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Operating Strategy Groups in Electric Industry

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Operating Strategy Groups in Electric Industry

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Abstract

In this article, we want to find out appropriate strategy and make some managerial suggestions for electronic companies in Taiwan. We take the listed 290 electric companies as our research sample from Taiwan Economic Journal Data Bank (TEJ Data Bank). Since we could not directly observe the management capabilities from each company, this paper start from the financial data to create a framework to provide simple principle to examine the management capabilities. We collect fourteen financial indicators in advance and conduct Principle Component Analysis (PCA) to find out the main factors related to managerial implications. There are six major management capabilities we derive, which are *Scale management, Knowledge management, Light-assets management, Relationship management, Continuity management, and Fixed-assets management.*

Based on the six management factors, we conduct K-means Cluster Analysis, which classify the electric industry into four strategic groups. In the end, we examine the configuration-performance relationship and derive the most ideal configuration for the electric industry.

Keyword: electric industry, principle component analysis, K-means cluster analysis, management capability

中文摘要

在本研究中，我們試圖探究現今台灣電子資訊公司最適切的營運策略，並加以進行策略族群的區隔。 由台灣經濟新報（TEJ Data Bank）290家上市的電子資訊公司作為研究樣本，由於我們無從得知每家公司的營運管理能力，本研究由財務數據出發，建立一套研究架構並提出簡易的準則來評估管理能力。首先，我們蒐集了十四項財務指標，並進行主成份因素分析，將財務指標和其背後的管理意涵萃取為六項主要管理能力：規模管理能力、知識管理能力、輕資產管理能力、關係管理能力、永續力管理能力、固定資產管理能力。

依據六項主要管理能力準則，我們進行K-means集群分析，每家電子資訊公司將被分入其中一個策略族群，實證數據得出四組策略族群。接下來，我們將檢驗不同策略族群與營運績效之間是否具有顯著影響關係？是否存在某一策略族群營運表現最佳？最後，我們將研究發現、研究貢獻及未來研究方向加以彙整。

關鍵詞: 電子資訊業、主成份因素分析、集群分析、管理能力

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CHAPTER 1

INTRODUCTION

1.1 Research background

Thomas Friedman shouted: “The world is flat” in 2005. Now, in 2008, the situation is much more “flat”. Due to the progress of globalization and network, the global industry trend have transformed into specialization and outsourcing. In the past, a company providing its goods to consumers would build its own factory, hire employees, set up its logistic, and even take charge of the after-care service. However, in nowadays, companies in the global industries have deleted the unnecessary working process, outsourced part of their workload, and specialized in its strength.

Additionally, China abruptly rises and reinforces the so-called “the world is flat” effect. Being a developing country as China, low labor cost and abundant national resource have attracted many multi-national companies outsourcing their manufacturing process toward China. In the middle of 1980s, Taiwan, the electronic industry grew up promptly, but the increase of labor cost and the appreciation of New Taiwan dollar both caused the electronic industry remove its production line toward China. Since 1993, the information electronic industry has plunged amount of capital into semiconductor, picture tube, and other key electric modules. Thus, the information electronic industry became the top growth business among Taiwan manufacturing industries.

Recently, China has developed its electric industry aggressively. Based on the government policy, China pulled the multi-national companies around the world in the electric industry. In the production side, China has accumulated its technology and capital through original equipment manufacturing (OEM). This strategy not only introduced new technology but also shortened the technique gap between developed countries and China. In the progress of China electric industry, Taiwan electric companies used to play an important role. However, China has become a tough competitor for Taiwan. Furthermore, National People's Congress had adopted the LAW OF THE PEOPLE'S REPUBLIC OF CHINA ON EMPLOYMENT CONTRACTS, which had been effective from January 2008.

Facing with all of the influential factors above, what would the electronic industry in Taiwan react is a critical issue.

1.2 Research objectives

In this article, we want to find out appropriate strategy and make some managerial suggestions for electronic companies in Taiwan. We take the listed electric companies as our research sample from Taiwan Economic Journal Data Bank (TEJ Data Bank) and classify them into different strategic groups. Then, we find out the strength and weakness between different organizational configurations. Followings are three main research objects.

1. Based on the financial indicators after literature review, we want to derive main measurement factors of management capabilities to examine operating performance.

2. Based on measurement factors, we want to find out if there exists a significant relationship between organizational configurations and operating performances. Furthermore, we want to investigate if there exists one organization configuration getting the best performance than the others.

3. According to the result of the literature review and empirical result, we would examine the well-performed companies through its different managerial capability and propose suggestions for the electronic industry in Taiwan.

1.3 Research scope

In this article, we want to examine the relationship between organization configurations and financial performances. In order to prevent our research results from certain research elements affluences, we take following measures to cope with our research data.

1. In order to avoid different industries attributes influencing our study results, we simply focus on listed electronic companies in electronic industry in Taiwan.

2. To reduce the variation among financial indicators, we take three-year (2005-2007) averaged financial data from TEJ Data Bank.

3. To prevent outlier data from distorting final research outcome, we standardize each financial indicator with zero mean and standard deviation one.

4. To avoid the outlier financial indicators and missing values among the companies, we delete companies with outlier financial indicators and missing values, which left 290 listed electronic companies in our research sample.

