# DEFINITION OF THE B TO B EXPERIENTIAL MARKETING STRATEGIES OF HIGH TECHNOLOGY SERVICE FIRMS BY USING A DEMATEL BASED HYBRID MCDM METHOD

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## ABSTRACT

The goal of experiential marketing is to establish connections in such a way that the customers respond to a product offering based on both emotional and rational response levels. Based on literature review results, the researches on experiential marketing during the past decade mainly focused on business to customer (B2C) transactions while very limited researches focused on business to business (B2B) transactions. Instead, most previous researches focused on general consumer goods industry. This research aims to investigate the factors influencing experiential marketing of high technology service firms and used the Strategic Experiential Modules and experiential provider as the tool**.** Finally, develop a MCDM framework for experiential marketing of the high technology service firms. Based on the result of the research, an empirical study shows that experiential marketing over B2B Company of the High-Technology service industry as well as demonstrates the effectiveness of this analytic framework. Finally, the results can also as standard criteria to apply to drawing suggestions of the high technology service operating strategy.

**Keywords:** Experiential Marketing, Decision Making Trial and Evaluation Laboratory (DEMATEL), Analytic Network Process (ANP), High-Technology Service industry, B2B.

## 1. Introduction

Experiences, events that involves a person in a memorable way [16], based marketing, or the experiential marketing, has emerged recently and become a novel marketing mindset. The traditional marketing views consumers as rational decision-makers who care about functional features and benefits; in contrast, experiential marketers view consumers as rational and emotional human beings who are concerned with achieving pleasurable experiences [3].

The traditional marketing strategy is product-based, not customer-based. Many traditional marketing managers still believe in product superiority, where the task is simply to push the product through the channel to the right target [1]. Most departments are organized around product categories and focus on pushing as many units of the same product as possible to any kind of customer. Because repeated selling of desirable products to a specific customer segment is not primary objective, traditional marketing is not really interested in-depth understanding of customers [2].

Schmitt [3] proposed that experiential marketing framework is conceptually much tighter and more focused than the classic marketing strategy model, which is hodgepodge of economic, psychological, and sociological analysis combined with some war metaphors and so-called "strategies" for the most part, it is but a list of factors to consider with few precise concepts and corresponding methodologies. When the model does focus on a specific factor (e.g., on competitive analysis), it gets so bogged down in details that it loses its practical relevance. In contrast, experiential marketing strikes the right balance and does not lose track of its goal: the management of the customer experience. And it provides a rigorous conceptual and methodological approach to achieving that goal [4].

While experiential marketing has become a cornerstone of recent advances in retailing, branding and events marketing [5], there is potential for its application in High-Technology Service industry marketing to be extended and improved. The goal of experiential marketing is to establish connections in such a way that the client responds to a product offering based on both emotional and rational response levels. By understanding what the client is likely to think and feel, it is possible to get an idea of how the customers can be steered in a direction that will relate to the product or services, and entice individuals to act on that impulse to purchase. As a result of past researches on experiential marketing which mainly focused on business to customer (B2C) like Segmenting online game customers [6], Customer experience creation [7], predict consumer behavior [8]. Transactions while very few were focused on business to business (B2B) transactions, especially for the popular industry in recent years—high-tech services. Therefore, this study considers that using experiential marketing strategies of high technology service firm is valuable.

The essence of high technology services firm requires special techniques—the traditional product-oriented sales cycle must be radically modified [9]. Dunn [9] says "High tech services are hard to buy and hard to sell but can be extremely beneficial to buyers and profitable to sellers." Observing the above mentioned phenomenon, the purpose of the this research are divide for three points: (1) to investigate the factors influencing experiential marketing of high technology service firms; (2) defining a multiple criteria decision making (MCDM) theories based framework for experiential marketing of the high technology service firms; (3) enhancing the competitiveness of high technology service firm by using the Strategic Experiential Modules and experiential provider as the tool**.**

And the results can also as standard criteria for high-technology service B2B Company to apply to drawing suggestions of its operating strategy. Meanwhile, high-tech managers and investors should decide on the strength of each experiential aspect in an effort to enhance their high-tech

service firm competitiveness. The paper also demonstrates how comparisons could be made while selecting the model, which gives a clear direction for high tech managers and investors when devising operating strategies and activities.

This research will be executed based on the following procedure. At first, previous studies being related experiential marketing, high technology services, and criteria for high technology experiential marketing definitions will be reviewed. Then, the critical criteria for defining experiential marketing of high technology firms will be derived by previous reviews. The validity of the derived criteria also will be confirmed by Delphic Oracle's Skills of Interpretation and Foresight (Delphi). The structure of the entire decision making problem will be developed by using the Decision Making Trial and Evaluation Laboratory (DEMATEL), which is based on pair comparisons of the cause and effect relationships between criteria. Finally, Weights of the criteria will be derived based on the structure being derived above using the Analytical Network Process (ANP). The proposed MCDM framework will be leveraged for selecting experiential marketing which are most suitable for the various functions of high technology service firms. After the analysis, appropriate experiential marketing of high technology service firms can be defined.

## 2. Literature Review

Sudharshan [10] defined marketing strategy as a function of an organization's marketing relationships (with particular emphasis on customers and channel members), the nature of the product offer, the timing of the offer to the market and the resources that will be provided to effect market delivery.

In this research, we reviewed some strategy by literature as follows:

### 2.1 Experiential Marketing

Although traditional marketing provided useable strategies, tools, and concepts that helped businesses succeed in an earlier age [11]. But, traditional marketing and business concepts offer hardly any guidance to capitalize on the emerging experiential economy. Experiential marketing has grown in importance because traditional marketing has largely ignored the notion of act experiences. [12].

Successful businesses bring about loyal customers by providing unforgettable experiences. These are memorable activities created by a business through its products and services to customers [16]. Prahalad and Ramaswany [13] argued that creating personal experience would be the competitive edge for companies in the future; Schmitt [3] further claimed that experiences are formed from the interaction among different events and psychology states.

All businesses must orchestrate memorable events for their customers [14]. Gilmore and Pine [15], two pioneers on the experience, asserted that: if you charge for stuff, then you are in the commodity business; if you charge for tangible things, then you are in the goods business; if you charge for the activities you perform, then you are in the service business; and if you charge for the time customers spend with you, then and only then are you in the experience business.

Experience may be defined as an event that involves a person in a memorable way [16]. This means that experiential goods cannot be treated with traditional criteria (for example, utilitarian), since they involve a greater affective component, hedonistic criteria, and customers' personal characteristics [17].

Experiential marketing, specifically, makes the purchase process easier according to their values, their enjoyment, personality type and social group in the loose sense not traditional segmentation approaches that have become too invasive and sophisticated [13].

McGregor [18] identified that in the generally neglected experiential view, the criteria for successful consumption are essentially esthetic in nature and hinge on an appreciation of the product for its own sake, apart from any utilitarian function that it may or may not perform [19]. Thus, the processes of experiential consumption are like the appreciation of art, emphasizing the nature of the product or service without regard to its functional utility.

Schmitt [3] argued that experiential marketing differs from traditional marketing focusing on features and benefits. Experiential marketing focuses on customer experiences, examines the consumption situation, considers customers are rational and emotional, and advocates methods and tools are eclectic.

The effect of experiential marketing on customer still needs to be discussed. But we can know that experiential marketing will become a major concept and tool in the marketing domain knowledge in the future [20].The research of experiential consumption is getting noticed for the past years. In recent, experiential marketing can also be applicable to different businesses in different industries, Experiential marketing motivates customers to make faster and more positive purchasing decisions [21], retail leisure property [22], tourism [23] and industry and innovation [24].

Today, products that are trying to differentiate through additional free services or services that are trying to differentiate by additional free products, along with traditional CRM programmers', are all beginning to look like commodities. Experience is the new currency of the modern marketing landscape, because people talk about experiences every day [25].

### 2.2. Strategic Experiential Modules and Experiential Provider

Experiential marketing is primarily submitting from the Schmitt [3]. At the same time, he suggested five strategic experiential modules, which include sense, feel, think, act, and relate [3]. According to Schmitt [3], five experiential modules of the SEMs include the sense experiential module, the feel experiential module, the think experiential module, the act experiential module and the relate experiential module. The definitions of the five modules are provided below.

Sense experiential module: involves sensorial experiences through vision, sound, taste, smell and touch such as: good-tasting food, magnificent game images and pleasing game music. Marketing strategies based on sensorial experiences may be used to stimulation aids in the customer's positive evaluation, stimulates their desire of consumption and add value to products and motivate customers [3].

Feel experiential module: involves customers' inner feelings and emotions. Feel marketing aims at creating affective experiences ranging from a moderate attitude to a strong emotion of joy and pride. The experience provider

intends to link closely the experience, products and customers by various means to stirring up the customers' feeling on a specific brand name or product. When customers do have feel experience, the joy help them to have a much more positive attitude. Emotions arise not only in the final phase of consumption, but in all phases constituting the experience [3].

Think experiential module: involves customers' ability to generate creative thoughts and appeals to the intellect with the objective of encouraging customers to engage in elaborative and creative thinking that may result in a revaluation of the company and products. And it may also inspire customers to be interested in products and help them think centrally and separately which urges them reassess the profits from new products and services [3].

Act experiential module: is about finding out the alternative ways of doing something, alternative lifestyle and interactions. Act marketing induces customers to change physically and mentally. When customers changes, they may further change their attitudes, start group behaviors and even reinterpret the interpersonal relationship [3].

