frac{1}{n_r} \sum_{i \in r} x_{il} \qquad \text{for } l = 1, 2, \ldots, p \quad (4)$$

A problem with centroid linkage is the possibility of reversals. This can happen when the distance between one pair of cluster centroids is less than the distance between the centroid of another pair that was merged earlier. In other words, the distances between clusters are not monotonically increasing. This could make results confusing and difficult to interpret. When this happens in the results, solutions from centroid linkage are subordinated.

For Ward's linkage, the fusion of two clusters is determined by the size of the incremental sum of squares. It looks at the increase in the total within-group sum of squares when clusters *r* and *s* are joined. The distance *DistW* between clusters *r* and *s* is given by:

$$DistW = n_r n_s DistC^2/(n_r + n_s) \quad (5)$$

Ward's method tends to combine clusters that have a small number of observations. It also has a tendency to locate clusters that are spherical and of the same size. Due to the sum of squares criterion, it is sensitive to the presence of outliers in the dataset.

Each of the above methods starts from a classification with *n* clusters in it where each cluster contains only one object. The algorithms proceed by successively merging two clusters into one at each stage until a single cluster is obtained. The merging criterion at each stage is to choose two clusters which have the least distance between them. A new classification is identified after two clusters have been merged and the distances between clusters are updated.

Since the agglomerative algorithms differ in their definition of distance, cophenetic correlation coefficient is used to determine the linkage method which best represents the data structure. It is a measure which determines how well the generated clusters represent dissimilarities between objects where values close to 1 representing better clustering. The coefficient measures the correlation between the distances generated by the linkage method and the Euclidean distances between the objects.

Letting *d* be the average of d_{ij} and letting *t* be the average of the t_{ij}, the distance generated by a linkage method at which two objects x_i and x_j are first joined together; the cophenetic correlation coefficient *r* is given by:

$$r = \frac{\sum_{i<j} (d_{ij} - d)(t_{ij} - t)}{\sqrt{(\sum_{i<j} (d_{ij} - d)^2)(\sum_{i<j} (t_{ij} - t)^2)}} \quad (6)$$

The outcome of hierarchical clustering is presented in the form of a tree known as dendrogram. The heights of the links of the dendrogram represent the distance at which each fusion is made such that greater dissimilarity between objects is reflected by larger distances and taller links.

While the dendrogram provides some indication on the number of clusters, the "optimal" number however could be rather subjective. In this regard, the pseudo-F index or Calinski–Harabasz index (CHI) developed by Calinski and Harabasz (1974) is used. Indeed, it has been detected by Milligan and Cooper (1985) to be the best measure among thirty cluster-stopping rules. This index is defined as:

$$CHI = \frac{S_b / (k-1)}{S_w / (n-k)} \quad (7)$$

Where S_b is the between-cluster sum of squares, S_w is the within-cluster sum of squares, *k* is the number of clusters, and *n* is the number of objects. Higher index values signify more distinctive partitioning and better clustering.

5. DISCRIMINANT ANALYSIS

Linear discriminant analysis is a statistical technique often used to examine whether two or more mutually exclusive groups can be distinguished from each other based on linear combinations of predictor variables. Thence, it can signify which variables contribute more to separation. For our purpose, the latter feature is applied on the correlations of cycles involving the gross domestic product components (i.e., the variables). The following note introduces the principles behind discriminant analysis[3].

If one seeks to classify an observation x into one of two groups, a rule is to assign observation x into the first group if the following condition is satisfied and into the second group if otherwise;

$$s(v) \equiv \left(x^1 - x^2\right)^a T^{-1}\left(v - \frac{1}{2}\left(x^1 - x^2\right)\right) \geq c \quad (8)$$

Where x^1 and x^2 are the vector means of two independent samples, T denotes the pooled sample covariance matrix, and v is a vector with p variables. The cut-off point c is chosen according to the following rule:

$$c = \ln \frac{p^2}{p^1} \quad (9)$$

Where p^n (n = 1,2) is the estimated prior probability of an observation coming from group n and can be obtained from the relative sizes of the two groups.

In order to separate two samples as much as possible, Fisher (1936) proposed this linear discriminant function:

$$LDF(v) \equiv \left(x^1 - x^2\right)' T^{-1} v \quad (10)$$

Which is a combination of the p variables. This function has the property that for any linear combination, say d'v , the squared difference between the two sample means (between-samples variance), divided by the pooled estimate of the variance of the difference, is maximized by:

$$d = \left(x^1 - x^2\right)' T^{-1} \quad (11)$$

For the present purpose, the coefficients assigned to each variable are used to signify the relative contribution of the respective variables to partitioning of the data.