1.4 Thesis structure

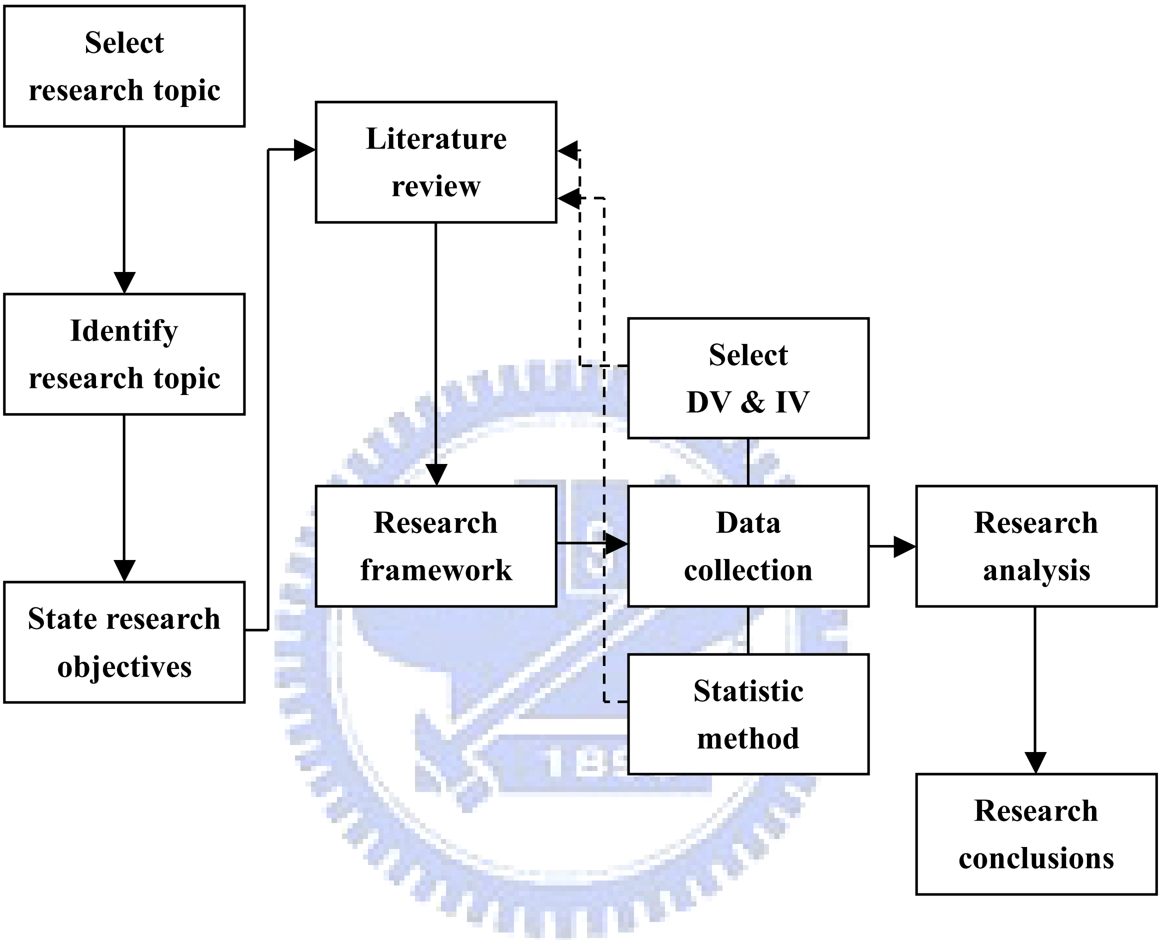


Figure1-1 Flowchart of research structure

CHAPTER 2

LITERATURE REVIEW

2.1 Equifinality

The concept of *equifinality* was originally defined in the context of General System Theory (Ludwig von Bertalanffy, 1972). *Equifinality* is said to be a general property of open systems such that "…as far as they attain a steady state, this state can be reached from different initial conditions and in different ways; it is thus equifinal!" (Ludwig von Bertalanffy, 1972). Early use of the concept in organization theory followed the von Bertalanffy approach. For instance, Katz and Kahn (1978) stated that *equifinality* in organizational settings occurs when "a system can reach the same final state, from different initial conditions and by a variety of different paths".

Recently, the concept of *equifinality* means that the final state or performance of an organization can be accomplished through multiple different organizational structures even if the contingencies the organization faces are the same (Tushman & Nadler, 1978; Scott, 1981; Van de Ven & Drazin, 1985; Hrebiniak & Joyce, 1985; Nadler & Tushman, 1988; Pennings, 1992; Galunic & Eisenhardt, 1994). Thus, *equifinality* implies that strategic choice or flexibility is available to organization designers when creating organizations to achieve high performance (Gresov & Drazin, 1997).

In this paper we apply the additional concept of functional equivalence to clarify the question of *equifinality.* Merton (1967) and Gidden (1979) suggested using the concept to develop an explanation for the processes that generate *equifinality* in organizational settings. Before applying the concept of functional equivalence, we have better understood the critical difference between the concept of function and structure. A function can be defined as the way in which a component part of a subsystem (i.e. a structure) contributes to the maintenance of the system and its ability to be adaptive to its environment (Scott, 1981). Function refers to the ability of the overall system to maintain interdependence with other social actors or environments (Giddens, 1979). However, a structure is a pattern of relationships between individuals that transfers and modifies information and physical objects. A structure can fulfill a function in relation to some other structure or to the whole system, but it does not equate to the function (Gresov & Drazin, 1997). Although the organization's functional needs may be indispensable for its capacity to meet environmental demands, functional requirements do not determine a particular social structure, but rather permit a range of structures that will fulfill the functions required (Merton, 1967).

Based on the clarification of function and structure, we propose that an organization will perform effectively if the critical functional requirements (which were determined by the environment) are met by its organizational structures. *Equifinality* occurs when different forms of structures yield the same functional effect.

2.2 Organization configuration

Organization configurations can be defined as commonly occurring clusters of attributes of organizational strategies, structures, and processes (Miller, 1987; Mintzberg, 1990). Group of firms shares a common profile of organizational characteristics (Meyer, Tsui, & Hinings, 1993; Miller & Mintzberg, 1984).

There are two principle approaches in configurations literature. The first and mostly common develops conceptual typologies; the second generates empirical taxonomies (Miller, D. & Shamsie, Jamal, 1996). In this article we employ methods of numerical taxonomy and an assortment of clustering algorithms and hypothesis testing techniques to identify natural clusters in the data. Some strategic groups' strategy has identified different strategy configurations that surface in specific industries (Cool and Schendel, 1987; Fiegenbaum and Thomas, 1990).

Compared to typologies, taxonomies are more firmly based on facts-or at least, on quantitative data. Their large sets of variables and sizeable samples can disclose important empirical regularities. Indeed, the merit of the taxonomy approach is that when it is well executed it discovers reliable and conceptually significant clusters of attributes (Miller, D. & Shamsie, Jamal, 1996).

2.3 Organizational configurations and performance

The brief that performance differences can be attributed to configurations is grounded in structural contingency theory (cf. Meyer et al., 1993). Webber's (1947) assertion that there are three types of authority in society-traditional, rational/legal, and charismatic is the early configuration idea. Each of these types has an appropriate administrative structure and Webber (1947) predicted the evolution and prosperity of these types to be contingent upon certain societal conditions. Later, Burns and Stalker (1961) identified two organizational structures, mechanistic and organic, and proposed each prospered in two particular types of environments, stable and dynamic. Following studies have provided a similar logic. Consequently, viewing the success of organizational configurations as a function of their appropriateness to environmental conditions is central to structural contingency theory (David J. Ketchen Jr., & James G. Combs, & Craig J. Russell, & Chris Shook, 1997).

Subsequent strategy researchers began to identify organizational configurations that appeared to be equally effective in multiple environments (e.g., Miles & Snow, 1978; Miller & Friesen, 1978). Ketchen (1997) concluded that some organizational types will fit a given environment better than others and it did not mean that only one approach to a given environment would be successful. The expectation that organizational configurations will vary in performance is based in contingency theory. Based on contingency theory, firms whose configurations are aligned with their environment should perform better than firms in nonaligned configurations (Ketchen et al., 1993). In this article we based on the assumptions above, then classified different forms of organizational configurations in electric information industry in Taiwan, and compared with different forms of organizational configurations according to their performance.

2.4 Strategic choices and superior financial performance

Strategy determines the basic long-term goals of an enterprise, the courses of action adopted, and the allocation of resources necessary for achieving these goals (Chandler, 1962). Strategy can also create a situation where the company's resource position is so strong that it becomes difficult for others to catch up (Wernerfelt, 1984). In this paper, we try to analysis the financial performance, which might appropriately reflect the firm's competitive advantage. From the process above, we tend to find out the strategic choices of firms. In order to identify the financial indicators in a systematic, we need to use the du Pont identity.

The du Pont identity is often used as managerial tool to quantify the factors driving financial return and assess the operating strengths or weakness of a firm (Grant, 1991; Firer, 1999). The du Pont identity decomposed the rate on invested capital (ROIC) to assess the value of a firm's value creation abilities. The company with high ROIC represents its efficiency of deploying its capital to generate cash flow. In this paper, we use ROIC as we performance indicator, which measures the overall achievement of each firm. Besides, we also adopt ROE and Net Profit as comparisons. We decompose the ROIC into several related financial indicators to observe the strategy choices of each firm.

$$ROIC = \frac{NOPLAT}{IC} = \frac{NOPLAT}{S} \times \frac{S}{IC} = \frac{(S - CGS - R\&D - Dep - SG\&A - Tax)/S}{(FA + AR + Inv - AP + Cash)/S}$$

Where *NOPLAT*=net operating profits less adjusted taxes=EBIT×(1-t); *EBIT*=earnings before interest and tax; *IC*=invested capital; *S*=price×sales quantity; *CGS*=cost of good sold; *R&D*=expenditures on research and development; *Dep*=depreciation; *SG&A*=selling, general and administration expenses; *FA*=fixed assets; *AR*=accounts receivable; *INV*=inventory; and *AP*=accounts payable.

The ROIC indicator comprises two main components, *NOPLAT* and *IC*, which separately stand for the operating efficiency and effective use of capital. In the operating efficiency part (the numerator), it includes the unit costs per dollar sale of diverse operating activities: (1) production, (2) research and development, and (3) selling, general, and administration. In the effective use of capital part (the denominator), it comprises diverse asset turnover ratios including the firm's capabilities in managing tangible entities (fixed assets), its relationships with customers (accounts receivable turnover), and its negotiation power with suppliers (accounts payable and inventory turnover) (Tang & Liou, 2007).