Relate experiential module: including all the above-specified experiences. The individuals experience needs to be perceived positively by others, and things through personal experience, rather than individual personality and feeling to highlight customers' desire such as being positively. Furthermore, it also makes connection between brand and social culture and by the way influences potential community members [3].

For each kind of experience, Schmitt [3] also defined appropriate instruments that marketing managers can provide experiences to stimuli customers through a set of experience providers including (1) communications: advertising, public relations, annual reports, brochures, newsletters, and magazine, (2) visual/verbal identity: names, logos, signage, and transportation vehicles; (3) product presence: product design, packaging, and point-of-sale displays; (4) co-branding: event marketing and sponsorships, alliances and partnerships, licensing, and product placement in movies or TV; (5) environments—retail and public spaces, trade booths, corporate buildings, office interiors, and factories; (6) web sites and electronic media—corporate sites, product or service sites, online advertising, and intranets; and (7) people: sales, customer-service representatives, technical support or repair providers, and CEOs and other executives.

### 2.3 High Technology Services

There is no agreed definition of services. According to the American Marketing Association's Dictionary of Marketing Terms, services are intangible or at least substantially so. If totally intangible, they are exchanged directly from producer to user, cannot be transported or stored, and are almost instantly perishable. Service products are often difficult to identify, because they come into existence at the same time they are bought and consumed. They comprise intangible elements that are inseparable; they usually involve customer participation in some important way; they cannot be sold in the sense of ownership transfer; and they have no title [26].

Services are defined as the application of specialized competences (skills and knowledge) through acts or processes for the benefits of another [27]. Services, it has argued, are not separate or distinct from tangible products because what customers buy is an offering, the complete package or bundle of benefits that includes how easy the product is to buy, how it has to be paid for, services that help the buyer get full value from the product's use, and sometimes assistance in disposing of the residual product when finished with it [28]. On the other hand, Service also can be defined as any act or performance one party can offer to another that is essentially intangible and does not result in the ownership of anything. Its production may or may not be tied to a physical product. Increasingly, however, manufacturers, distributors, and retailers are providing value-added services, or simply excellent customer service, to differentiate themselves [14].

Services have four unique characteristics that distinguish them from goods are as follows [29] [30]. (1) Intangible: the inability of services to be touched, seen, tasted, heard, or felt in the same manner that goods can be sensed; (2) Inseparable: the inability of the production and consumption of a service to be separated. Consumers must be present during the production; (3) Variable: there is a great deal of difference in the quality of service provided by various providers, or even by the same providers at different times; and (4) Perishable: the inability of services to be stored, warehoused, or inventoried. Each characteristic poses challenges and requires certain strategies. Marketers must find ways to give tangibility to intangibles; to increase the productivity of service provider; to increase and standardize the quality of the serviced provided; and to match the supply of services with market demand [14].

As such, service became significant parameter of product differentiation and important basis of competitive advantages. After the boom of information technology branch in the 1990s the concept of high technology has become increasingly popular but still lacks of commonly definition [31]. Moriarty and Kosnik [32] defined that "High tech" as "high uncertainty about technology and the market." And "High" means potential customers often cannot articulate what they need. The term high technology (high tech) refers to advanced or sophisticated technologies. High technologies are utilized by a wide variety of industries certain characteristics. Even definitions offered by experts. Further, they also defined technology as "the practical knowledge, know-how, skills, and artifacts that can be used to develop a new product or service and/or a new production/delivery system. Technology can be embodied in people, materials, cognitive and physical processes, plant, equipment, and tools." This definition includes both product technology and process technology [32]. High-tech firms can also means "engaged in the design, development and introduction of new products and/or innovative manufacturing processes through the systematic application of scientific and technical knowledge" [33]. The definition shifts over time means that high technology generally refers to cutting-edge or advanced technology [31].

Some researchers described that a company is classified as high-tech if it fits the following description [34] [35]: (1) It has high levels expenditure of research-and-development; (2) It has the potential to use technology for rapid growth, and its survival is threatened by the emergence of competing technology; (3) Technological innovation is their competitiveness; (4) It has highly educated employs. A large number of scientists and engineers are employees; (5) Compared with other industries, its technology is changing at

a faster rate.

Mohr, et al. [31] described that high tech can include a wide range of industries and product like robotics, biotechnology, nanotechnology, pharmaceuticals, and medical equipment, with the focus on using technology to solve global problems; it can also include energy and transportation technologies and green building technologies. Furthermore, there are some traditional domains of "high tech" include areas such as information technology [36], computer hardware, software [37], telecommunications and Internet infrastructure [38], and consumer electronics [39], among others.

Effects of inter firm differences are investigated in the new service development phase of the innovation process. Successful innovation is crucial for firm survival in high-technology service industries [40]. The speed of technological developments and the related globalization of markets, most high-technology service providers currently experience hyper competition and exceptional turbulence in their marketplaces [41]. As a consequence of many opportunities for service innovation have created by revolutionary technological developments, while these new high-technology services potentially create significant value for providers as well as users [42]. A revolution is at work in the high technology industry: the irresistible growth of business-to-business high tech services [43]. High tech services are the firms that offering a new range of sophisticated services to their corporate customers, quite different from the traditional hardware maintenance and repair services. Their business can be defined as offering value to their customers through services, based on innovative information technology (hardware and software) implemented by personnel who have required expertise and who rely heavily on methodology [44] .

A list of the most significant information technology (IT) based services [45], includes professional services such as consulting [46], systems engineering, systems integration [47], support outsourcing [48], e-business services [49]. Similarly with the explosion of the internet, consumer services companies have emerged. They are mostly on-line information, electronic-transactions, and electronic business services [44].

There are some important features to make a distinction of high technology services [44]:

(1) Their ownership is not transferred at the time of the purchasing; (2) They cannot be easily demonstrated before purchasing; (3) They are intangible; (4) They are location independent but time dependent; (5) Customers are associated with them; (6) They are relatively homogeneous so they can be stored and quality controlled.

The product life cycles will become increasingly short; it means an urgent need for effective, fast, and continuous innovation [50]. Therefore, the trend in the macro environment of high-tech firms has turned high-technology service is necessary.

### 2.4 High Tech Service Marketing Strategy

Many firms like IBM, HP—have turned to services as a way to augment their revenue streams [51]. Other companies include many of the outsource providers of information technology and business services are exist solely to provide high tech services [52].

In conjunction with the increasing importance of services in the economy, a new paradigm in the marketing field, "the services-dominant logic of marketing," also emphasizes the role of service in companies' strategies [27].

(1) Augment high tech product sales with services revenue.

Companies that sell a tangible high tech product such as hardware or consumer electronics can augment their product sales with services revenue in several ways. First, a company might offer consulting services in conjunction with its product sales. Second, the company might offer training, repair, or maintenance contracts to supplement its revenues from product sales. The increasing popularity of a variety of industry trade groups attests to the viability of this strategy. The goal of technology companies is to engage their development, service, and support organizations—the teams involved in delivering elements of the customer experience that lower the total cost of ownership, accelerate the business benefit of the product, and build valuable new product features that were not part of the original product purchase. Indeed, the focus on long-term customer relationships suggests that augmenting product sales with service revenues might be the best strategy for many high tech services companies.

(2) Offer "pure" high tech services.

Companies that offer high tech services might include contract research firms, consulting companies that advise customers on implementation of technology solutions, and service providers that offer outsourced information technology or business process outsourcing services to corporate customers. Some of these companies offering high tech services must rely on high tech to deliver their services. They use of sophisticated imaging equipment to provide oil exploration services for its clients. More commonly, the issue faced by these high tech services companies is how to leverage the customized developments made on behalf of one client to other revenue opportunities. Indeed, creating a platform for standardization of services is the key to such leverage.

(3) Use technology to improve services in traditional products companies.

For companies that offer more traditional products, issues related to the intersection of services and technology include the adoption of technologies to improve customer service or make the supply chain more efficient. To be successful, technology providers that offer technology solutions to these traditional companies must develop an intimate understanding of these customers' industries. The technology companies will succeed only if they can communicate in the language of their customers' business.

(4) Use technology to improve traditional services industries

Finally, companies that offer "low-tech" services also must use technology as part of their service-delivery strategy. Many traditional service industries—not R&D-intensive services—are affected by new technological innovations. The movement to self-service technologies has allowed many industries to automate previously labor-intensive operations [53].

Both cell 3 and 4 offer the potential for introducing self-service technologies, either to consumers or to employees. A critical issue for companies is how to get consumers or employees to adopt them. Recent research has shown that, in addition to innovation characteristics and adopter characteristics, adopter readiness variables (such as

their motivation and ability) play an important role in customer's willingness to try out these new technologies [53]. Managers of these technologies can stimulate user's ability through training and handholding new customers, and they can stimulate users' motivation by emphasizing the benefits such as time or cost savings.