6. DATA ANALYSIS

6.1. Hierarchical Cluster Analysis Findings

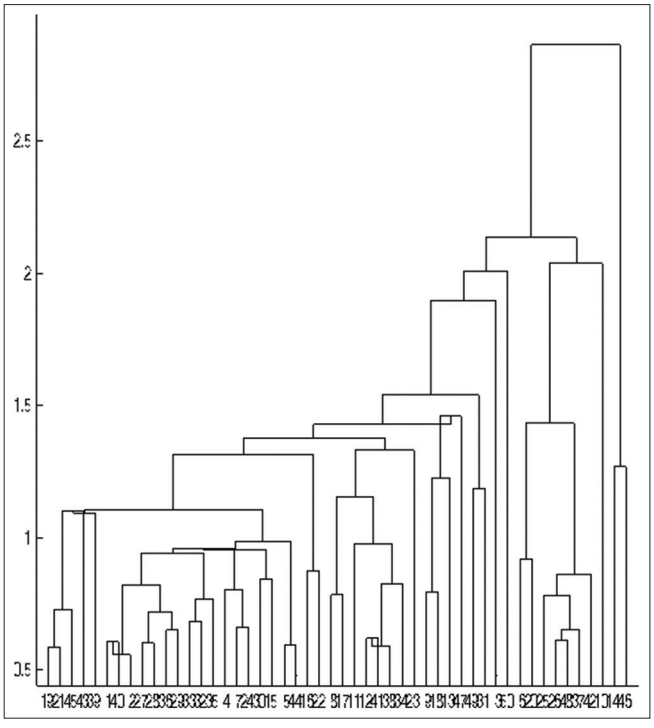
To restate, the agglomerative algorithms used for hierarchical cluster analysis are the group average, the centroid, and the Ward's linkage method. Solutions from the linkage method yielding the highest cophenetic correlation coefficients are used. Recall that cophenetic correlation is used to measure the correlation between the distances generated by the linkage method and the inherent dissimilarities (Euclidean distances) between the objects in the data.

For the present data, the coefficients from average, centroid, and Ward methods are 0.74, 0.74, and 0.53 respectively. Though the coefficient from the centroid method is the largest, the between-cluster distances are not monotonically increasing, making the results confusing. For an illustration of this glitch, shown in Figures 1 and 2 for the dendrograms (by centroid and Ward algorithms). For this reason, the average linkage solution with the second largest cophenetic coefficient is used. This decision should not affect the qualitative finding since the coefficients from both centroid and average methods are equally high.

Figure 3 portrays the dendrogram using average agglomeration method of which the horizontal axis corresponds to the k^{th} firm while the vertical axis represents the Euclidean distances between the firms. Firms with smaller distances between them are converged first. For instance, on the far left of the diagram, firms 32 and 41 are merged first at the smallest distance as shown by the shortest vertical lines at which they are joined. Equally early mergers include the mergers of cases 1-31 and 28-50. The firms and/or clusters of firms are amalgamated at stages until all firms are combined at the final stage.

The next step is to ascertain the appropriate number of clusters and hence the groupings. Figure 4 plots the values of the CHI of which greater values correspond to more distinct