2.5 Financial Variables

In order to identify configurations in electric information industry in Taiwan, we should first select appropriate variables. However, the scope of variables used to identify configurations has been controversial. Thus, choosing the variables is the most fundamental step in the application of cluster analysis. This process is concerned with three crucial issues: (1) how to select variables (2) whether or not to standardize variables (3) how to deal with multicollinearity among variables (Ketchen & Shook, 1996).

2.5.1 Selection of variables

There are three basic approaches to identifying appropriate clustering variables: inductive, deductive, and cognitive (Ketchen et al., 1993). The inductive approach based on exploratory classification of observation. Without deductive theory or prior knowledge, this method seems to follow McKelvey's suggestion to consider as many variables as possible because one can not know which variables differentiate among observations in advance (Ketchen, 1996). When we use broad sets of variables, we could decrease error in classifying firms as configuration members and it would be more likely to capture true underlying different performance of organizational configurations.

Following with the deductive approach, the number and suitability of clustering variables, as well as the expected number and nature of groups in a cluster solution, are strongly tied to theory (Ketchen et al., 1993). Methodological research proposed that it is wise to use deductive theory to lead variable choice. Cluster analysis derives the most internally consistent groups across all variables, thus irrelevant variables can cause a deterioration of a solution's validity (Punj and Stewart, 1983). Thus, selecting variables with solid theoretical foundation would do help to our study.

Like the inductive approach, the cognitive approach also avoids making theory-based predictions. While inductive configurations are defined along dimensions that researchers view as important, the cognitive approach relies on the perceptions of expert informants such as industry executives to define clustering variables (Ketchen, 1996). However, the information based on top managers' perspective of view might not be "objective".

In this article, we adopt the deductive approach to select critical variables based on prior research framework. We use the financial indicators, which Tang and Liou (2007) suggest and consider goodwill and intangible assets as our independent variables. We summarize each financial indicator and its management implication in Table 2-1.

Table 2-1 Financial Indicators

Financial Indicator	Management Implication
Accounts receivable turnover $= \frac{Net\ \ credit\ \ sales}{Average\ \ net\ \ accounts\ \ receivable}$	Measures ability to collect cash from customers. (Charles & Walter & Linda, 2002) Company with higher account receivable turnover indicates its good quality of account receivable and good relationship with its customers.
Inventory turnover $= \frac{Cost\ \ of\ \ goods\ \ sold}{Average\ \ inventory}$	Measures the number of times a company sells its average level of inventory during a year. (Charles & Walter & Linda, 2002) Company with higher inventory turnover indicates that the company did not hold on too much inventory and possessed high usage efficiency for its inventory.
Account payable turnover $= \frac{Cost\ \ of\ \ goods\ \ sold}{Average\ \ accounts\ \ payable}$	Measures how many times per period the company pays its average payable amount. Company with low account payable turnover has more flexibility to apply its capital. Also, it indicates that exist a good relationship with suppliers.
Cost of good sold/Sales	Measures the ability how each company controls its cost to sales. Company with low Cost of good sold/Sales reveals its unique

	efficiency in production.
R&D expenses/sales	Measures how much resources each company invest in its R&D activities to sales. Company with higher R&D expenses/sales reveals its strengths in creating core value and differentiating from its competitors.
SG&A expenses/sales (R&D included)	Measures how much resource each company invest in its SG&A activities to sales. Company with higher SG&A expenses/sales reveals its strengths in management and administration.
Fixed asset turnover $= \frac{Sales}{Average\ net\ fixed\ assets}$	Measures the usage efficiency of firm's fixed assets. Company with low fixed asset turnover means that the company did not utilize its fixed assets to create profits.
Depreciation/sales	Measures the usage efficiency of firm's fixed assets. Company with low Depreciation/sales means that the company did utilize its fixed assets to create profits.
Goodwill	Excess of the cost of an acquired company over the sum of the market values of its net assets (assets minus liabilities). (Charles & Walter & Linda, 2002) Company with higher goodwill reveals its great reputation and

	celebrity.
Intangible assets	Assets with no physical form such as patents and copyrights. Valuable because of the special rights they carry. (Charles & Walter & Linda, 2002) Company with higher intangible assets could increase its competitive advantages toward its competitors.
Total assets $= Current\ \ assets + Fixed\ \ assets$	Total assets can be thought of as current and fixed. Fixed assets that will last for a long time contain tangible fixed assets and intangible fixed assets. Current assets have short lives such as inventory. Total assets could reveal the scale of the company.
Employees	The number of employees whom were hired by the company could reveal the scale of the company.
Company category	According to TEJ Data Bank, there are 8 categories in electronic industry.
Operating years	Operating years are accounted since the company originated.

2.5.2 Standardization of variables

Because variables with large ranges are given more weight in defining a cluster solution than those with small ranges (Hair et al., 1992), a subset of variables would dominate the definition of clusters. Besides, there is a need to eliminate the potential effects of scale differences among variables. Thus, we conducted standardization, which transforms each variable to have a mean of zero and a standard deviation of one. This process allows variables to contribute equally to the definition of clusters but may also eliminate meaningful differences among elements (Edelbrock, 1979). Although there is a trade-off effect of standardization, in this paper, we ignore the large element ranges and regard each variable of equal contribution.

2.5.3 Multicollinearity among variables

High correlation among clustering variables can be problematic because it mat overweight one or more underlying constructs (Ketchen, 1996). In this article, we prefer that constructs be equally weighted. Thus, we need to correct multicollinearity. Multicollinearity can be addressed through subjecting variables to principle component analysis with orthogonal rotation and using the resultant uncorrelated factor scores for each observation as the basis for clustering (Punj & Stewart, 1983). Like standardization, this remedy for multicollinearity has a cost. In the PCA approach, we often drop all factors with low eigenvalues (a statistic representing the amount of variance explained by a factor), which may represent unique and important information. Hence, the ideal approach is to perform a cluster analysis multiple times changing only the method of addressing multicollineraity (Ketchen, 1996).

CHAPTER 3

RESEARCH METHODOLOGY

This chapter has three sections. The first section portrays the research framework of this study. The second section describes the data source and collection. The third section represents the methodologies used in this study, including principle components analysis, and cluster analysis.

3.1 Research framework

The research framework of this study is shown in Figure 3.1. There are three main section of my research framework, which are principle component analysis, k-means cluster analysis, and multiple regressions.

1. The first section is to use principle component analysis to extract the important factors. Each factor including few financial indicators, whose loading above 0.50, would show the critical managerial capability. Besides, financial indicators within the factor would demonstrate either identical or opposite effect toward the relative management abilities.

2. Then we utilize the factors (eigenvalue > 1) to conduct K-means cluster analysis. Based on the K-means cluster analysis, each company would be classified into mutually exclusive clusters. Each cluster would differentiate from other clusters according to various managerial capabilities. However, each company within the cluster would demonstrate identical managerial capabilities.

3. The last part is to employ multiple regressions to evaluate the performance among different clusters. We would like to know which cluster or so-called organizational configuration has superior performance than other ones. After clustering analysis and multiple regressions, we will identify several diverse strategic groups, which we hope that could provide some meaningful suggestions for the electronic industry.