## 3. Methods

### 3.1 The DEMATEL Method

The DEMATEL method was developed by the Battelle Geneva Institute (1) to analyze complex 'world problems' dealing mainly with interactive man-model techniques; and (2) to evaluate qualitative and factor-linked aspects of societal problems [54]. The applicability of the method is widespread, ranging from industrial planning and decision-making to urban planning and design, regional environmental assessment, analysis of world problems, and so forth. It has also been successfully applied in many situations, such as marketing strategies, control systems, safety problems, developing the competencies of global managers and group decision-making [55]. Furthermore, a hybrid model combining the two methods has been widely used in various fields, for example, e-learning evaluation [56] and innovation policy portfolios for Taiwan's SIP Mall [57]. Therefore, in this paper we use DEMATEL not only to detect complex relationships and build a NRM of the criteria, but also to obtain the influence levels of each element over others; we then adopt these influence level values as the basis of the normalization supermatrix for determining ANP weights to obtain the relative importance. To apply the DEMATEL method smoothly, the authors refined the definitions based on above authors, and produced the essential definitions indicated below. The DEMATEL method is based upon graph theory, enabling us to plan and solve problems visually, so that we may divide multiple criteria into a relationship of cause and effect group, in order to better understand causal relationships. Directed graphs (also called digraphs) are more useful than directionless graphs, because digraphs will demonstrate the directed relationships of sub-systems. A digraph typically represents a communication network, or a domination relationship between individuals, etc. Suppose a system contains a set of elements, $S=\{s_1,s_2,\ldots,s_n\}$, and particular pair-wise relationships are determined for modeling, with respect to a mathematical relationship, MR. Next, portray the relationship MR as a direct-relation matrix that is indexed equally in both dimensions by elements from the set $S$. Then, extract the case for which the number 0 appears in the cell $(i,j)$, if the entry is a positive integral that has the meaning of: the ordered pair $(s_i,s_j)$ is in the relationship MR; it has the kind of relationship regarding that element such that $s_i$ causes element $s_j$. The digraph portrays a contextual relationship between the elements of the system, in which a numeral represents the strength of influence. The elements $s_1$, $s_2$, $s_3$ and $s_4$ represent the factors that have relationships in Fig.3. The number between factors is influence or influenced degree. For example, an arrow from $s_1$ to $s_2$ represents the fact that $s_1$ influences $s_2$ and its influenced degree is two. The DEMATEL method can convert the relationship between the causes and effects of criteria into an intelligible structural model of the system [55].

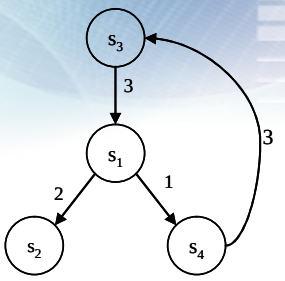


Fig.3. An Example of the Directed Graph

Definition 1: The pair-wise comparison scale may be designated as eleven levels, where the scores 0,1,2,…,10 represent the range from 'no influence' to 'very high influence'.

Definition 2: The initial direct relation/influence matrix $\boldsymbol{A}$ is an $n\times n$ matrix obtained by pair-wise comparisons, in terms of influences and directions between the determinants, in which $a_{ij}$ is denoted as the degree to which the $i^{th}$ determinant affects the $j^{th}$ INC.

$$\boldsymbol{A}=\begin{bmatrix} a_{11} & a_{12} & \mathrm{L} & a_{1n} \\ a_{21} & a_{22} & \mathrm{L} & a_{2n} \\ \mathrm{M} & \mathrm{M} & \mathrm{M} & \mathrm{M} \\ a_{n1} & a_{n2} & \mathrm{L} & a_{nn} \end{bmatrix}$$

Definition 3: The normalized direct relation/influence matrix $\boldsymbol{N}$ can be obtained through Equations (1) and (2), in which all principal diagonal elements are equal to zero.

$$\boldsymbol{N}=z\boldsymbol{A}$$

$$z=\min\left\{1/\max_i\sum_{j=1}^{n}a_{ij},1/\max_j\sum_{i=1}^{n}a_{ij}\right\},$$

$$i,j\in\{1,2,\ldots,n\}$$

In this case, $\boldsymbol{N}$ is called the normalized matrix. Since $\lim_{l\to\infty}\boldsymbol{N}^l=[0]$.

Definition 4: Then, the total relationship matrix $\boldsymbol{T}$ can be obtained using Equation (3), where $\boldsymbol{I}$ stands for the identity matrix. $\boldsymbol{T}=\boldsymbol{N}+\boldsymbol{N}^2+\ldots+\boldsymbol{N}^l=\boldsymbol{N}(\boldsymbol{I}-\boldsymbol{N})^{-1}$ (3)

where $l\to\infty$ and $\boldsymbol{T}$ is a total influence-related matrix; $\boldsymbol{N}$ is a direct influence matrix and $\boldsymbol{N}=[x_{ij}]_{n\times n}$; $\lim_{l\to\infty}\left(\boldsymbol{N}^2+\mathrm{L}+\boldsymbol{N}^l\right)$ stands for a indirect influence matrix;

[Explanation]

$$\boldsymbol{T}=\boldsymbol{N}+\boldsymbol{N}^2+\boldsymbol{N}^3+\ldots+\boldsymbol{N}^l$$

$$=\boldsymbol{N}(\boldsymbol{I}+\boldsymbol{N}+\boldsymbol{N}^2+\ldots+\boldsymbol{N}^{l-1})(\boldsymbol{I}-\boldsymbol{N})(\boldsymbol{I}-\boldsymbol{N})^{-1}$$

$$=\boldsymbol{N}(\boldsymbol{I}-\boldsymbol{N}^l)(\boldsymbol{I}-\boldsymbol{N})^{-1}$$

$$=\boldsymbol{N}(\boldsymbol{I}-\boldsymbol{N})^{-1},\text{when } l\to\infty,\ \boldsymbol{N}^l=[0]_{n\times n} \qquad (3)$$

where $0\le x_{ij}<1$, $0<\sum_{j=1}^{n}x_{ij}\le 1$ and $0<\sum_{i=1}^{n}x_{ij}\le 1$, at least one row or column of summation is equal to 1, but not all , then $\lim_{l\to\infty}\boldsymbol{N}^l=[0]_{n\times n}$.

The $(i, j)$ element $t_{ij}$ of matrix $\boldsymbol{T}$ denotes the direct and indirect influences of factor $i$ on factor $j$.

Definition 5: The row and column sums are separately denoted as $\boldsymbol{r}$ and $\boldsymbol{c}$ within the total-relation matrix $\boldsymbol{T}$ through Equations (4), (5), and (6).

$$\boldsymbol{T} = [t_{ij}], \quad i, j \in \{1, 2, ..., n\} \tag{4}$$

$$\boldsymbol{r} = [r_i]_{n\times 1} = \left( \sum_{j=1}^{n} t_{ij} \right)_{n\times 1} \tag{5}$$

$$\boldsymbol{c} = [c_j]_{n\times 1} = \left( \sum_{i=1}^{n} t_{ij} \right)'_{1\times n} \tag{6}$$

where the $\boldsymbol{r}$ and $\boldsymbol{c}$ vectors denote the sums of the rows and columns, respectively.

Definition 6: Suppose $r_i$ denotes the row sum of the $i^{th}$ row of matrix $\boldsymbol{T}$. Then, $r_i$ is the sum of the influences dispatching from factor i to the other factors, both directly and indirectly. Suppose that $c_j$ denotes the column sum of the $j^{th}$ column of matrix $\boldsymbol{T}$. Then, $c_j$ is the sum of the influences that factor $i$ is receiving from the other factors. Furthermore, when $i = j$ (i.e., the sum of the row sum and the column sum $(r_i + c_i)$ represents the index representing the strength of the influence, both dispatching and receiving), $(r_i + c_i)$ is the degree of the central role that factor $i$ plays in the problem. If $(r_i - c_i)$ is positive, then factor $i$ primarily is dispatching influence upon the strength of other factors; and if $(r_i - c_i)$ is negative, then factor $i$ primarily is receiving influence from other factors [57].

### 3.2 The Analytic Network Process Method

The ANP method, a multi criteria theory of measurement developed by Saaty [58], provides a general framework to deal with decisions without making assumptions about the independence of higher-level elements from lower level elements and about the independence of the elements within a level as in a hierarchy. Compared with traditional AHP (Analytic Hierarchy Process) [59] based applications which usually assume the independence between criteria, ANP, a new theory that extends AHP to deal with dependence in feedback and utilizes the supermatrix approach [58], is a more reasonable tool for dealing with complex MCDM problems in the real world. In this section, concepts of the ANP are summarized based on Saaty's earlier works [59].

The ANP is a coupling of two parts. The first consists of a control hierarchy or network of criteria and subcriteria that control the interactions. The second is a network of influences among the elements and clusters. The network varies from criterion to criterion and a different supermatrix of limiting influence is computed for each control criterion. Finally, each of these supermatrices is weighted by the priority of its control criterion and the results are synthesized through addition for all the control criteria [60]. A control hierarchy is a hierarchy of criteria and subcriteria for which priorities are derived in the usual way with respect to the goal of the system being considered.

The criteria are used to compare the components of a system, and the subcriteria are used to compare the elements. The criteria with respect to which influence is presented in individual supermatrices are called control criteria. Because all such influences obtained from the limits of the several supermatrices will be combined in order to obtain a measure of the priority of overall influences, the control criteria should be grouped in a structure to be used to derive priorities for them. These priorities will be used to weight the corresponding individual supermatrix limits and add. Analysis of priorities in a system can be thought of in terms of a control hierarchy with dependence among its bottom-level alternatives arranged as a network as shown in Fig.4. Dependence can occur within the components and between them.

A control hierarchy at the top may be replaced by a control network with dependence among its components, which are collections of elements whose functions derive from the synergy of their interaction and hence has a higher-order function not found in any single element. The criteria in the control hierarchy that are used for comparing the components are usually the major parent criteria whose subcriteria are used to compare the elements need to be more general than those of the elements because of the greater complexity of the components.