Figure 1: Dendrogram using centroid method



3 For details see http://www.ics.uci.edu/~welling/classnotes/papers_class/Fisher-LDA.pdf

Figure 2: Dendrogram using Ward's method

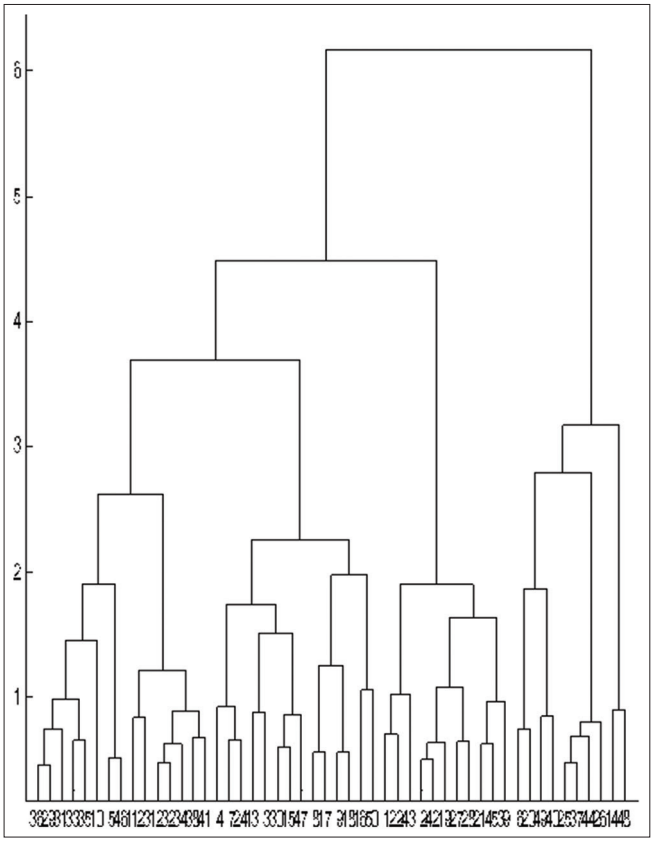
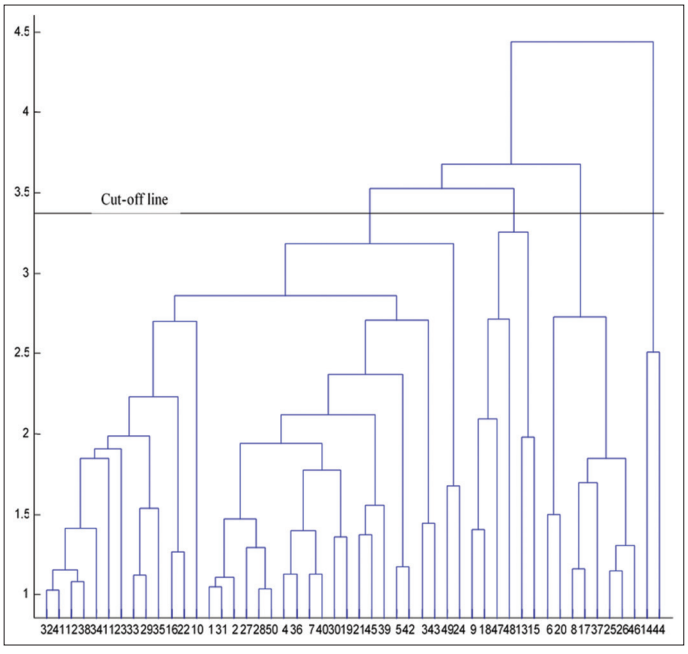


Figure 3: Dendrogram using group average agglomeration method



Source: Hierarchical cluster analysis

partitioning. From the plot it is apparent that 4 is the right number of clusters.

Table 2 presents the clusters of firms and their features, expressed as group averages of standardized values of the variables. Rankings of the means are also provided. The first group is the largest, containing 56 firms, followed by the second cluster, 10, the third cluster, six, and the fourth group, two. Total number of firms or cases is 74.

The first group which makes up the majority, that is, about 76% of the sample, scores moderately across the five facets of inter-partner fit. This can be seen easily from the mean rankings, where for each dimension, "1" represents the greatest score while "4" indicates the lowest score. For strategic fit, organizational fit, and inter-partner relations fit, this dominant group obtains rank of 2 whilst for national culture fit and organizational culture fit, it attains rank of three.

The second group comprising of 14% of the sample obtains low scores over all the facets; that is, rank four for strategic fit, national culture fit, and organizational culture fit, and rank 3 for organizational fit and inter-partner relations fit. The third group of 8% of the sample maintains higher rank of one for organizational fit and organizational culture fit, rank two for national culture fit, and lower ranks of three and four for strategic fit and inter-partner relation fit respectively. Lastly, the fourth cluster consisting of about 3% of the sample attains higher rank of one for strategic fit, inter-partner relation fit, and national culture fit, rank 2 for organizational culture fit, but lower rank of four for organizational fit.

To summarize, the bulk of the ventures only have moderate levels of strategic, organizational, inter-partner relations, national culture, and organizational culture fits, with somewhat greater degrees of fit in the latter two facets. Of all the firms, no single grouping has the highest degree of fit in all aspects. At most, only 3% of the sample, the fourth cluster, can be described as having the greatest conformity, with the greatest fit in 3 out of the 5 dimensions of inter-partner fit.

Also, it may be of interest to note that cluster three or 8% of the ventures have very high degree of conformity in organizational fit and organizational culture fit but low conformity in strategic fit and inter-partner relations fit[4]. This directly shows that ventures can have asymmetric degrees of conformity over the facets.