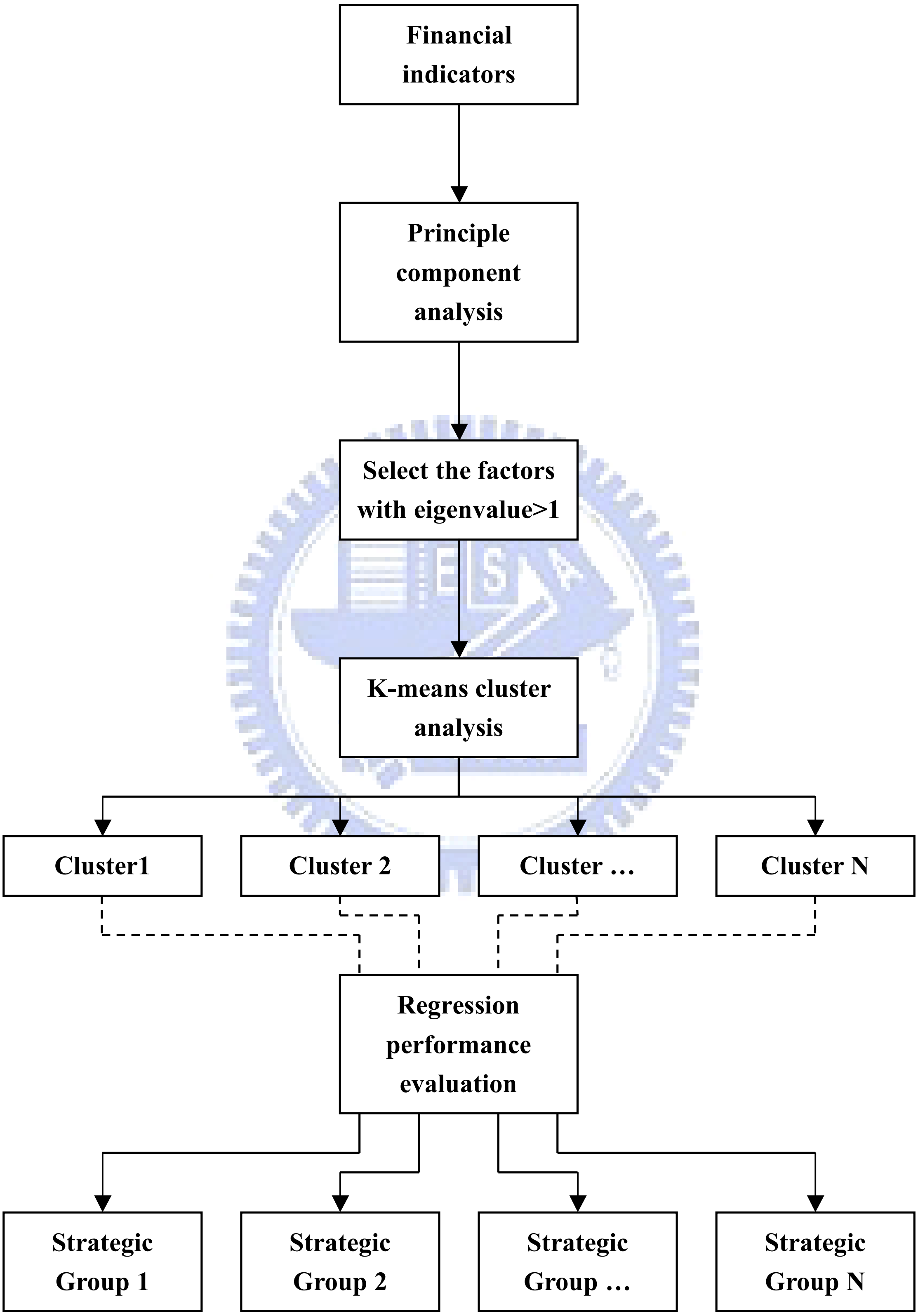


Figure 3-1 Research framework

3.2 Data sources and collection

In this paper, our research target focus on listed electric information companies in Taiwan. We use Taiwan Economic Journal Data Bank (TEJ Data Bank) to collect three year (2005-2007) financial indicators of each firm. Then, we average the three year financial data to prevent the large range among these indicators from dominating the research results. After deleting the companies with missing values, there are 290 listed electric information companies in our samples.

3.3 Research methodology

3.3.1 Principle components analysis

Principle component analysis is a method for re-expressing multivariate data. It allows the researcher to reorient the data so that the first few dimensions account for as much of the available information as possible. If there is substantial redundancy present in the data set, then it may be possible to account for most of the information in the original data set with a relative small number of dimensions. This dimension reduction makes visualization of the data more straightforward and subsequent data analysis more manageable (Lattin, Carroll, & Green, 2003).

Additionally, the principle components solution has the property that each component is uncorrelated with all others, which has the advantage of eliminating multicollinearity when using the results in an analysis of dependence (Lattin, Carroll, & Green, 2003).

In the clustering literature, principle component analysis is sometimes applied to reduce the dimensionality of the data set prior to clustering. The hope for using principle component analysis prior to cluster analysis is that principle components may extract the cluster structure in the data set.

3.3.2 Cluster analysis

Cluster analysis is a statistical technique that sorts observations into groups, which have similar characteristics. Without prior knowledge, cluster analysis was applied to develop our taxonomy of strategic groups. Existing clustering algorithms can be mainly classified into two categories: hierarchical and non-hierarchical methods. In our study, we use K-means algorithm, one of the non-hierarchical methods, due to no prior knowledge with the electronic industry. Hence, cluster analysis grouping organizations by minimizing the multivariate distance between firms within group while maximizing the distance between groups, using all observed relationships among configuration-defining variables to assign firms to clusters (Hair, Anderson, Tatham, & Black, 1992).

Besides, we wonder what numbers of clusters should be chosen. The Cubic Clustering Criterion (CCC) and Pseudo F statistic (PSF) are used to estimate the number of clusters. The Cubic Clustering Criterion (CCC) was developed by SAS as a comparative measure of the deviation of the clusters from the distribution expected if data points were obtained from a uniform distribution (Sarle, 1983). The pseudo-*F* statistic is intended to capture the 'tightness' of clusters, and is in essence a ratio of the mean sum of squares between groups to the mean sum of squares within group (Lattin *et* *al.*, 2003: 291). Values of the Cubic Clustering Criterion greater than 2 or 3 indicate good clusters; values between 0 and 2 indicate potential clusters, and negative values could indicate outliers. The local peak of the Cubic Clustering Criterion (CCC) should be chosen. On the other hand, relatively large values of Pseudo F statistic (PSF) indicate a stopping point.

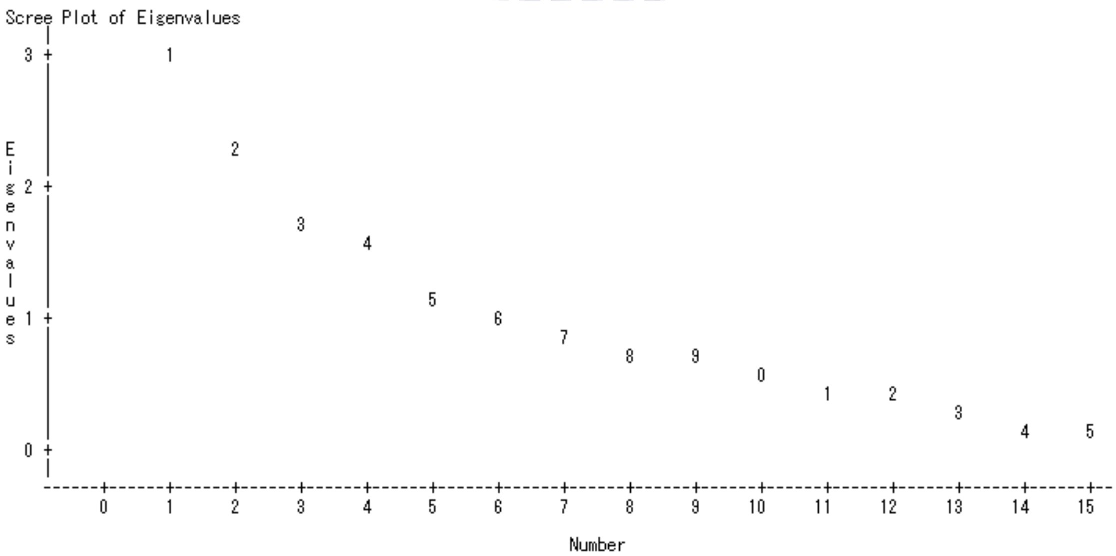
CHAPTER 4

RESULTS AND DATA ANALYSIS

4.1 Principle components analysis

A principle component analysis was conducted to identify source configurations correlated with the financial performance indicators in the 290 firms. We apply a varimax rotation and identify six factors (eigenvalue>1), which account for 71.83% of the total variance. Figure 4-1 shows the scree plot and Table 4-1 shows these six source configurations and their associated financial indicator loadings. The significant loadings (0.50 and above) would highlighted in bold.