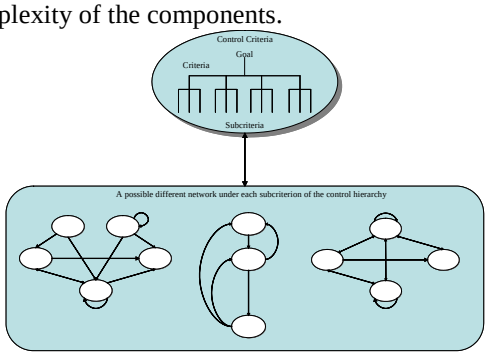


Fig.4. The Control Hierarchy
Source: Saaty [58]

A network connects the components of a decision system. According to size, there will be a system that is made up of subsystems, with each subsystem made up of components, and each component made up of elements. The elements in each component interact or have an influence on some or all of the elements of another component with respect to a property governing the interactions of the entire system, such as energy, capital, or political influence. Fig.5 demonstrates a typical network. Those components which no arrow enters are known as source components such as $\mathbf{C}_1$ and $\mathbf{C}_2$. Those from which no arrow leaves are known as sink component such as $\mathbf{C}_5$. Those components which arrows both enter and exit leave are known as transient components such as $\mathbf{C}_3$ and $\mathbf{C}_4$. In addition, $\mathbf{C}_3$ and $\mathbf{C}_4$ form a cycle of two components because they feed back and forth into each other. $\mathbf{C}_2$ and $\mathbf{C}_4$ have loops that connect them to themselves and are inner dependent. All other connections represent dependence between components which are thus known to be outer dependent.

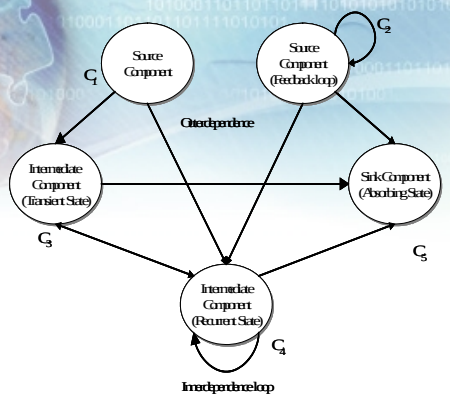


Fig.5. Connections in a Network
Source: Saaty [58]

A component of a decision network which was derived by the DEMATEL method in Section 3.1 will be denoted by $\boldsymbol{C}_h, h = 1, \ldots, m$, and assume that it has $n_h$ elements (determinants), which we denote by $e_{h1}, e_{h2}, \ldots, e_{hm}$. The influences of a given set of elements (determinants) in a component on any element in the decision system are represented by a ratio scale priority vector derived from paired comparisons of the comparative importance of one criterion and another criterion with respect to the interests or preferences of the decision makers. This relative importance value can be determined using a scale of 1–9 to represent equal importance to extreme importance [28]. The influence of elements (determinants) in the network on other elements (determinants) in that network can be represented in the following supermatrix:

$$\boldsymbol{W} = \begin{array}{c|c} & \begin{array}{ccccccccc} \boldsymbol{C}_1 & & & \boldsymbol{C}_2 & & & \cdots & \boldsymbol{C}_m & \\ e_{11} & \cdots & e_{1n_1} & e_{21} & \cdots & e_{2n_2} & \cdots & e_{m1} & \cdots \; e_{mn_m} \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \end{array} \begin{array}{c} e_{11} \\ e_{12} \\ \vdots \\ e_{1n_1} \\ e_{21} \\ e_{22} \\ \vdots \\ e_{2n_2} \\ \vdots \\ e_{m1} \\ e_{m2} \\ \vdots \\ e_{mn_m} \end{array} \begin{array}{c} \boldsymbol{C}_1 \\ \\ \\ \\ \boldsymbol{C}_2 \\ \\ \\ \\ \cdots \\ \\ \boldsymbol{C}_2 \\ \\ \\ \end{array} \begin{bmatrix} \boldsymbol{W}_{11} & \boldsymbol{W}_{12} & \cdots & \boldsymbol{W}_{1m} \\ \boldsymbol{W}_{21} & \boldsymbol{W}_{22} & \cdots & \boldsymbol{W}_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ \boldsymbol{W}_{m1} & \boldsymbol{W}_{m2} & \cdots & \boldsymbol{W}_{mm} \end{bmatrix} \end{array}$$

A typical entry $\boldsymbol{W}_{ij}$ in the supermatrix, is called a block of the supermatrix in the following form where each column of $\boldsymbol{W}_{ij}$ is a principal eigenvector of the influence of the elements (determinants) in the $i^{th}$ component of the network on an element (determinants) in the $j^{th}$ component. Some of its entries may be zero corresponding to those elements (determinants) that have no influence.

$$\boldsymbol{W}_{ij} = \begin{bmatrix} w_{i_1 j_1} & w_{i_1 j_2} & \cdots & w_{i_1 j_{n_j}} \\ w_{i_2 j_2} & w_{i_2 j_2} & \cdots & w_{i_2 j_{n_j}} \\ \vdots & \vdots & \ddots & \vdots \\ w_{i_{n_i} j_1} & w_{i_{n_i} j_2} & \cdots & w_{i_{n_i} j_{n_j}} \end{bmatrix}$$

After forming the supermatrix, the weighted supermatrix is derived by transforming all columns sum to unity exactly. This step is very much similar to the concept of the Markov chain in terms of ensuring that the sum of these probabilities of all states equals 1. Next, the weighted supermatrix is raised to limiting powers, such as Equation (7) to get the global priority vector or called weights [61].

$$\lim_{\theta \to \infty} \boldsymbol{W}^{\theta} \qquad (7)$$

In addition, if the supermatrix has the effect of cyclicity, the limiting supermatrix is not the only one. There are two or more limiting supermatrices in this situation, and the Cesaro sum would need to be calculated to get the priority. The Cesaro sum is formulated as follows.

$$\boldsymbol{w} = \lim_{\psi \to \infty} \left(\frac{1}{\nu}\right) \sum_{j=1}^{\nu} \boldsymbol{W}_j^{\psi}$$

To calculate the average effect of the limiting supermatrix (i.e. the average priority weights can be shown by the vector $\boldsymbol{w}$) where $\boldsymbol{W}_j$ denotes the $j^{th}$ limiting supermatrix. Otherwise, the supermatrix would be raised to large powers to get the priority weights [15]. The weights of the $k^{th}$ determinants derived by using the above ANP processes, namely $\omega_k$, $k \in \{1, 2, \ldots, n\}$, will be used as weights for aggregating the performance score versus each alternative.

### 3.3 Grey Relational Analysis

Since Deng [62] proposed Grey theory, related models have been developed and applied to MCDM problems. Similar to fuzzy set theory, Grey theory is a feasible mathematical means that can be used to deal with systems analysis characterized by inadequate information. Fields covered by the Grey theory include systems analysis, data processing, modeling, prediction, decision-making, and control engineering [63]. In this section, we briefly review some relevant definitions and the calculation process for the Grey Relation Model. This research modified the definitions by Chiou and Tzeng [64] and produced the definitions indicated below. GRA is used to determine the relationship between two sequences of stochastic data in a Grey system. The procedure bears some similarity to pattern recognition technology. One sequence of data is called the 'reference pattern' or 'reference sequence,' and the correlation between the other sequence and the reference sequence is to be identified [64]. The relationship scale also may be designated into eleven levels, where the scores 0,1,2,…,10 represent the range from 'no relationship' to 'very high relationship' between the specified evaluation criteria and the fuel cell technologies. The initial relationship matrix $\boldsymbol{G}$ is a $m \times n$ matrix, where there are $m$ $(k = 1, 2, \ldots, m)$ fuel cell technologies and $n$ criteria $(j = 1, 2, \ldots, n)$, obtained by surveying the relationships, where $g_{kj}$ is denoted as the relationship between the $j^{th}$ criterion and the $k^{th}$ technology.

$$\boldsymbol{G}=\begin{bmatrix} g_{11} & \mathrm{L} & g_{1j} & \mathrm{L} & g_{1n} \\ \mathrm{M} & \mathrm{O} & \mathrm{M} & \mathrm{O} & \mathrm{M} \\ g_{k1} & \mathrm{L} & g_{kj} & \mathrm{L} & g_{kn} \\ \mathrm{M} & \mathrm{O} & \mathrm{M} & \mathrm{O} & \mathrm{M} \\ g_{m1} & \mathrm{L} & g_{mj} & \mathrm{L} & g_{mn} \end{bmatrix}$$

The normalized relationship matrix $\boldsymbol{G}$ can be obtained through Equations (9) and (10).

$$x_k(j)=\frac{g_{kj}}{aspiration-value\ x_0(j)} \qquad (9)$$

$$\boldsymbol{X}=\begin{bmatrix} x_1(1) & \mathrm{L} & x_1(j) & \mathrm{L} & x_1(n) \\ \mathrm{M} & \mathrm{O} & \mathrm{M} & \mathrm{O} & \mathrm{M} \\ x_k(1) & \mathrm{L} & x_k(j) & \mathrm{L} & x_k(n) \\ \mathrm{M} & \mathrm{O} & \mathrm{M} & \mathrm{O} & \mathrm{M} \\ x_m(1) & \mathrm{L} & x_m(j) & \mathrm{L} & x_m(n) \end{bmatrix} \qquad (10)$$