6.2. Discriminant Analysis Findings

Upon exploring the groupings, discriminant analysis is used to find out which of the 5 facets are more important in defining the clusters. This exercise involves only the first three groups because only two cases belong to group four, which is insufficient to be included in the analysis.

To check one required assumption, we will make sure if the means of the variables are unequal across groups one, two, and three. To determine whether the group means are significantly different, the Wilks' lambda statistic is used, of which results are shown in Table 3. The statistic is calculated as the ratio of the within-groups sum of squares to the total sum of squares. It is the proportion of the variance not explained by differences between groups. If all observed group means are equal, lambda is one. Small values occur when most of the observed variability can be attributed to differences between groups.

4 Whilst the identities of the firms are not revealed here, the findings here will be presented to the firms. A firm will be able to know its position in comparison to other firms and hence it can make necessary adjustments in those facets.

Table 2: Group features (standardized values)

Cluster	N	Mean (mean ranking)				
		Strategic fit	Organizational fit	Inter-partner relations fit	National culture fit	Organizational culture fit
1, 2, 3, 4, 5, 7, 10, 11, 12, 15, 16, 19, 21, 22, 23, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40, 41, 42, 43, 44, 45, 48, 49, 50, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 66, 67, 68, 69, 71, 72	56	0.333 (2)	0.285 (2)	0.325 (2)	−0.014 (3)	−0.107 (3)
6, 8, 17, 20, 25, 26, 37, 46, 65, 73	10	−1.772 (4)	−1.344 (3)	−0.911 (3)	−0.509 (4)	−0.111 (4)
9, 13, 18, 47, 51, 74	6	−0.308 (3)	0.633 (1)	−1.635 (4)	427 (2)	1.21 (1)
14, 70	2	0.468 (1)	−3.170 (4)	0.350 (1)	1.655 (1)	−0.071 (2)

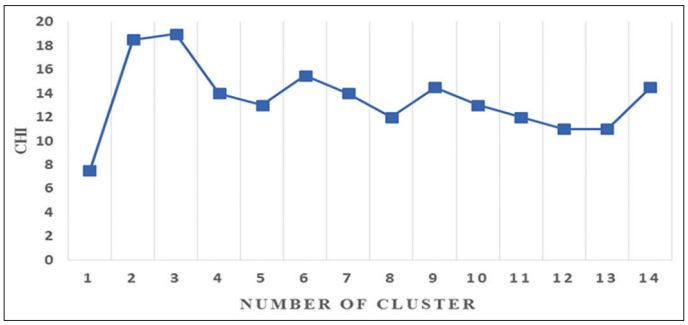
Source: Hierarchical cluster analysis

Table 3: Wilks' lambda test of equality of group means

Constructs	Wilks' lambda	F	df1	df2	Significant
Strategic fit	0.474	38.294	2	69	0.000***
Organizational fit	0.533	30.283	2	69	0.000***
Inter-partner relations fit	0.584	24.618	2	69	0.000***
National culture fit	0.947	1.919	2	69	0.154
Organizational culture fit	0.864	5.409	2	69	0.007***

Source: Discriminant analysis, ***Significant at P<0.01

Figure 4: Calinski–Harabasz index. In general, an effective representation of data requires that the number of clusters be neither too small nor too large. The number of clusters considered here should suffice for meaningful interpretations



Source: Hierarchical cluster analysis.

Since the observed significance levels for strategic fit, organizational fit, inter-partner relation fit, and organizational culture fit are small, we can reject the null hypothesis that the population means for the variables are equal. The F values shown are the F values from one-way analysis of variance for each variable.

The next step is to check whether the variables are highly correlated because when variables have large correlations, their contributions to the discriminant model cannot be separated. From the correlation matrix in Table 4, one can see that the variables are not highly correlated, where the coefficients are <0.5[5].

Upon inspecting the essential assumptions, we shall look at the unstandardized and standardized discriminant function coefficients shown in Table 5. Because there are three groups (group four is not included), there are two sets of coefficients. To gauge the relative contribution of the variables to separation of the cases, we shall look at the magnitudes of the standardized coefficients. The coefficients signify that for function one, strategic fit, inter-partner relations fit, and organizational culture fit are more important whilst for function two, organizational fit, inter-partner relations fit, and organizational culture fit are more predominant. Only national culture fit is not substantive for both functions and hence contributes little to separation of cases. Notably, as shown in Table 6, function one has an Eigen value of 2.156, canonical correlation of 0.826[6], and explains 73% of the between-groups variance. On this evidence, it seems that strategic fit, inter-partner relations fit, and organizational culture fit, identified as more substantive by function one, are relatively more relevant in defining the groupings.