Figure 4-1 Scree plot



Source: this study

Table 4-1.Principle component analysis

Financial Indicators	Source Configuration					
	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6
	Scale	*Knowledge*	*Light-assets*	*Relationship*	*Continuity*	*Fixed-assets*
Employees	**0.90**	-0.07	0.14	0.03	-0.06	-0.06
Total assets	**0.89**	-0.10	0.18	0.05	0.05	0.02
SG&A/Sales	-0.09	**0.85**	0.02	0.02	0.00	-0.20
R&D/Sales	0.03	**0.79**	-0.16	0.02	-0.35	-0.05
CGS/Sales	0.10	**-0.73**	-0.22	0.00	-0.05	0.00
Inventory turnover	-0.13	0.03	**0.86**	-0.02	-0.04	-0.03
Intangible assets	0.38	0.05	**0.80**	0.06	-0.04	0.03
Goodwill	0.42	0.03	**0.73**	0.01	-0.02	-0.05
Accounts payable turnover	-0.04	-0.05	-0.03	**0.89**	0.02	-0.11
Accounts receivable turnover	0.14	0.12	0.05	**0.81**	-0.18	0.28
Company category	-0.15	-0.03	0.07	-0.03	**0.78**	0.20
Operating years	0.08	-0.09	-0.16	-0.10	**0.73**	-0.17
Fixed assets turnover	-0.06	-0.24	-0.01	0.06	-0.05	**0.75**
Dep/Sales	0.49	0.04	0.04	-0.14	-0.24	**-0.50**
Eigenvalue	3.02	2.32	1.74	1.52	1.11	1.06
Accumulated variance (%)	0.20	0.36	0.47	0.57	0.65	0.72

Source: this study

In Factor 1, the significant indicators are related to *Scale management.* This includes *Employees* and *Total assets*.

In Factor 2, the significant indicators are related to *Knowledge management.* This includes R&D/sales, SG&A/sales, and cost of good sold/sales. From R&D/sales and SG&A/sales ratios, we could assess the firms' efficiency of resource deployment. There is also a negative correlation between CGS/sales and Factor 2 (-0.73), indicating that good knowledge management can pay off respect to a lower cost of good.

In Factor 3, the significant indicators are related to *Light-assets management*, which includes inventory turnover, goodwill, and intangible assets.

In Factor 4, the significant indicators are related to *Relationship management*. This includes customer relationship management (accounts receivable turnover) and supplier relationship management (accounts payable turnover).

In Factor 5, the significant indicators are related to *Continuity management*, which includes company category and operating years.

In Factor 6, the significant indicators are related to *Fixed-assets management*, which includes fixed assets turnover and Depreciation/sales.

4.2 Cluster analysis

In this section, we conduct K-means cluster analysis according to six key factors in section 4.1. K-means cluster analysis is a multivariate statistical technique, which involves grouping similar objects into mutually exclusive clusters. By the K-means clustering method, each company would be classified into single cluster so that each cluster wouldn't be overlapped. After the grouping process, each company would be accurately positioned in the cluster, which possesses the most similarities within the clusters.

According to Cubic Clustering Criterion, the best appropriate number of cluster would be four, which presents Pseudo F Statistic 44.05 and Cubic Clustering Criterion 0.11. Table4-2 shows the Cubic Clustering Criterion value.

Table 4-2 Cubic Clustering Criterion

	MAXC=2	MAXC=3	**MAXC=4**	MAXC=5
Pseudo F Statistic	32.85	41.39	**44.05**	40.82
R-Squared	0.13	0.23	**0.32**	0.38
Cubic Clustering Criterion	-4.44	-1.07	**0.11**	-2.49

Source: this study

From the Table 4-3, we could know six management factors of each cluster according to cluster means, which had been standardized earlier. Each cluster has a similar organizational configuration when we decomposed the management capabilities of each company. Companies in the same cluster represent as their strength in certain managements as their weakness in certain managements.

Cluster 1 reveals their strength in *Knowledge management* and *Relationship management* rather than weakness in *Scale management* and *Light-assets management.* Thus, we name Cluster 1 “Knights”.

Cluster 2 has no superior management capability than other clusters. In addition, they have the worst performance in the *Knowledge management*, *Continuity management*, and *Fix-assets management*. Thus, we name Cluster 2 “Paupers”.

Contrast to Cluster 2, Cluster 3 has superior management capabilities in the *Continuity management*, and *Fix-assets management*. However, Cluster 3 was the worst one in the *Relationship management.* Thus, we name Cluster 3 “Laborers”.

Unlike those Clusters above, Cluster 4 having two strength managements, *Scale management* and *Light-assets management,* but having no weakest management capabilities. Thus, we name Cluster 4 “Kings”.

Table 4-3 Cluster Means

Factors / Clusters	**Factor1** *Scale management*	**Factor2** *Knowledge management*	**Factor3** *Light-assets management*	**Factor4** *Relationship management*	**Factor5** *Continuity management*	**Factor6** *Fixed-assets management*
Cluster1 *Knights*	**-0.26419**	**1.80838**	**-0.15276**	**0.61441**	-0.27726	-0.00134
Cluster2 *Paupers*	-0.04352	**-0.41365**	-0.08825	-0.08563	**-0.87757**	**-0.17403**
Cluster3 *Laborers*	-0.14822	-0.21581	-0.08284	**-0.11910**	**0.67150**	**0.12635**
Cluster4 *Kings*	**3.99021**	0.12082	**2.94842**	0.17546	0.01318	-0.12089

Source: this study

The electronic industry was categorized into four organizational configurations by K-means cluster method. Next, we use discriminate analysis to check the accuracy of the classification result. Cross-validation is done by recalculating the discriminant function for all companies other than the validated companies. Table 4-4 shows the overall hit ratio is 95.17%, which reveal that the classification of the K-means cluster is considerably fit.

Table 4-4 Classification Results used for Cross-Validation

Clusters	Cluster1	Cluster2	Cluster3	Cluster4	Total
Cluster1	36	0	3	0	39
Cluster2	0	98	0	0	98
Cluster3	0	11	133	0	144
Cluster4	0	0	0	9	9

95.17% ((36+98+133+9)/290) of the cross-validated firms remain correctly classified.

Table 4-5 shows four clusters of the 290 electronic companies. There are 39 firms in cluster1, 98 firms in cluster2, 144 firms in cluster3, and 9 firms in cluster4. Cluster4, comprising only 9 firms, includes many well-known firms such as Hon Hai Precision Ind Co., Taiwan Semiconductor Mfg. Co., United Microelectronics Corp., AU Optronics Corp. etc. In addition, three main telecommunication firms, Chunghwa Telecom Co., Taiwan Mobile Co., and Far EasTone Telecommunications Co., also classified into the same cluster. Next section, we would examine the performance among four clusters.

Table 4-5 Companies in the clusters1

Cluster1-*Knights*	
Chung Fu Chen Yeh Enterprise Corp.	Faraday Technology Corp.
Microtek International Inc.	Global View Co., Ltd.
Silicon Integrated Systems Corp.	Ali Corp.
Realtek Semiconductor Corp.	Carry Technology Co., Ltd.
Advantech Co., Ltd.	King Billion Electronics Co., Ltd.
Sunplus Technology Co., Ltd.	Promise Technology, Inc.
AverMedia Technologies Inc.	Davicom Semiconductor, Inc.
Aurora Systems Corp.	104 Corp.
Mediatek Incorporation	Cheertek Inc.
Elan Microelectonics Corp.	Genius Electronic Optical Co., Ltd.
Aaeon Technology Inc.	HiTi Digital Inc.
C Sun Mfg. Ltd.	Gintech Energy Corp.
Springsoft Inc.	Cyberlink Corp.
Infortrend Technology, Inc.	Sonix Technology Co., Ltd.
E-Lead Electronic Co., Ltd.	Everfocus Electronics Corp.
ITE Tech. Inc.	Adlink Technology Inc.
Cradle Technology Corp.	Holtek Semiconductor Inc.
Loop Telecommunication Int'L Inc.	DrayTek Corp.
Test Research, Inc.	ATEN International Co., Ltd.
	Inventec Besta Co., Ltd.