In this case, let $\boldsymbol{x}_0$ be the aspiration-value vector with $n$ criteria: $\boldsymbol{x}_0 = (x_0(1),...,x_0(j),...,x_0(n)) = (10,...,10,...,10)$ and the matrix containing the normalized mapping information of each strategy (fuel cell technology) to the innovation competence (criteria), be one of the $m$ strategic patterns with $n$ criteria to be compared with the aspiration vector $\boldsymbol{x}_0$ where $\boldsymbol{x}_k$ is written as: when $x_{kj}=x_k(j)$, $j=1,2,...,n$ in Eqs (9) and (10), then $\boldsymbol{x}_k = (x_k(1),...,x_k(j),...,x_k(n))$, $k=1,2,...,m$. How much grade of strategy $\boldsymbol{x}_k$ close to aspiration level $\boldsymbol{x}_0$ in cell technology. Let $\boldsymbol{X}$ be a normalized strategic performance set of grey relations, $\boldsymbol{x}_0 \in \boldsymbol{X}$ the aspiration level for referential sequence, and $\boldsymbol{x}_k \in \boldsymbol{X}$ the kth strategy for comparative sequence; with $x_0(j)$ and $x_k(j)$ representing the numerals at criterion $j$ for $\boldsymbol{x}_0$ and $\boldsymbol{x}_k$, respectively. If $\gamma(x_0(j),x_k(j))$ and $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_k)$ are real numbers, and satisfy the grey axioms being defined in Deng [65], then call $\gamma(x_0(j),x_k(j))$ the grey relation coefficient, and the grade of the grey relation $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_k)$ is the average value of $\gamma(x_0(j),x_k(j))$. Deng also proposed a mathematical equation for the grey relation coefficient, as follows:

$$\gamma(x_0(j),x_k(j))=\frac{\min_k \min_j \left|(x_0(j)-x_k(j))\right| + \zeta \max_k \max_j \left|(x_0(j)-x_k(j))\right|}{\left|(x_0(j)-x_k(j))\right| + \zeta \max_k \max_j \left|(x_0(j)-x_k(j))\right|} \qquad (11)$$

where $\zeta$ is the coefficient ( $\zeta \in [0,1]$ ). Generally, $\zeta$ =0.5.

Based on Deng [8], if the grey relation coefficient in $x_k(j)$ corresponding to $x_0(j)$ is $\gamma(x_0(j),x_k(j))$, then the grey relation grade in $\boldsymbol{x}_k$ corresponding to $\boldsymbol{x}_0$, $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_k)$, must satisfy the following four axioms.

1. Norm Interval $0<\gamma(x_0(j),x_k(j))\le 1,\ \forall j;\ \gamma(\boldsymbol{x}_0,\boldsymbol{x}_k)=1\ iff\ \boldsymbol{x}_0=\boldsymbol{x}_k;$ $\gamma(x_0,x_k)=0\ iff\ x_0,x_k\in\varnothing;$ where $\varnothing$ is an empty set.

2. Duality Symmetric $\boldsymbol{x},\boldsymbol{y}\in\boldsymbol{X} \Rightarrow \gamma(\boldsymbol{x},\boldsymbol{y})=\gamma(\boldsymbol{y},\boldsymbol{x})\ iff\ \boldsymbol{X}=\{\boldsymbol{x},\boldsymbol{y}\}.$

3. Wholeness $\gamma(\boldsymbol{x}_k,\boldsymbol{x}_{k'}) \overset{often}{\neq} \gamma(\boldsymbol{x}_{k'},\boldsymbol{x}_k)$ $iff\ \ \boldsymbol{X}=\{\boldsymbol{x}_k \mid k=0,1,\mathrm{K},m\},\ m>2.$

4. Approachability $\gamma(x_0(j),x_k(j))$ decreases when $\left|(x_0(j)-x_k(j))\right|$ increases.

If $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_k)$ satisfies the four grey relation axioms, then $\gamma$ is called the Grey Relational Map. If $\Gamma$ is the entirety of the grey relational map, $\gamma\in\Gamma$ satisfies the four axioms of the grey relation, and X is the factor set of the grey relation, then $(\boldsymbol{X},\Gamma)$ will be called the grey relational space, while $\gamma$ is the specific map for $\Gamma$. Let $(\boldsymbol{X},\Gamma)$ be the grey relational space, and if $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_k)$, $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_p)$, ... , $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_q)$ satisfy $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_k) > \gamma(\boldsymbol{x}_0,\boldsymbol{x}_p) > ... > \gamma(\boldsymbol{x}_0,\boldsymbol{x}_q)$ then we have the grey relational order: $\boldsymbol{x}_k$ f $\boldsymbol{x}_p$ f ... f $\boldsymbol{x}_q$. When the grey relational coefficient is conducted with respect to various fuel cell technologies, we then can derive the grade of the grey relation $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_k)$ between the reference alternative

$$\gamma(\boldsymbol{x}_0,\boldsymbol{x}_k)=\sum_{j=1}^{n} w_j \times \gamma(x_0(j),x_k(j)). \qquad (12)$$

where $j$ is the number of criteria (innovation competences), $w_j$ expresses the weight of the $j^{th}$ criterion, by ANP and $\gamma(\boldsymbol{x}_0,\boldsymbol{x}_k)$ represents the grade of grey relation in $\boldsymbol{x}_k$ (shown as $k^{th}$ manufacturing or logistics strategy) correspondence to $\boldsymbol{x}_0$ (aspiration level). In this study, we make the order of the strategies following the grade of grey relation.

## 4. Empirical Study

This chapter shows the integrated circuit (IC) design service industry introduction first. The aspect and criteria influencing the IC design service industry by using experiential marketing strategy will be discussed in the second section. Then, an empirical study on experts' opinions will be leveraged for verifying the feasibility of the proposed analytic framework.

### 4.1 IC design service industry Introduction

A revolution is at work in the high tech industry: there is an unstoppable growth of business-to-business high-tech services [43]. IC design service firms are typical examples of knowledge-based labor intensive high-tech firms. According to James [64], IC design service industry is a high technology knowledge industry. This industry requires professional engineering technology knowledge, high speed internet networks, a convenient communication digital platform, a high performance supply chain system, and a staff of highly

skilled experts, who must be paid regardless of whether they're actually working on a project for the IC design industry [66].

To enhance the design service capabilities, and thus innovation competences, design service firms keep looking for external engineering, financial, intellectual property, and R&D, as well as human resources, while continuously enhancing internal engineering, marketing, and sales as well as turnkey capabilities through different Open R&D strategies, including alliances, R&D contracts, etc [67].

In recent year, more IC design or system companies are leaning toward the use of IC design service firms in making their chips to market on time and within budget [67]. The major function of IC design service is to act as a mediator between IC design and manufacturing, providing IC designers with an IP library, IP integration and customized modification, and IC manufacturing process technique to reduce not only the development cost but also design time [68]. Furthermore, the IC design service companies provide turnkey solutions to produce ASICs and/or handle the manufacturing process in the comprehensive supply chain. The solutions provided include wafer foundry, IC packaging, IC testing, reliability qualification, failure analysis and logistic service. In return, the traditional IC design companies can focus on their core competence of product design, as well as becoming the marketing and sales channels which define the product specifications [66].

Albeit design service firms expanded innovation competences through various open innovation strategies, defining the optimum open innovation strategies and developing the competitive advantages has become the major concern for top managements of the design service firms [67].

### 4.2 Empirical Study in Experiential Marketing

There were 11 engineering experts work in the IC design service company with more than 6-years working experiences. They were invited to evaluate each of the twenty-one criteria belong to five aspects, the aspects and criteria are summarized below in Table 4-1. Further, definitions of the criteria are provided in Table 4-2 as a foundation for this research.

Table 4-1 Aspect and Criteria for the IC design service industry

| Aspect | Criteria | Aspect | Criteria |
|---|---|---|---|
| Sense ($A_1$) | ($c_1$) Company | Think ($A_3$) | ($c_{11}$) Professional |
| | ($c_2$) Enterprise | | ($c_{12}$) Pricing Strategy |
| | ($c_3$) Transaction Content | | ($c_{13}$) Brand Value |
| | ($c_4$) Product Design | | ($c_{14}$) Induced Stimulation |
| | ($c_5$) Style Performance | Act ($A_4$) | ($c_{15}$) After-sale Service |
| Feel ($A_2$) | ($c_6$) Decoration and | | ($c_{16}$) Trading Interactive |
| | ($c_7$) Service Attitude | | ($c_{17}$) Experience |
| | ($c_8$) Trading Arrangement | Relate ($A_5$) | ($c_{18}$) Brand Community |
| | ($c_9$) Face to Face Interaction | | ($c_{19}$) Social Norms |
| | ($c_{10}$) Emotional Advertising | | ($c_{20}$) Group Attribution |

Source: This Research

Since the inter-relationship for individual dimensions between criteria which are summarized through the literature review and professional experts based brainstorming process. All of the criteria of the aspects decision problem structure will be deducted by using the DEMATEL method which was introduced in Chapter 3.4.