Incidentally, for the discriminant analysis to be optimal, the samples must be from equal variance-covariance matrices in the populations. One test for testing the null hypothesis that the population variance-covariance matrices are equal is Box's M of which the results are shown in Table 7. Since the Box's M-statistic is not significant, this assumption cannot be violated.

7. DISCUSSION AND IMPLICATION

The cluster analysis has assigned the 74 firms into 4 groupings. Firms within each grouping are homogenous with each other and dissimilar from the rest in terms of the five criteria explored. The findings of this paper will be presented to the 74 firms surveyed so that each firm can recognize its relative position *viz*. the others, which could be critical in strategic planning.

In a nutshell, it is found that the sample is predominantly characterized by moderate levels of conformity to the criteria. If we regard the sample as a representation of the population involving Malaysian firms, it can be concluded that there is still much room for improvement with respect to enhancing the extent of inter-partner fit between the Malaysian firms and their foreign counterparts.

Meantime, a substantial 14% of them are distinguished by low levels of fit over all the facets. This group of firms should be critical of their current ventures and implement necessary adjustments to achieve better fit. They may refer to the literature review presented earlier and the sources cited therein as a reference for that purpose.

5 The correlation matrix is called a pooled within-groups matrix because it is obtained by averaging the separate covariance matrices for all groups and then computing the correlation matrix from the pooled-covariance matrix.

6 Values close to 1 indicate that most of the observed variability in the discriminant scores is explained by differences between groups.

Table 4: Pooled within-groups correlation matrix

	Strategic fit	Organizational fit	Inter-partner relations fit	National culture fit	Organizational culture fit
Strategic fit	1.000	0.337	0.160	0.057	0.302
Organizational fit	0.337	1.000	0.226	0.359	0.277
Inter-partner relations fit	0.160	0.226	1.000	0.163	0.399
National culture fit	0.057	0.359	0.163	1.000	0.186
Organizational culture fit	0.302	0.277	0.399	0.186	1.000

Source: Discriminant analysis

Table 5: Discriminant function coefficients

Function	Unstandardized coefficients		Standardized coefficients	
	1	2	1	2
Strategic fit	1.331	0.308	0.672	0.155
Organizational fit	0.562	1.358	0.293	0.710
Inter-partner relation fit	1.409	−1.582	0.630	−0.708
National culture fit	−0.124	0.030	−0.065	0.016
Organizational culture fit	−1.394	0.926	−0.648	0.430
(Constant)	−12.440	−3.768		

Source: Discriminant analysis

Table 6: Eigen values

Function	Eigen value	Percentage of variance	Cumulative %	Canonical correlation
1	2.156	73.0	73.0	0.826
2	0.798	27.0	100.0	0.666

Source: Discriminant analysis

Table 7: Box's M test of equal population covariance matrices

Box's M	48.632
F	
Approximately	1.100
df1	30
df2	725.285
Significant	0.327

Source: Discriminant analysis

Finally, the small groups of three and four firms with high levels of fit in some criteria but low degrees of fit in other criteria may need to maintain their performance in those "high" facets and to improve their position in the "low" facets.

In addition to the above, the discriminant findings might also be useful. The findings signify strategic fit, inter-partner relations fit, and organizational culture fit as predominant facets that demarcate the firms. Since these variables are more important in distinguishing one firm from another, a firm may want to concentrate on these factors to move up its position amongst the firms.

Lastly, to scholars, this paper demonstrates another application of cluster and discriminant analysis in the context of social science—in this case, in the field of strategic management using data collected from a survey.

8. CONCLUSIONS

In conclusion, the two hypotheses posed in the beginning cannot be rejected. Firstly, the results signify that Malaysian joint ventures with foreign partners are not homogenous in terms of their conformity to the criteria defining inter-partner fit. Several subgroups can be detected with each exhibiting different levels of the dimensions. Secondly, a subset of the criteria or dimensions of inter-partner fit, namely strategic fit, inter-partner relations fit, and organizational culture fit are found to be more predominant in distinguishing the groupings of firms.

In spite of the above, this paper faces two major limitations. First, with 74 cases as the sample, it is difficult to generalize the findings to the population. Provided greater response rate, future work can consider a larger sample size. Second, as been mentioned in the analysis, due to technical difficulty, the discriminant analysis only uses three larger groups from the cluster analysis as the input. Hence, the discriminant results are valid for the three groups or 72 cases of the sample. If the fourth group had been larger, thus sufficient to be included into the discriminant algorithm, the discriminant results could have been different.

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