Table 4-6 Companies in the clusters2

Cluster2-*Paupers*	
Lite-On Technology Corp.	Novatek Microelectronics Corp.
Siliconware Precision Ind. Co., Ltd.	Emerging Display Technologies Corp.
Elitegroup Computer Systems Co., Ltd.	Aopen Inc.
Macronix International Co., Ltd.	Sintek Photronic Corp.
Taiwan Mask Corp.	U-Tech Media Corp.
OPTO Tech Corp.	Optimax Technology Corp.
Behavior Tech Computer Corp.	Altek Corp.
Mosel Vitelic Inc.	Formosa Epitaxy Inc.
Winbond Electronics Corp.	CyberTan Technology Inc.
Ritek Corporation	International Semiconductor Technology L
Qisda Corp.	Kinsus Interconnect Technology Corp.
Asustek Computer Inc.	Wistron Corp.
Mustek Systems Inc.	Powertech Industrial Co., Ltd.
Lingsen Precision Industries, Ltd.	Silitech Technology Corp.
Gigabyte Technology Co., Ltd.	Alpha Networks Inc.
Micro-Star International Co., Ltd.	Global Unichip Corp.
Avision Inc.	Innolux Display Corp.
Arima Computer Corp.	Well Shin Technology Co., Ltd.
Quanta Computer Inc.	Young Optics Inc.
Wintek Corp.	ASRock Inc.
Sunrex Technology Corp.	Gamma Optical Co., Ltd.
Prodisc Technology Inc.	Lite-on Semiconductor Corp.
Biostar Microtech Int'l Corp.	SerComm Corp
Gigastorage Corp.	Sysage Technology Co., Ltd.
Nanya Technology Corp.	Hannstar Display Corp.
Lung Hwa Electronics Co., Ltd.	In Win Development Inc.
Walton Chaintech Corp.	Forhouse Corp.
Tyntek Corp.	Yoko Technology Corp.
Mospec Semiconductor Corp.	Cameo Communications Inc.
Weltrend Semiconductor, Inc.	Power Quotient International Co., Ltd.
Ralec Electronic Corp.	Harvatek Corp.
Jean Co., Ltd.	Billionton Systems Inc.
Lead Data Inc.	Radiant Opto-Electronics Corp.
Abocom Systems, Inc.	Aiptek International Inc.
Epistar Corp.	Taiwan Nano Electro-Optical Technology
King Yuan Electronics Co., Ltd.	Sigurd Microelectronics Corp.
Transcend Information Inc.	Flexium Interconnect Inc.

Leadtek Research Inc.	Wistron NeWeb Corp.
Pan Jit International Inc.	Richtek Technology Corp.
Amtran Technology Co., Ltd.	Arima Optoelectronics Corp.
Infodisc Technology Co., Ltd.	Lite-onit Corp.
Turbocomm Tech. Inc.	Sitronix Technology Corp.
Prime Optical Fiber Corp.	Nan Ya Printed Circuit Board Corp.
MiTac Technology Corp.	Compal Communications, Inc.
Elite Semiconductor Memory	Arima Communications Corp.
Technology In	Giantplus Technology Co., Ltd.
Precision Silicon Corp.	Walton Advanced Engineering Inc.
Asia Vital Components Co., Ltd.	Darfon Electronics Corp.
ICP Electronics Inc.	Creative Sensor Inc.
	Associated Industries China, Inc.

Table 4-7 Companies in the clusters3

Cluster3-*Laborers*	
GTM Corporation	Excel Cell Electronic Co., Ltd.
Solelytec Enterprise Corporation	Siward Crystal Technology Co., Ltd.
Delta Electronics, Inc.	Zinwell Corp.
Kinpo Electronics, Inc.	I-Chiun Precision Industry Co., Ltd.
Compeq Manufacturing Co., Ltd.	Hanpin Electron Co., Ltd.
Microelectronics Technology Inc.	Walsin Technology Corp.
MITAC International Corp.	High Tech Computer, Corp.
Wus Printed Circuit Co., Ltd.	Ahoku Electronic Co., Ltd.
Tecom Co., Ltd.	K.S. Terminals Inc.
Compal Electronics, Inc.	National Aerospace Fasteners Corp.
Yageo Corp.	Largan Precision Co., Ltd.
Pan International Industrial Corp.	Wah Lee Industrial Corp.
D-Link Corporation	Ji-Haw Industrial Co., Ltd.
Accton Technology Corp.	Chenming Mold Industrial Corp.
Synnex Technology International Corp.	FSP Technology Inc.
Universal Scientific Industrial Co., Ltd	Asia Optical Co., Inc.
Sdi Corporation	Sinbon Electronics Co., Ltd.
Acer Inc.	Action Electronics Co., Ltd.
Foxconn Technology Co., Ltd.	Billion Electric Co., Ltd.
Chin-Poon Industrial Co., Ltd.	Zenitron Corp.
Inventec Corp.	Bright Led Electronics Corp.
Solomon Technology Corp.	Compucase Enterprise Co., Ltd.
Chroma Ate Inc.	Weikeng Industrial Co., Ltd.
Clevo Co.	Wintech Microelectronics Co., Ltd.
KYE Systems Corp.	Unimicron Technology Corp.
Gold Circuit Electronics Ltd.	Txc Corp.
Tatung Co., Ltd	Powercom Co, Ltd.
Ability Enterprise Co., Ltd.	Tripod Technology Corp.
Teapo Electronic Corp.	Edimax Technology Co., Ltd.
Elite Material Co., Ltd.	Edom Technology Co., Ltd.
Chicony Electronics Co., Ltd.	Apex Science & Engineering Corp.
EverSpring Industry Co., Ltd.	Spirox Corp.
ZyXEL Communications Corp.	Leader Electronics Inc.
Cheng Uei Precision Industry Co., Ltd.	Min Aik Technology Co., Ltd.
Everlight Electronics Co., Ltd.	Nichidenbo Corp.
DFI Inc.	Maxtek Technology Co., Ltd.
Ichia Technologies, Inc.	Inventec Appliances Corp.

Yosun Industrial Corp.	Shin Zu Shing Co., Ltd.
United Integrated Services Co., Ltd.	Wha Yu Industrial Co., Ltd.
Shuttle Inc.	Paragon Technologies Co., Ltd.
Phoenixtec Power Co., Ltd.	Lotes Co., Ltd.
Universal Microelectronics Co., Ltd.	WPG Holding Co., Ltd.
Unitech Electronics Co., Ltd.	GemTek Technology Co., Ltd.
Cx Technology Corp.	Topco Scientific Co., Ltd.
Hitron Technologies Inc.	HannStar Board Corp.
Zippy Technology Corp.	I-Sheng Electric Wire & Cable Co., Ltd.
Sunonwealth Electric Machine Industry Co	Aeco Technology Co., Ltd.
Good Will Instrument Co., Ltd.	General Plastic Industrial Co., Ltd.
Mercuries Data Systems Ltd.	Golden Bridge Electech Inc.
Thinking Electronic Industrial Co., Ltd.	Fullerton Technology Co., Ltd.
Tsann Kuen Enterprise Co., Ltd.	L&K Engineering Co., Ltd.
Lien Chang Electronic Ent. Co., Ltd.	Plotech Co., Ltd.
Merry Electronic Co., Ltd.	Career Technology (Mfg.) Co., Ltd.
Space Shuttle Hi-Tech. Co., Ltd.	King Core Electronics Inc.
Senao International Co., Ltd.	Jye Tai Precision Industrial Co., Ltd.
Cyntec Co., Ltd.	Promate Electronic Co., Ltd.
Syscom Computer Engineering Co., Ltd.	Global Brands Manufacture Ltd.
Chilisin Electronics Corp.	Lumax International Corp. Ltd.
Phihong Technology Co., Ltd.	Marketech International Corp.
Audix Corp.	Jess-Link Products Co., Ltd.
Gem Terminal Ind. Co., Ltd.	Chant Sincere Co., Ltd.
Taiwan Line Tek Electronic Co., Ltd.	Flytech Technology Co., Ltd.
Mirle Automation Corp.	Kinko Optical Co., Ltd.
COSMO Electronics Corp.	Aurotek Corp.
Ares International Corp.	Waffer Technology Corp.
Lelon Electronics Corp.	Tong Hsing Electronic Industries, Ltd.
Catcher Technology Co., Ltd.	AcBel Polytech Inc.
Chunghwa Picture Tubes Ltd.	Shun On Electronic Co., Ltd.
G-Shank Enterprise Co., Ltd.	Topoint Technology Co., Ltd.
Meiloon Industrial Co., Ltd.	Chang Wah Electromaterials Inc.
Ta-I Technology Co., Ltd.	Supreme Electronics Co., Ltd.
Stark Technology Inc.	
Uniform Industrial Corp.	