At first, the direct relation matrix $\boldsymbol{A_1}$ is introduced as shown in Figure 4-1(a) according to the experts' opinions on pairwise comparisons in terms of influence and direction between evaluation criteria. After that, the normalized direct relation matrix $\boldsymbol{N_1}$ is normalized based on Equation (1) and the normalized direct relation matrix $\boldsymbol{N_1}$ is shown in Figure 4-1(b). Finally, the total relationship matrix $\boldsymbol{T_1}$ is deducted based on Equation (4) and shown in Figure 4-1(c).

$$A_1 = \begin{bmatrix} 0.000 & 2.455 & 3.091 & 2.727 & 2.909 & 2.273 \\ 3.182 & 0.000 & 2.091 & 2.273 & 2.818 & 3.091 \\ 3.818 & 1.909 & 0.000 & 3.818 & 2.636 & 1.727 \\ 3.909 & 2.091 & 4.273 & 0.000 & 3.273 & 1.818 \\ 3.909 & 2.818 & 2.818 & 3.182 & 0.000 & 3.273 \\ 2.909 & 3.636 & 1.909 & 1.909 & 2.909 & 0.000 \end{bmatrix}$$

Figure 4-1(a) The Direct Relation Matrix $\boldsymbol{A_1}$

$$N_1 = \begin{bmatrix} 0.000 & 0.138 & 0.174 & 0.154 & 0.164 & 0.128 \\ 0.179 & 0.000 & 0.118 & 0.128 & 0.159 & 0.174 \\ 0.215 & 0.108 & 0.000 & 0.215 & 0.149 & 0.097 \\ 0.221 & 0.118 & 0.241 & 0.000 & 0.185 & 0.103 \\ 0.221 & 0.159 & 0.159 & 0.179 & 0.000 & 0.185 \\ 0.164 & 0.205 & 0.108 & 0.108 & 0.164 & 0.000 \end{bmatrix}$$

Figure 4-1(b) The Normalized Direct Relation Matrix $\boldsymbol{N}_1$

$$T_1 = \begin{bmatrix} 0.656 & 0.613 & 0.695 & 0.670 & 0.692 & 0.583 \\ 0.801 & 0.492 & 0.646 & 0.643 & 0.685 & 0.618 \\ 0.857 & 0.603 & 0.570 & 0.735 & 0.700 & 0.572 \\ 0.919 & 0.655 & 0.814 & 0.606 & 0.774 & 0.619 \\ 0.938 & 0.707 & 0.768 & 0.770 & 0.638 & 0.700 \\ 0.781 & 0.658 & 0.630 & 0.620 & 0.682 & 0.466 \end{bmatrix}$$

Figure 4-1(c) The Total Relationship Matrix $\boldsymbol{T_1}$

Figure 4-1 Decision Problem Structuring for Sense

$$A_2 = \begin{bmatrix} 0.000 & 4.000 & 4.545 & 3.000 \\ 3.818 & 0.000 & 3.909 & 2.727 \\ 4.636 & 4.364 & 0.000 & 3.000 \\ 2.818 & 2.636 & 2.455 & 0.000 \end{bmatrix}$$

Figure 4-2(a) The Direct Relation Matrix $\boldsymbol{A_2}$

$$N_2 = \begin{bmatrix} 0.000 & 0.333 & 0.379 & 0.250 \\ 0.318 & 0.000 & 0.326 & 0.227 \\ 0.386 & 0.364 & 0.000 & 0.250 \\ 0.235 & 0.220 & 0.205 & 0.000 \end{bmatrix}$$

Figure 4-2(b) The Normalized Direct Relation Matrix $\boldsymbol{N}_2$

$$T_2 = \begin{bmatrix} 1.959 & 2.176 & 2.194 & 1.783 \\ 2.056 & 1.785 & 2.024 & 1.653 \\ 2.295 & 2.249 & 1.976 & 1.829 \\ 1.616 & 1.583 & 1.569 & 1.156 \end{bmatrix}$$

Figure 4-2(c) The Total Relationship Matrix $\boldsymbol{T_2}$

Figure 4-2 Decision Problem Structuring for Feel

$$A_3 = \begin{bmatrix} 0.000 & 4.182 & 4.727 & 3.727 & 3.364 \\ 3.273 & 0.000 & 3.909 & 4.091 & 3.545 \\ 3.000 & 4.636 & 0.000 & 4.091 & 2.727 \\ 2.727 & 3.455 & 2.909 & 0.000 & 2.727 \\ 2.636 & 3.818 & 3.818 & 3.727 & 0.000 \end{bmatrix}$$

Figure 4-3(a) The Direct Relation Matrix $\boldsymbol{A_3}$

$$N_3 = \begin{bmatrix} 0.000 & 0.260 & 0.294 & 0.232 & 0.209 \\ 0.203 & 0.000 & 0.243 & 0.254 & 0.220 \\ 0.186 & 0.288 & 0.000 & 0.254 & 0.169 \\ 0.169 & 0.215 & 0.181 & 0.000 & 0.169 \\ 0.164 & 0.237 & 0.237 & 0.232 & 0.000 \end{bmatrix}$$

Figure 4-3(b) The Normalized Direct Relation Matrix $\boldsymbol{N}_3$

$$T_3 = \begin{bmatrix} 1.244 & 1.824 & 1.773 & 1.775 & 1.472 \\ 1.328 & 1.508 & 1.634 & 1.683 & 1.393 \\ 1.295 & 1.703 & 1.410 & 1.655 & 1.335 \\ 1.111 & 1.432 & 1.352 & 1.233 & 1.155 \\ 1.247 & 1.630 & 1.563 & 1.600 & 1.156 \end{bmatrix}$$

Figure 4-3(c) The Total Relationship Matrix $\boldsymbol{T_3}$

Figure 4-3 Decision Problem Structuring for Think

$$A_4 = \begin{bmatrix} 0.000 & 3.545 \\ 4.000 & 0.000 \end{bmatrix}$$

Figure 4-4(a) The Direct Relation Matrix $\boldsymbol{A_4}$

$$N_4 = \begin{bmatrix} 0.000 & 0.886 \\ 1.000 & 0.000 \end{bmatrix}$$

Figure 4-4(b) The Normalized Direct Relation Matrix $\boldsymbol{N}_4$

$$T_4 = \begin{bmatrix} 7.800 & 7.800 \\ 8.800 & 7.800 \end{bmatrix}$$

Figure 4-4(c) The Total Relationship Matrix $\boldsymbol{T_4}$

Figure 4-4 Decision Problem Structuring for Act

$$A_5 = \begin{bmatrix} 0.000 & 3.000 & 4.273 \\ 2.636 & 0.000 & 2.909 \\ 4.364 & 2.727 & 0.000 \end{bmatrix}$$

Figure 4-5(a) The Direct Relation Matrix $\boldsymbol{A_5}$

$$N_5 = \begin{bmatrix} 0.000 & 0.413 & 0.588 \\ 0.363 & 0.000 & 0.400 \\ 0.600 & 0.375 & 0.000 \end{bmatrix}$$

Figure 4-5(b) The Normalized Direct Relation Matrix $\boldsymbol{N}_5$

$$T_5 = \begin{bmatrix} 4.026 & 3.742 & 4.450 \\ 3.563 & 2.829 & 3.625 \\ 4.352 & 3.681 & 4.029 \end{bmatrix}$$

Figure 4-5(c) The Total Relationship Matrix $\boldsymbol{T_5}$

Figure 4-5 Decision Problem Structuring for Relate

$$A_6 = \begin{bmatrix} 0.000 & 3.727 & 3.091 & 3.455 & 3.273 \\ 3.364 & 0.000 & 3.091 & 3.091 & 2.818 \\ 2.636 & 3.455 & 0.000 & 3.727 & 3.364 \\ 3.000 & 3.636 & 3.364 & 0.000 & 3.000 \\ 3.000 & 3.273 & 3.273 & 3.273 & 0.000 \end{bmatrix}$$

Figure 4-6(a) The Direct Relation Matrix $\boldsymbol{A_6}$

$$N_6 = \begin{bmatrix} 0.000 & 0.265 & 0.219 & 0.245 & 0.232 \\ 0.239 & 0.000 & 0.219 & 0.219 & 0.200 \\ 0.187 & 0.245 & 0.000 & 0.265 & 0.239 \\ 0.213 & 0.258 & 0.239 & 0.000 & 0.213 \\ 0.213 & 0.232 & 0.232 & 0.232 & 0.000 \end{bmatrix}$$

Figure 4-6(b) The Normalized Direct Relation Matrix $\boldsymbol{N}_6$

$$T_6 = \begin{bmatrix} 2.104 & 2.601 & 2.396 & 2.511 & 2.348 \\ 2.149 & 2.225 & 2.240 & 2.332 & 2.175 \\ 2.214 & 2.535 & 2.166 & 2.471 & 2.303 \\ 2.209 & 2.518 & 2.336 & 2.238 & 2.264 \\ 2.187 & 2.476 & 2.308 & 2.402 & 2.066 \end{bmatrix}$$

Figure 4-6(c) The Total Relationship Matrix $\boldsymbol{T_6}$

Figure 4-6 Decision Problem Structuring between Aspect

Then, the row and column sum is separately denoted as $\boldsymbol{r}$ and $\boldsymbol{c}$ within the total relationship matrix T using by equation (5) and (6), and the casual diagram could be derived by mapping a dataset of ($\boldsymbol{r + c}$, $\boldsymbol{r - c}$). In the following tables, the values of $\boldsymbol{r + c}$ and $\boldsymbol{r - c}$ for each criterion are demonstrated.