Table 4-8 Companies in the clusters4

Cluster4-*Kings*	
United Microelectronics Corp. Advanced Semiconductor Engineering, Inc. Hon Hai Precision Ind Co., Ltd. Taiwan Semiconductor Mfg. Co., Ltd.	AU Optronics Corp. Chunghwa Telecom Co., Ltd. Chi Mei Optoelectronics Corp. Taiwan Mobile Co., Ltd. Far EasTone Telecommunications Co., Ltd.

Source: this study

4.3 Multivariate regression result

In this section, we would examine the different performance between clusters. We use three performance criterions, which include ROIC, ROE, and Net profit to test the difference. Table 4-6, we present three average financial performance of each cluster. Cluster4 dominate over the other clusters, which hold ROIC 13.759%, ROE 8.003%, and Net profit 15.006%. Cluster3 win the second position in three performance criterions, which were separately 12.414%, 8.003%, and 6.567%. Cluster2 have the worst ROIC and ROE, which are -20.078% and 2.749%, but have more superior performance at Net Profit than Cluster1. Cluster2 are the worst configurations according to their performance.

Table 4-9 Average performance of each cluster

Cluster	No. of firms	ROIC	ROE	Net Profit
Cluster1-knights	39	0.08658	0.05889	-1.11708
Cluster2-paupers	98	-0.20078	0.02749	0.01202
Cluster3-laborers	144	0.12414	0.08003	0.06567
Cluster4-kings	**9**	**0.13759**	**0.08376**	**0.15006**

Source: this study

According to Table 4-6, we know that Cluster4 perform the best. From Table4-7, we conduct multiple analysis of variance (MANOVA) and analysis of variance (ANOVA) tests to examine the significance of configuration-performance relationship. A multivariate test (Wilks' Lambda=0.9455; p<0.10) indicated that the configuration-performance relationship is slightly significant, which means various organizational configurations possess different financial performances. To summarize, different configurations possess different management capabilities, which result in various financial performances. Cluster4, especially, would be the best ideal configuration in electronic industry.

Table 4-10 Multivariate Regression Analysis

	ROIC	**ROE**	**Profit**
Cluster1	**4.77****	**1.91**	**161.42*****
Cluster2	**0.80**	**5.88*****	**9.10*****
Cluster3	**4.49*****	**2.69***	**27.04*****
Cluster4	**19.21***	**3.92**	**13.11***
F-Value	**2.44^{+}**	**2.35^{+}**	**2.05^{+}**
R-square	**0.0249**	**0.0241**	**0.0210**
MANOVA Wilks' Lambda=0.9455 F=1.79^{+}			

$^{+}p \leqq 0.10$; $^{*}p \leqq 0.05$; $^{**}p \leqq 0.01$; $^{***}p \leqq 0.001$.

Source: this study

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Research Finding

Following the entire research process, this study derives some meaningful findings based on the empirical data analysis for the electronic industry. The main research findings are generalized into four conclusions below:

1. **Derive the six management capabilities.** According to Principle Component Analysis (PCA), we could derive six major management capabilities from the fourteen financial indicators. We decompose the six major management capabilities in Table 5-1.

Table 5-1 Decomposition of the six management capabilities

Management capability	Elements
Scale management	*Employees* *Total assets*
Knowledge management	R&D/sales SG&A/sales Cost of good sold/sales
Light-assets management	Inventory turnover Goodwill Intangible assets
Relationship management	Accounts receivable turnover Accounts payable turnover
Continuity management	Company category Operating years
Fixed-assets management	Fixed assets turnover Depreciation/sales

Source: this study

2. **Classify four strategy groups.** Table 5-2 shows financial values of each cluster.

Cluster1-Kinghts

Strengths: *Knowledge management, Relationship management*

Weaknesses: *Scale management*, *Light-assets management, Continuity management, and Fixed-assets management*

There are 39 companies belong to Cluster1, whose scale are the smallest. Most of these companies belong to semiconductor category. These companies have the least assets and employees. Besides, they get the least goodwill and the lowest inventory turnover, which would result from inefficiency of inventory management system and result in additional cost.

On the other hand, Cluster1 are good at *knowledge management.* They spend more capital in administration and research & development, and thus decrease the cost of good sold, which only 0.579. Besides, they have a good relationship with their consumers, which result in a high accounts receivable turnover. Cluster1 focus their strategy on *Knowledge management* and *Relationship management.*

Cluster2-Paupers

Strengths: No superior management

Weaknesses: *Scale management, Knowledge management, Light-assets management, Relationship management, Continuity management, and Fixed-assets management.*

There are 98 companies belong to Cluster2. Most of them deal with photoelectrics. Cluster2 have no core strategy and get the highest cost of good sold 0.851, which indicates the inefficiency of their overall process.

Cluster3-Laborers

Strengths: *Continuity management*, and *Fix-assets management*

Weaknesses: *Scale management, Knowledge management, Light-assets management, and Relationship management*

There are 144 companies belong to Cluster3, which are the most common form in electric industry. These companies deal with Electric component and have the highest operating years, which indicates their experience and speciality in this category. Besides, they get the highest fixed assets turnover and lowest depreciation/sales, which indicates their strength in utilizing their fixed assets to create profit. However, they have poor relationship with both their suppliers and consumers, which cause higher account payable turnover and lower account receivable turnover. In a short, Cluster3 focus on their speciality and adopt a *Fix-assets management* strategy.

Cluster4-Kings

Strengths: *Scale management, Knowledge management, Light-assets management, Relationship management, Continuity management*

Weaknesses: *Fixed-assets management*

There are 9 companies belong to Cluster4. Three of them are engaged in semiconductor and the other three companies deal with Internet communication. These companies feature for their large scale and great deal of goodwill such as trademark and intangible assets such as patents, which elaborate a synergy in their overall operation. In addition, they get along well with both their suppliers and consumers, which cause the lowest accounts payable turnover and highest accounts receivable turnover. In short, Cluster4 focus their strategies on scale, light-assets, and relationship management.

Table 5-2 Average financial values of each cluster

	Cluster1 Knights	Cluster2 Paupers	Cluster3 Laborers	Cluster4 Kings
Employees	432.74	1417.43	866.48	13437.67
Total assets	7223862	26229058	19017172	388944216
SG&A/Sales	0.316	0.114	0.113	0.132
R&D/Sales	0.113	0.035	0.023	0.028
CGS/Sales	0.579	0.851	0.801	0.722
Inventory turnover	4.564	8.381	7.082	16.316
Intangible assets	129605	202427	70734	4226394
Goodwill	22950	71364	42522	4148644
Accounts payable turnover	72.566.	64.438	73.836	42.218
Accounts receivable turnover	8.234	5.983	4.860	8.337
Company category (Mode)	1	3	5	1 & 4
Operating years	17.4	15.2	26.2	18.1
Fixed assets turnover	5.657	9.745	17.715	2.167
Depreciation/Sales	0.040	0.077	0.037	0.197

Source: this study

5.2 Research contribution

In this paper, we start from the financial data and develop a framework to examine variously listed companies in electric industry. Based on our research framework, we use relative financial indicators to distinguish major management capabilities, which provide a new principle to look into each company. In addition, we construct four strategies groups according to six management capabilities. The main contributions of this study are discussed below:

1. **Distinguish the measurement factors of management capabilities**. In this study, we adopt fourteen financial indicators to conduct Principle Component Analysis (PCA), and generate six principle measurement factors to illustrate the various management capabilities. These measurement factors are *Scale management, Knowledge management, Light-assets management, Relationship management, Continuity management,* and *Fixed-assets management*.

2. **Classify strategy groups within the electronic industry**. Based on the six principle measurement factors, we conduct K-means cluster analysis to classify the electric industry into four type configurations. Cluster4 are the best configurations, whose strategies are focused on *Scale management* and *Light-assets management.* Cluster3 are the second configurations, whose strategies are focused on *Continuity management*, and *Fix-assets management.* Cluster1 are the third configurations, whose strategies are focused on *Knowledge management* and *Relationship management.* Cluster2 are the worst configurations, which have no superior management capability.

3. **Verify the significance relationship between organizational configurations and operating performances**. Based on the empirical data examination, the significant results from MANOVA test (Wilks' Lambda=0.9455; $p<0.10$) proved that organizational configurations do affect the operating performances. Hence, different configurations determined by each firm would become a strategy to enhance management capabilities and obtain outstanding financial performances.

4. **Derive the most profitable organizational configuration**. After measuring the operating performance indicator such as *ROIC*, *ROE*, we find out Cluster4 dominate the other clusters. Cluster4 is the most profitable organizational configuration in the electronic industry. Cluster4 get superior capabilities in *Organizational-scale management* and *Light-assets management*. Cluster4 are composed of large-scale companies such as Hon Hai Precision Ind Co and Taiwan Semiconductor Mfg. Co. These companies possess a good deal of assets and employees. Besides, they get goodwill and intangible assets such as patents and trademark which could lead to a leverage effect and generate a synergy. In addition, their inventory turnovers are more than the other clusters, which means these companies are good at selling its inventory and generating income.

5.3 Research limitation

In this paper we adopt listed electric companies as our research sample. Hence, we only acquire empirical results to support our prior hypothesis in electric industry rather than obtain a general truth, especially empirical study would vary by various industries.

In addition, we adopt the deductive approach to select critical variables provided by the TEJ Data Bank. Thus, we might ignore some meaningful financial indicators, which TEJ Data Bank did not provide and have crucial influences to our research result.

Last, this paper focused on Taiwan electric companies without considering International electric companies. Hence, we could not compare both to derive the ideal strategic group, which decrease the research contributions for Taiwan electric companies.

5.4 Research recommendation

There are two main research recommendations for future study below:

1. In this paper, we derive the ideal configuration in electric industry, which got the highest performance. However, we are wondering if there exists a penalty relationship for configurations deviating from the ideal configuration?
2. In this paper, we distinguish six major management factors. However, we are wondering if there exists a trade-off relationship among these factors or if there exists a dominant management factor contributes to performance most.

Reference

Burns, T., & Stalker, G. M. 1961. The management of innovation. London: Tavistock.

Chandler, A., 1962. Strategy and Structure. MIT Press, Cambridge, MA.

Charles T. Horngren, Walter T. Harrision Jr., & Linda Smith Bamber, 2002. Accounting (5th edition). Prentice Hall International, Inc..

Cool, K. O., & Schendel, D. 1987. Strategic group formation and performance: The case of the U.S. pharmaceutical industry, 1963-1982. Management Science, 33: 1102-1124.

Christopher Gresov & Robert Drazin, 1997. Equifinality: Functional equivalence in organization design. Academy of Management Review, vol. 22, No. 2, 403-428.

Edelbrock, C. 1979. Comparing the accuracy of hierarchical clustering algorithms: The problem of classifying everybody. Multivariate Behavioral Research, 14, 367-384.

Fiegenbaum, A., & Thomas, H. 1990. Strategic groups and performance: The U.S. insurance industry, 1970-1984. Strategic Management Journal, 11: 197-215.

Fisher C. 1999. Driving financial performance through the du Pont identity: A strategic use of financial analysis and planning. Financial Practice & Education, vol. 9, No. 1, 34-45.

Galunic, D. C., & Eisenhardt, K. M. 1994. Renewing the strategy-structure-performance paradigm. Research in organizational behaviour, vol. 16: 215-255.

Giddens, S. 1979. Central problems in social theory. Berkeley: University of California Press. Grant, R. 1991. The resource-based theory of competitive advantage: implications for strategy formulation. California Management Review, vol. 33, No. 3, 114-135.

Hair, J. F., R. E. Anderson, R. L. Tatham, & W. C. Black, 1992. Multivariate Data Analysis (3rd ed.). Macmillan, New York.

Hrebeniak, L., & Joyce, W. 1985. Organizational adaptation: Strategic choice and environmental determinism. Administrative Science Quarterly, 30: 336-349.

Katz, D., & Kahn, R. L. 1978. The social psychology of organizations. New York: Wiley.

Ketchen, D. J., J. B. Thomas, C. C. Snow. 1993. Organizational configurations and performance: A comparison of theoretical approaches. Academy of Management Journal, vol. 36, 1278-1313.

Ketchen, D. J., C. L. Shook. 1996. The application of cluster analysis in strategic management research: An analysis and critique. Strategic Management Journal, 17 (6) 441-458.

Ketchen, D. J., & James G. Combs, & Craig J. Russell, & Chris Shook, 1997. Organizational configurations and performance: A meta-analysis. Academy of Management Journal, vol. 40, No. 1, 223-240.

Ludwig Von Bertalanffy, 1972. The history and status of general systems theory. Academy of Management Journal 15, 407-426.

Merton, R. K. 1967. On theoretical sociology. New York: Free Press.

Meyer, A. D., Tsui, A. S., & Hinings, C. R. 1993. Configurational approach to organizational analysis. Academy of Management Journal, 36: 1175-1195.

Miles, R. E., C. C. Snow. 1978. Organizational Strategy, Structure, and Process. McGraw-Hill, New York.

Miller, D., & Peter H. Friesen, 1978. Archetypes of strategy formulation. Management Science, vol. 24, No. 9, 921-933.

Miller, D., & Mintzberg, H. 1984. The case for configuration. Organizations: A quantum view: 125-170.

Miller, D. 1987. The genesis of configuration. Journal of Management Studies, 12: 686-701.

Miller, D. & Shamsie, Jamal, 1996. The resource-based view of the firm in two environments: The Holleywood film studios from 1936 to 1965. Academy of Management Journal, vol. 39, No. 3, 519-543.

Mintzberg, Henry, 1990. The Design School: Reconsidering the basic premises of strategic management. Strategic Management Journal, vol. 11, 171-195.

Nadler, D. A., & Tushman, M. L. 1988. Strategic organization design. Glenwood, IL: Scott, Foresman.

Pennings, J. 1992. Structural contingency theory: A reappraisal. Research in Organizational Behavior, 14: 267-309.

Punj, G., D. W. Stewart, 1983. Cluster analysis in marketing research: Review and suggestions for application. Journal of Marketing Research, 20, 134-148.

Scott, W. R. 1981. Organization: Rational, natural and open systems. Englewood Cliffs, NJ: Prentice-Hall.

Tang, Ying-chen, & Liou Fen-May, 2007. Asset-Light Business Model: A theoretical framework for sustained competitive advantage.

Tushman, M. L., & Nadler, D. A. 1978. Information-processing: An integrating concept in organization design. Academy of Management Review 3, 613-624.

Van de Ven, A. H., & Drazin, R.1985. The concept of fit in contingency theory. Research in organizational behaviour, vol. 7: 333-365.

Weber, M. 1947. The theory of social and economic organization. New York: Oxford University Press.

Wernerfelt, B., 1984. A resource-based view of the firm's. Strategic Management Journal, vol. 5, No. 2, 171-180.