Table 4-3 The Degree of full Influence under Sense aspect

| Aspect | Criteria | $r + c$ | $r - c$ |
|---|---|---|---|
| Sense ($A_1$) | ($c_1$) Company Promotion | 8.863 | -1.043 |
| | ($c_2$) Enterprise Environment | 7.615 | 0.159 |
| | ($c_3$) Transaction Content | 8.161 | -0.088 |
| | ($c_4$) Product Design | 8.433 | 0.344 |
| | ($c_5$) Style Performance | 8.690 | 0.350 |
| | ($c_6$) Decoration and equipment | 7.395 | 0.278 |

Remark: The Shaded number is the Highest in Each Column

Table 4-5 The Degree of full Influence under Think aspect

| Aspect | Criteria | $r + c$ | $r - c$ |
|---|---|---|---|
| Think ($A_3$) | ($c_{11}$) Professional Knowledge | 14.314 | 1.863 |
| | ($c_{12}$) Pricing Strategy | 15.643 | -0.551 |
| | ($c_{13}$) Brand Value | 15.130 | -0.335 |
| | ($c_{14}$) Induced Stimulation | 14.229 | -1.664 |
| | ($c_{15}$) After-sale Service | 13.708 | 0.686 |

Remark: The Shaded number is the Highest in Each Column

Table 4-6 The Degree of full Influence under Act aspect

| Aspect | Criteria | $r + c$ | $r - c$ |
|---|---|---|---|
| Act ($A_4$) | ($c_{16}$) Trading Interactive | 32.2 | -1.000 |
| | ($c_{17}$) Experience | 32.2 | 1.000 |

Remark: The Shaded number is the Highest in Each Column

Table 4-7 The Degree of full Influence under Relate aspect

| Aspect | Criteria | $r + c$ | $r - c$ |
|---|---|---|---|
| Relate ($A_5$) | ($c_{18}$) Brand Community | 24.160 | 0.277 |
| | ($c_{19}$) Social Norms | 20.269 | -0.236 |
| | ($c_{20}$) Group Attribution | 24.166 | -0.042 |

Remark: The Shaded number is the Highest in Each Column

Table 4-8 The Degree of full Influence between Aspect

| Aspect | $r + c$ | $r - c$ |
|---|---|---|
| Sense ($A_1$) | 22.821 | 1.097 |
| Feel ($A_2$) | 23.476 | -1.234 |
| Think ($A_3$) | 23.136 | 0.242 |
| Act ($A_4$) | 23.518 | -0.389 |
| Relate ($A_5$) | 22.595 | 0.284 |

Remark: The Shaded number is the Highest in Each Column

Source: This Study

Base on the definitions of the ANP procedures in Chapter 3, the weights versus each criterion were derived.

Based on the decision problem structure being derived by the DEMATEL, the ANP method can be applied for calculating the weight versus each criterion. Pair-wise comparison results for the importance level of criteria being connected to the same goal are deprived according to experts' opinions and were provided as inputs for the ANP. With the aid of the Super Decision [60], a software which is used for decision-making with dependences and feedbacks by implementing the ANP, the limit super matrix $\boldsymbol{W}$ is calculated and shown in all of Figure 4-13. Then, the performance values of the evaluation criteria being rated against each criterion and aggregated are presented in all of Table 4-9.

$$\boldsymbol{W} = \begin{bmatrix}
1.000 & 0.767 & 0.907 & 1.116 & 0.884 & 0.674 & 1.140 & 1.000 & 1.140 & 0.721 & 1.186 & 1.140 & 1.116 & 0.791 & 1.023 & 0.767 & 0.860 & 0.930 & 0.698 & 0.884 \\
1.303 & 1.000 & 1.182 & 1.455 & 1.152 & 0.879 & 1.485 & 1.303 & 1.485 & 0.939 & 1.545 & 1.485 & 1.455 & 1.030 & 1.333 & 1.000 & 1.121 & 1.212 & 0.909 & 1.152 \\
1.103 & 0.846 & 1.000 & 1.231 & 0.974 & 0.744 & 1.256 & 1.103 & 1.256 & 0.795 & 1.308 & 1.256 & 1.231 & 0.872 & 1.128 & 0.846 & 0.949 & 1.026 & 0.769 & 0.974 \\
0.896 & 0.688 & 0.813 & 1.000 & 0.792 & 0.604 & 1.021 & 0.896 & 1.021 & 0.646 & 1.063 & 1.021 & 1.000 & 0.708 & 0.917 & 0.688 & 0.771 & 0.833 & 0.625 & 0.792 \\
1.132 & 0.868 & 1.026 & 1.263 & 1.000 & 0.763 & 1.289 & 1.132 & 1.289 & 0.816 & 1.342 & 1.289 & 1.263 & 0.895 & 1.158 & 0.868 & 0.974 & 1.053 & 0.789 & 1.000 \\
1.483 & 1.138 & 1.345 & 1.655 & 1.310 & 1.000 & 1.690 & 1.483 & 1.690 & 1.069 & 1.759 & 1.690 & 1.655 & 1.172 & 1.517 & 1.138 & 1.276 & 1.379 & 1.034 & 1.310 \\
0.878 & 0.673 & 0.796 & 0.980 & 0.776 & 0.592 & 1.000 & 0.878 & 1.000 & 0.633 & 1.041 & 1.000 & 0.980 & 0.694 & 0.898 & 0.673 & 0.755 & 0.816 & 0.612 & 0.776 \\
1.000 & 0.767 & 0.907 & 1.116 & 0.884 & 0.674 & 1.140 & 1.000 & 1.140 & 0.721 & 1.186 & 1.140 & 1.116 & 0.791 & 1.023 & 0.767 & 0.860 & 0.930 & 0.698 & 0.884 \\
0.878 & 0.673 & 0.796 & 0.980 & 0.776 & 0.592 & 1.000 & 0.878 & 1.000 & 0.633 & 1.041 & 1.000 & 0.980 & 0.694 & 0.898 & 0.673 & 0.755 & 0.816 & 0.612 & 0.776 \\
1.387 & 1.065 & 1.258 & 1.548 & 1.226 & 0.935 & 1.581 & 1.387 & 1.581 & 1.000 & 1.645 & 1.581 & 1.548 & 1.097 & 1.419 & 1.065 & 1.194 & 1.290 & 0.968 & 1.226 \\
0.843 & 0.647 & 0.765 & 0.941 & 0.745 & 0.569 & 0.961 & 0.843 & 0.961 & 0.608 & 1.000 & 0.961 & 0.941 & 0.667 & 0.863 & 0.647 & 0.725 & 0.784 & 0.588 & 0.745 \\
0.878 & 0.673 & 0.796 & 0.980 & 0.776 & 0.592 & 1.000 & 0.878 & 1.000 & 0.633 & 1.041 & 1.000 & 0.980 & 0.694 & 0.898 & 0.673 & 0.755 & 0.816 & 0.612 & 0.776 \\
0.896 & 0.688 & 0.813 & 1.000 & 0.792 & 0.604 & 1.021 & 0.896 & 1.021 & 0.646 & 1.063 & 1.021 & 1.000 & 0.708 & 0.917 & 0.688 & 0.771 & 0.833 & 0.625 & 0.792 \\
1.265 & 0.971 & 1.147 & 1.412 & 1.118 & 0.853 & 1.441 & 1.265 & 1.441 & 0.912 & 1.500 & 1.441 & 1.412 & 1.000 & 1.294 & 0.971 & 1.088 & 1.176 & 0.882 & 1.118 \\
0.977 & 0.750 & 0.886 & 1.091 & 0.864 & 0.659 & 1.114 & 0.977 & 1.114 & 0.705 & 1.159 & 1.114 & 1.091 & 0.773 & 1.000 & 0.750 & 0.841 & 0.909 & 0.682 & 0.864 \\
1.303 & 1.000 & 1.182 & 1.455 & 1.152 & 0.879 & 1.485 & 1.303 & 1.485 & 0.939 & 1.545 & 1.485 & 1.455 & 1.030 & 1.333 & 1.000 & 1.121 & 1.212 & 0.909 & 1.152 \\
1.162 & 0.892 & 1.054 & 1.297 & 1.027 & 0.784 & 1.324 & 1.162 & 1.324 & 0.838 & 1.378 & 1.324 & 1.297 & 0.919 & 1.189 & 0.892 & 1.000 & 1.081 & 0.811 & 1.027 \\
1.075 & 0.825 & 0.975 & 1.200 & 0.950 & 0.725 & 1.225 & 1.075 & 1.225 & 0.775 & 1.275 & 1.225 & 1.200 & 0.850 & 1.100 & 0.825 & 0.925 & 1.000 & 0.750 & 0.950 \\
1.433 & 1.100 & 1.300 & 1.600 & 1.267 & 0.967 & 1.633 & 1.433 & 1.633 & 1.033 & 1.700 & 1.633 & 1.600 & 1.133 & 1.467 & 1.100 & 1.233 & 1.333 & 1.000 & 1.267 \\
1.132 & 0.868 & 1.026 & 1.263 & 1.000 & 0.763 & 1.289 & 1.132 & 1.289 & 0.816 & 1.342 & 1.289 & 1.263 & 0.895 & 1.158 & 0.868 & 0.974 & 1.053 & 0.789 & 1.000
\end{bmatrix}$$

Figure 4-13 The Limit Super Matrix $\boldsymbol{W}$ of experiential marketing selection

Table 4-9 The Weights of experiential marketing Evaluation Criteria

| Criteria | $c_1$ | $c_2$ | $c_3$ | $c_4$ | $c_5$ | $c_6$ | $c_7$ | $c_8$ | $c_9$ | $c_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Weight | 0.053 | 0.041 | 0.048 | 0.06 | 0.047 | 0.036 | 0.061 | 0.053 | 0.061 | 0.038 |
| Criteria | $c_{11}$ | $c_{12}$ | $c_{13}$ | $c_{14}$ | $c_{15}$ | $c_{16}$ | $c_{17}$ | $c_{18}$ | $c_{19}$ | $c_{20}$ |
| Weight | 0.063 | 0.061 | 0.06 | 0.042 | 0.055 | 0.041 | 0.046 | 0.05 | 0.037 | 0.047 |

Source: This Study

After constructing the structure of the decision problem, weights versus each criterion was derived by using the ANP (refer Table 4-8). The GRA is applied to derive the relationships between criteria and Experiential Strategies then.

The experiential strategies being reviewed in Section 2.2.1 including (1) Communications, (2) Visual/verbal identity, (3) Product presence, (4) Co-branding, (5) Spatial Environments, (6) Web sites and electronic media, and (7) Staff will be introduced to enhance the selected experiential strategy.

The initial relationship matrix for deriving experiential strategy, $\boldsymbol{G}_1$, is a $20\times7$ matrix, where there are seven experiential strategies and twenty determinants for high technology industry, obtained by surveying the relationships, The normalized relationship matrix $\boldsymbol{X}_1$ can be obtained through Equations (9) and (10). The grey relation coefficients can be calculated by using Equation (11). By setting the distinguished coefficient $\zeta$ as 0.5, the Grey relation coefficients were derived. Then the grades of Grey relation $\gamma(x_0, x_i)$ were derived. We established the result that Type 3 f Type 1 f Type 4 f Type 7 f Type 2 f Type 5 f Type 6. Finally, the Grey grades versus each experiential strategy can be derived and shown in Table 4-9.

Table 4-9 The grades of Grey relation with respect to experiential strategy ( $\zeta = 0.5$ )

| Type | Experiential Strategy | Gray Grade |
|---|---|---|
| 1 | Communications | 0.703 |
| 2 | Visual/verbal identity | 0.597 |
| 3 | Product presence | 0.706 |
| 4 | Co-branding | 0.690 |
| 5 | Spatial Environments | 0.580 |
| 6 | Web sites and electronic media | 0.485 |
| 7 | Staff | 0.697 |

Source: This Study

## 5. Discussion

Based upon experiential marketing strategy derived using Delphi, the decision problem being structured by DEMATEL, weighting each experiential criterion versus the goal of the decision problem by ANP, and the resulting experiential strategy portfolio was derived by mapping competences by GRA and then deriving the most important experiential strategy by gray grades. An empirical analysis based on design service firms was used to illustrate the analytical procedures.

In the "Sense Aspect", the shaded number of the criterion Company Promotion (8.863) stands for the criterion with the highest (***r*** **+** ***c***) value. That it is the connections between the criteria with other criteria are strong as well as Company Promotion plays the central role in the decision problem. Meanwhile, the shaded number of the criterion Style Performance (0.350) stands for the highest (***r*** **-** ***c***) value. Style Performance serves as the main influence dispatching criterion which affects other criteria. The (***r*** **+** ***c***) value of the criteria Decoration and equipment (7.395) is the lowest. This means that it is neither an influence dispatching criterion nor an influence receiving criterion. The criterion Company Promotion (-1.043) is with the lowest (***r*** **-** ***c***) value which implies that it is the main criterion of receiving influence from other criteria.

In the "Feel Aspect", the shaded number of the criterion Face to Face Interaction (16.111) stands for the criterion with the highest (***r*** **+** ***c***) value. That is the connections between the criterions Face to Face Interaction with other criteria are strong as well as Face to Face Interaction plays the central role in the decision problem. Meanwhile, the shaded number of the criterion Face to Face Interaction (0.586) stands for the highest (***r*** **-** ***c***) value. Face to Face Interaction serves as the main influence dispatching criterion which affects other criteria. The (***r*** **+** ***c***) value of the criteria Emotional Advertising (12.343) is the lowest. This means that is neither an influence dispatching criterion nor an influence receiving criterion. Criterion Emotional Advertising (-0.497) is with the lowest (***r*** **-** ***c***) value which implies that Emotional Advertising Emotional Advertising is the main criterion of receiving influence from other criteria.

In the Think Aspect, the shaded number of the criterion Pricing Strategy (15.643) stands for the criterion with the highest (***r*** **+** ***c***) value. That is the connections between the criterion Pricing Strategy with other criteria are strong as well as Pricing Strategy plays the central role in the decision problem. Meanwhile, the shaded number of the criterion Professional Knowledge (1.863) stands for the highest (***r*** **-** ***c***) value. Professional Knowledge serves as the main influence dispatching criterion which affects other criteria. The (***r*** **+** ***c***) value of the criteria After-sale Service (13.708) is the lowest.

This means that is neither an influence dispatching criterion nor an influence receiving criterion. Criterion Induced Stimulation (-1.664) is with the lowest (***r - c***) value which implies that Induced Stimulation is the main criterion of receiving influence from other criteria.

In the Act Aspect, the shaded number of the criterion Trading Interactive (32.2) and Experience (32.2) stands for the criterion with the highest (***r + c***) value. That is the connections between the criterion Trading Interactive and Experience with other criteria are strong as well as Trading Interactive and Experience plays the central role in the decision problem. Meanwhile, the shaded number of the criterion Experience (1.000) stands for the highest (***r - c***) value. ($c_{17}$) serves as the main influence dispatching criterion which affects other criteria. The (***r + c***) value of the criteria Trading Interactive (32.2) and Experience (32.2) is the lowest. This means that is neither an influence dispatching criterion nor an influence receiving criterion. Criterion Trading Interactive (-1.000) is with the lowest (***r - c***) value which implies that Trading Interactive is the main criterion of receiving influence from other criteria.

In the Relate Aspect, the shaded number of the criterion Group Attribution (24.166) stands for the criterion with the highest (***r + c***) value. That is the connections between the criterion Group Attribution with other criteria are strong as well as Group Attribution plays the central role in the decision problem. Meanwhile, the shaded number of the criterion Brand Community (0.277) stands for the highest (***r - c***) value. Brand Community serves as the main influence dispatching criterion which affects other criteria. The (***r + c***) value of the criteria Social Norms (20.269) is the lowest. This means that is neither an influence dispatching criterion nor an influence receiving criterion. Criterion Social Norms (-0.236) is with the lowest (***r - c***) value which implies that Social Norms is the main criterion of receiving influence from other criteria.

Finally, between Aspect, the shaded number of the aspect Act (23.518) stands for the aspect with the highest (**r + c**) value. That is the connections between the aspect Act with other aspect are strong as well as Act plays the central role in the decision problem. Meanwhile, the shaded number of the aspect Sense (1.097) stands for the highest (**r - c**) value. Sense serves as the main influence dispatching aspect which affects other aspect. The (**r + c**) value of the aspect Relate (22.595) is the lowest. This means that is neither an influence dispatching aspect nor an influence receiving aspect. Aspect Feel (-1.234) is with the lowest (**r - c**) value which implies that Feel is the main aspect of receiving influence from other aspect.

After determining the relationship structure between dimensions of the evaluating systems, the ANP method is applied to derive the weights of the criteria. These pairwise comparisons are based on Saaty's 9-point scale and represent the importance of one element over another. By calculating the limiting power of the weighted supermatrix, the top three priorities weights in the evaluating systems are: Professional Knowledge (0.063), Service Attitude, Face to Face Interaction and Pricing Strategy (0.061), Product Design and Brand Value (0.060).

After constructing the structure of the decision problem, weights versus each criterion was derived by using the ANP. The GRA is applied to derive the relationships between criteria and Experiential Strategies then. In this research, seven experiential provider's strategies: (1) communicate (2) verbal and visual recognition (3) Product Presence (4) co-branding (5) Spatial Environment (6) Web Sites and Electronic Media (7) Staff were proposed for enabling the experiential marketing strategy of the high technology service industry. The top three priorities experiential strategies in the evaluating systems are: Product presence, Communications and People. It means that high technology firm's manager can upgrade their competence through those three strategies.

## 6. Conclusions

Because of high-tech firm's marketing strategy almost similar and IC design service plays an important role in semi-conductor industry development, and it is an emerging business model in the IC design era, furthermore, few firms used experiential marketing strategy to regard as the high technology firm's tactic. Therefore, developing a Strategic Experiential Modules and comparing its suitability to major alternatives are needed for managers to sharpen their competitive edge. The thesis presents a multi-criteria decision model for selecting appropriate experiential strategy for high-tech firms. The process of deriving the solution is illustrated through an easy-to-understand empirical study. Results demonstrate that the model can provide a framework to assist policymakers to use SEMs strategy and making a dispassionate and objective selection.

These criteria in the thesis provide assistance, convenience and a good experience not only to the clients, those experiential marketing strategy can also be developed for the high-technology service firm. Meanwhile, high-tech managers and investors should decide on the strength of each experiential aspect in an effort to enhance their high-tech service firm's competences, scale, profitability capabilities and revenue. This thesis also demonstrates how comparisons could be made while selecting the model, which gives a clear direction for high tech managers and investors to apply to drawing suggestions of the high technology service operating strategies and activities.

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